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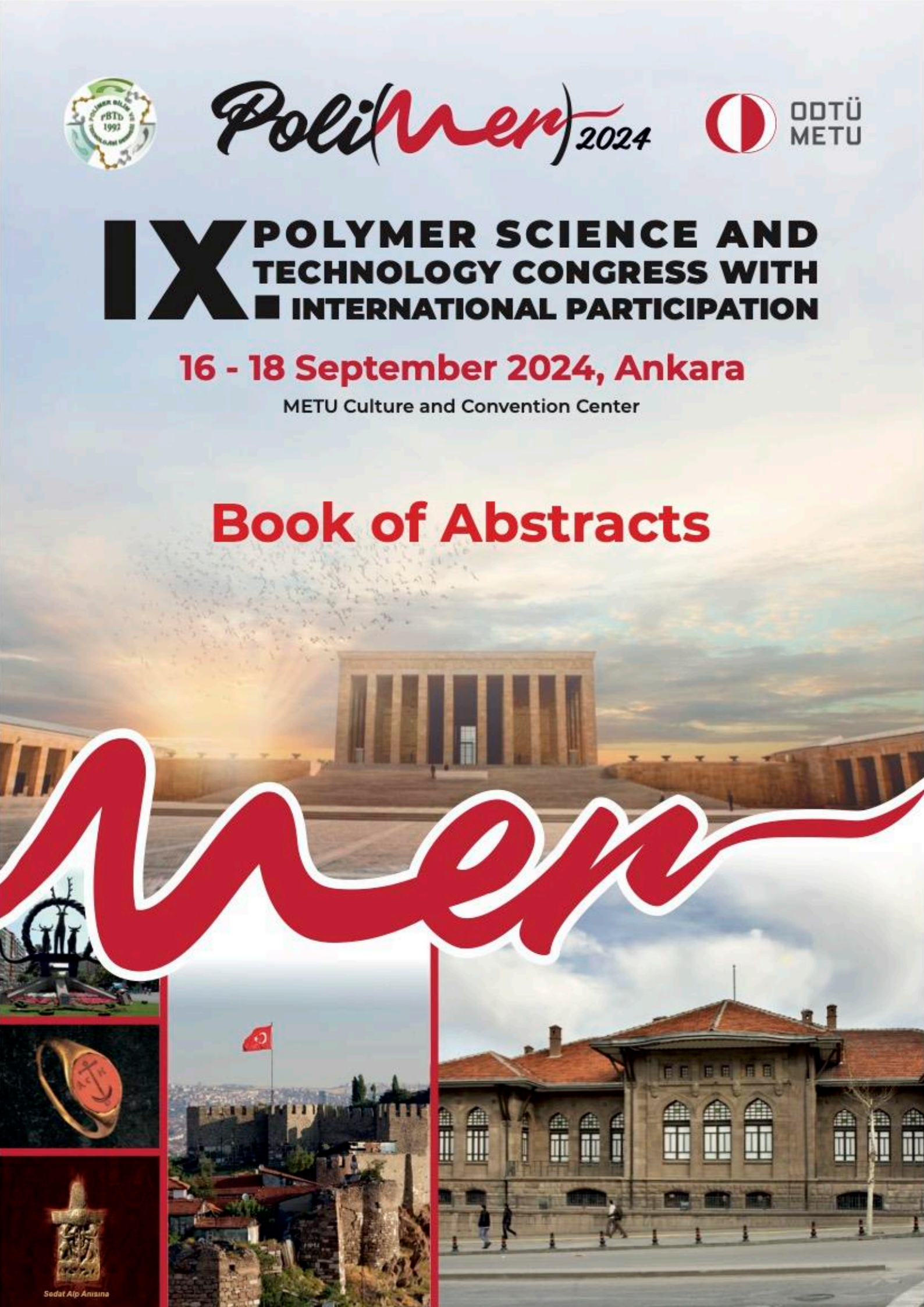

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Middle East Technical University

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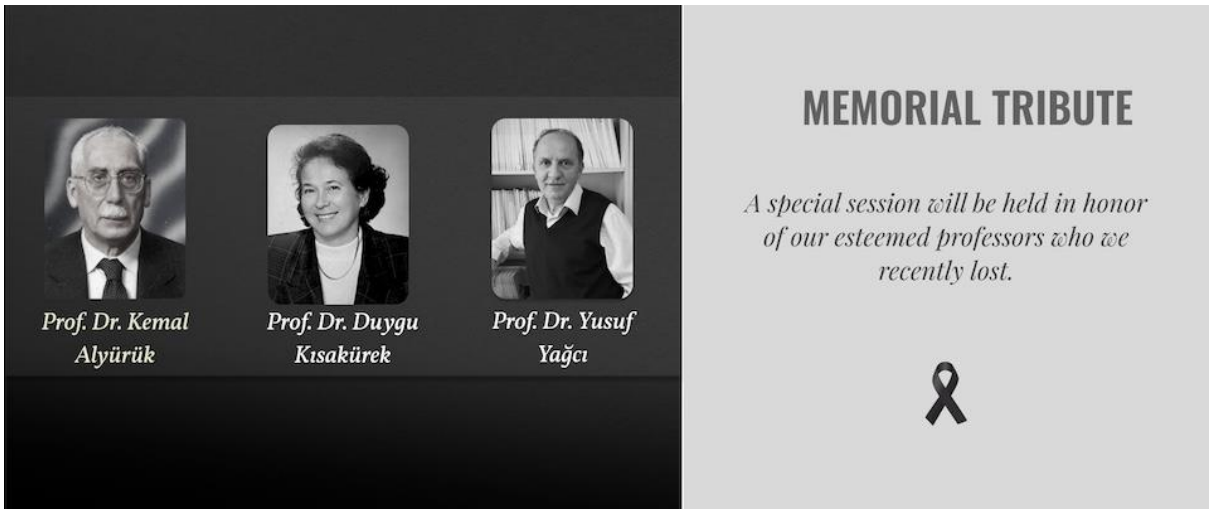
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Praface

It is with great pride that we present the proceedings of the **9th Polymer Science and Technology Congress** (PolymerTR), organized by the Polymer Science and Technology Association and held at the Middle East Technical University in Ankara, Türkiye, from 16 to 18 September 2024.

The congress brought together a diverse assembly of leading scientists, experts, and professionals from academia, research institutions, and industry, highlighting the critical importance of collaboration between these sectors. This year's event was marked by an exceptional level of industry participation, underscoring the growing integration of scientific innovation with practical industrial applications in the field of polymer science.

Since its inception in 2006, PolymerTR has steadily grown into a key scientific gathering not only in Türkiye but also across the region. We are deeply appreciative of the vision and efforts of our founding members, particularly **Prof. Dr. Teoman Tinçer**, whose foundational work continues to inspire and guide this vibrant community. Our goal remains to further elevate the international profile of PolymerTR as a globally recognized platform for the advancement of polymer science and technology.

The 9th edition of PolymerTR was distinguished by its broad representation of 650 participants from 13 different countries, including 225 academicians, 206 students and early-career researchers, and 219 professionals from industry. This balance of academic, early-career, and industrial participants reflects our commitment to fostering collaboration across the full spectrum of the polymer science ecosystem. We received an impressive 407 abstract submissions, of which 171 were selected for oral presentations and 209 for poster presentations, offering a comprehensive view of the latest research and innovations in polymer science and technology. We were honored to host distinguished plenary speakers, **Prof. Nikos Hadjichristidis** and **Prof. Sang Ouk Kim**, alongside 36 invited speakers who shared their cutting-edge research and insights.

Finally, we wish to express our sincere gratitude to the Middle East Technical University for hosting the congress, and to the organizing committee, volunteers, and all contributors for their invaluable efforts. It is through their dedication that this congress was made possible.

We hope that the knowledge and connections formed during the 9th Polymer Science and Technology Congress will continue to inspire innovation and collaboration within our field.

Sincerely,

The Organizing Committee
9th Polymer Science and Technology Congress (PolymerTR)

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PLENARY SPEAKERS

ID: 429

Well-defined Polymers Based on Polyglycolides. Enriching the Biodegradable Family with New Valuable Members

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Polylactides (PLAs) are the most widely utilized biodegradable polyesters; however, their high ceiling temperatures (>600 °C in bulk or 275 °C with tin catalysts) impede efficient recycling and reuse due to equilibrium between polymerization and depolymerization processes. In contrast, polyglycolide (PGA) exhibits superior crystallinity, gas barrier properties, and degradability compared to PLA, making it ideal for biomedical applications, bio-absorbable sutures, and single-use packaging. Despite these advantages, controlled polymerization of the glycolide monomer (GL) at room temperature has been elusive because PGAs are insoluble in common organic solvents, complicating solution polymerization and characterization. Traditional bulk ring-opening polymerization (ROP) of GL requires high temperatures (150 °C–230 °C) and results in polymers with high dispersity (Đ > 1.5) and limited compatibility with other monomers. Here, we present the first living/controlled anionic ROP of GL using strong protic fluoroalcohols (FAs), which are typically incompatible with anionic polymerization. This innovative approach enables the synthesis of well-defined PGA with dispersity (Đ) below 1.15 and molecular weights up to 55.4 kg/mol at room temperature. NMR titration and computational analyses demonstrate that FAs activate both the chain end and monomer without participating in the initiation process. Additionally, low-boiling FAs and PGAs can be efficiently recycled through distillation and sublimation at 220 °C under vacuum, offering a sustainable method to mitigate plastic pollution. Utilizing a novel fluoroalcohol-assisted catalyst switch strategy, we successfully synthesized the first pentacrystalline pentablock quintopolymer, polyethylene-b-poly(ethylene oxide)-b-poly(ε-caprolactone)-b-poly(L-lactide)-b-polyglycolide (PE-b-PEO-b-PCL-b-PLLA-b-PGA). Solid-state NMR spectroscopy, X-ray diffraction, and differential scanning calorimetry confirmed the presence of five distinct crystalline phases. This work advances the synthesis of well-defined multiblock PGA-based polymers, providing essential model systems for studying crystallization physics, phase separation, self-assembly, and enhancing material mechanical properties.

ID: 418

Directed Nanoscale Assembly of Block Copolymers & Low-dimensional Graphene Based Materials for Post-AI Era

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Molecular self-assembly is an intriguing nanofabrication principle widespread in natural living system. Delicate interplay among biomolecules, including DNA, RNA, and protein enables sophisticated nanostructure formation and relevant interesting functionalities in the living system, including human. We are highly motivated to learn from nature how to manipulate the molecular level ultrafine nanostructure formation for highly functional, practically meaningful artificial nanofabrication technologies. My research group have been working on the directed nanoscale assembly of block copolymers (BCPs) and various functional low-dimensional materials, such as carbon nanotubes (CNTs) and graphene over the past two decades.

BCP self-assembly can generate dense, periodic nanopatterns with sub-10-nm scale pattern precision, particularly interested in the semiconductor nanolithography application. I have contributed to this research field from the early days and established many interesting technologies, such as the birth of directed self-assembly (DSA) principle by nanoscale epitaxy (1,2), novel light induced DSA principles, and DSA for nonplanar geometry by exploiting mechanically compliant graphene substrates. Recently, we reported an interesting IoT security application of BCP self-assembly by applying the defective fingerprint like self-assembled nanopatterns to physically unclonable function (PUF) label (3,4).

Low-dimensional carbon materials, including CNTs and graphene, have attracted a great deal of attentions in the era of nanotechnology. Despite superior inborn characteristics of the nanoscale building blocks, their potential value for real-world application can be greatly boosted up by judicious nanoscale assembly (5). In this regard, our discovery of graphene oxide liquid crystal (GOLC) at 2009 triggered a big advance in the development of functional nanomaterials based on the solution processing of graphene based structures (6,7). Interestingly, GOLC allows us a valuable opportunity for the highly ordered molecular scale assembly, such as liquid crystalline 1D graphene fibers, highly ordered 2D graphene membrane/film, and 3D nanoporous graphene assembly. Recently, we succeeded in the development of human muscle like strong artificial muscle with the graphene based composite structures that enables versatile biomimetic movements by laser driven remote control (8).

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Keyword: *AI, Copolymers, graphene*

ORAL PRESENTATIONS

ID: 58

Sustainable Polybenzimidazole Synthesis in Deep Eutectic Solvents for Proton Exchange Membrane Applications

Not Presented

ID: 287

Biopolymer-Based Protection Films Against Dendrite Growth on Zinc Anodes in Zinc Ion Batteries

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Electrochemical energy storage, one of the cleanest and safest ways of converting and storing energy, is considered as an alternative to fossil fuels. Lithium-ion batteries domain the important part of the market being applied in portable electronic devices such as smartphones and laptops. However, drawbacks related to this kind of batteries in terms of safety problems and manufacturing costs make scientists think of other types of batteries. Aqueous zinc ion batteries have attracted scientists' attention as promising electrochemical energy storage devices that are safe, low-cost, and easy to deal with. The main challenge associated with these batteries is dendrite formation on the zinc anode surface during plating/stripping, which leads to short circuits and thus affects battery performance. One solution to tackle this problem and extend the life cycle of zinc ion batteries is to modify zinc anode surface by coating carbonaceous materials, which enable controlled charge flux and homogeneous zinc anode distribution. In this work, environmentally friendly biopolymers were applied as carbon sources to form a protective layer on zinc anode. By carbonizing the polymer layer using a nanosecond laser, a carbon material is left on zinc foil, which was directly applied as the anode in zinc ion batteries. According to the data obtained, the biopolymer-derived carbon-coated zinc anode demonstrates significant enhancement in terms of cycling performance and lower polarization voltage compared to the bare zinc foil. A symmetric cell with modified zinc anodes displays a long cycle lifespan of 1000 cycles, much better than a bare zinc anode. We will present a detailed analysis of the electrochemical properties of the fabricated batteries to underline their charge storage behavior.

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Keyword: *energy storage, polymer-derive carbon, batteries*

ID: 160

Inducing Neuronal Differentiation in Mesenchymal Stem Cells Using Plant-Oil-Based Hydrogels

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Understanding neurological pathology mechanisms is essential for developing effective therapies for neurological disorders[1]. However, research faces significant challenges due to the complex and inaccessible nature of the human brain, compounded by the absence of established neuronal cell lines and limitations in animal models' fidelity to human brain physiology[2]. Advances in stem cell technologies aim to address these challenges by refining disease models to mimic human conditions better. While various methods have been employed to differentiate mesenchymal stem cells into neurons, ensuring the functional maturity of these neurons within the model remains critical. In this study, we developed plant-oil-based hydrogels incorporating acrylate methyl ricinoleate (AMR) derived from castor oil[3], using different monomer/crosslinker ratios via the photopolymerization method. These hydrogels provide a biomimetic environment conducive to neuronal differentiation, thereby enhancing their efficacy in guiding stem cell differentiation toward functional neurons. We characterized the composition, morphology, and surface properties of AMR hydrogels using FTIR, SEM, swelling tests, and cytotoxicity assays. Neuronal differentiation and expression of neuronal markers will be evaluated using RT-PCR, Western blotting, and immunostaining techniques in the presence of AMR hydrogels. This comprehensive approach aims to provide valuable insights into the potential of AMR-hydrogels as a platform for enhancing neuronal differentiation, thereby contributing to the development of advanced therapeutic strategies for neurological disorders.

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Keyword: *hydrogel, neuron differentiation, acylated methyl ricinoleate*

ID: 25

Parafin Kapsüllenmiş Polimetil Metakrilat-Polietilen Glikol Kopolimerlerinin Sentezi ve Faz Değişim Özelliğinin İncelenmesi

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Enerji depolama sistemlerindeki temel zorlukları çözmek için yenilikçi malzemeler geliştirme konusundaki ilgi artmaktadır. Faz değişim malzemeleri (FDM'ler), enerji endüstrisinde önemli bir yere sahiptir çünkü faz değişim sürecinde önemli miktarda ısının absorbsiyonunu veya salınımını sağlayabilirler. Güneş ısısı depolama, ısı değiştiriciler ve bina yalıltım malzemeleri gibi termal yönetim sistemleri, FDM'lerin kullanımına dayanmaktadır. Ancak, bu malzemelerin pratik kullanımı için stabil bir ortamın oluşturulması gerekmektedir; burada FDM'lerin faz değişimini sızıntı olmadan gerçekleştirebilmesi ve uzun süre yüksek termal iletkenlik sergileyebilmesi önemlidir.

Bu çalışmada, Rubitherm® markasına ait RT-28 (bir tür parafin) kodlu FDM'nin mekanik dayanıklılığını artırmak ve uygulama sürecinde kullanımını iyileştirmek amacıyla metil metakrilat ve polietilen glikol esaslı polimerik kabuklar sentezlenmiştir. Sentezlenen içi RT-28 dolgulu kapsüllerin yüzeyi ikinci bir tabaka olarak silika veya karboksimetil selüloz ile kaplanmıştır. Çift katmanlı mikrokapsüllerin üretimi için daldırma ve sprey kaplama teknikleri uygulanmıştır. Kaplanmış mikrokapsüllerin termal depolama kapasitesi, Diferansiyel Taramalı Kalorimetri (DSC) kullanılarak değerlendirilmiştir. Değerlendirme sonrası 80°C sıcaklıkta 50 döngüye kadar dayandığı görülmüştür. Bu araştırma, FDM'lerin performansını ve pratik uygulanabilirliğini geliştirmek için yenilikçi kaplama yöntemlerini araştırarak enerji depolama teknolojilerini ilerletmeyi amaçlamaktadır.

Keyword: *faz değişim malzemeleri, ısıl iletkenlik, diferansiyel taramalı kalorimetri*

ID: 331

Light Controlled Discharging of Static Charges on Polymers

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Large electrostatic potential can develop on insulator polymer surfaces upon contact. These charges may remain on the surfaces for days to weeks. In many industries, such as electronics, air and space, plastic manufacturing, pharmaceuticals, and food, this retention causes material losses and fire hazards. Here, we show that embedding organic dyes, charge transfer complexes, and inorganic core-shell quantum dots into a common polymers can let the fast decay of charges under illumination. The mechanism involves the excitation of the additive materials by wavelength matching their absorption wavelength. The results show that the nature of the additive material affect the discharge rates. Contrary to the observations with organic dyes and charge-transfer complexes, the charges are stabilized upon illumination for some dot types. We surmise an electronic interaction with polymer mechanospecies and the dot's surface for the observed charge (de)stabilization. The charge manipulation by the presented additives and illumination does not alter the polymers' conductivity, which is advantageous for applications such as in electronic coatings.

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Keyword: *static charging, polymers, additives*

ID: 214

Application of Bio-Based Phenol-Formaldehyde Resins in Wood-Based Panels: Advances and Challenges

Ayda Göyçek Ünlü
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The increasing environmental concerns and depletion of fossil fuel resources have prompted the development of sustainable materials in various industries, including the wood-based panel sector. While considering that bio-based adhesives offer significant advantages in terms of reducing formaldehyde emissions and reliance on non-renewable materials, this study also discusses the applicability of this sustainable solutions from the industrial point of view.

One of the primary bio-based materials investigated for PF resin synthesis is lignin, a major component of lignocellulosic biomass. Lignin's structure makes it a promising substitute for petroleum-based phenol. Various methods have been developed to extract and modify lignin aiming to enhance lignin's reactivity and formaldehyde compatibility, resulting in resins with competitive mechanical properties. Studies have shown that lignin-based PF resins can achieve similar performance compared to traditional PF resins in terms of thermal stability and water resistance.

Another significant bio-based material is tannin, a polyphenolic compound extracted from tree-bark. Tannins are highly reactive and have been used in adhesive formulations. Tannin-based-adhesives exhibit excellent moisture resistance and mechanical strength, making them suitable for wood-based panels. However, challenges such as high viscosity and variability in reactivity need to be addressed to enhance industrial applicability.

Other bio-based phenolic substitutes include cardanol, derived from cashew-nut-shell-liquid; and bio-based substitutes for formaldehyde include 5-hydroxymethylfurfural (HMF), derived from carbohydrates. Cardanol-based resins have shown promise due to their flexibility and thermal properties. Research has demonstrated the feasibility of using HMF to produce bio-based PF resins with desirable properties for wood adhesives.

The integration of bio-based resins in the wood-based-panel industry faces several technical and economic challenges. These include the high cost of bio-based raw materials, variability in their chemical composition, and the need for process optimization to achieve consistent performance. Advances in bio-refinery technologies and the development of efficient extraction and modification techniques are crucial to overcoming these challenges. The environmental benefits of bio-based resins, such as lower carbon footprints and reduced indoor air pollution, provide strong incentives for their adoption. The findings suggest that with continued research and development, bio-based PF resins can become applicable but not as much a total alternative to traditional petrochemical adhesives.

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Recent Advances in the Production of Bio-Based Phenol Formaldehyde Resins; Turkcoat, Oct 26, 2022

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Keyword: *Bio-based resins, Phenol-formaldehyde, Wood-based panels*

Yeşil Dönüşümün Polimer Üretim ve Kullanımına Etkileri Ne Olur?
Yavuz Eroğlu

ID: 276

Aesthetic and Functional Life: Color Stabilization Strategies in ABS Polymers

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The objective of this study is to investigate the color change processes of Acrylonitrile Butadiene Styrene (ABS) polymers under both light and dark conditions after exposure to UV light. The yellowing observed in ABS polymers upon UV exposure is a common issue causing aesthetic and economic losses, particularly in the household appliance and furniture sectors. This project aims to explore the causes and solutions for the continued yellowing in the dark and the subsequent blueing observed under light conditions. These behaviors are closely related to the photo-oxidative degradation and chemical changes in the polymer.

Advanced material characterization and spectroscopic methods were employed to investigate the complex photo-oxidative and other potential degradation processes. Various UV absorbers, Hindered Amine Light Stabilizers (HALS), and antioxidants were used to study the yellowing and blueing mechanisms in emulsified ABS co-polymer edge bands. Edge band formulations included Rutile-type titanium dioxide pigments at concentrations of 2%, 4%, and 5%, and were produced in 1mm thickness using co-rotating twin-screw extrusion machines. All formulations contained 4500 ppm of bis(2,2,6,6-tetramethyl-4-piperidyl) sebacate HALS. The ABS used was the standard emulsified polymerization ABS from Formosa, commonly utilized in our operations.

Additionally, formulations included UV absorber Phenol, 2-(2H-benzotriazol-2-yl)-4-methyl, and antioxidants Octadecyl 3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate and 3,9-bis(2,4-di-tert-butylphenoxy)-2,4,8,10-tetraoxa-3,9-diphosphaspiro[5.5]undecane, ranging from 500-4500 ppm. Lightfastness tests were conducted on the produced edge bands according to ISO 4892 standards for 168 hours using a Xenon lamp device that accurately reflects the broad spectrum of sunlight. Results were evaluated on a grey scale from 1 to 5, and color changes after 168 hours were measured and recorded using a Konica Minolta spectrophotometer based on the CIELab color system. Parallel to the lightfastness tests, samples exposed to D65 and F11 light sources were monitored daily for the first week and then weekly for four weeks to assess the impact on color stability, following ISO 105 standards and recorded within the CIELab color coordinate system.

Keyword: *ABS, Antioxidant, UV Absorber*

ID: 396

Enhancing Properties and Diverse Applications of Starch Hydrogels

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Hydrogels, defined as cross-linked three-dimensional polymer networks that can absorb large amounts of water, are generally prepared through physical and/or chemical bonding between the polymer chains that form them. Starch, a natural polymer abundant in nature, has recently been intensively investigated for the development of hydrogels. However, starch-derived gels often have poor mechanical properties. Here, the synthesis of starch gels in different forms with improved properties prepared by various methods and cross-linkers and the potential of these gels to be used as sorbents for polycyclic aromatic hydrocarbons and therapeutic agent carriers in diseases such as pancreatic or duodenal cancer will be discussed.

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Keyword: *starch, hydrogels, polymer*

ID: 369

Hypericum Perforatum Nano-Mikropartiküller ve Bunların Biyomedikal Uygulamaları

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Sarı Kantaron (Hypericum perforatum L.) bitkisi Hypericaceae familyasına ait çok yıllık önemli bir türdür. Halk arasında kantaron, binbirdelik otu, kılıç otu, kuzukıran gibi birçok isimle bilinen bu bitki türünün Türkiye genelinde 96 türü bulunmakta olup, bu türlerin 46'sı endemik sınıftadır. H. perforatum'dan elde edilen ekstraktlardan yapılan bilimsel çalışmalarda; antidepresan, yara iyileşmesini hızlandırıcı, antioksidan ve antibakteriyal özellikleri detaylı bir şekilde gösterilmiştir [1-4].

Bu çalışmada Hypericum perforatum bitkisinin su ve alkol ekstraktları hazırlanmıştır. Elde edilen ekstraktlar ana giriş maddesi olarak doğrudan kullanılmış olup hidro(solvo)termal sentez prosesi ile nano-mikro polimerik partikülleri sentezlenmiştir. Ayrıca, hazırlanan yapılara farklı fonksiyonel grupların takılması, protonlama/quaternizasyon gibi kimyasal modifikasyonlar ile fonksiyonelleştirilerek yeni polimerik yapılar oluşturulmuştur. Hazırlanan nano-mikro partiküller ve modifiye formları, termal gravimetrik analiz (TGA), fourier dönüşümlü kızılötesi (FT-IR) spektroskopisi, zeta potansiyel (ZP), dinamik ışık saçılması (DLS) ve floresan mikroskop analizleri ile karakterize edilmiştir. Nano-mikro partiküllerin ve bunların modifiye formlarının, antioksidan aktiviteleri, biyouyumlulukları ve anti-kanser etkileri test edilmiştir. Ayrıca bu yapıların ilaç taşıyıcı sistem olarak salım profilinin incelenmesi ile biyomedikal alanda uygulama potansiyeli belirlenmiştir.

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Keyword: *Hypericum perforatum, Hidro(solvo)termal sentez, Nano(mikro) partikül*

ID: 183

A Novel Antibacterial Double-Layered Wound Dressing Material Loaded by Tigecycline via Electrospinning and Solvent Casting Methods

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Skin is the largest organ of the body, and the primary function of it is to protect organs, muscles, bones, etc. However, burns, accidental trauma, or chronic ulcerations can cause wounds or injuries on the skin. These wounds are susceptible to contamination and carry a risk of infection. Therefore, wound care is of great importance in terms of providing rapid and effective healing by minimizing the risk of infection [1]. In this context, antibacterial wound dressings are one of the important developments in this field. The aim of this study is to fabricate an antibacterial double-layered wound dressing by electrospinning and solvent-casting methods. Tigecycline is a type of minocycline with broad antimicrobial activity and the first glycylcycline antibiotic approved by the US Food and Drug Administration (FDA). This antibiotic shows in vitro activity against a wide range of Gram-positive and Gram-negative microorganisms [2]. Polycaprolactone (PCL), the first polymer to be used as a wound dressing, is a biodegradable, biocompatible, and hydrophobic synthetic polymer with high mechanical stability and weak cell adhesion [3]. On the other side, chitosan (CS) is a polysaccharide found in nature and has a biocompatible and biodegradable structure derived from chitin. It shows good cell adhesion and proliferation properties. Utilizing the advantages of these polymers, a double-layered PCL-Tigecycline/CS composite material was produced by electrospinning and solvent casting methods. The chemical and surface characterizations were performed. The results of antibacterial assays on S. aureus and E. coli bacteria showed that the fabricated wound dressing material had a significant antibacterial effect. In conclusion, this study can contribute to the field of wound dressing materials with biocompatible and biodegradable polymeric matrices.

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Keyword: *Wound dressing, polycaprolactone, chitosan*

ID: 413

Powder Polymers in Cementitious Systems: Innovative Applications and Strategic Importance

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Water-based acrylic polymers were first produced in the 1940s, and with the advancement of this technology, powder polymers began to develop, particularly from the 1980s onwards. Powder polymers remain an emerging field, offering continuous innovations. Thanks to our innovative approach in this area, Organik Kimya enjoys the distinction of being the pioneer and sole producer of powder polymers in Turkey. Our vision, focused on excellence and technology, reinforces our leadership and pioneering role in the industry.

Studies on the innovative applications and strategic importance of powder polymers in cementitious systems highlight the potential of these materials in structural engineering. When integrated into cementitious mixtures, powder polymers can significantly enhance the mechanical properties and durability of the material. In particular, they improve critical performance indicators such as water impermeability, impact resistance, and long term stability, thereby offering higher-performance and sustainable solutions for construction and infrastructure projects.

Keyword: *Powder Polymers, Cementitious Systems, Sustainable Solution*

ID: 199

Development of Functional Cellulose Microspheres with Affinity Towards Bacterial Cells and Liposomes Containing Negatively Charged Phospholipids

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Bacteremia, which is defined as the presence of viable bacterial cells in the bloodstream, is a serious condition that may lead to sepsis and death. In the US alone close to two million patients suffer from sepsis, a majority of these cases being of bacterial origin, and of these patients more than 16% die as a result this condition.[1] Almost a third of deaths occurring in hospital intensive care units are attributable to bacteremia.[2] There is no rapid clinical diagnosis for bacteremia: Blood must be cultured and the pathogens isolated from the culture and identified. Diagnosis alone may take 2-3 days and treatment up to 2 weeks. Many patients die within this time period. In order to allow for the rapid diagnosis and treatment of this disease we have developed functional cellulose microspheres with the ability to bind to biomembranes containing negatively charged phosphate amphiphiles, like those found bacterial cell membranes and walls.[3] In this study, three distinct derivatization strategies were developed to functionalize cellulose microspheres (CMs, 62 um diameter) with bis(dipicolylamine) (BDPA) ligands. Zn(II) complexes of BDPA ligands (Zn_2BDPA complexes) are known to bind to biomembranes containing negatively charged phosphate amphiphiles, including those of bacterial cells.[4] Experiments were conducted that demonstrated that these functional CMs were capable of selectively binding to liposomes containing negatively charged phospholipids. Furthermore, effective binding of multiple bacterial species to these materials was also demonstrated. The materials developed in this study have the potential to play a key role in novel strategies for the diagnosis and treatment of bacteremia.

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Keyword: *Cellulose, Microspheres, Bacteremia*

ID: 110

Electrospinning Parameter Optimization for Neat and POSS Filled PLA Nanofibers

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Electrospinning technique is the most practical method to produce polymer and polymer composite electrospun nanofibers. A wide range of applications can be facilitated by the unique qualities that polymer-based materials with a nanofiber structure may possess, including high surface area, high porosity, and better mechanical, chemical, and electrical capabilities. Polylactide (PLA), which has relatively higher mechanical, thermal and chemical properties than other biopolymers, also attracts attention in the tissue engineering and biomedical sector with its biodegradation and biocompatibility characteristics. In order to obtain novel nanocomposite structures, Polyhedral Oligomeric Silsesquioxane (POSS) particles include an inorganic silica cage with adjustable organic groups at the corners. Electrospinning equipment generally includes three parts such as a grounded collector to deposit fibers, a syringe to transfer the polymer solution to the needle and a high voltage power supply to charge the polymer solution. In this study, the optimum electrospinning parameters of neat PLA was determined by the Taguchi technique and these parameters were applied to the electrospinning of PLA/POSS nanofibers. Therefore, the most important four optimum process parameters for PLA nanofibers were obtained by only nine experiments instead of 81 experiments to decrease time, labor, and material consumption. The optimum parameters were obtained that 8% w/v of PLA solution concentration, 1.8 mL/h of feeding rate, 18 cm of needle to collector distance, 15 kV of applied voltage for the minimum PLA fiber diameter. Furthermore, it can be concluded that the optimum parameters for neat PLA nanofibers could be also applied to electrospinning of PLA/POSS nanofibers with 3 wt% KCl salt addition into the polymer solution.

Keyword: *biocomposites, electrospinning, nanomaterials*

ID: 129

In-Situ Self-Reinforcement of Amorphous PLA and Its Incorporation into PLA/PBAT Blends

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In-situ self-reinforced PLA based structures were prepared by introduction of crystallites of a semicrystalline polylactide (cPLA) in an amorphous PLA (aPLA) and its blends with poly (butylene adipate-co-terephthalate) (PBAT). To ensure self-reinforcing, cPLA as a minor phase was blended with aPLA and aPLA/PBAT at processing temperatures below the crystal melting peak of cPLA. Blending process was first applied via injection molding (IM) to produce self-reinforced PLA (SR-PLA) at various ratios of 100/0, 95/5, 90/10, 85/15, and 80/20 (wt/wt). Temperatures in the IM barrel and mold had significant effects on maintaining the cPLA crystallites, which improved the mechanical properties of SR-PLA. Then, PBAT was melt-blended with SR-PLA samples at different aPLA/cPLA weight ratios of 100/0, 90/10, 80/20, and 70/30 (wt/wt) to create SR-PLA/PBAT at a specified ratio of 85/15 (wt/wt). These mixtures were first produced in an internal melt mixer (MM) to assess their rheological characteristics. cPLA reinforcing efficiency was confirmed through the rheological analysis both in aPLA and aPLA/PBAT. In order to investigate the mechanical and thermal properties of the SR-PLA/PBAT blends, similar blends were also produced through IM method. The notable impact of cPLA ratios in blends resulted in remarkable increases in toughness and strain at break values. This resulted from the expanded crystallite network within the matrix, which further refined the PBAT droplets. Morphological observations of the blends processed using MM and IM revealed further refinement of PBAT droplets in the IM process. The cPLA crystallites could have been further stretched toward a fiber-like structure as a result of the generated shear during molding, which could also have increased matrix viscosity and refined PBAT droplets.

Keyword: *Polylactide, PLA/PBAT blend, induced crystallization*

ID: 200

Biodegradable Biocomposite Films Reinforced with Modified Microfibrillated Lignocellulose

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Microfibrillated cellulose (MFC) is the bio-based materials having high potential for nanocomposite, biomedical and pharmacological applications due to its high mechanical performance, low cost, biodegradability, biocompatibility, sustainability, recyclability, and non-toxicity [1]. It is isolated from wood or other lignocellulosic sources using mechanical treatments after delignification during which lignin is removed using harmful pulping and bleaching chemicals. However, lignin containing MFC (microfibrillated lignocellulose - MFLC) has high production yield and low environmental impact as its production technology does not need chemical pulping and bleaching processes [2]. Further, a high lignin and hemicellulose content of MFLC could improve its modification efficiency as the result of the amorphous structures of lignin and hemicellulose. Here, we successfully isolated high lignin content MFLC from chemi-thermomechanical pulp (CTMP) using homogenizer without delignification, and modified its surface using a transesterification method. The changes of morphological and chemical structures of MFLC after modification were determined using Scanning Electron Microscope (SEM) and X-Ray Photoelectron Spectroscopy (XPS), respectively. Moreover, we determined the thermo-mechanical properties of modified MFLC (M-MFLC) reinforced composite films in which biodegradable polylactic acid (PLA) was used as a polymer matrix. Results showed that the thermo-mechanical properties of PLA significantly improved with the addition of M-MFLC, since surface modification of MFLC increased both dispersibility of microfibrils into PLA matrix and interfacial adhesion between microfibrils and PLA. The investigation into the biodegradability of biocomposites under soil condition showed that the addition of MFLC and M-MFLC had no significant effect on the biodegradation properties of PLA matrix. This reveals that surface modification of MFLC improves the physical and mechanical properties of MFLC-PLA biocomposites without affecting the biodegradability of polymer matrix.

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Keyword: *Polylactic Acid, Biocomposites, Biodegradation*

ID: 389

Bio-based Molecularly Imprinted Polymer Nanoparticles for Protein Recognition

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Molecularly imprinted polymers (MIPs) are synthetic materials designed for the specific and selective recognition of target molecules.[1,2] Compared to biomacromolecules, MIPs are more accessible, cost-effective, and offer an alternative to antibodies due to their superior chemical and physical stability. MIP-based biomimetic systems are used in applications such as sensing, catalysis, and separation, thanks to their unique recognition properties. While current methods are reliable for imprinting small molecules, challenges remain in imprinting macromolecules like proteins, nucleic acids, cells, bacteria, and viruses.[3] The innovative approach of imprinting only a small fragment of a protein, such as an epitope, rather than the entire protein, has proven effective, offering reduced costs and compatibility with various synthetic conditions.

In this research, the functional monomer, acrylated methyl ricinoleate, derived from castor oil, was employed.[4] MIP nanoparticles were designed to recognize a cardiac peptide comprising 10 amino acid residues. Utilizing a castor oil-based monomer not only promotes an environmentally friendly process but also yields a biocompatible and non-immunogenic natural biomaterial. The synthesized MIP nanoparticles exhibited monodisperse properties, with an average particle size of 81 nm and a low polydispersity index (PDI=0.064). Characterization studies using scanning electron microscopy (SEM) and Fourier-transform infrared (FTIR) spectroscopy confirmed their structural integrity. Particle size distribution was further analyzed using a Zetasizer particle size analyzer. Furthermore, the impact of the molar ratio between the castor oil-based hydrophobic monomer and the hydrophilic monomer on the binding characteristics was investigated. The results demonstrated a significant increase in the imprinting factor of MIP nanoparticles with a higher molar ratio of the hydrophobic monomer.

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Keyword: *molecular imprinting, protein recognition, plant oil*

ID: 347

Harnessing the Multifunctionality of Bio-Decorated Polymers for the Point-of-Care Diagnostics

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Polymers have long captivated the scientific community with their remarkable properties, and bio-decorated polymers stand at the forefront of innovation in analytical sciences and diagnostics. These versatile materials, celebrated for their high conductivity, flexibility, biocompatibility, and ease of functionalization, offer a transformative platform for creating ideal surfaces in various biomedical applications. Their tunable characteristics make them exceptional matrices for the entrapment and immobilization of biomolecules. Our research has successfully pioneered the preparation of biofunctional polymers through the immobilization of enzymes[1], antibodies[2,3], and aptamers[4,5], paving the way for the next generation of biosensors and cell adhesive surfaces. We have utilized polymeric and co-polymeric structures, including polypeptide side chains with electroactive properties, to construct sophisticated electrochemical biosensors. These sensors, enhanced by biorecognition molecules such as aptamers and antibodies, have demonstrated unparalleled efficacy in small molecule analysis, glucose monitoring, and cell sensing.
Beyond biosensor development, biofunctional polymers hold immense potential in bio-imaging and imaging-guided drug delivery, thanks to their intrinsic optical and structural properties. This study elucidates innovative strategies for developing biofunctional surfaces, underscoring their transformative impact on diagnostic tools and biomedical applications.

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ID: 220

Development and Characterization of Alginate-Guar Gum Biopolymer Films

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Edible films and coatings for alginate-based food packaging applications are being researched, and many novel studies are being added to the literature every day to functionalize the materials[1]. Gum films attract great interest due to their sustainability, biodegradability, and biocompatibility[2,3]. Alginate and guar gum are important biopolymers used in food, pharmaceutical, and other industrial applications. The preparation of alginate-guar gum films and their development as a material that will provide advantageous properties as food packaging agents is a very current and important research topic. The aim of this study is to determine that biopolymer films developed using alginate and guar gum can be applied as environmentally friendly packaging agents. In this study, alginate and guar gum films had been prepared, and cross-linking studies were carried out in the presence of Ca^{2+} ions to improve the mechanical properties of films prepared from alginate-guar gum composition. The method is based on the release of Ca^{2+} ions from $CaCO_3$ in acidic media is employed first time for alginate-guar gum composites in this present study, and is quite harmless and based on the ionic cross-linking of film. Via this approach, it is aimed to develop packaging candidate materials that are durable in aqueous environments with an environmentally friendly method that does not release toxic chemicals into the environment. Following the preparation of the films, their physical properties were examined in detail. This project includes the stages of preparing the biomaterials in the film form by mixing the two biopolymers in different proportions. The physical properties such as water absorption capacity and water vapor permeability of the resulting films had been investigated for their usability in the field of food coating. The alginate-guar gum composite films obtained in this study were seen to be in the form of durable materials, and it was shown that the films could be candidates for food coating materials with more detailed experimental investigations in future studies.

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Keyword: *Food packaging, Calcium alginate, Gum*

ID: 316

Physically Cross-Linked Three Dimensional Gelatin/Poly Glyceryl Stearate-Based Nano Hydrogel Dressing to Promote Burn Wound Healing

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Burn wounds are one of the most serious problems faced worldwide. Annually, around 300,000 deaths are reported as a result of burns caused by chemicals, radiation, and fire. This has prompted researchers to focus on developing a wound dressing material that is susceptible to bacterial infections, is biocompatible and biodegradable, and possesses good antioxidant properties. In the present study, we aim to synthesize a physically cross-linked three-dimensional gelatin/polyglyceryl stearate/graphene oxide (GPGO) hydrogel loaded with the antioxidant drug β-carotene (0.5 mg/mL) to treat burn wounds. The hydrogels were characterized using TGA, FE-SEM, FT-IR, and rheology to confirm their successful formation. The in vitro release experiment demonstrated that the sustained release of β-carotene increased as the concentration of GO increased, which can be altered by changing physiological conditions. Among all the formulations, GPGO-3 β hydrogel showed excellent antioxidant potency (57.75%), compatibility with blood (< 5%), viability with fibroblast NIH 3T3 cells, promoted cell migration, and filled in wound gaps. Furthermore, the hydrogel exhibited potent antibacterial activity against S. aureus and E. coli bacteria. These findings demonstrated that GPGO-3 β hydrogel is a promising material to promote burn wound healing.

Keyword: *hydrogel, Wound Healing, anti-bacterial*

ID: 5

Thermoresponsive Poly(N,N'-dimethylacrylamide)-based Diblock Copolymer Worm Gels via RAFT Solution Polymerization: Synthesis, Characterization and Cell Biology Applications

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RAFT solution polymerization was used to polymerize 2-hydroxypropyl methacrylate (HPMA). The resulting PHPMA precursor was then chain-extended using N,N'-dimethylacrylamide (DMAC) to produce a series of thermoresponsive PHPMA-PDMAC diblock copolymers. Such amphiphilic copolymers can be directly dispersed in cold water and self-assembly to form spheres, worms or vesicles depending on their copolymer composition. Construction of a pseudo-phase diagram is required to identify the pure worm phase, which corresponds to a rather narrow range of PDMAC DPs. Such worms form soft, free-standing gels in aqueous solution at around ambient temperature. Rheology studies confirm the thermoresponsive nature of such worms, which undergo a reversible worm-to-sphere on cooling below ambient temperature. This morphological transition leads to in situ degelation and variable temperature ^{1}H NMR studies indicate a higher degree of (partial) hydration for the weakly hydrophobic PHPMA chains at lower temperatures. The trithiocarbonate end-group located at the end of each PDMAC chain can be removed by treatment with excess hydrazine. The resulting terminal secondary thiol group can form disulfide bonds via coupling, which produces PHPMA-PDMAC-PHPMA triblock copolymer chains. Alternatively, this reactive thiol group can be used for conjugation reactions. A $PHPMA_{141}$-$PDMAC_{36}$ worm gel was used to store human mesenchymal stem cells (MSCs) for up to three weeks at 37 ^oC. MSCs retrieved from this gel subsequently undergo proliferation and maintain their ability to differentiate into osteoblastic cells.

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Keyword: *Mesenchymal Stem-Cells, Aqueous Dispersion Polymerization, Polyelectrolyte-Stabilized Nanoparticles; Nano-Objects*

ID: 185

The Combination of two-Dimensional TiS_2 Nanosheet and Conjugated Polymer Nanoparticles for Catechol Sensing

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Electrochemical tyrosinase (TYR)-based catechol biosensor was constructed using novel conjugated polymer nanoparticles (BzPimBiT NPs) and their composite with 2-dimensional titanium disulfide nanosheets (2D-TiS_2). P-BzPimBiT NPs were combined with 2D-TiS_2 to improve the biosensing performance. In addition, interaction of P-BzPimBiT NPs with TiS_2 was explored at molecular level by employing vdW dispersion corrected DFT calculations and classical all-atom molecular dynamics simulations. As indicated by the hypothetical examinations, the presence of TiS_2 layer expands the interfacial communication with the formed polymer by means of electrostatic connections. Using cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), field-emission scanning electron microscopy (FE-SEM), and energy dispersive X-ray spectroscopy (EDS) analysis, the production of SPE/TiS_2@P-PimBzBt NPs/TYR nano biosensor were analyzed. The sensing layer made of TiS_2@P-PimBzBt NPs composites has the ability to target the catechol with a detection range of 3.0 to 27.5 M, a LOD of 0.33 M, and sensitivity values of 3.89 A $M^{-1}cm^{-2}$. Utilizing commonly interfering ions and compounds like citric acid, urea, glucose, uric acid, KCl, and NaCl, its selectivity was examined. Applying the nano-biosensor to actual samples (tap water and black tea) was done with high accuracy. According to the results, the biosensing platform composed of P-PimBzBt NPs and 2D-TiS_2 nanomaterial could be used to make a cheap, fast, and high-selectivity electrochemical biosensor to detect catechol in real samples.

Acknowledgement
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Keyword: *Conjugated polymer nanoparticles, titanium disulfide (TiS2), electrochemical biosensor*

ID: 333

Effect of Hydroxyl-Terminated Polybutadiene (HTPB) Characteristics on Mechanical and Ballistic Performance of Composite Solid Rocket Propellants

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Composite solid rocket propellants (CSRP) based on Hydroxyl-terminated polybutadiene (HTPB) polyurethane elastomers are widely used in launch vehicles and missiles. HTPB serves as the primary polymeric binder due to its excellent mechanical properties, facilitating the attachment of ammonium perchlorate (AP) oxidizer particles and aluminum (Al) metallic fuel.

Solid rocket motors endure various stresses throughout production, storage, transportation, ignition, and flight, including heat, impact, vibration, ignition pressure, and acceleration overload. Therefore, structural stability, tensile strength, and strain resilience are crucial to prevent issues such as grain fracture and deformation, which could severely impair performance or lead to catastrophic failure. The burning rate of the propellant under pressure is a critical ballistic property that determines performance and safety characteristics. The burning rate is typically evaluated over a specific pressure range using a power law.

In this study, HTPB synthesized via free-radical polymerization using a peroxide initiator with varying hydroxyl (OH) values (0.73, 0.52, 0.69, 0.87 mmol/g) was examined to understand its impact on polymer characteristics and subsequently on propellant mechanical properties and ballistic performance. The polyurethane and composite propellants are investigated separately.

In characterizing polyurethane, HTPB with the lowest OH value (0.52 mmol/g) and highest molecular weight decreased the glass transition temperature (Tg) and increased chain mobility, enhanced toughness in dynamic and tensile tests due to the decreased degree of cure. When incorporated into propellant formulations, this polymer significantly improved mechanical properties, yielding higher stress and strain values. Conversely, HTPB with the highest OH value (0.87 mmol/g), despite having moderate molecular weight, showed the highest polydispersity index and the lowest Mark-Houwink slope parameter. This resulted in a higher Tg and lower stress values for the polyurethane, along with reduced strain and toughness for composite propellant. Ballistically, the propellant using HTPB with the lowest OH value demonstrated increased burning rate and a higher pressure exponent (0.71) at elevated pressures. In contrast, the propellant with the highest OH value exhibited the lowest pressure exponent (0.37).

In conclusion, the molecular properties of the polymeric binder significantly impact both mechanical and ballistic characteristics. HTPB with the highest molecular weight and lowest OH value enhances mechanical properties while also increasing burning rate with a highest pressure exponent.

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Keyword: *Hydroxyl-terminated polybutadiene, composite solid rocket propellant, mechanical and ballistic performance*

ID: 314

Modifiye Edilmiş Polimerik Katyon Değiştrici Reçine ile Maden Liç Çözeltilerinden Ca^{2+} ve Mg^{2+} İyonlarının Uzaklaştırılması

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Cevher örneklerinde bulunan hedef metal iyonlarının çözelti ortamına alınması süreçlerinde optimum koşullarda liç işlemleri uygulansa da genellikle safsızlık oluşturan ve istenmeyen metal iyonları da liç çözeltisine geçmektedir[1]. Cevherden elde edilmek istenen nihai ürünün saflık derecesini etkilediği için veya yan ürün olarak ayrıca değerlendirilmek istendiği için safsızlık oluşturan bu metal iyonlarının liç çözeltilerinden uzaklaştırılması gerekir. Bu amaçla; flotasyon, çözgen ekstraksiyonu, kompleks oluşumu, adsorpsiyon gibi farklı pek çok yöntem kullanılmaktadır.

Kuvvetli asididk katyon değiştirici reçinelerin kullanıldığı iyon değiştirme yöntemi safsızlıkların çözelti ortamından uzaklaştırılmasında yaygın olarak kullanılan yöntemlerden bir tanesidir. Kuvvetli asidik katyon değiştirici reçineler; geniş adsorpsiyon kapasiteleri, hızlı adsorpsiyon mekanizmaları, mekanik dayanıklılıkları, kolay rejenerasyonları gibi avantajlarından dolayı birçok alanda yaygın olarak kullanılmaktadır[2].

Bu çalışmada; alüminyum cevher liçi çözeltisinden Ca^{2+} ve Mg^{2+} iyonlarının seçici olarak uzaklaştırılması için; Dowex 50WX4 polimerik reçine, EDTA ile modifiye edilerek kullanılmıştır. Batch teknik kullanılarak adsorpsiyon öncesi ve sonrası model çözeltilerdeki Ca^{2+} ve Mg^{2+} iyonlarının derişimleri alevli atomik absorpsiyon spektrofotometresi (FAAS) ile belirlenmiş ve bulunan derişimlerden adsorpsiyon oranı ve adsorpsiyon kapasitesi hesaplanmıştır. Her iki iyon için pH 4'te, 120 dk sonra 25 mg/L iyon varlığında % 95'in üzerinde adsorpsiyon verimi elde edilmiştir. Ayrıca iyon değiştirme mekanizmasının anlaşılması için modifikasyon öncesi, modifikasyon sonrası ve adsorpsiyon sonrası reçine FTIR ve SEM-EDX analizleri ile karakterize edilmiştir.

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Keyword: *EDTA modifiye reçine, Ca2+ ve Mg2+ uzaklaştırılması, Dowex50WX4, katyon değiştirici reçine*

ID: 158

Poliüretan Sektöründe Yeşil Dönüşümün Anahtarı; Biyopoliol İçerikli Sert Poliüretan Köpüklerin Hazırlanması, Uygulamaları ve Geleceği

Emre Baştürk
Kimteks Poliüretan Sanayi ve Ticaret A.Ş.

Biyopolioller; bitkisel yağlar, şekerler, nişasta ve diğer biyolojik kaynaklardan elde edilen polimerlerdir. Biyopolioller, geleneksel petrokimya temelli poliollerin yerine çevre dostu ve sürdürülebilir alternatifler olarak kullanılmaktadırlar. Çevre dostu ve sürdürülebilir malzemelere olan talep her geçen gün artarken, biyopolioller poliüretan köpük endüstrisinde polieter poliollerin yerine önemli bir alternatif haline gelmektedirler. Biyopoliollerin kullanımı, çevre üzerindeki olumsuz etkileri azaltma, fosil yakıtların tüketimini ve karbon ayak izini azaltma gibi çeşitli avantajlar sunmaktadır. Bu avantajlar, poliüretan köpük endüstrisinde biyopoliollerin kullanımını teşvik etmekte ve sektörde sürdürülebilirlik odaklı bir dönüşümü desteklemektedir.
Bu çalışmada; sert poliüretan köpük formülasyonları içinde polieter poliollerin yerine kullanılacak biyopoliol sentezi yapılmıştır. Bu amaçla biyopoliolun sentezinde bitkisel yağ kaynağı kullanılmıştır. Reaksiyon geleneksel polyester sentezi ile yapılmıştır. Biyopoliol tepkimeleri FT-IR ile takip edilmiştir. Sert poliüretan köpük formülasyonların da farklı yüzdelerde biyopolioller kullanılarak poliüretan sert köpükler hazırlanmıştır. Hazırlanan sert poliüretan köpüklere reaksiyon profili analizleri, yoğunluk ve basma mukavemeti testleri uygulanmıştır. Isıl özelliklerin belirlenmesi için sert poliüretan köpük ürünlere diferansiyel taramalı kalorimetri (DSC) ile Tg analizi yapılmıştır. Sert poliüretan köpüklerde yalıtım özelliklerini belirlemek amacı ile ısıl iletkenlik katsayısı ve kapalı hücre yüzdesi analizi yapılmıştır. Ayrıca sert poliüretan köpüklerde optik mikroskop ile gözenek dağılımı incelenmiştir.

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Tailoring Mechanical Properties of Rigid Polyurethane Foams by Sorbitol and Corn Derived Biopolyol Mixtures
Novel Rigid Polyisocyanurate Foams from Synthesized Biobased Polyester Polyol with Enhanced Properties
Biomass based polyols and biomass based polyurethane materials as a route towards sustainability.

Keyword: *biyopoliol, poliüretan sert köpük, yeşil dönüşüm*

ID: 431

Innovative Polymer Solutions and Additives: Akkim Kimya's Contributions to all Industrial applications

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Akkim Kimya Sanayi ve Tic. A.Ş.

Akkim Kimya is a leading innovator in the chemicals industry, renowned for its diverse range of polymer products and specialized additives. The company produces polyamidoamine epichlorohydrin (PAE) copolymers, which are instrumental in textile applications due to their superior adhesion and water resistance properties. In the construction sector, Akkim Kimya's polycarboxylate superplasticizers significantly enhance the workability and strength of concrete. The company also manufactures styrene butyl acetate copolymers, which are utilized in surface sizing applications to improve coating durability and performance. Furthermore, functional polydimethylsiloxane (PDMS) produced by Akkim Kimya finds widespread use across various applications, including as a processing aid and surface treatment agent. Beyond these polymers, Akkim Kimya specializes in synthesizing a wide range of monomers and oligomers, tailored to meet the needs of numerous industries. Their expertise in developing advanced additives further supports the functionality and performance of polymeric materials across diverse industrial applications.

ID: 147

Çok Bileşenli Polimerizasyon Yöntemiyle Çeşitli Aromatik Politiyoürelerin Sentezi, Karakterizasyonu ve Uygulamaları

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Süre geldiğimiz zaman zarfı içinde araştırmacıların dikkat çekici bulduğu bir konu olarak ortaya çıkan çok bileşenli polimerizasyon (ÇBP) yöntemi, sunduğu birçok avantaj ile öne çıkmaktadır. Bu yöntem, literatürde bulunan ve kendi eşleniklerine göre, katalizör kullanımı olmadan, ılımlı koşullar altında sentezlenebilen polimerler olarak bilim insanlarının işini kolaylaştırmaktadır. Özellikle araştırmacılara sağladığı, yüksek polimerizasyon verimi, yüksek atom ekonomisi ve sağladığı yüksek moleküler ağırlıklar sebebiyle de tercih edilmektedir. Ancak, bu yöntemde genellikle alifatik aminler kullanılmakta, aromatik aminler doğrudan kullanılmamaktadır. Bu durum, özellikle politiyoamid sentezlerinde aromatik diaminlerin önce aromatik diizosiyanitlere dönüştürülmesi gerekliliğiyle sentez maliyetini artırmaktadır. Ayrıca, aromatik diaminlerin doğrudan politiyoürelerin sentezinde kullanımıyla ilgili literatür oldukça sınırlıdır. Bu bilgiler ışığında, yürüttüğümüz projede ekonomik ve etkili bir yöntem olarak değerlendirilen ÇBP yöntemi kullanılarak, doğrudan elementel kükürt ve aromatik diamin kullanımıyla işlevsel ve işlenebilir politüyoürelerin eldesi amaçlanmıştır. Bu yöntemde daha önce kullanılan dialkin tepkimesine oranla daha reaktif olan diizosiyanitler kullanılmıştır. Ayrıca, ÇBP'de kullanılan elementel kükürt, ucuz, zehirsiz ve kolayca bulunabilen bir madde olup aromatik diaminlerle birlikte kullanıldığında pratik ve uygun maliyetli bir sentez yolu da sağlamıştır. Projenin bir diğer hedefi ise çevre dostu teknolojilerin geliştirilmesine katkıda bulunmaktır. Bu doğrultuda, hidrojen üretimi ve atık sulardaki organik maddelerin giderimi için nanokatalizörlerin ve ağır metal giderimi sağlayan malzemelerin hazırlanması önem taşımaktadır. ÇBP yöntemi ile sentezlenmiş farklı politiyoüreler, içerdikleri tiyoüre fonksiyonel grupları sayesinde civa gideriminde kullanılabileceği gibi, gümüş nanoparçacıklarının üretimi için destek malzemesi olarak da kullanılmıştır. Çalışma kapsamında öncelikle birbirinden farklı yollar ile politiyoüreler sentezlenmiş ve sentez yollarının aynı polimerleri elde ettirdiği yapılan Fourier Transform Infrared Spectroscopy (FTIR) ve Nuclear Magnetic Resonance (NMR) analizleri ile kanıtlanmıştır. Öte yandan sentezlenen polimerlerin civa giderim kapasiteleri denenmiştir. Bu analizlerin ardından ağır metal giderimi yapabildiği anlaşılan bir politiyoüre model polimer olarak seçilmiş ve gümüş nanoparçacıklar için destek malzemesi olarak kullanılmıştır. Yapılan TEM analizi ile de gümüş nanopartiküllerin destek malzeme üzerinde varlığı kanıtlanmıştır.

Keyword: *polimer, politiyoüreler, çok bileşenli polimerizasyon yöntemi*

ID: 171

Yeni Bir Tiyokzanton Bazlı Poli(ε-kaprolakton) Türevi Makrofotobaşlatıcının Sentezi ve Karakterizasyonu

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UV ışığı absorplayarak polimerizasyon reaksiyonunu başlatan ve serbest radikalleri oluşturan fotobaşlatıcılar, UV ile kürleşen formülasyonların anahtar bileşikleridir. Serbest radikal oluşturma mekanizmasına göre fotobaşlatıcılar I. tip ve II. tip olmak üzere iki sınıfa ayrılabilir [1].
Fotobaşlatıcıların bazı fotoürünleri, fotobaşlatmanın verimliliğini ve kürlenmiş ürünün performansını azaltan çeşitli fiziksel ve kimyasal özellikler sergileyebilir. Hem I. tip hem de II. tip fotobaşlatıcıların fotoürünleri, radikallerin kararsızlığı nedeniyle, yeniden düzenlenme, birleşme, oksidasyon ve ayrışmaya uğrayabilir. Bu yan ürünlerden bazıları renkli veya kokulu olabilir ve yüzeye göç etme eğilimi gösterebilir. Fotobaşlatıcı parçalarının göçü, özellikle gıda ambalajı ve medikal uygulamalar için kullanılan malzemelerde istenmeyen bir durumdur; kaplamalarda koku ve sararmaya neden olabilir. Diğer bir risk, UV kürleme işleminde reaksiyona girmeyen fotobaşlatıcı kalıntılarıdır [2]. Ayrıca fotobaşlatıcı/amin ikili sistemlerinde tersiyer amin göçü, aminin hem toksik hem de mutajenik olması nedeniyle sağlık açısından tehlikelidir [3].
Makrofotobaşlatıcılar, ışık absorpsiyonu ile bir polimerin ana zincirinde ya da zincir uçlarında polimerizasyon tepkimelerini başlatabilme yeteneğine sahip fotoaktif grup taşıyan moleküllerdir. Genel olarak polimerin varlığı formülasyon uyumluluğunu geliştirir ve film yüzeyine göçü azaltır. Böylece az kokulu ve toksik olmayan kaplamaların üretilmesine katkıda bulunur [4, 5].
Bu çalışmada, bir ditiyokzanton disülfit türevi olan [OH-TX-S-]$_2$ varlığında **ε**-kaprolaktonun halka açılma polimerizasyonu ile disülfit bağına sahip fotoaktif poli(**ε**-kaprolakton) (PCL-[TX-S-]$_2$-PCL) polimerinin sentezi gerçekleştirilmiş, karakterize edilmiş ve makrofotobaşlatıcı olarak kullanımı incelenmiştir. Metil metakrilatın fotokimyasal serbest radikal polimerizasyonunda, UV ışığa maruz bırakıldığında homolitik bölünmeye uğrayan PCL-[TX-S-]$_2$-PCL makrofotobaşlatıcı olarak kullanılmış ve elde edilen polimerin karakterizasyonu spektrofotometrik ve kromatografik olarak yapılmıştır.
Bu çalışma, Yıldız Teknik Üniversitesi Bilimsel Araştırma Projeleri Koordinasyon Birimi tarafından FDK-2022-4876 no'lu proje kapsamında desteklenmektedir. Elif Özçelik Kazancıoğlu, TÜBİTAK BİDEB 2211/C Yurtiçi Öncelikli Alanlar Doktora Burs Programı tarafından desteklenmektedir.

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Keyword: *fotoaktif, makrofotobaşlatıcı, tiyokzanton*

ID: 437

Macromolecular Design Strategies with Poly(2-oxazoline)s

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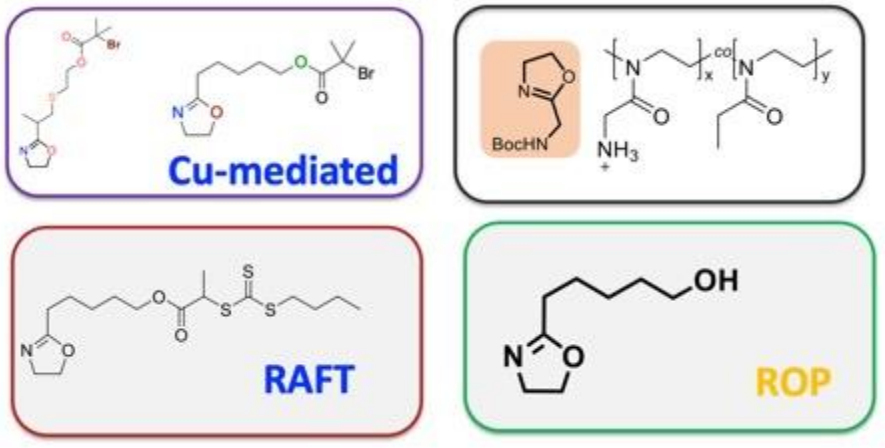
Poly(2-oxazoline)s are promising class of polymers that allows several design possibilities. Functional 2-oxazoline monomers with initiator or chain transfer agents allow creating macroinitiators for brush copolymers. In this talk, we will highlight various combinations of 2-oxazolines that are polymerized by cationic ring opening polymerization and acrylates/acrylamides that are polymerized by controlled radical polymerization techniques.



Development of Anti-Wear Biopolymeric Materials That Can Be Used in Fuel Filters and Investigation of Their Effects

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Due to the developing automobile industry, intensive research and development is carried out on engines and their components. When we look at the damages experienced in automotive engines, injection pump failures are usually the leading cause. The reason for this is the sulfur content in fuels. Reducing the sulfur content in fuels is accomplished by chemical processes such as hydrotreating. However, this has not been effective as it also removes some of the highly lubricating hydrocarbons. The loss of lubricating material has been addressed by the addition of lubricant additives. Nowadays, with the increase in fuel diversity, fuels with suitable lubricant properties are being investigated. There is an increase in targets for the use of renewable energy sources and a corresponding diversification of fuels and components available or expected in the market [1]. In order to avoid any blockage in fuel systems and engine damage, the fuel must be filtered very well. Poor filtration leads to problems such as reduced engine performance, increased fuel consumption, malfunctions in engine operation and shortened engine life. Fuel filters clean the fuel from solid particles, which are very dangerous for fuel systems and engines [2].

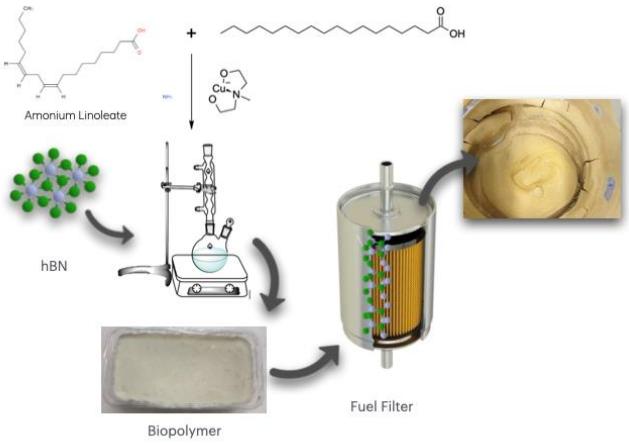

Figure. Synthesis and application of biopolymer

In this study, engines using jet fuels and the spin-on fuel filter used to filter these fuels are discussed. It is aimed to develop a polymeric lubricating agent to add lubricity to the fuel during the filtration process and to investigate its effects. For this purpose, biopolymers with a wider range of applicability, improved additive performances and thermophysical and thermomechanical properties have been produced by copolymerization of free fatty acid esters of ammonium linoleate. An important additive here is hexagonal boron nitride. This lubricity-enhancing additive will protect the components of fuel filtration systems against excessive wear. It will gradually increase fuel lubrication over the lifetime of the filter used, eliminating free and emulsified water.

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Keyword: *Fuel Filter, Automotive Industry, Biopolymer*

ID: 346

Advanced SEC Analysis of Complex Polymer Architectures with Triple Detection

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The growing potential of polymers in conventional applications as well as pharmaceutical applications leads to the importance of characterising them thoroughly. The complexity and diversity in the formation of various structures in polymers is a great challenge and leads to the fact that the structure-property relation is one of the key areas that the polymer researchers are currently looking into in detail. SEC-MALS, being a powerful tool for polymer characterization, can provide molecular and structural information and is therefore used to characterize linear and branched polymers as well as polymeric nanoparticles, single chain nanoparticles, star-shaped or helical structured polymers etc.

Keyword: *SEC/GPC-MALS, Polymer Architecture, Triple Detection*

ID: 118

Reactivity of Anhydride- and Epoxy-Based Chain Extender Mixtures with PET/PBT Blends: Rheological, Thermal, and Foaming Behaviors

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Chain extenders offer an easy-to-implement and cost-effective solutions for recovering the polyester recyclates which suffer from reduced properties as a result of recycling processes. Addition of chain extenders can recover these reduced properties to a degree but after a few more recycling attempts, properties of the recycled material would be dramatically altered which reduces its long-term sustainability. However, addition of chain extender mixtures with different functional groups can reach a higher efficiency by also reacting with each other during melt processing and lower the total amount of chain extender required to obtain similar results. In this study, recycled PET (rPET), polybutylene terephthalate (PBT) and their blends were melt mixed with two different chain extenders, Joncryl ADR 4468 (epoxy-based) and PMDA (Pyromellitic anhydride, anhydride-based). Chain extenders mixtures of Joncryl/PMDA with total of 1.0wt% (1.0/0, 0.75/0.25, 0.5/0.5, 0.25/0.75, 0/1.0) and 0.5wt% (0.5/0, 0.25/0.25, 0/0.5) additions were added during melt processing. Melt properties were examined using small amplitude oscillatory shear (SAOS) rheological analysis to reveal the effect of chain extender addition in all samples. Furthermore, extensional viscosity and foaming behavior were also examined through sentmanat extensional rheology (SER) and batch-based autoclave foaming, respectively. Moreover, thermal properties were analyzed through differential scanning calorimetry (DSC). It was revealed through SAOS with processed samples that peak reactivity of Joncryl and PMDA differ which is around 5 minutes for PMDA and 10 minutes for Joncryl. SER analysis showed that melt strength of all modified samples increased with 1.0wt% modified samples also showing strain hardening. 1.0wt% modified samples also had the most homogenous foam morphologies while most unmodified samples failed to achieve cellular foams. DSC analysis showed that 1.0wt% modified samples had their melting temperatures and crystallinity reduced the most.

Keyword: *Chain Modification, Polyethylene Terephthalate, Polymer Blend*

ID: 65

PA6/TPE Harmanlarının Tekrarlı Ekstrüzyon Sonrası Reolojik, Morfolojik ve Mekanik Özelliklerinin İncelenmesi: Multepposs Nanotaneciğinin Etkisi

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Poliamit 6 (PA6), çeşitli endüstriyel uygulamalarda olağanüstü mukavemet ve sertliğe sahip önemli bir mühendislik termoplastiği olarak öne çıkmaktadır. Bununla birlikte, çentik hassasiyetine sahip olması potansiyel kullanım alanlarını kısıtlamaktadır. PA6'nın tokluğunu arttırmak için oldukça etkili bir strateji, termoplastik elastomer (TPE)'ler ile karışımlarının oluşturulmasıdır. Bununla birlikte, PA6'nın termoplastik elastomerlerle harmanları, kararsız faz morfolojisi oluşturmaları nedeniyle genellikle zayıf mekanik ve morfolojik özellikler sergilemektedir ve bu özelliklerin iyileştirilmesi için uyumlaştırıcıların kullanılması gerekmektedir. Reaktif uyumlaştırma yöntemi polimer karışımlarında istenilen özelliklerin sağlanabilmesine katkı koymakla birlikte polimerik malzemelerin döngüsel kullanımı için de kritik bir öneme sahip olma potansiyeli taşımaktadır. Bu çalışma kapsamında bu noktadan hareketle, yeni nesil bir nanotakviye ajanı olan polihedral oligomerik silseskuiokzan (POSS) nanopartikülleri PA6/TPE karışımları için bir uyumlaştırıcı olarak kullanılmıştır. POSS türü olarak çoklu reaktif epoksi fonksiyonel gruplarına sahip MultEpPOSS nanotanecikleri kullanılmıştır. Ayrıca, bu çalışmanın en önemli motivasyonu tekrarlı ekstrüzyon prosesine maruz bırakılan PA6/TPE harmanlarında özellikle düşen mekanik özelliklerin MultEpPOSS nanotanecikleri varlığında iyileştirilmesinin amaçlanmasıdır. POSS içeren ve içermeyen PA6/TPE harmanları eriyik harmanlama yöntemiyle Xplore model laboratuvar ölçekli mikro-harmanlayıcıda hazırlanmıştır. Ardından bu karışımlar, granülatör ile granül haline getirilmiş ve bu işlem dört kez peş peşe tekrarlanmıştır. Her bir tekrarlı işleme sonrasında karışımlar Xplore marka bir laboratuvar ölçekli mikro-enjeksiyon kalıplama cihazıyla kalıplanmış ve standart test örnekleri üretilmiştir. Her bir ekstrüzyon basamağından sonra örneklerin kimyasal yapıları, mekanik, reolojik ve morfolojik özellikleri incelenmiştir. Elde edilen bulgular, MultEpPOSS varlığında tekrarlı prosese maruz bırakılan örneklerin performans özelliklerinin kayda değer derecede iyileştirildiğini göstermiştir.

Teşekkür: Bu çalışma Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından 120M718 numaralı proje ile desteklenmektedir.

Keyword: *PA6, POSS, Tekrarlı Ekstrüzyon*

ID: 117

Effectiveness of Different Chain Modifiers in Upgrading the Thermoplastic Polyurethane Waste Materials

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Exploring the melt rheological behavior of thermoplastic polyurethane (TPU) materials with high hard-segment crystal melting peak is quite challenging due to the possible recrystallization at certain temperatures and degradation and polycondensation beyond certain temperatures. When producing TPU, producers often have excess TPU waste that contains different grades including ester and ether-based types. To repurpose this TPU waste as valuable resources, the rheological properties need to be improved through modifying the molecular structure with appropriate chain extenders. Adding chain extenders like Joncryl ADR 4468 affected the melt rheological properties of ester-based TPU, but had minimum impact on ether-based TPU. In this study, Joncryl ADR 4468, pyromellitic dianhydride (PMDA), polymeric-methylene diphenyl diisocyanate (PMDI), and hexamethylene diisocyanate (HDI) were melt mixed using an internal melt mixer with waste TPU materials which majorly contain ester-based TPUs with certain contents of ether-based grades. The rheological, thermal and mechanical properties of modified TPU wastes were analyzed to examined the efficiency of each chain modification on upgrading the TPU wastes. Mechanical properties were examined with tensile and Shore A & D hardness tests. By adding different chain extenders to the structure, mechanical properties such as tensile strength, modulus and ductility improve at different rates. According to the differential scanning calorimetry (DSC) results crystallization rate, amount and type have been suppressed differently depending on type of chain modifier.

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Keyword: *Thermoplastic polyurethane, chain modification, waste material*

ID: 102

Mechanical, Thermal and Melt Properties of Polypropylene-g-Maleic Anhydride Compatibilized Polypropylene/Recycled Polyamide 6 Blends

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The environmental hazards posed by plastic wastes, including pollution and resource depletion, necessitate innovative recycling solutions. This research explores the property enhancements of polypropylene (PP)/recycled polyamide6 (rPA6) blends at various weight ratios (i.e., 95/5, 90/10, 85/15, 80/20, 75/25) through compatibilization using polypropylene-grafted-maleic anhydride (PP-g-MA) at various contents ranging from 2.5 to 10 wt%. Fourier transform infrared spectroscopy analysis confirmed the formation of chemical bonds between PP-g-MA and rPA6. Accordingly adding PP-g-MA significantly improved interfacial bonding between PP and rPA6, which enhanced tensile and impact strengths of the blends. Differential scanning calorimetry analysis revealed improved crystallinity in compatibilized blends which could also contribute to the improvements in tensile and impact strengths. Heat deflection temperature tests showed that compatibilized blends exhibited higher thermal resistance, making them more suitable for engineering applications. The melt flow index results demonstrated that the melt properties of the blends improved with PP-g-MA compatibilization resulting in improved processability. Capillary rheometer analysis confirmed the viscosity enhacements through compatibilization using PP-g-MA. The findings demonstrated that the use of compatibilizer at a given rPA6/PP-g-MA weight ratio of 3/1 more effectively caused improvements in mechanical, thermal and melt properties of PP/rPA6 blends. This approach offers a promising avenue for the economic utilization of plastic wastes in engineering applications.

Keyword: *recycled polyamide 6, polypropylene, compatibilizer*

ID: 355

Esnek Poliüretan Köpük Atıklarından Poliol Eldesi

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Safaş Saf Plastik A.Ş

Poliüretan köpükler dünyada en çok kullanılan polimerlerden biri olup 2021 yılı küresel poliüretan köpük pazar büyüklüğü 79 milyar ABD dolarıdır. Pazar araştırmalarına bakıldığında köpük pazarının %53'ünü esnek poliüretan köpük oluşturmaktadır. Esnek poliüretan köpük atıkları yakma, gömülme ve depolama gibi yöntemler kullanılarak bertaraf edilmektedir. Fakat bu yöntemler çevreye zarar vermektedir. Esnek poliüretan köpük atıklarının çevreye zararlarını önlemek amacıyla da geri dönüşüm yöntemleri uygulanmaktadır. Günümüzde kimyasal, mekanik ve termokimyasal olmak üzere üç farklı geri dönüşüm yöntemleri kullanılmaktadır. Mekanik geri dönüşüm yönteminde atık köpükler bir bağlayıcı kullanılarak ve basınç ile sıkıştırılarak yeni ürünler elde edilmektedir. Fakat bu ürünlerin talebi çıkan atık düşünüldüğünde çok azdır ve çıkan tüm atıkların geri dönüşümü için yeterli değildir. Termokimyasal geri dönüşüm yöntemleri ise endüstriyel olarak tercih edilmemektedir. Kimyasal geri dönüşüm yöntemlerinde ise esnek poliüretan köpük atıkları uygun reaksiyon koşulları ile poliüretan köpüğün ana hammaddelerine dönüştürülmektedir. Kimyasal geri dönüşüm yöntemi ile, ürün hammaddesine geri dönüşüm sağlandığı için, bu yöntemler endüstriyel olarak ilgi çekici hale gelmiştir. Asidoliz, glikoliz ve aminoliz en çok kullanılan kimyasal geri dönüşüm yöntemleri arasındadır. Glikoliz, esnek poliüretan köpük atıklarının yüksek sıcaklıklarda çeşitli diol bileşikleri ile reaksiyonudur. Aminoliz ise poliüretanların, mono ve dialkanolaminler ile parçalanması reaksiyonudur. Asidoliz, çeşitli inorganik ve organik asit türleri kullanılarak esnek poliüretan köpükten poliol elde edilmesini sağlayan reaksiyondur. Aminoliz ve glikoliz yöntemleri kullanıldığında tek faz ürün üretmek çok zor olduğundan, reaksiyon sonrasında saflaştırma işlemleri gerçekleştirilmektedir. Saflaştırma işlemi yüksek verim ile gerçekleşmemesinin yanında ekonomik de değildir. Bu nedenle, bu çalışmada kimyasal geri dönüşüm yöntemlerinden asidoliz kullanılarak esnek poliüretan köpük atıklarından poliol elde edilmiştir. Formülasyonda asit olarak ftalik anhidrit, %40 oranında esnek poliüretan köpük atığı ve reaksiyon sırasında viskozitenin artmasını engellemek amacı ile de çözücü olarak polieter poliol kullanılmıştır. Asidoliz için kullanılan asidin reaksiyonu sonrasında oluşan üründeki -COOH bağları ile reaksiyona girmesi için palm yağı kullanılmıştır. Asidin ve yağın etkinliğini sağlamak ve reaksiyonu başlatmak amacı ile hidrojen peroksit kullanılmıştır. Çalışmalar sonunda elde edilen geri dönüşüm poliol 60-65 mgKOH/g OH değerine, 2300 cP viskoziteye ve %40 biyo içeriğe sahiptir. Esnek poliüretan köpük atıklarından elde edilen %40 biyo içeriğe sahip geri dönüşüm poliol kullanılarak esnek poliüretan köpük üretimi yapılmıştır.

Keyword: *kimyasal geri dönüşüm, esnek poliüretan köpük atıkları, asidoliz*

ID: 204

Chemical Recycling of Waste Plastics into Refinery and Petrochemical Feedstock

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Three hundred eighty million tonnes of plastic are produced worldwide each year. The plastic industry is constantly growing with an anticipated rate of plastic production quadrupled by 2050. Most of the plastics that reach the end of their useful lifetimes are discarded and accumulate uncontrollably in the environment, causing plastic pollution, or are burned inefficiently in power plants for electricity generation, causing the release of CO_2, a greenhouse gas. Current recycling methods favor the linear economy by failing to recover the chemical and energy values of plastics and causing the loss of value of fossil fuels used in plastic production. Chemical recycling is a technology developed to transform plastic waste that cannot be recycled sustainably through mechanical processes into valuable molecules. Since the final products obtained from this process can be used as feedstock alternatives in the production of virgin polymers such as polyethylene and polypropylene, it is considered a promising technology that can achieve a circular economy in plastic production. SOCAR R&D and Innovation Inc. in collaboration with METU aims to develop catalysts and processes for the production of suitable raw materials for the petrochemical industry with high efficiency by using chemical methods from plastic waste. With the developed catalyst and process, it will be possible to convert waste polyolefins into high-value-added products under milder conditions. The naphtha-like product obtained by chemical recycling methods can be used as raw material in the petrochemical industry. In refineries, it can be used as feedstock in various units if it provides the targeted charging properties. This study will evaluate liquid products obtained by chemical recycling methods for producing olefins/aromatics and use in refineries.
Within the scope of our studies up to now, in addition to testing commercial catalysts, inorganic metal oxide supported heterogenous catalysts have been synthesized. By testing different temperature and pressure profiles in the batch reactor and using GC-based characterization methods, a naphtha-like liquid with a paraffin ratio of 95-96% and an olefin ratio of 0.2-0.5%, which can be used as a feedstock in olefin production, has been successfully obtained.

Keyword: *chemical recycling, petrochemical feedstock, waste plastics*

ID: 71

Organohydrogels: A New Class of Smart Gels Mimicking Biological Systems

Not Presented

ID: 178

Effect of Benzoylation Treatment on the Interface and Mechanical Properties of Hemp/Epoxy Biocomposites

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In recent years, interest in renewable and sustainable natural fiber composites has increased in the composite industry due to economic and environmental concerns. Beside their advantages such as low density, high mechanical properties and biodegradability, natural fiber composites have certain shortcomings such as high water uptake and incompatibility between hydrophilic natural fibers and hydrophobic polymer resins. Within the scope of this study, hemp fiber reinforced epoxy biocomposites were produced and their properties were characterized for possible application in the automotive industry. In order to solve the problem of water uptake and fiber/matrix interface incompatibility, hemp fibers were modified using benzoylation treatment [1-4]. In order to determine the effect of benzoylation treatment on composite performance, the mechanical properties of the produced composites were determined by means of tensile and three point-bending tests. The effects of the treatment on the fiber/matrix interface and fracture behavior were analyzed via SEM study. The results indicated that benzoylation can be used as an effective method for improving fiber-matrix interface of hemp fiber/epoxy biocomposites.

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Keyword: *Hemp fiber, Biocomposites, Benzoylation*

ID: 190

Synthesis of New Conjugated Polymer Nanoparticles for Melanoma Treatment and Investigation of Their Potential for Use in Prospective Diagnosis

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Melanoma is one of the most dangerous and common types of cancer in humans. Inhibition of melanin biosynthesis can help eliminate these dermatological disorders. For this, inhibition of tyrosinase (TYR), inhibition of melanocyte metabolism and proliferation, or melanin removal, is required. Excessive production and accumulation of melanin pigment causes conditions such as hyperpigmentation, postinflammatory pigmentation, melasma, and skin aging. Therefore, TYR inhibitor compounds that can reduce or inhibit melanin formation are of great interest in the medical, cosmetic, and food industries. Tranexamic acid (TXA) is widely used to reduce melanin synthesis, and it is also gaining importance as an important raw material for functional melanin-inhibiting cosmetics.

Herein, the conjugated polymer carrying thiophene and fluorene units in its main chain was synthesized and characterized, and then nanoparticles of this polymer was prepared. In addition, the potential use of the TYR inhibitor nanoparticle model developed by functionalizing with TXA as a TYR inhibitor in the treatment of melanoma for therapeutic purposes was examined. Moreover, the inhibitory effect of TXA, which is thought to have direct or indirect effects on melanoma, on TYR activity was examined electrochemically. The effectiveness of the designed new system on skin cancer was evaluated with in vitro experiments to be performed with B16-F10 cells. The effectiveness and possible mechanism of action of the developed system was also investigated through studies such as viability tests, determination of the inhibition efficiency of tyrosinase activity, and examination of the changes in the gene expression of metabolic systems controlled by tyrosinase in cancer development. In conclusion, the presented work could lead to the development of new systems in terms of demonstrating the success of melanoma treatment by examining the potential of conjugated polymers to be used in the production of therapeutic platforms without the need for an extra imaging agent.

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Keyword: *Conjugated polymer nanoparticles, melanoma, tranexamic acid*

ID: 11

Phthalocyanines Into or Onto Polymers: Materials for PDT

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To improve the biocompatibility and tumour delivery of photosensitisers in biomedical photodynamic applications, polymeric formulations, encapsulations or conjugations strategies have been implemented. In the framework of our research devoted to improving the therapeutic efficiency of phthalocyanines for PDT [1], several strategies have been developed, such as the encapsulation into micelles formed Pluronic® block copolymers [2], or formulation into polyvinylpyrrolidone [3-4]. Phthalocyanines have also been covalently grafted onto poly-L-glutamic acid [5] or used as initiator of E-caprolactore to form biocompatible nanoparticles [6].
The respective advantages and drawbacks of each strategy will be discussed.

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Keyword: *Phthalocyanines, Photodynamic therapy, Formulation*

ID: 306

Jelatin Bazlı Hibrid Cerrahi Sızdırmazlık Malzemelerinin Sentezi, Karakterizasyonu ve Biyomedikal Uygulamaları

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Yaralı dokuları kapatma esnasında oluşan bu sorunları çözmek amacıyla çeşitli cerrahi malzemeler kullanılmıştır. Bu amaçla birkaç cerrahi sızdırmazlık malzemesi kullanılmasına rağmen, bu malzemelerin genellikle düşük mekanik özellik, toksisite, ve zayıf yapışma mukavemeti gibi uygulamayı sınırlayan bazı dezavantajlara sahiptir; bu nedenle bu biyomalzemelerin hiçbiri dikişlerin ve zımbaların yerini alabilmesi için gerekli tüm ihtiyaçları karşılamamaktadır. İdeal bir cerrahi sızdırmazlık malzemesinin, cerrahi işlem sonrası kanamayı durdurabilecek hemostatik özellik göstermesi, herhangi bir mikrobial etkileşime karşı antibikrobial olması, doğal dokuların dinamik hareketine uyum sağlayabilmesi, mükemmel biyouyumluluk ve kontrollü biyobozunurluğa sahip olması ve özellikle vücut sıvılarının varlığında yüksek yapışma mukavemeti ve yapışma basıncı sağlayabilmesi için esnek olması gerekmektedir. Biyouyumlu olduğundan dolayı doğal polimer jelatin cerrahi sızdırmazlık malzemesi çalışmalarında özellikle tercih edilirken, cerrahi işlem sonrası uygulama kolaylığı sağlamak amacıyla toksik olmaya görünür ışıkla jelleşebilen jelatinler en popüler malzemelerdir. Bu çalışamamızda ilk defa farklı moleküller yardımıyla sentezlenmiş jelatin methakrilatın (GelMA) makromolekülünün görünür ışık yardımıyla jelleştirilerek özellikle vücut için cerrahi uygulamalarda sızdırmazlık malzemesi olarak kullanılabilirliğini karşılaştırdık. Optimize malzemenin ağ yapısına doğrudan bağlanarak, sulu ortamda ki yapışma özelliğini geliştirmek amacıyla midyelerden esinlenerek ilk defa sentezlediğimiz, katekol ve methakrile fonksiyonel aljinat (AlgMAC) makromoleküllerini ekleyerek yüksek yapışma mukavemetine sahip yeni ve oldukça esnek sızdırmazlık malzeme formülasyonları tasarladık. Fiziksel ve yapışma özellikleri karakterize edilen bu formülasyonların hücre ile olan etkileşimleri incelenerek ex vivo ve in vivo performansları değerlendirilmiştir. Bu çalışmamızda tasarlanan yüksek oranda yapışkan cerrahi sızdırmazlık malzemelerinin, doku yapıştırıcısı olarak anastomozlar, kardiyovasküler ameliyatlar, diş ameliyatları akciğer ve idrar kesesi ameliyatından gibi çeşitli cerrahi uygulamalardan sonra sızıntılarını durdurmak ve yaralı doku bölgelerini onarmak amacıyla yeni doku oluşumunu destekleme potansiyeli vardır.

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Keyword: *Jelatin, katekol, biyoyapışkan*

ID: 106

Hierarchically Porous PolyHIPEs: Efficient Supports for Reusable Pt Catalysts in Alkene Hydrosilylation

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Platinum (Pt) catalysed hydrosilylation of alkenes has emerged as one of the largest applications of industrial homogeneous catalysis over the last 50 years [1]. In order to reduce the catalyst cost of the industrial hydrosilylation process, studies to develop heterogeneous Pt catalysts-in which Pt metal can be reused with minimal loss of activity-are of great importance. In this respect, the polymerized High Internal Phase Emulsions (polyHIPEs), having interconnected macro-sized open porosity with an average BET surface area of 5-10 m2/g, exhibit good mechanical-thermal resistance and stands out as a distinguished support material alternative in heterogeneous catalyst design [2]. It is a fact that, heterogeneous catalyst designs using polyHIPEs as support materials for alkene hydrosilylation are very limited in the literature. For this purpose, in this study, a series of vinyl benzyl chloride-styrene-divinylbenzene based polyHIPE materials in different molar ratios were synthesized to have 90% nominal porosity. Friedel Crafts alkylation (hypercrosslinking) reaction was applied further to increase the surface area of macroporous polyHIPE material by introducing meso-micro porosity to its structure. Chemical and morphological properties of the resulting polyHIPE materials have been characterized by using FT-IR, SEM, EDS, TGA, and BET surface area and porosity analysis techniques. Results revealed that hierarchically porous hypercrosslinked polyHIPE (HCLPH) materials with a surface area varying between 100-1000 m2/g BET surface area were obtained successfully. SEM-EDS surface mapping analysis proved that all HCLPHs exhibit homogeneously distributed surface functional -Cl groups, which is critical for further functionalization for the ligand design of the catalyst. Future studies will continue to obtain a heterogeneous hydrosilylation catalyst carrying Markó-type NHC-Pt metal-ligand complex with further modifications on the surface of these polyHIPE-based HCLPH support materials.

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Keyword: *PolyHIPE, Hypercrosslinked Polymers, Catalyst Support*

ID: 39

Fabrication of Light-Responsive Smart Coatings with Switching Wettability

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Smart and stimuli-responsive coating with tunable wettability has gained increasing attention due to its potential applications in sensors, microfluidics, and oil-water separations [1–3]. The wettability can be controlled by external stimuli such as temperature[4], light [5] and pH [6]. Spiropyrans (SPs) are one the most popular photoresponsive materials and change their structure and polarity during photoinitiation. Typical commercial SPs respond to radiation within the near ultraviolet leading to rapid isomerization to purple-colored and more polar merocyanine (MC). They whereby visible (Vis) light of appropriate wavelengths aids return to the colorless and polar state. The polarity differences influence the surface leading to changes wettability of surfaces[7]. Here in, we report light-responsive poly(glycidyl methacrylate-methacrylated spiropyran) (poly(GMA-MSP)) coating on glass surfaces. The glass surfaces were cleaned with piranha solution to activate hydroxyl (–OH) groups. The subsrates were modified by immersing aminopropyltriethoxysilane (APTES). Spiropyran-containing responsive polymer was carried out with free radical polymerization of glycidyl methacrylate (GMA) and methacrylated spiropyran (MSP) presence of initiator azobisisobutyronitrile in dioxane. The poly(GMA-MSP) was attached to amine-functionalized surfaces through the graft-to method with a simple dip coating. The APTES-modified and polymer-coated substrates were characterized by water contact angle measurements. The chemical structure of poly(GMA-MSP) was performed with ^{1}H-NMR and FTIR. The switching wettability of coatings was conducted to measure the contact angle of surfaces after UV and/or Vis irradiation. Reversible isomerization of SP-MC was also followed by UV-Vis absorption spectroscopy.

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Keyword: *smart coating, switching wettability, light stimuli*

ID: 198

Effects of Fluorinated Backbone Structure of Polyester on Surface Wettability of Coatings: Synthesis of Short-Length Perfluoroalkyl Based Polyesters

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Fluorinated oligomeric polyesters (FOP) consisting of a perfluoroalkyl-based backbone and perfluoropolyether (PFPE) tails were synthesized to obtain oleophobic coatings. To investigate the effect of the fluorinated backbone structure of polyesters on their oleophobicity, FOP with a short-length perfluoroalkyl backbone (PF_{octa}) was synthesized. Later, they were blended with oleophilic polyethylene terephthalate (PET) at varying concentrations. For comparison, a model FOP with a PFPE-based backbone (P3) was utilized. The morphology and surface wettability of PET/PF_{octa} surfaces were characterized using atomic force microscopy and contact angle measurements. The addition of just 5 wt.% PF_{octa} to the PET film increased water contact angle (WCA) values from 58° to 79° and shifted hexadecane contact angle (HCA) from a wet state to 58°. Even at this low content, the films exhibited greater oleophobicity than PTFE (HCA_{PTFE}≈48°). With an increase in fluorine content up to 33 wt.%, the surface almost approached superhydrophobicity (WCA≈110°), and HCA increased to 68°. Furthermore, the introduction of PF_{octa} into PET resulted in a notable reduction in the surface energy of the films; even with a mere 5% PF_{octa} addition, the surface energy decreased from 46 mN/m to 28.8 mN/m. Notably, as the PF_{octa} content in PET increased, the surface energy of the films exhibited a further decrease. Specifically, films containing 33% PF_{octa} demonstrated a surface energy of 15 mN/m, which is even lower than the surface energy of PTFE (18 mN/m).A comparative analysis between PET/PF_{octa} and PET/P3 films, the PFPE-based backbone was found to reduce oil and water repellency due to a conformational entropy penalty at the surface, whereas the short-length perfluoroalkyl backbone (PF_{octa}) provided superior repellency characteristics. These advancements present promising applications in various fields, including electronics, textiles, and medical supplies, where such functional coatings can significantly enhance product performance.

Keyword: *Hydrophobicity, Oleophobicity, Fluorinated polyester*

ID: 279

Preparation of Polymer Nano- and Micro-Reactors for Enzymatic Reactions

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This study aimed preparation of polymer nano- and micro-reactors for enzymatic reactions. Glucose oxidase (GOx) and Horseradish peroxidase (HRP) containing polymer nano-reactors were prepared separately by aqueous self-assembly of poly(2-isopropyl-2-oxazoline)-b-poly(2-phenyl-2-oxazoline)-b-poly(2-isopropyl-2-oxazoline) (PiPOX-b-PPhOX-b-PiPOX) into polymersomes with temperature-responsive inner and outer corona. GOx- and HRP-containing polymersomes were mixed and the effects of pH and temperature on cascade enzymatic reactions were examined. Next, hollow polymer capsules were prepared through layer-by-layer (LbL) self-assembly technique. GOx-containing polymersomes were self-assembled onto colloidal silica particles using pH-responsive Tannic Acid (TA), followed by template removal. The effects of pH and temperature on the capsule wall permeability and enzymatic reaction were examined.

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Keyword: *stimuli-responsive polymersome, Layer-by-Layer Capsule, enzymatic reactions*

ID: 348

Chlorodimethylsilane-Mediated Reductive Etherification Reaction: A Robust Method for Polyether Synthesis

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Polyethers have always been privileged in polymer chemistry and have found extensive applications in both academic research and industry. However, the currently employed strategies for their synthesis require harsh conditions such as ionic polymerizations together with limited precursor monomer options. In this study, chlorodimethylsilane (CDMS)-mediated reductive etherification reaction (RER) is introduced as a versatile strategy for polyether synthesis. Accordingly, terephthalaldehyde (TPA) and 1,4-butanediol (BD) were first reacted at room temperature in the presence of CDMS using nitromethane (CH_3NO_2) as the polymerization solvent to reveal the optimum conditions for the proposed system. Subsequently, a variety of diols ranging from linear to sterically congested diols were reacted with TPA (and its isomers) under the optimized conditions to create a polyether library. Meanwhile, in addition to polyether having the expected alternating units, the formation of polyether stem from the self-condensation of TPA was found to be inevitable in all cases. From the proposed strategy, polyethers with a molecular weight of up to 110.4 kDa and a high alternating unit of up to 93% were obtained. The versatile and robust character of the presented strategy was supported by a model end-group study and the polymerization behavior was examined mechanistically. It is anticipated that the presented method might be a strong candidate for polyether synthesis with different backbones, given the unlimited sources of diols.

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Keyword: *Polyether, Reductive Etherification Reaction, Chlorodimethylsilane*

ID: 317

The Effect of Different DAAM/ADH Ratios on the Coating Performance of Soft Core/Hard Shell Self-Crosslinking Acrylic Emulsions

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This study investigates the effect of varying Diacetone acrylamide (DAAM)/Adipic acid dihydrazide (ADH) ratios on the coating performance of self-crosslinking acrylic emulsions. By adjusting these ratios, we evaluated changes in film formation, durability, and mechanical properties. The goal was to identify optimal coating formulations that enhance adhesion, flexibility, and resistance properties. Specifically, the study examined the performance of latexes with DAAM concentrations ranging from 1 to 5 wt% and assessed the impact of incorporating DAAM exclusively in core or shell formulations. The copolymers were synthesized using emulsion copolymerization and subsequently isolated and characterized. Structural analysis, thermal and mechanical behavior (using DSC and DMA), and coating performance tests were conducted, revealing that the optimal DAAM/ADH ratios significantly improve coating properties, with key insights into how DAAM placement within the polymer structure influences overall performance.

Keyword: *Self-crosslinking, DAAM/ADH, core-shell acrylic emulsion*

ID: 162

Lokalize İlaç Salımı için Yenilenebilir Poli(Menthide)-PEG Kopolimerlerinden Enjekte Edilebilir Isıya Duyarlı Hidrojellerin Geliştirilmesi

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Kanser, her yıl teşhis edilen milyonlarca yeni vaka ve hastalığa atfedilen önemli sayıda ölüm ile önemli bir küresel sağlık sorunu olmaya devam etmektedir. Geleneksel sistemik kemoterapi, yaygın olarak kullanılmasına rağmen, ciddi hedef dışı toksisiteler ve tümör bölgelerine verimsiz ilaç dağıtımı gibi sınırlamalardan muzdariptir. Bu sorunları ele almak için, enjekte edilebilir polimerik hidrojeller, kanser tedavisinde lokalize ilaç dağıtımı için umut verici araçlar olarak ortaya çıkmıştır. Bu hidrojeller fizyolojik bölgelere enjekte edildikten sonra hızlı jelleşmeye uğrar, böylece sistemik maruziyeti en aza indirir ve sağlıklı dokular üzerindeki olumsuz etkileri azaltırken terapötik etkinliği artırır.

Geleneksel poli(etilen glikol)-bazlı polilaktid, poli(laktid-ko-glikolid) ve/veya poli(ε-kaprolakton) (PEG-bazlı PLA, PLGA veya PCL) enjeksiyonla uygulanabilen ısıya duyarlı hidrojel platformlarının eksikliklerini ele almak ve de sürdürülebilir kaynakların kullanımı ile elde edilen yeni biyomalzemelerin lokal bögeye yönelik ilaç salımı amaçlı formüle edilmesi son derece önemlidir. Bu amaçla, yenilenebilir monomerlerden yararlanarak eşdeğer veya daha iyi özelliklere sahip polimerik malzemelerin hazırlanmasına yönelik araştırmalara olan ilgi artmaktadır.

Yenilenebilir kaynaklara örnek olarak (-)-mentolün ticari olarak temin edilebilen bir keton türevi olan (-)-mentonun, basit Baeyer-Villiger oksidasyonu yoluyla kolayca yedi üyeli lakton (-)-mentide dönüştürülebilmesidir. Hillmyer ve ekibi tarafından katalizör olarak çinko-alkoksitin kullanılması ile 91,000 g/mol'e kadar moleküler ağırlığa sahip poli(menthide) (PM) homopolimerleri sentezlenmiştir. Ayrıca, biyolojik olarak yenilenebilir termoplastik elastomerlerdeki uygulamalar için stereokimyayı göz önünde bulundurarak çeşitli laktidlerden PLA-b-PM-b-PLA triblok kopolimerleri elde edilmiştir. Bu triblok kopolimerler hidrolitik olarak parçalanabilen basınca duyarlı yapıştırıcılar olarak kullanışlıdır. Ayrıca, PM üzerinden tulipalin A ve γ-metil-α-metilen-γ-bütirolakton gibi doğal monomerlerin kullanımı ile termoplastik elastomerler veya yapıştırıcılar da hazırlanmıştır.

Yenilenebilir kaynaklardan elde edilen biyobozunur poli(menthide) polimerler ile yapılan ilk çalışmalar literatürde genellikle bu polimerlerin termoplastik elastomerik davranışları üzerine odaklanmıştır. Kanser tedavisinin ve sürdürülebilir polimerik malzemelerin önemini göz önünde bulundurarak, bu çalışmada ilk kez, (-)-menthide'in hidrofilik ve biyouyumlu bir poli(etilen glikol) makro başlatıcı ile halka açılması polimerizasyonundan sentezlenen sıcaklığa duyarlı poli(menthide)-PEG blok kopolimerleri, lokal bölgede enjekte edilebilir hidrojeller olarak potansiyel faydalarını değerlendirmek için araştırıldı. PEG sayesinde, bu sıcaklığa duyarlı hidrojeller 40-44 ºC civarında enjekte edilebilir sıvı özellikleri göstermiş ve vücut sıcaklığında bir jel oluşturarak bu sistemlerin lokal ilaç taşıyıcı sistemleri için potansiyel adaylar olabileceğini göstermiştir.

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Polym. Chem., 2023, 14, 1141–1154

Keyword: *Poli(Menthide), Isıya Duyarlı Polimerik Malzemeler, Lokal Tedavi*

ID: 447

A New Perspective for Nanoconfined Polymer Crystals

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Nanoporous hard templates provide a two-dimensional confined space in which self-organization processes such as crystallization, protein secondary structure formation, and phase separation can be fundamentally different from those obtained in thin films and in bulk. A particular advantage of hard templates is that they provide a range of parameter space (pore diameter, curvature, nature of pore walls) that can induce or manipulate nucleation and crystal growth. Nowadays, a broad range of soft materials can be formed into nanotubes utilizing nanoporous hard templates containing arrays of self-ordered cylindrical nanopores. Understanding the crystallization, thermodynamics, and dynamics of soft materials under confinement allows for their rational design as functional devices with tunable mechanical strength, processability, and electronic and optical properties. The principal focus of this lecture is finding the basic underlying principles that give rise to nucleation and crystal growth in a range of soft materials (crystallizable polymers, amphiphilic molecules, liquid crystals, low-molecular-weight liquids, and biopolymers) under hard confinement. The confining geometry is also important since curvature affects Laplace pressure. In this context, we provide a detailed analysis of the impact of compartmentalization, space, curvature, interfacial interaction, and molecular weights on the nano-crystallization process.

Keyword: *Polymer Crystals*

ID: 238

Evaluating the Rheological, Mechanical, and Sustainability of NBR Materials Prepared by Using Different Plasticizers

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Nitrile Butadiene Rubber (NBR), produced by emulsion polymerization of acrylonitrile and butadiene, is one of the most important synthetic rubbers. NBR has excellent oil and chemical resistance, making it ideal for O-rings and sealing applications. These properties make NBR suitable for fuel hoses, V-belts, gaskets, and other automotive parts. NBR rubbers are difficult to process due to their high viscosity. Plasticizers are therefore added to the compound to reduce its viscosity and improve its processability. The most commonly used plasticizers for NBR are phthalate esters. However, phthalate plasticizers cause direct and indirect risks to humans and the environment. Phthalate plasticizers were first classified as R45 and T (toxic) by the Swedish chemical agency KEMI in 1994 and later by European Union Directive 67/548/EEC. Therefore, the research for alternative renewable non-toxic plasticizers for NBR has become more important.

This study aims to evaluate vegetable-based oil, commercial aromatic plasticizer Diisononyl Phthalate (DINP), and non-phthalate-based commercial plasticizers that can be used in NBR rubber compounds. The rheometric and mechanical properties of these compounds were tested and compared. The effects of plasticizers on the environment were also assessed at the same time. Reductions in the effects of acidification and eutrophication, and particularly in the effects of climate change, are noted when environmental impacts are assessed in the life cycle dimension.

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Keyword: *NBR, plasticizer, Life Cycle Assesment*

ID: 373

Preparation and Characterization of Zn Doped TiO_2/MA-POSS Hybrid Material and Evaluation of Photocatalytic Activity

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Rapid industrialization growth is the major cause of water pollution. Dyes are a class of organic compounds, widely used in textiles, printing and food industry. Dye effluents have a considerable negative influence on the environment, and most of them are highly toxic and non-biodegradable. The exposure of dyes in a small level of less than 1 mgL^{-1} can seriously affect the water quality of the aquatic environment[1].

Several water treatment methods such as adsorption, membrane separation, ozonation coagulation-flocculation have been used for removing these highly toxic compounds; however, due to different limitations, these pollutants cannot be eliminated from waste water. Advanced oxidation process (AOPs) are a class of oxidation techniques in which organic contaminants are degraded to harmless products. Some semiconductors are used as photocatalyst for AOPs in order to photocatalytic degradation of organic pollutants. TiO_2 is one of the most widely used semiconductors. TiO_2 is bright and has a very high refractive index, among the highest available in nature. Furthermore, it is easily available, relatively inexpensive, harmless and chemically stable[2].

In this study, anatase Zn doped TiO_2 nanoparticles (Zn-TiO_2 NP) was synthesized by the sol gel method and then grafted to methacrylate-polyhedral oligomeric silsesquioxane (MA-POSS) in chloroform solution. Thus a new powder nano hybrid coating material (Zn-TiO_2/MA-POSS) was prepared in order to increase mechanical, chemical resistance and further photoactive under visible light. Zn-TiO_2/MA-POSS NPs were characterized by XRD, SEM-EDX, FTIR, XRF, BET, particle size distribution, zeta potential measurement, band gap energy and TGA analysis. Photocatalytic performances of the powder nano hybrid material before coating to substrate under both UV and visible light were tested on 25 mg/L methylene blue solution. Photocatalytic degradation percentages were determined by UV-Vis spectrophotometer and total organic carbon (TOC) analysis. 97.02% and 95.31% of methylene blue was degraded via new hybrid material respectively under UV-C light and visible light in 180 min.

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Keyword: *Photocatalytic degradation, Waste water treatment, Zn doped TiO_2, Methylene blue, methacrylate-polyhedral oligomeric silsesquioxane*

ID: 31

Modeling Plastic Degradation Using Shock Compression and Reactive Molecular Dynamics

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Plastic is one of the most extensively utilized materials globally, with a world production of 359 million tons in 2018. [1] Consequently, the generation of plastic waste is a prominent environmental problem and an emerging issue. Micro and nanoplastic particles exhibit various unique characteristics and significance, such as ubiquity and persistence, along with challenges in management. Normally, plastic is considered chemically inert, and its toxicity is presumed to be more closely related to its physical and material properties than its chemical reactivity. However, when plastics are discarded and exposed to ultraviolet (UV) irradiation and other environmental degradation processes, they can degrade and fragment into smaller pieces with an extended surface area and a significantly altered chemical state on that surface. This weathering of microplastics further enhances their hydrophilic activity, allowing them to bind a wide variety of organic and inorganic pollutants through the creation of hydrogen bonds, electrostatic interactions, and ion complexation.
In the current study polyethylene therephtalate (PET) and polystyrene (PS) underwent a comprehensive investigation into their mechanical and chemical degradation through reactive molecular dynamics simulations. The detailed methodology was described in our recent papers. [2,3] The simulations utilized the ReaxFF force field for CHO systems in the combustion branch. The study included equilibrium simulations to determine densities and melting temperatures, non-equilibrium simulations for stress-strain and Young moduli determination, mechanical cleaving to identify surface species resulting from material fragmentation, and shock compression simulations to elucidate chemical reactions activated by some external energy sources. The reactive dynamics analysis yielded crucial insights into the surface composition of fragmented polymers. Both polymers exhibited backbone breakage, leaving CH2 and C2H radicals as terminals. PET demonstrated substantial fragmentation, while PS showed a tendency to develop crosslinks. The bulk chemical structure of both polymers has been significantly altered after shock compression, leading to the formation of various new connections between atoms. A detailed analysis of chemical reactions resulting from increasing activation due to increasing value of compression pressure will be presented and discussed.

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Keyword: *nanoplastic, degradation, molecular dynamics*

ID: 381

Geri Dönüştürülmüş Silikon Kullanılarak Hazırlanan Elastomerlerin Mekanik Özelliklerinin İncelenmesi

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Silikon kauçukların omurgasını (Si-O-Si) bağları oluşturmaktadır ve yapılarında bulunan bu siloksan bağları sayesinde diğer organik kauçuklarla kıyaslandıklarında daha kararlı bir yapıya sahiptirler. Ayrıca silikon molekülleri arasında intermoleküler kuvvetlerin düşük olması nedeniyle diğer geleneksel kauçuklar ile kıyaslandığında yüksek elastikiyete, yüksek sıkıştıralabilirliğe ve mükemmel düşük sıcaklık direncine sahiptirler. Bunun yanı sıra, yapısındaki inorganik bağlar sayesinde hidrofobisiteleri oldukça yüksektir. Silikon kauçuklar yüksek yalıtım direncine sahiptirler ve yalıtım özellikleri geniş bir sıcaklık aralığında ve geniş bir frekans aralığında stabil kalmaktadır. Bu üstün özellikleri sayesinde savunma sanayi, gıda sektörü, medikal malzemelerin üretimi gibi pek çok alanda yaygın şekilde kullanılmaktadırlar. Günümüzde geri dönüşüm ve sürdürülebilirlik plastik ve kauçuk malzemeler için öne çıkan önemli konuların başında gelmektedir. Sentetik ve doğal kauçuklardan mamul ürünlerin geri dönüştürülmesi konusunda bir çok çalışma yapılmış olmasına rağmen silikon elastomerlerin geri dönüştürülmesi ve yeniden kullanılması konusundaki çalışmalar oldukça sınırlıdır.

Bu çalışmada silikon esaslı atık malzemeler geri dönüştürülerek yeniden ham silikon ile karıştırılmış ve elde edilen silikon elastomerlerin pişme davranışlarında, reolojik, mekanik ve dinamik-mekanik özelliklerinde meydana gelen değişimler incelenerek tekrar kullanılabilirliği araştırılmıştır.

Çalışmada ilk olarak atık silikon izolatörler bir öğütücü yardımı ile parçalanmıştır. Daha sonra öğütülmüş silikonlar elekten geçirilerek farklı boyut dağılımına sahip fraksiyonları elde edilmiştir. Bu farklı boyutlara sahip atık silikonlar farklı oranlarda ham silikon içerisine karıştırılarak yeni hamurlar hazırlanmıştır. Hazırlanan hamurların Hareketli Kalıp Reometesi kullanılarak pişme ve reolojik özellikleri incelenmiştir. Her bir hamurdan test plakaları diskler hazırlanmış ve geri dönüştürülmüş silikon boyutunun ve miktarının ham silikonun mekanik özelliklerine etkisini incelemek amacıyla gerilim-gerinim testleri ve basma testi ile şok absorpsiyon davranışları ve dinamik mekanik özellikleri incelenmiştir. Tüm bu çalışmaların sonucunda atık silikon kullanılarak hazırlanan yeni elastomerler için optimum atık silikon boyutunun ve oranının ne olması gerektiği belirlenmeye çalışılmıştır.

Keyword: *Geri Dönüşüm, Silikon Elastomer*

ID: 277

Thermal Energy Storage Performances of N-octadecane@PVC Microencapsulated PCMs in Potential Building Materials

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Recycling of PVC polymer is important due to the chlorine atoms it contains. However, due to its rheological properties, PVC cannot be evaluated by processing with polyolefins. Due to the large amount of waste, it is important to consume large amounts in applications where it is used. Using the solution evaporation technique by means of tetrahydrofurane, our study converts waste PVC into microcapsules that store heat energy. The produced microcapsules are more suitable for construction materials because they have higher density and particle size than in-situ polymerization. Moreover, PVC has flame-retardant properties with limiting oxygen value of 44. PVC does not require a cross-linker due to its crystallization feature therefore the process is cost effective. Our proposed study is on the determination of quantity-dependent heat energy storage properties of n-octadecan@PVC microcapsules in cement mortar, plaster, lime, and plastic coating materials. It includes theoretical studies and partly experimental verification studies. The studies revealed that the encapsulation ratio of n-octadecane is considerable as the particle size averages of over 100 μm.

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Keyword: *Recycling of PVC, Building energy conservation, Microencapsulated PCM*

ID: 53

Degradation Strategies for Commercial non-Hydrolyzable Polymers and Their Possible Future Applications

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Developing an efficient recycling methods for widely used polymers has always been an immensely important topic as we are moving towards a greener and more sustainable world while daily life is becoming increasingly dependent on commodity plastics. Even though there are efforts to produce degradable alternatives for the vast majority of plastics, it takes great effort to scale up the production numbers and the dependence on commodity plastics is still increasing. Herein, we are developing novel approaches 1-3 to degrade poly(methyl methacrylate), polystyrene and polyvinyl chloride polymers and working on to adapt them in recyling purposes, additive manufacturing and lithography processes.

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Keyword: *Photodegradation, Photodepolymerization, Additive manufacturing*

ID: 253

Recycling and Re-Synthesis of Poly(ethylene terephthalate)

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The increase in plastic production leads to generation of more and more plastic waste, which triggers the destruction of the natural environment. Polyethylene terephthalate (PET) has become one of the most investigated polymers because of its high consumption. The high consumption of PET products means huge quantities of PET waste, which causes significant environmental pollution. Therefore, recycling of PET waste is an important issue to be addressed. Accordingly, in the first step of the study, the recycling of different types of PET materials by glycolysis using different catalysts was investigated. Different types of PET materials such as transparent PET beverage bottles and PET yarns were depolymerized using zinc acetate ($Zn(OAc)_2$) and 1,3-Dimethylurea/$Zn(OAc)_2$ deep eutectic solvent (1,3-DMU/$Zn(OAc)_2$ DES). The obtained Bis(2-hydroxyethyl) terephthalate (BHET) was characterized with regards to its chemical structure and thermal properties and compared to commercially available BHET. Additionally, the yields of different applied glycolysis processes were evaluated. In the further step of the study, the focus was on the conversion of BHET into PET. To achieve this goal, polymerization reactions were carried out to synthesize PET from BHET obtained. The synthesis reactions were carried out under different reaction conditions in order to optimize the synthesis conditions. The influence of time & temperature, the addition of phosphoric acid, the amount of catalyst and the vacuum time on the properties of the PET product was investigated. In addition, SSP processes with different reaction conditions were applied to synthesized PET products. The obtained recycled PET was characterized with regards to its chemical structure as well as its physical and thermal properties.

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Keyword: *Chemical recycling, Polymerization, Poly(ethylene terephthalate)*

ID: 165

Atık Esnek Poliüretan Köpükten Poliol Eldesi ve Tekrar Kullanımı

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Poliüretan günlük yaşamda kullanılan mobilyalar, ayakkabılar, otomotiv, yapı malzemelerinden medikal uygulamalara kadar birçok eşyada kendine yer bulmaktadır. Poliüretanın kendine bulduğu bu yaygın kullanım alanları sağladığı konfor ve kolaylıklar yanında kullanım ömrünü tamamlayan eşyalar ile birlikte oluşan atıklar ile ciddi sorunlar oluşturmaktadır.
Bu atıklar ile baş etmenin yollarından biri geri dönüşümdür. Poliüretanın geri dönüşümü genel olarak fiziksel ve kimyasal geri dönüşüm olarak ayrılabilir. Fiziksel geri dönüşümde poliüretan mekanik olarak tekrar kullanılacak şekilde parçalara ayrılarak ürünlere katılır. Kırpılmış sünger parçaları tekrar yapıştırılarak daha düşük kalitede çeşitli süngerler elde edilir. Kimyasal geri dönüşümde ise poliüretan köpüğü oluşturan hammaddelerden en büyük oranda kullanılan poliolün geri kazanımı hedeflenir. Kimyasal geri dönüşüm ile atık köpükten elde edilen poliolün yeniden formülasyonda kullanılarak orijinal köpükten herhangi mekanik ve konfor özelliğini kaybetmeden yeniden yaşam döngüsüne katılımı hedeflenir.
Çalışmamızda mobilya sistemlerinde kullanılan köpüğün kimyasal yolla geri dönüşümü gerçekleştirilerek formülasyonda yeniden kullanımı gerçekleştirilmiştir. Orijinal sistem ve atık köpükten geri dönüştürülmüş poliol içeren süngerin mekanik özellikleri karşılaştırılmıştır.
Atık poliüretan köpüğün geri dönüşümü ile hedeflenen çıktılar başta kimyasal geri dönüşüm yöntemlerini geliştirip sanayide uygulanabilir hale getirirken; atıkların azaltılması, karbon ayak izinin düşürülmesi, dışa bağımlı olan poliüretan sektöründe hammadde tasarrufu sağlanması ve sürdürülebilirlik politikalarına katkı sağlaması hedeflenmiştir.
Bu çalışmadan elde edilen sonuçlar ile otomotiv sektörü de dahil olmak üzere diğer sektörlerde poliüretanın geri dönüşümü için temel oluşturulacaktır.

Keyword: *polimer, poliüretan, geri dönüşüm*

ID: 161

Unlocking the Toolbox: Benzoxazine Chemistry for Advanced Phenolic Materials

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Polybenzoxazines have attracted polymer scientists for the past decade due to their exceptional properties. These polymers are synthesized through ring-opening polymerization at temperatures above 220 °C, these versatile materials exhibit near-zero shrinkage upon curing, excellent thermal stability, and strong chemical resistance. This unique combination makes them ideal for demanding applications in electronics, aerospace, and beyond. [1] Accordingly, the field of benzoxazine chemistry has witnessed significant progress in recent years. Beyond conventional high-performance thermosetting applications, researchers are now harnessing the power of benzoxazines to design advanced materials for unconventional uses. A growing body of research explores exciting possibilities, including self-healing polybenzoxazines, porous structures, smart coatings, batteries, electrochromic materials, shape memory polymers, and superhydrophobic surfaces. [2] On the other hand, the traditional curing process often requires high temperatures, raising concerns about energy consumption and processing limitations. Fortunately, various strategies were applied to successfully lower cure temperatures for specific benzoxazine types.[3]
This presentation provides a comprehensive overview of polybenzoxazines, highlighting their recent advancements in benzoxazine based material designs. Moreover, this presentation gives specific examples like self-healing materials, sulfur-benzoxazine chemistry, and strategies to reduce cure temperatures.

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Keyword: *Benzoxazines,, Polybenzoxazines, Thermosets*

ID: 59

Elyaf Takviyeli Epoksi Matrisli Kompozitlerin Fotopolimerizasyon ile Üretimi

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Görünür bölge ışınları ile oda sıcaklığında kısa sürede kürlenen endüstriyel tip epoksi reçine (diglisidil eter bisfenol A ve diglisidil eter bisfenol F (DGEBA/F)) geliştirilmiş ve elyaf takviyeli kompozitlerin üretiminde kullanılmıştır. Bu amaçla, endüstriyel tip epoksi reçinenin derin kürlenmesi için fotopolimerizasyon sırasında üretilen ısının kullanımına dayanan radikal başlatılmış katyonik ön polimerizasyon (RICFP) tekniği seçilmiştir. Bu teknikte, yüzeyde gerçekleşen fotopolimerizasyon reaksiyonu sonucu açığa çıkan ısı enerjisi, formülasyondaki radikal başlatıcıyı aktive eder ve parça kalınlığı boyunca kürlenme sağlanır. Geliştirilen formülasyonda DGEBA/F esaslı bir epoksi reçine ile birlikte fotobaşlatıcı olarak iyodonyum tuzu, uyarıcı olarak tiyoksanton, hızlandırıcı olarak oksetan ve radikal başlatıcı olarak 1,1,2,2-tetrafenil-1,2-etandiol kullanılmıştır. Öncelikle hazırlanan formülasyonlara kalınlık, sertlik, kürlenme hızı ve mekanik özellikler açısından optimizasyon çalışması yapılmış ve görünür ışıkla en etkili kürlenen formülasyon seçilmiştir. Bu formülasyon FT-IR, DSC, TGA ve üç nokta eğme testleri ile karakterize edilerek özellikleri belirlenmiştir. Daha sonra farklı elyaf formlarında (keçe, çok yönlü, dokuma) cam ve karbon elyaflar ile optimize edilmiş epoksi reçine formülasyonu kullanılarak el yatırması, vakum torbalama ve vakum infüzyon yöntemleriyle elyaf takviyeli kompozitler hazırlanmıştır. Bu kompozitler görünür bölge ışınları ile oda sıcaklığında 15 dakika gibi oldukça kısa sürede elde edilmiştir. El yatırması yöntemiyle hazırlanan cam elyaf takviyeli kompozitler diğer kompozitlere göre daha iyi kürlenme performansı göstermiştir. Bu kompozitlerin eğme, çekme ve kayma testleri gibi mekanik karakterizasyonları ilgili uluslararası standartlara göre yapılmış ve konvansiyonel yöntemle amin esaslı sertleştirici ile termal olarak kürlenen referans kompozitler ile karşılaştırılmıştır. Fotopolimerizasyon ile kürlenen kompozitler, referans kompozitler ile benzer mekanik özellikler göstermiştir. Kompozitlerin kırılma yüzeylerinin morfolojik analizi sonucu iyi bir elyaf-matris yapışmasının oluştuğu ve kırılmaların arayüzden meydana geldiği tespit edilmiştir. Ayrıca geliştirilen sistem ile bir prototip imalatı gerçekleştirilmiş ve geleneksel yöntem ile proses karşılaştırması yapılmıştır.
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Keyword: *Fotopolimerizasyon, Polimer Kompozitler, Elyaf Takviyeli Kompozitler*

ID: 151

Tek-Zincir Polimer Nanopartiküllerin Oluşturulmasında Güncel Yaklaşımlar

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Tek-zincir polimer nanopartiküller (SCNP'ler), bir polimer zincirinin molekül içi katlanması ve/veya çapraz bağlanması sonucu oluşan, genellikle birkaç nanometre çapında olan partiküllerdir. Bu yapılar, proteinlerin katlanmalarını taklit eder ve tek bir polimer zincirinin belirli bir konformasyona sabitlenmesiyle elde edilir. SCNP'ler tek zincirden oluştukları için oldukça kararlı yapılar meydana getirirler ve çoğu zaman sulu veya organik çözücülerde çözünürler. Zincirin katlanma ve çapraz bağlanma yöntemine bağlı olarak çeşitli fonksiyonel gruplar içerebilirler. SCNP oluşumu, hem supramoleküler hem de kovalent çapraz bağlanma yoluyla gerçekleştirilmekte olup dinamik veya geri dönüşü olmayan nanopartikül sistemleri elde edilebilmektedir. Çapraz bağlama reaksiyonunda, monomer birimlerinin homo- ve hetero-bağlanmasının yanı sıra çapraz bağlayıcının neden olduğu zincir katlanmasını içeren çok çeşitli sentetik stratejiler kullanılmaktadır [1]. Polimer kimyası, fonksiyonel SCNP'lerin hazırlanması için neredeyse sınırsız bir çeşitlilik sağlamakta ve partiküllerin yüzey kimyasını kontrol ederek suda çözünürlük, biyouyumluluk ve hedefleme yetenekleri kazandırmaktadır. SCNP'lerin sentezi, SCNP'lerdeki zincir katlanmasını analiz etmek için jel geçirgenlik kromatografisi (GPC) ve kimyasal yapının değerlendirilmesi için NMR spektroskopisi dahil olmak üzere çeşitli karakterizasyon teknikleri ile izlenirken boyut ölçümleri tipik olarak dinamik ışık saçılımı (DLS), atomik kuvvet mikroskobu (AFM), küçük açılı X-ışını saçılımı (SAXS) ve transmisyon elektron mikroskobu (TEM) ile gerçekleştirilmektedir.

Bu sunumda, SCNP oluşturulmasında kullanılan güncel yaklaşımlar değerlendirilecek olup son yıllarda çalışmalarımızın önemli bir kısmını oluşturan SCNP'lerin sentezi için kullandığımız startejiler ile ilgili örnekler verilecektir [2-5].

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Keyword: *Tek-zincir polimer nanopartiküller, Çapraz bağlanma, Zincir içi etkileşim*

ID: 157

Preparation of Poly(oxanorbornene) Based Single and Double-Folding Polymers via Nucleophilic Aromatic Substitution Reaction

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A facile approach is introduced to prepare single-chain nanoparticles (SCNPs) utilizing intramolecular crosslinking based on nucleophilic aromatic substitution reaction. The linear polymeric precursor comprising dichlorotriazine (DCT) moiety as a reactive pendant group is synthesized via ring-opening metathesis polymerization (ROMP). The reactive chlorine atoms on DCT motifs are substituted with a dithiol nucleophile in varying degrees to yield individually intramolecularly crosslinked polymer nanoparticles. In addition, double-collapse and modification reactions are exploited through the substitution reaction from the remaining unreacted chlorine atoms. A significant reduction in hydrodynamic volumes of the corresponding SCNPs is observed compared to their linear analogue. The obtained nanoparticles are characterized by size exclusion chromatography (SEC), proton nuclear magnetic resonance spectroscopy (^{1}H NMR), diffusion-ordered spectroscopy (DOSY), dynamic light scattering (DLS), and transition electron microscopy (TEM) techniques.

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Keyword: *Single chain nanoparticles, soft nanoparticles, chain folding*

ID: 244

Sustainable Practices in EPDM Rubber Formulations

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Sustainability studies on EPDM (Ethylene Propylene Diene Monomer) rubber formulations conducted in Standard Profil R&D Center is reviewed in this paper. More sustainable rubber products can be achieved by developing novel EPDM rubber formulations containing recycled and sustainable raw materials.

This paper focuses on the use of sustainable practices including micronized rubber waste powder, recovered carbon black, recycled and bio-sourced raw materials, such as biobased oils, for the development of environmentally friendly EPDM rubber products. Incorporating sustainable solutions into EPDM rubber production not only reduces environmental impact but also offers manufacturers a lower carbon footprint. For the performance evaluation of sustainable formulations, comprehensive characterization techniques, including rheological analysis, mechanical property testing, and thermal stability analysis were employed. The focus is on the various sustainable rubbers and functional rubber additives that have been studied in our laboratory, highlighting their potential and limitations.

Through this review, we aimed to provide insight and guidance for future advances in sustainable EPDM rubber formulations, contributing to the broader goals of environmental sustainability and resource efficiency. While our review highlights the importance of sustainable EPDM rubber formulations, it is important to note that there are also challenges that need to be addressed, such as the high cost and limited availability of sustainable materials. Future research should explore ways to overcome these challenges and make sustainable EPDM rubber formulations more accessible and cost-effective.

Keyword: *EPDM, Sustainable, recycle*

ID: 174

Impact of Molecular Structure of Poly(epichlorohydrin-co-ethylene oxide-co-allyl glycidyl ether) (GECO) on Mechanical Properties of GECO-Based Elastomers

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The production and utilization of elastomers based on poly(epichlorohydrin-co-ethylene oxide-co-allyl glycidyl ether) (GECO) have seen increased interest in recent years due to advancements in synthesis techniques. While previous studies have explored the impact of curing agents, fillers, and ionizing radiation on the mechanical properties of these elastomers, there remains a lack of research on how the structural parameters of GECO polymers affect these properties. This study aimed to prepare GECO-based elastomers using specific formulations and investigate how the structural parameters of these polymers influence their mechanical, thermo-mechanical, dynamic-mechanical, and damping properties. The findings indicate that the ratio of ethylene oxide (EO) monomer significantly affects the crosslink density of GECO elastomers, thereby influencing their mechanical properties. Moreover, the presence of long chain branching in GECO polymers was found to notably impact energy dissipation and damping characteristics of these elastomers.

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Keyword: *poly epichlorohydrin, GECO, mechanical properties*

ID: 67

Effects of Ionizing Radiation on Natural Rubber and Silicone Rubber Used in Medical Devices and Applications

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Polymers are widely used in applications such as medical devices, implants, and drug delivery systems due to their economic advantages like lightness and resistance to sterilization processes. Considerable percentage of all single-use polymer-based medical devices produced worldwide are sterilized using ionizing radiation using one of two common processes: cobalt-60 radioisotope (gamma irradiation) or an electron accelerator using electron beam irradiation or X-rays. Gamma irradiation has some disadvantages in terms of safety, transportation, supply, and disposal of the source (Cobalt-60).

The aim of this study is to compare the effects of gamma and electron beam irradiation at different doses and dose rates on natural rubber (NR) and silicone rubber (SR), which are commonly used in medical devices and applications. Initially, the vulcanization conditions were optimized using a moving die rheometer (MDR). The prepared NR and SR test samples were subjected to gamma irradiation at two different dose rates (High Dose Rate (HD): 213 Gy/h and Low Dose Rate (LD): 18 Gy/h) and six different doses of 10, 20, 30, 40, 60, and 80 kGy. Electron beam irradiation was performed at a single dose rate (1 kGy/s) and at total doses of 10, 20, 30, 40, 60, 80, and 120 kGy. For both irradiation methods, the swelling ratio, gel fraction, and crosslink density were determined for irradiated and non-irradiated NR and SR test samples. Structural, mechanical, thermal, dynamic-mechanical, and morphological properties were characterized respectively using a Universal Testing Machine, FTIR, TGA, DSC, DMA, and SEM analyses. Based on the findings of the study, changes in mechanical properties were observed due to crosslinking or chain scission reactions occurring simultaneously and competitively with increasing irradiation dose for both types of rubber and irradiation methods. It was concluded that the commonly used 25 kGy irradiation dose for sterilization did not create a critical difference between gamma and electron beam irradiation for both types of rubber.
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Keyword: *Natural Rubber, Silicone Rubber, Irradiation*

ID: 326

Epokside Doğal Kauçuk Esaslı Karma Matrisli Membranlar ile Biyogazın Saflaştırılması

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Yeşil enerji eldesinde kullanılan en yaygın kaynaklardan biri biyogazdır. %55-70'i metan (CH_4), %30-45'i karbon dioksit (CO_2), azot (N_2) ve hidrojen sülfür (H_2S) gazlarının karışımından oluşan biyogaz, sentez gazı ve hidrojen üretiminde, içten yanmalı motorlar, gaz türbinleri ve yakıt hücrelerinde doğrudan yakıt olarak kullanılabilmektedir. CO_2'in CH_4'dan ayrılması yoluyla saflaştırılması biyogazın enerji verimliliğini arttırmaktadır. CO_2 gideriminde kriyojenik yöntemler, adsorpsiyon ve membran gaz ayırma sistemleri gibi yöntemler kullanılmaktadır. Membran ile gaz ayırma işleminin avantajları arasında geleneksel yöntemlere göre uygulama kolaylığı, düşük işletme maliyeti, düşük enerji ihtiyacı, kolay kurulumu ve çevre dostu olması sayılabilir. Yeni nesil bir kauçuk çeşidi olan epokside doğal kauçuk (ENR), doğal kauçuğun birçok özelliğini sergilemesinin yanı sıra, epoksi gruplarının polimer ana zinciri üzerinde rastgele sıralanması nedeniyle nitril kauçuğa yakın yağ direnci ve bütil kauçuğa yakın gaz bariyer özellikleri ile dikkat çekmektedir. Bu çalışmada, molce %25 (ENR-25) ve %50 (ENR-50) epoksidasyon derecesinde sentezlenmiş iki farklı epokside doğal kauçuk tipinin biyogaz saflaştırmadaki etkinliği incelenmiştir. Farklı ENR-25 ve ENR-50 oranlarında hazırlanan membran malzemelerinin reolojik, mekanik, ısıl ve gaz geçirgenlik özellikleri karşılaştırmalı olarak değerlendirilmiştir.

Teşekkür: Bu çalışma Kocaeli Üniversitesi BAP Koordinasyon Birimi FOA-2023-3167 No'lu proje kapsamında desteklenmiştir.

Keyword: *Biyogaz saflaştırma, Epokside doğal kauçuk, Karma matrisli membran*

ID: 242

İleri Teknoloji Yüksek Sönümlü Deprem İzolatörü Kauçuk Kompozitlerinin Hazırlanması ve Karakterizasyonu

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Sismik taban izolasyonu, temel üzerine ve bina altına yerleştirilen, yapının depreme maruz kalması sırasında yapıyı temellerin hareketinden ayıran, temellerden yapıya aktarılan kuvveti sönümleyen ve kauçuğun karbon bağlarını kırarak sismik yükü absorbe eden, bu nedenle genel olarak tesisatları deprem hasarından koruyan bir sistemdir. Başka bir deyişle, izolatörün işlevi yapının periyodunu arttırmak, deprem enerjisini dağıtmak ve yapıya depreme karşı koyabilmesi için uygun yatay esneklik kazandırmaktır[1].
HDR'de kullanılan yüksek sönümlemeli kauçuk, bazı iyileştirme malzemeleri (karbon siyahı, yüksek viskoziteyi arttırıcı reçine vb.) içeren kauçuğa dayanmaktadır. İyileştirme malzemeleri enerji dağıtma kapasitesini artırır; bu arada, kauçuğun elastik toparlanma kabiliyetini sağlayarak HDR'nin LNR'den daha yüksek bir sönümleme oranına sahip olmasını sağlar. Ayrıca HDR, LRB'ye göre daha yüksek akma öncesi sertliğine sahiptir ve bu da yapının rüzgâr direnci açısından daha avantajlıdır. Üstelik HDR'de kurşun bulunmadığından okyanuslar ve göller gibi ekolojik koruma açısından özel gereksinimlere sahip yerlere çok uygundur.[2]
Depremlerin ve araç trafiğinin etkileşimli stresi altında yüksek kaliteli sönümleme malzemelerine yönelik acil talebi karşılamak için yüksek performanslı sönümleme kauçuğunun geliştirilmesi gerekmektedir. Doğal kauçuk (NR) mükemmel esnekliğe ve iyi işlenme özelliklerine sahiptir. Sönümlemeli kauçuk ürünlerin imalatında yaygın olarak kullanılmaktadır.[3] Ayrıca, farklı karbon türlerin sönümleme kapasitesi üzerine etkisi tanecik boyutuna bağlı bir özelliktir. Esneklik önemlidir çünkü kauçuk ürünün çalışma sıcaklığını etkiler, dolayısıyla dayanıklılığını ve yaşlanma davranışını etkiler. Uygun tanecik boyutu ürünlerin hazırlanmasında kullanışlı ve ekonomik bir stratejidir.[4]

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Keyword: *HDRB (Yüksek Sönümlemeli Kauçuk Mesnet), İzalator,Kauçuk Mesnet, Sismik İzalator*

ID: 164

Epiklorohidrin Esaslı Kauçuklar ve Elastomerler Hakkında Bilinmeyenler

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20. yüzyılda polimer bilimi ve teknolojisi konusunda yapılan sınırsız çalışmaların sonucunda bugün birçok polimerin günlük hayatımızın vazgeçilmez bir parçası haline geldiği, plastik ve kauçuklar olmadan yüksek teknolojik ürünlerinin hazırlanmasının neredeyse imkansız olduğu çok iyi bilinmektedir. Bu gelişmelere rağmen polimer kimyacıları hala daha üstün ve farklı özelliklerde yeni polimerlerin sentezi ve endüstriye aktarılması konusunda çalışmalarına devam etmektedir. Yeni polimerlerin hazırlanması yanı sıra mevcut polimerlerin yerine alternatif oluşturacak polimerlerin geliştirilmesi konusu da son yıllarda ilgi uyandıran bir konudur.

Epiklorohidrin kauçuğu, kloropren kauçuğunun (CR) üretiminde yaşanan sıkıntılar nedeniyle CR'ye alternatif olarak geliştirilmiş bir kauçuk olmasının yanı sıra PVC/NBR karışımına da alternatif olmuştur. Poli(epiklorohidrin) (PECH) homopolimeri, Poli(epiklorohidrin-ko-etilen oksit)P(ECH-ko-EO) ve Poli(epiklorohidrin-ko-allil glisidil eter) kopolimerleri ve Poli (epiklorohidrin-ko-etilen oksit-ko-allil glisidil eter) P(ECH-ko-EO-ko-AGE) terpolimeri temelde ECH, EO ve AGE monomerlerinin farklı oralarda polimerizasyonu sonucunda hazırlanan ve polieter ailesinin birer üyesi olan polimerlerdir.

CO, ECO, GCO, GECO ticari isimleri ile bilinen bu homo, -ko ve -ter polimerlerden hazırlanan elastomerler otomotiv endüstrisinde geniş bir kullanım alanı bulmuş ve yakıt hortumları, emisyon boru sistemleri, hava kanalları, contalar ve diyafram gibi çeşitli bileşenlerin temel polimerlerinden birisi olmuştur. Hydrin kauçuğu olarak da bilinen bu polimerler otomotiv uygulamalarında karşılaşılan sıcaklık ozon gibi zorlu koşullara dayanma yeteneği, kimyasal bozulmaya karşı direnci ve yüksek sönümleme özellikleri ile birleştiğinde, özel kullanımlar için önümüzdeki yıllarda daha fazla tercih edilen bir malzeme haline gelmesi beklenmektedir.

Bu sunumda önce PECH polimerleri tanıtılacak bu polimerlerin moleküler mimarisinin değişimi ile fiziksel özelliklerinin nasıl değiştiği hakkında bilgi verilecektir. Daha sonra bu kauçuklardan elastomer sistemlerinin hazırlanmasında kullanılacak metodolojiler hakkında bilgi verilecektir. Hidrin elastomerlerinin hazırlanmasında kullanılan pişirici kimyasalların, dolguların plastikleştirici gibi yardımcı kimyasalların elastomerlerin mekanik, dinamik- mekanik ve enerji sönümleme özelliklerine etkisi hakkında da bilgiler verilecektir. ECH esaslı polimerlerin ve elastomerlerinin radyasyon kimyası konusunda yapılmış son çalışmalar ve bu polimerlerle yürütülen en yeni araştırmalar bu sunumun diğer başlıklarıdır [1-2].

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Keyword: *Epiklorohidrin, Elastomer, ECO*

ID: 75

Uyarı-Cevap Polimerik Yapıların Fonksiyonel Yumuşak Robotik Uygulamalarda Kullanımı

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Dışarıdan yapılan bir uyarı ile istenildiği zaman şeklini değiştirebilen malzemeler son yıllarda özellikle çok işlevli ve kompleks yapıların üretiminde önemli bir rol oynamaktadır. 2-Boyuttan 3-Boyutlu olarak şeklini değiştirme olgusu sadece temel bilimsel olarak değil aynı zamanda farklı uygulamalar için ilgi çekmektedir. Kullanılacak dış uyaran ve üretim yaklaşımlarına bağlı olarak farklı malzemeler bu noktada kullanılmalarına rağmen metal ve seramik gibi deforme olma kabiliyetleri sınırlı sert malzemeler yerine yumuşak malzemeler deformasyon kabiliyetleri ve dış uyarılara daha hızlı cevap verebilmeleri nedeni ile daha çok tercih edilmekte ve çok işlevli malzemelerin üretiminde büyük yenilikler getirebilmektedirler.[1] Son zamanlarda, şekil değiştiren hidrojeller, şekil hafıza polimerler, sıvı kristal elastomerler ve dielektrik elastomerler yumuşak robotik, biomimetik makinalar, doku mühendisliği ve akıllı paketleme gibi birçok ileri teknoloji uygulamada kendilerine yer bulabilmiştir.
Sunum kapsamında, araştırma grubumuzda gerçekleştirilen uyarı-cevap polimerik yapıların üretimi ve bir dış uyarıcı varlığında (Işık, manyetik alan vb.) hareket kapiliyetlerinin kontrolleri hakkında bilgiler verilecektir.[2-5] Ayrıca polimer temelli malzemeler kullanılarak araştırma grubumuz tarafından üretilen yumuşak robotik sistemler ve moleküler tespit alanında getirdikleri yenilikler ile ilgili bilgiler paylaşılacaktır.

Bu çalışmalar, TÜBİTAK 22AG056 nolu proje kapsamında desteklenilmektedir.

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Keyword: *Uyarı-Cevap Polimerler, Yumuşak Robotlar*

ID: 87

PANI Temelli Süperkapasitör Elektrot Malzemelerinin Geliştirilmesinde Fenilendiamin İzomerlerinin Etkisi

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Bu çalışma, iletken bir polimer olan polianilinin (PANI) enerji depolama sistemlerinde kullanılabilirliğini kısıtlayan dezavantajlarını ortadan kaldırmak için fenilendiamin (PDA) bileşiğinin farklı izomerik yapılar (orto/o-PDA, meta/m-PDA ve para/p-PDA) ile kopolimerizasyonunu gerçekleştirilmiştir. Bu doğrultuda, sentezlenen PANI/PDA kompozitlerinin fiziksel, kimyasal, morfolojik ve elektrokimyasal özellikleri detaylıca irdelenmiştir. Bulgular, farklı izomerlere sahip PDA'nın PANI ile kopolimerizasyonundan elde edilen son malzemelerin yüzey morfolojilerinin belirgin farklılıklar gösterdiğini ortaya çıkarmıştır. Empedans analizi, elektrot olarak P(ANI-co-o/PDA) [PANI/o-PDA] kopolimerinin kullanıldığı tasarımlarda direncin azaldığını ve elektrokimyasal özelliklerin arttığını ortaya çıkarmıştır. PANI/o-PDA tasarımları, 541 F/g'lik önemli bir spesifik kapasitans (Cs) ve sırasıyla 7,5 Wh/kg ve 23,9 kW/kg'lık kayda değer enerji ve güç yoğunluğu değerleri vermiştir. Ayrıca, PANI ve PANI/PDA kopolimerlerinin kusur yapıları EPR kullanılarak analiz edilmiş ve PDA'nın değişen izomerik yapılara dahil edilmesi nedeniyle malzemelerin g-faktörü değerlerinde ve tepe yoğunluklarında dikkate değer değişiklikler ortaya gözlenmiştir. Bulgular, malzemelerin sentezinde PDA'nın çeşitli izomerlerle birlikte kullanılmasının, enerji depolama sistemlerinde PANI'lerin elektrokimyasal özelliklerini ve döngüsel stabilitesini geliştirebileceğini göstermektedir.

Keyword: *polianilin, fenilendiamin, süperkapasitör*

ID: 203

Development of Barrier Films Using EVOH with Increased Ethylene Content

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With advancing technology, traditional packaging is being replaced by innovative packaging structures that are lighter and easier to handle. Barrier films are attracting high interest due to the increasing demand for food packaging. These films have the effect of extending the shelf life of products, reducing the need for preservatives that can be used in food. Barrier films are preferred in the food packaging industry because they are lighter than rigid packaging and eliminate the use of glass and tin cans. High-barrier film is a superior packaging system for maintaining product quality and freshness, especially in food. These films are typically used in applications such as food and beverages to protect the food from air, oxygen, moisture, dust, and other contaminants. The barrier property required for foodstuff can be achieved with a single polymer layer or multilayer films containing different polymers, coatings, metal foils. The preferred polymers to obtain high barrier films are Polyethylene Terephthalate (PET), Biaxially-oriented PET (BOPET), Aluminum foil, Ethylene vinyl alcohol (EVOH), Polyamide (PA), Polyethylene (PE) and Polypropylene (PP). Especially EVOH copolymer is highly preferred due to its gas barrier properties against oxygen, carbon dioxide, and water vapor. Thanks to the hydroxyl groups in their structure, gas permeability is limited [1]. In a study conducted in the literature, it is stated that EVOH containing 38 mol% ethylene content provides optimum barrier properties [2]. Within the scope of this study, films with improved barrier properties were produced by the blown extrusion technique. A 9-layer PE film sample and EVOH free PA/PE film were used as control samples. Then, 9-layer barrier films containing EVOH with two different ethylene ratios (32% and 38%) and PA with 2 different mole content ratios were obtained. The mechanical properties of the produced films were determined by tensile testing, and their thermal properties were determined by differential scanning calorimetry (DSC) and heat seal test. In addition, the barrier properties were characterized by oxygen transmission rate (OTR) testing. As a result, it was determined that oxygen permeability increased with the increasing ethylene ratio, while the tensile strength value increased from 54 MPa to 61 MPa.

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Keyword: *Barrier Film, Oxygen Permeability, EVOH*

ID: 399

Polymers of Thienothiophene and Dithienothiophene for Organic Materials

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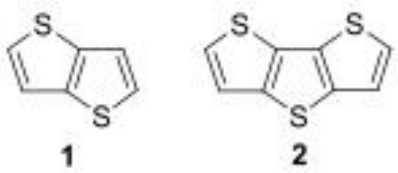
Thienothiophenes (TT, **1**) and dithienothiophenes (DTT, **2**) are of fused two and three thiophene rings, respectively, which have been receiving attention due to being important building blocks for various organic materials, such as OLEDs, solar cells, capacitors, batteries, electrochromic devices, transistors, memories and sensors.[1,2] They have electron rich character with the presence of sulfur atoms, flat geometry and good conjugation. These properties provide them with such wide range of applications. A simple synthetic method developed by our group led to an easy modification of TT and DTT and preparation of their various applications. Some recent designs and applications of their small molecules and polymers for organic material applications are presented.



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ID: 329

The Fabrication of a Polymer Acousto-Microfluidic Chip Using Additive Manufacturing

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Additive manufacturing is gaining momentum in microfluidics applications since it enables flexibility in design, and fast as well as low-cost prototyping compared to clean-room fabrication methods. Acoustophoresis is a microfluidic approach that uses acoustic waves to manipulate and separate microparticles. Also, since resonant acoustic conditions are sensitive to the geometric dimensions of the channel and the channel dimensions are at the microscale, manufacturing acoustofluidic microfluidic chips with additive manufacturing is a challenging process. An additional challenge comes from the polymer materials used in additive manufacturing processes. The attenuation of the acoustic waves in polymer materials is significantly higher compared to metal and ceramic counterparts.
In this study, we try to overcome the challenges of manufacturing a microchannel with acceptable dimensional consistency and aim to show that even an off-the-shelf stereolithographic 3D printer which is not research-grade can be used to fabricate acoustofluidic chips. We also try to overcome the high attenuation of waves in the polymer resin material by mixing low-attenuation microspheres/whickers into the resin. The effect of the mixed materials on curing and dimensional accuracy will be investigated. The performance of the acousto-microfluidic chip which is polymer-based and 3D printed will be demonstrated with experiments.

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Keyword: *microfluidic, acoustophoresis, stereolithography*

ID: 422

Nişasta Bazlı Atıklardan Yüksek Performanslı Biyobazlı Plastik Hammaddesi Üretimi

Büşra Köksal
PM Biomaterials

Bu çalışma, nişasta bazlı atıkların biyobazlı plastik hammaddesine dönüştürülmesi üzerine odaklanmaktadır. Plastik kirliliği ve fosil yakıt bazlı plastiklerin çevresel etkileri, sürdürülebilir ve çevre dostu alternatiflere olan ihtiyacı artırmaktadır. Bu bağlamda, nişasta bazlı atıklar, biyobazlı plastik üretimi için potansiyel bir hammadde kaynağı olarak değerlendirilmiştir.

Çalışmada, nişasta atıkları çeşitli kimyasal ve biyoteknolojik işlemlerle modifiye edilerek, polimerizasyon süreçleri ile biyobazlı plastik hammadde üretimi gerçekleştirilmiştir. Üretilen biyobazlı plastiğin mekanik ve termal özellikleri incelenmiş ve geleneksel plastiklerle karşılaştırmalı analizler yapılmıştır. Elde edilen sonuçlar, üretilen biyobazlı plastiğin çevresel açıdan daha sürdürülebilir ve ekonomik açıdan uygun bir alternatif olabileceğini göstermektedir.

Bu araştırma, hem atık yönetimine katkıda bulunmakta hem de biyobazlı plastikler alanında yenilikçi bir çözüm sunmaktadır. Sonuçlar, biyobazlı plastiklerin geniş bir uygulama alanına sahip olduğunu ve gelecekteki araştırmalar için önemli bir temel oluşturduğunu göstermektedir.

Keyword: *Biyobazlı plastik hammadde, nişasta bazlı atıklar, sürdürülebilirlik*

ID: 332

Biyobazlı 3D DLP Baskılı Doku İskelesi Geliştirilmesi ve Karakterizasyonu

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Bu çalışmada sürdürülebilir kaynaklardan elde edilmiş biyobazlı akrilat monomer ve oligomer karışımı fotopolimer reçineden UV-tabanlı 3 boyutlu yazma teknolojisi (DLP-Direct Light Processing) ile doku iskelesi oluşturulmuş ve iskele üzerinde hücre tohumlu (cell-seeding) büyüme incelenmiştir. UV ışığının tetiklediği fotopolimer reçine; yağ asidi temelli polyester akrilat, dekandiol dimetakrilat ve polimerik fotobaşlatıcı TPO-L (Ethyl phenyl(2,4,6-trimethylbenzoyl)phosphinate)'den oluşmaktadır. Fotopolimer reçinelerin biyouyumluluğunu arttırmak ve aralarındaki farkı gözlemlemek amacı ile BP-1 formülasyonunda diğerlerine ek olarak hindistancevizi yağı ile; BP-2 formülasyonunda ise diğerlerine ek olarak Poli(ethilen glikol) (average mol wt 300) (PEG300) ile çalışılmıştır. Fotopolimer reçinelerin kürlenme davranışı diferansiyel foto kalorimetri (Photo-DSC) ile karakterize edilmiştir. Hindistan cevizi yağının fotopolimerizyon hızını Poli(ethilen glikol)'e kıyasla %35 artırdığı gözlemlenmiştir. Bu nedenle 3 boyutlu iskele çalışmaları, BP-1 formülasyonu ile yapılmıştır. 35 derecelik izotermal modda gerçekleştirilen BP-1 fotopolimerizasyonu; 50 mikronluk katman kalınlığı için optimum UV ışık yoğunluğu 45 w/cm^2 ve 13 saniye maruz kalma süresi ile 3 boyutlu yazıcıda uygulanmıştır.

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Keyword: *Photo-DSC, 3D printing, sustainable sources*

ID: 201

Advanced Morphing Airfoil Structure: The Integration of Trichiral, Tetrachiral, and Hexachiral Auxetic Patterns in Aircraft Wings Through Additive Manufacturing

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The innovative design of an aircraft's wing plays a major role in improving the efficiency of the air vehicles in various flight conditions. The aerospace industry has gone through a change in airfoil design with the utilization of auxetic materials and morphing airfoil concept in the literature. Auxetic materials is a kind of material that are generated by the means of special geometrical configurations both macroscopic and microscopic levels [1]. Re-entrant, chiral, honeycomb and 3D printed complex geometries are the most common geometrical arrangements responsible for auxetic effect of the materials. These materials possess negative poison's ratio (NPR) and a reversed deformation mechanism as compared to conventional materials. They expand transversely under uniaxial stresses (vice versa for compression) and this offers distinct advantages including enhanced flexibility, tailorable stiffness, higher shear modulus, indentation toughness and energy absorption [2,3]. These properties are essential especially for dynamic flight conditions. In addition, the coupling of auxetic structures with various types of materials has revealed a broad range of applications, not only in aerospace industry but also in other areas such as smart filters, sensors, medical devices and tissue engineering. Although it has many advantages, there are some limitations in terms of manufacturing method. Therefore, additive manufacturing (AM) gains attention since it is more convenient and cost-effective than the conventional production methods [4]. There are numerous researches and promising findings about auxetic materials and their implementation to many applications in the literature. However, best of author's knowledge, there is no comprehensive work on the effect of geometrical configurations on mechanical properties of aircraft's wing fabricated by additive manufacturing using different polymeric filaments. In this work, airfoil structures made of 3- (Trichiral), 4-(Tetrachiral) and 5-(Hexachiral) geometries with different dimensions were produced by additive manufacturing. PLA, Carbon Fiber (CF) PLA and ABS filaments were used to fabricate the auxetic airfoil structure. Then, they were subjected to tensile and compression tests to examine mechanical properties. Thereafter, behavior of airfoil under different flight conditions was estimated using finite element analysis (FEA). The results obtained were compared and the auxetic airfoil structures most suitable for different flight conditions were presented.

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Keyword: *morphing airfoil, auxetic structure, additive manufacturing*

ID: 438

The Usage of Polymers In ''PCR'' Tyre Tread Production and Their Effects on Performance Parameters

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In tyres, there are many compounds such as tread, sidewall, belt, ply, inner liner and so on. Thus, their compatibility is very important. However, while providing a good compatibility among compounds, the performance parameters like abrasion resistance, low temperature properties, wet traction, rolling resistance and heat build-up should be also considered. The main raw material in a compound recipe is rubber. Therefore, the decision of rubber polymer is very crucial.

This research was studied on the features of rubber polymers which are natural rubber (NR), isoprene rubber (IR), butadiene rubber (BR), styrene-butadiene rubber (SBR), isoprene-isobutylene rubber (IIR) in PCR tyre tread compounds and their effects on performance parameters. Natural rubbers, isoprene rubbers and butadiene rubbers are homopolymers. On the other hand, styrene-butadiene rubbers and isobutylene-isoprene rubbers are copolymers.

Natural rubber is derived from latex which contains cis-1,4-polyisoprene. It provides high tensile and tear strength without fillers, excellent resilience and good cold resistance. The features of isoprene rubber are similar with that of NR. IR has the same microstructure is of NR, but with a lower molecular weight and lower amount of pure 1,4-cis configuration (~97%). Butadiene rubber is produced by the polymerization of 1,3-butadiene via acatalyst. The catalyst used in the production determines the type of BR: Nd catalyst (98% cis, 1% trans); Co catalyst (96% cis, 2% trans); Li catalyst (96% cis, 3% trans). BR has high fatigue and abrasion resistance, low hysteresis and good properties at low temperatures. Styrene-butadiene rubber is synthesized via free-radical polymerization as an emulsion in water, called Emulsion-SBR (E-SBR), or anionically in solution, called Solution-SBR (S-SBR). In E-SBR production, the only variables that are modifiable are the ratio of styrene to butadiene and the molecular weight. Therefore, cis, trans, and vinyl ratios in the material are random. On the other hand, because S-SBR is produced under better controlled conditions, the microstructure of the butadiene component can be more precisely controlled, and a more linear polymer chain with less branching can be produced. This primarily enhances the material's elasticity, rolling resistance, and wet grip. Isobutylene-isoprene rubber has excellent aging stability, high impermeability to gases and high resistance to heat.

As a result, it could be concluded that in order to improve performance parameters of a PCR tyre tread compound, the compatibility and dispersibility of polymers among them and between other chemicals should be provided well, and their quantity should be adjusted properly in the compound recipe.

ID: 187

Smart Polymers Based on N-Alkyl (Meth)Acrylates with Excellent Processability, Self-Healing, and Shape Memory Properties

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Three-dimensional (3D) printing is a revolutionary manufacturing technique that allows for exact layer-by-layer construction of products directly from computer-aided digital designs, fostering mass customization, enabling low-volume production, and lowering manufacturing costs and material waste. Light-based 3D printing stands out among the many types of 3D printing because to its high resolution, control over material characteristics, quick prototyping capabilities, and effectiveness in lowering manufacturing time. However, it is challenging to strike a compromise between obtaining high resolution and maintaining production speed with this technology. The normal exposure time, in particular, is an important variable in this type of printing since it influences the entire success of the 3D printing process by impacting the quality, accuracy, speed, and mechanical qualities of the final print. It is a delicate balance that must be carefully calibrated to achieve the finest potential results. Photo-DSC is an effective method for estimating the normal exposure duration for photopolymer resins in 3D printing by examining the resin's curing kinetics and thermal characteristics during light exposure. The goal of this study is to show how machine learning (ML) methodologies may be used with photo-dsc analysis to speed up the creation of resin compositions for light-based 3D printing. Using photo-DSC, the effects of monomers such as 2-Hydroxyethyl methacrylate (HEMA) and 2-Hydroxyethyl acrylate (HEA), as well as photoinitiators like diphenyl(acyl) phosphine oxide (TPO) and phenylbis(acyl) phosphine oxide (BAPO), and crosslinkers that include dipropylene glycol diacrylate (DPGDA) on curing time were studied. A central composite design (CCD) generated a coordinative mathematical model for these variables using Minitab 17 software. The results showed that the theoretical data can be correlated with the experimental data from photo-dsc analysis, and that the normal exposure time can be determined using the curing time obtained by photo-DSC, with a 2-3 s fluctuation. Together, these modeling techniques, together with photo-dsc, might be used to forecast the usual exposure time for light-based 3D printing.

Keyword: *3D printing, photo-curing, self-healing, smart polymers*

ID: 79

PETG Continuous Carbon Fiber Filament Fabrication for 3D Printing

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The rising global demand for high-quality, on-demand products, coupled with the need for flexible and efficient production systems, has spurred the development of additive manufacturing technologies. Combining human-free production with sustainable thermoplastic polymers will yield long-term applicability. The primary challenge with thermoplastic matrices in composites lies in impregnating fiber reinforcements with highly viscous resins. Various processing paths were explored and optimized to address this issue, ultimately leading to the development of several approaches that are either currently in use or nearing commercialization. These efforts aim to produce well-wetted thermoplastic matrix composites. This study outlines the direct melt impregnation method and continuous impregnation process for infusing thermoplastic resin into dry carbon fiber tow. PETG resin was chosen for its established properties, with the aim of assessing the compatibility between DowAksa's carbon fibers and PETG resin with new impregnation die design. Optimal operating conditions were established for impregnating PETG resin into carbon fibers sourced from DowAksa and other supplier. Once production parameters were defined, continuous carbon fiber filaments were manufactured and supplied to a 3D printer to create test coupons. The PETG continuous carbon fiber filaments underwent testing for tensile strength and morphology, while the 3D-printed samples were characterized in terms of interlaminar shear strength, dynamic mechanical analysis and morphology. The findings suggest that sizing and broken filaments of carbon fibers impact fuzz accumulation during impregnation. Carbon fibers with lower fuzz accumulation exhibit improved tensile properties when incorporated into PETG-impregnated filament form. Moreover, 3D printed samples prepared using DowAksa carbon fibers demonstrate a 24% improvement in interlaminar shear strength (ILSS) performance compared to samples prepared using carbon fibers from other source. While the properties of the matrix and carbon fibers are key determinants of ILSS properties, the impregnation process and wetting also play critical roles.

Keyword: *carbon fiber, continuous filament fabrication, additive manufacturing*

ID: 105

PBF-LB Process Parameter Effects on Functionalized PA12 Powder Feedstocks Produced via Dissolution-Precipitation Process

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Polyamide-12 (PA12) is the most promising material in the Powder Bed Fusion (PBF) process and can be used to develop mechanical, electrical, or optical properties through the addition of functional additives. In this study, PA12 powder feedstocks were produced by varying several dissolution-precipitation process parameters in a 20-liter reactor, including pressure and temperature. The as-produced powders were then functionalized by additives with an amount of <4 wt.%. The additives were fumed silica to improve flowability during PBF-LB process; nano TiO_2 and antioxidants to obtain long-term white color in printed parts, and micro-glass beads to improve the mechanical properties of printed parts. The particle size distribution, morphology, sintering window, melt flow index, and Hausner ratio of functionalized PA12 powders were evaluated before PBF-LB process. The powder feedstocks were processed and optimized SLS processing parameters were identified by varying volumetric energy density between 0.200 and 0.500 J/mm³. Following the parameter detection experiments, 0.26 and 0.27 J/mm³ energy densities were used to print specimens for tensile, 3-point bending, and impact test methods following ISO standards. The tensile properties, flexural modulus, Charpy impact strength, and Izod impact strength of the investigated printed specimens were evaluated.

Keyword: *Additive Manufacturing, Laser Powder Bed Fusion, Thermoplastic Polymer*

ID: 315

Moleküler Baskılı Polimerlerde Bağlanma Bölgelerinin Boyut ve Boyut Dağılımının İncelenmesi

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Moleküler baskılama, hedef molekül adı verilen çeşitli moleküller için polimerik matrislerde tanıma (bağlanma) bölgelerinin oluşumu ile başta akıllı adsorbanların geliştirilmesi olmak üzere sensör ve katalizör gibi pek çok farklı uygulamada kullanılabilecek malzeme sentezine olanak sağlayan bir yöntemdir. Bu yöntemde hedef molekül ve fonksiyonel monomer(ler) bir ön-polimerizasyon kompleksi oluşturur. Bu kompleks daha sonra bir çapraz bağlayıcının varlığında polimerleştirilir/çapraz bağlanır. Hedef molekülün çıkarılmasıyla polimer ağ yapıda hedef molekülü şekil, işlevsellik ve boyut açısından tanıyabilen boşluklar oluşur. Bu boşlukların boyutu hedef molekülün seçici olarak yeniden bağlanmasını sağlayan etkenlerden biridir. Özellikle kimyasal yapı açısından birbirine son derece yakın olan moleküllerin seçimli ayrımında bağlanma bölgelerinin boyutu ve boyut dağılımı önem kazanmaktadır [1].
Bu çalışmada yerinde polimerizasyon ve yüzey baskılama gibi farklı yöntemler ile hazırlanan moleküler baskılı polimerler için bağlanma boyutu ve boyut dağılımı positron yok olma ömrü spektroskopisi (PALS) ile incelenmiştir. PALS, polimerik ağ yapılarda serbest hacimli boşlukların boyut ve boyut dağılımını incelemek için kullanılan mutlak yöntemlerden biridir [2]. Yapılan PALS analizleri sonucunda hedef molekülün serbest hacimli boşluk boyut dağılımında homojenliğe sebep olduğu farklı moleküller için hazırlanan farklı baskılama sistemleri için görülmüştür.

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Keyword: *moleküler baskılama, PALS, seçimli ayırma*

ID: 145

One Pot Synthesis of SCNP-IPN Systems

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Polymeric nanoparticles range in size from 1 to 100 nm and can be loaded in different ways. There are two types of nanoparticles: nanocapsules and nanospheres, which can be distinguished by morphological methods. Nanostructures formed by intramolecular folding of polymeric chains in ultra-dilute media are called "Single chain polymeric nanoparticles (SCNP)" in literature. In addition to the diversity given by these structures, SCNPs cross-linked by dynamic covalent bonds, more intelligent nanoparticles with the ability to be reversible back to linear polymers with an external effect or to change the cross-link density can also be successfully produced. These structures, which can be dissolved instead of dispersed in the solvent, also exhibit homogeneous distribution in suitable polymer matrices, enabling the production of composite materials with superior properties.

An Interpenetrating polymer network is a polymer comprising two or more networks that are at least partially interlaced on a polymer scale but not covalently bonded to each other. IPN is obtained when at least one of the polymers is synthesized or crosslinked in the immediate presence of the other polymer without any covalent bond between them. IPN can also be defined as a combination of two or more polymers in the form of a network in which one polymer is crosslinked in the presence of the other.

In our study, the synthesis of single chain polymeric nanoparticles was combined with organogel formation, and starting from intramolecular crosslinking (SCNP), a transition was made to single chain nanogel (SCNG) via urethane bonds with intermolecular crosslinking. During the SCNG synthesis, a second gel system was realized in the same reaction medium using furan and bismaleimide functionalities to form the SCNP-IPN system.

GPC, 1H-NMR, FTIR, TEM, SEM, DSC, DSC, TGA, DLS techniques were used for the characterization of the synthesized molecules, polymers with different functionalities, and SCNP-IPN structure.

For the first time in the literature, SCNP-based IPN synthesis was realized. The use of full-IPN strategy with SCNP and SCNG structures constitutes a source for the literature.

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Keyword: *single chain nanomeric particles (SCNP), single chain nanogels, ınterpenetrated polymer network(IPN)*

ID: 426

SASA Polyester Vertical Integration Roadmap

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SASA is currently the biggest polyester producer in European region and wants to keep this position in near future. However, overall profit margins of global polyester market are getting lower due to low product cost pressure coming from far east and tightening of European carbon emissions regulations. Therefore, SASA needs to complete "Polyester Value Chain" in order to survive under this market conditions and become a regional leader in polyesters, olefins and aromatics derivatives production. With the COTC Project, SASA will supply its own feedstock to grow its chemical business (polyesters) and supply feedstock to Turkish producers and regional consumers. This presentation gives details of SASA's road map of completing "Polyester Value Chain" and reaching its ultimate target. It also summaries SASA's current new investments, together with SASA COTC's (Crude Oil to Chemicals) staggered investments.

ID: 36

Sentezlenen Antibakteriyel Polimerler ile Değişken Sıcaklıklarda Ultrafiltrasyon Membran Üretimi

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Membran alanında ki en büyük gelişme Loeb ve Sourirajan tarafından asimetrik yapılı membranların keşfedilmesi ile başlamıştır. Bu membranların yüzeyi yoğun tabakalı olup yüksek seçicilik ve akı sağlarken iç tabaka membrana dayanıklılık sağlamaktadır. Asimetrik membranların üretilmesinde faz dönüşüm metodu uygulanmış, polimer çözeltisi, çöktürücü sıvı içerisinde bekletildiğinde, membranların morfolojilerinin asimetrik gözenekli yapıda olduğu keşfedilmiştir.
Membran teknolojisi temelde bir sıvının daha konsantre hale getirilmesi veya sıvının içerisindeki bileşenlerin ayrılması olarak tanımlanabilir. Membran teknolojisi içme suyu arıtımı, atıksu arıtımı, gıda endüstrisi, tekstil endüstrisi, ilaç endüstrisi gibi birçok alanda kullanılmaktadır. Gelişen membran teknolojisi ile mikrofiltrasyon, ultrafiltrasyon, nanofiltrasyon, ve ters ozmoz sistemlerinin bir arada kullanıldığı sistemler geliştirilmiştir. Bu sistemler düz, hollow (içi boş) fiber, spiral sargı, borusal modüller hazırlanarak kullanılmaktadır. Genellikle spiral sargı ve hollow fiber membran modülleri kullanırken, spiral sargı modüllerinin geçirgenlik ve temizlenme özellikleri üstün tarafı iken, hollow fiberlerin aynı hacimde yüksek yüzey alanları üstün tarafıdır. Membran üretiminde genellikle solüsyon çekim prosesi uygulanmakta, solüsyon oranı, solüsyon sıcaklığı, solüsyon çekim hızı, banyo sıcaklığı ve içeriği gibi birçok faktör membran morfolojisini, mekanik özelliklerini, gözenek çapı ve dağılımı ile yüzey özelliklerini doğrudan etkilemektedir.
Membran teknolojisinin kullanımı birçok avantaj sağlamasına rağmen tıkanma, kek oluşumu, biyofilm oluşumu ve kirlenme gibi sorunlar membranların kullanımını sınırlamaktadır. Membranın doğal hidrofobik yapısının, kirlenme, kek oluşumu, tıkanma gibi sorunları arttırdığı bilinmektedir. Membranın yüzeyinde kalan bakterilerin oluşturduğu biyofilmler ise membranın tıkanmasına ve ömrünün kısalmasına neden olmaktadır.
Bu çalışmada, membranın geçirgenlik performansını arttırmaya yönelik olarak gözenek yapıcı hidrofilik katkı ve sentezlenen N-halamin polimerinin yapıya eklenmesi ile, antibakteriyel düz membranlar üretilmiştir. Gözenek yapıcı hidrofilik katkılar tıkanma, kirlenme gibi sorunları azaltırken, sentezlenen antibakteriyel N-halamin polimeri biyofilm oluşumunun önüne geçmektedir. Üretilen membranların termal, morfolojik, temas açısı, yüzey özellikleri ve mekanik özelllikleri belirlenmiş katkıların ve üretim sıcaklıklığı değişiminin membran üzerine etkileri tespit edilmiştir.

Keyword: *Membran, Antibakteriyel, N-halamin*

ID: 421

Electrospun Sulfonated-Silica-Based Proton Exchange Membranes for PEM Fuel Cells applications

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Nafion® membranes are the leading choice among commercially available options for PEM fuel cells, owing to their exceptional chemical and mechanical stability, as well as their high ionic conductivity in fully humidified environments. However, the high cost and diminished conductivity at lower humidity levels are significant drawbacks of these membranes. Two commen approaches have been extensively explored to address these challenges: completely replacing Nafion® with more cost-effective alternative membranes, or improving its characteristics by developing Nafion-based hybrid/composite membranes.

In this study, electrospinning used as well-known method for the fabrication of multi-component composite membrane material with freestanding fibrous structure for PEM fuel cells. P(VDF-TrFE) copolymer was employed as carrier polymer for this purpose, marking the first time this approach has been reported in the literature. First, sulfonated silica (S-SiO_2) nanoparticles with high water retention ability were synthesized through the hydrothermal method. These inorganic particles were dispersed in a PVDF or P(VDF-TrFE) solution, as carrier polymers, to prepare an electrospinnable solution. By applying a high voltage, polymeric fibers of fully and homogeneously covered with S-SiO_2 naparticles were obtained. The effect of polymer type and S-SiO_2 content on final properties of these membranes was studied preparing samples with three different S-SiO_2/polymer ratios. As a second approach, a combination of sol-gel and dual electrospinning method was employed to fabricate a three-component composite proton-conducting membrane composed of a S-SiO_2 network, Nafion®, and PVDF or P(VDF-TrFE). The aim of this work was to incorporate a sol-gel fabricated S-SiO_2 network into the Nafion®/carrier polymer matrix. In both approaches electrospun fibrous mats were transformed to a compact membrane via optimized hot-pressing process prior to electrochemical tests. The electrospun mats and compact membranes were characterized using various techniques such as FTIR, XPS, SEM, ionic conductivity, ion exchange capacity, water uptake, and tensile tests. In final step, membrane electrode assemblies (MEAs) were prepared using these membranes to investigate their fuel cell performance. In both cases the P(VDF-TrFE)/S-SiO_2-based membranes show superior ionic conductivities (102 and 132 mS/cm) compared to commercial Nafion® membranes at same condition. Additionally, improved fuel cell performance was achieved under low humidity condition (344 mW/cm² at 60% RH) due to the presence of S-SiO_2, which enhances water retention even at low humidity levels.

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Keyword: *Electrospinning, Proton conducting, Sulfonated silica, PEM fuel cell*

ID: 401

Kalkojen Esaslı Polimerlerin Sentezi ve Uygulamaları

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Kuşkusuz bulunduğumuz çağın adı bir malzemenin adı ile anılmış olsa idi bu ad "Polimer Çağı" olacaktı. Günümüzde eldivenden merdivene hayatımızın hemen hemen her yerinde polimerik malzemeleri kullanıyoruz. Gün geçmiyor ki farklı özelliklere sahip polimerik malzemeler ile karşılaşmayalım. İnsanoğlunun sınır tanımayan istekleri karşısında kuşkusuz polimerik malzemelerin özellikleri de sürekli bir devinim içerisinde kendisini yeniliyor. Bu devinime en çok katkısı olanlardan biri de "kalkojenler" olarak da anılan periyodik tablonun 16. Grubundaki atomlardır: oksijen (O), kükürt (S), selenyum (Se), tellür (Te) ve polonyum (Po). Kalkojen üyeleri birbirinden farklı atom büyüklükleri, elektronegativitileri ve metalik karakterlerinden dolayı yapısında bulundukları polimerik malzemeye farklı kimyasal, elektrokimyasal, optiksel, mekanik, termal vb. özellikler katabilirler. Örneğin kükürt ve selenyum esaslı polimerik malzemelerden hem iletken hem de yalıtkan polimerik malzemeler elde etmek mümkünken gerek kimyasal gerekse elektrokimyasal yöntemlerle elde edilen polimerik malzemerin farklı kullanım alanları da mümkündür: ileri malzemeler, sensörler, optik cihazlar (elektrokromik cihazlar ve ışık saçan diyotlar vb), transistörler, fotovoltaik hücreler vb. Bu çalışmada kalkojen esaslı iletken ve yalıtkan polimerik malzemerin sentezi, karakterizasyonu ve farklı uygulama alanları anlatılacaktır. Aynı polimerik malzeme içerisinde bulunan kalkojenlerin ilgili polimerin özelliklerine etkisi incelenecektir.

ID: 275

Vanilin İçeren Biyobazlı Monomer Sentezi ve 3B Yazıcı Uygulaması

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Petrol türevi bileşiklerin yerine alternatif ürünlerin geliştirilmesi, günümüzün en önemli araştırma konularından bir tanesidir. Biyokütleden ve biyo-bazlı hammaddelerden sentezlenen polimerler, petrol bazlı polimerlerin kullanımını azaltmakta ve böylece çevre dostu biyo bazlı polimerler elde edilmektedir [1,2]. Vanilin, türevlendirmeye uygun serbest hidroksil ve aldehit grupları içermesi nedeniyle polimer kimyası alanında sıklıkla kullanılmaktadır [3,4]. Bu çalışmada vanilinden başlanılarak, yine biyo-bazlı bir diamin olan dimer diamin bileşiği ile 3 boyutlu yazıcıda kullanılmak üzere imin yapıları içeren biyo-bazlı bir monomer sentezlenmiştir. 3 boyutlu yazıcılar hızlı ve ucuz olması, istenilen bileşiğin zaman ve mekan kısıtlaması olmadan elde edilebilmesi gibi bir çok avantaja sahiptir [5]. 3 boyutlu yazıcılarda doğal kaynaklardan elde edilen monomerlerin kullanılması ile petrol kökenli polimer türevlerinin yerine çevreci polimer ürünleri elde edilebilecektir. Ayrıca çalışmada yardımcı başlatıcı olarak kullanılabilecek yapıların polimerizasyon üzerine etkileri incelenmiştir. Sentezlenen monomer ve iki bileşenli başlatıcı sisteminin fotopolimerizasyon basamakları üzerine etkisini anlayabilmek için değişik başlatıcılar ile birlikte çeşitli ölçümler alınmış ve kinetik özellikleri araştırılmıştır. Elde edilen sonuçlarda fotopolimerizasyon kinetiğinde değişimlerin meydana geldiği gözlemlenmiştir. Ayrıca hazırlanan formülasyonların fiziksel, optik ve termal özellikleri incelenmiştir.

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Keyword: *vanilin, 3B yazıcı*

ID: 138

Designing of PLA Biocomposites Filled with Biomass Resources for 3D Printing Applications

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Polylactic acid (PLA) stands out as one of the most preferred materials in 3D printing applications, but PLA loses its dimensional stability due to its low glass transition temperature and melting temperature. To modify the thermal and mechanical properties of PLA, composites of PLA and biomass materials obtained at varying amounts of recycled PLA (0.5 wt.%, 1 wt.%, 3 wt.%, and 5 wt.%) were prepared through the internal mixing method. The structural (GPC, FTIR, XRD, SEM) and thermal (TGA, DSC) characterizations of the composites were developed. It was observed that the addition of biomass enhances the thermal stability and degree of crystallinity of PLA. The SEM images revealed a uniform distribution of biomass within the PLA matrix. Surface modification will be performed in order to improve the interaction between PLA and biomass.

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Keyword: *biocomposites, 3D printing applications, biomass resources*

ID: 379

Plastik Ambalajlarda Kaplama Teknolojisi ve Geri Dönüşüm

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Gıda güvenliği, gıdaların üretimi, işlenmesi, saklanması ve tüketilmesi süreçlerinde uyulması gereken standartlar ve önlemler bütünüdür. Gıdalardaki kimyasal, mikrobiyolojik ve fiziksel kontaminasyon risklerinin minimize edilmesini ve gıdaların tüketiciye güvenli bir şekilde ulaştırılmasını sağlamayı amaçlar. Petrol rafinelerinden çıkan çeşitli ürünlerin petrokimya tesislerinde işlenmesi ile edilen plastik ambalajlar birçok sektörde olduğu gibi gıda sektöründe yaygın olarak kullanılmaktadır.Gıda sektöründe termoplastik özellik gösteren geri dönüştürülebilir pet ambalajların kullanımı yaygındır.PET şişeler, içine doldurulan meşrubat gibi karbonatlı içeceklerin dayanıklılığı için yaygın olarak kullanılır. Ancak, karbonatlı içeceklerde bulunan karbonik asit, PET'nin bariyer özelliklerini etkileyebilir. Bu asit, PET şişenin moleküler yapısına nüfuz edebilir ve şişenin bariyer özelliğini azaltabilir. Özellikle, karbonik asit ile basınç altında duran meşrubatlar zamanla bu etkiye daha fazla maruz kalabilir. Bu durumda, PET şişenin içindeki gazlar dışarı sızar dışarıdan da hava alabilir. Bu durum içeceğin kalitesini ve tadını olumsuz etkileyebilir, çünkü karbonatlı içeceklerin lezzeti genellikle karbondioksit (CO2) varlığına bağlıdır. Bununla birlikte, PET şişeler genellikle CO2 bariyer özellikleri için ek kaplama veya teknolojilerle güçlendirilir. Örneğin, PET şişelerin iç yüzeylerine CO2 bariyeri sağlamak için kaplama maddeleri uygulanabilir veya çok katmanlı yapılar kullanılabilir. Bu teknolojiler, içeceğin kalitesini korumak için CO2 kaçağını önler ve ambalajın dayanıklılığını artırır. Kaplama, cam gibi saydam olmasına rağmen esnek, darbeye ve sürtünmeye dayanıklıdır. Ayrıca, difüzyonu büyük ölçüde azaltır ve içeceklerin raf ömrünü uzatır. Ancak, ambalaj endüstrisi tarafından geliştirilen teknolojiler sayesinde, PET şişelerin CO2 bariyer özellikleri artırılarak içeceğin kalitesi ve tazeliği korunabilir.Günümüz endüstrisinde kullanılan PET şişelerin gaz bariyeri özelliğini geliştirmek için Coating, Multilayer, Blending, Oxygen scavenger teknolojiler tek başına veya birleştirilerek kullanımı yapılır. Şişe kaplama teknolojisi içecek sektöründe yaygın olarak kullanılmaktadır.Kaplama malzemeleri ürün içeceğini dış etkenlere karşı koruyarak ürünün raf ömrünün uzamasını sağlamasının yanında ürün tat, koku ve dışarıdan gelebilecek kontaminasyon riskini azaltarak daha sağlıklı ürünlerin sunulmasını sağlar. Yıllarca plastik ambalajların üretim aşamasında fosil yakıtların kullanılması sonucunda ortaya çıkan zararlı atıklar kaplama teknolojisi sayesinde ürünün sadece camla temasın sağlanmasıyla malzemelerin geri dönüşümü, kaynakların yeniden kullanılmasını sağlayarak doğal kaynak tükenmesini azaltır, enerji tasarrufu sağlar ve atık miktarını azaltır. Sonuç olarak, geri dönüşümlü, yenilenebilir çevre dostu malzemeler üretilerek doğal kaynakların korunmasını, atık miktarını azaltmayı ve karbon ayak izini minimize etmeyi hedeflemektedir.

Keyword: *Polimer, Kaplama teknolojisi, Geri Dönüşüm*

ID: 354

Solventli ve Solventsiz Boya Sistemleri için Silikonsuz Polimer Bazlı Hava Giderici Ajanların Geliştirilmesi

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Endüstriyel boya ve kaplama sistemlerinde üretim ve uygulama süreçleri sırasında hava kabarcıklarının oluşumu, ürün performansını ve yüzey kalitesini olumsuz yönde etkileyen önemli bir sorundur. Bu kabarcıklar, kaplamalarda yüzey kusurlarına neden olarak nihai ürünün estetik ve işlevsel özelliklerini düşürebilir. Mevcut hava giderici çözümler genellikle silikon bazlı ajanları içermektedir; ancak bu bileşikler bazı uygulamalarda uyumluluk sorunlarına yol açarak istenmeyen boya kusurlarına sebep olabilmektedir. Bu nedenle, çeşitli boya formülasyonlarıyla yüksek uyumluluk gösteren ve etkili hava giderimi sağlayan, hem solventli hem de solventsiz boya ve kaplama sistemlerinde kullanılmak üzere özel olarak tasarlanmış yeni polimer bazlı hava giderici ajanlar sentezlenmiştir.

Çalışma, pazarda kullanımı olan ithal ürünlerin (rakip ürünlerin) yapılarının analizi ile başlatıldı ve bu ürünlerin kilit özellikleri incelendi. Bu ürünlerin karakterizasyonu tamamlandıktan sonra deneysel çalışmalar başlatıldı. Deneysel süreç, uygun akrilik monomerlerin belirlenmesi, polimerleştirilmesi ve formüle edilerek performanslarının değerlendirilmesi şeklinde planlandı ve yürütüldü. Sentezlenen polimerlerin yapısını doğrulamak için Nükleer Manyetik Rezonans (NMR) ve Fourier Dönüşümlü Kızılötesi Spektroskopisi (FTIR) gibi spektroskopik yöntemler kullanılırken, molekül ağırlığı dağılımı analizi için Jel Geçirgenlik Kromatografisi (GPC) kullanıldı.

Silikon içermeyen polimerik hava giderici ajanların performansı, öncelikle solventli akrilik boya formülasyonunda değerlendirildi. Karşılaştırmalı ilk çalışmalar, polimer bazlı ajanların hava giderim etkinliği, boya parlaklık değerleri ve ürün uyumluluğu açısından en az ithal rakip ürünler kadar iyi performans gösterdiğini ortaya koydu.

Sonuç olarak, bu çalışmada geliştirilen yeni polimer bazlı hava giderici ajanlar, boya katkı maddeleri alanında önemli bir yerel ilerlemeyi temsil etmektedir. Boya ve kaplama sistemlerinde hava kabarcıklarının giderilmesi için etkili, silikon içermeyen bir çözüm sunarak, endüstriyel ürünlerin kalite ve performansını artırmak için umut verici bir yerel alternatif sunmaktadır. Yapılan çalışmalar, sentezlenen polimerlerin çeşitlendirilmesi, büyük ölçekli üretim için sentez sürecinin optimize edilmesi ve farklı endüstrilerde ek uygulamaların keşfedilmesi amacıyla genişletilecektir.

Keyword: *Polimer bazlı hava giderici ajan, Boya ve kaplama sistemleri, Silikonsuz köpük kesici*

ID: 392

Conjugated Polymer Nanoparticles for Ethanol Sensing Applications

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Objectives: Due to conjugated polymers (CPs) numerous semiconducting qualities, ease of chemical modification, high fluorescence efficiency, large absorption cross-section, low cytotoxicity, and surface functionalization, they are highly sought after, particularly in the domains of biology, electronics, and sensing. Conjugated polymer nanoparticles (CPNPs) and water-soluble CPs produced by substituting hydrophilic functional groups for side chains have also garnered significant interest in several application domains [1]. They are thought to be promising nanomaterials with potential uses in biomedical application. Herein, CPNPs synthesized using the reprecipitation method in this instance [2], characterized, and utilized as a supporting material for biosensor applications.

Materials-Technique: Water-soluble CPs and CPNPs were synthesized and in order to obtain CPNPs, reprecipitation method was used [3]. This technique involves dissolving a conjugated polymer in a water-miscible organic solvent. The resulting solution is then quickly injected into water, which is sonicated or forcefully stirred while acting as a poor solvent for the polymer. Dynamic Light Scattering Spectrometer (DLS), Fluorescence Spectrophotometer, UV-Vis-NIR Spectrophotometer, and High Contrast Transmission Electron Microscope (CTEM) techniques were used to characterize synthesized conjugated nanoparticles.

Results and Conclusions: Using the reprecipitation technique, CPNPs were synthsized from CPs, and ethanol sensing studies were conducted for wearable technology.

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Keywords: Conjugated polymers, Polymer nanoparticles, Electrochemical biosenso

ID: 337

Polyvinyl Ferrocene Functionalized Electrodes for Electrochemically Mediated Boron Ion Adsorption

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Water scarcity is one of the major problems in the world and it has impeded the sustainable development of human society in recent years due to some factors such as population growth, climate change, increasing urbanization, agriculture and industrialization. According to research, a third of the world's population experiences severe water stress. Great effort has been put into finding methods to produce clean water. Among these methods, electrochemical processes are well-known platforms to be a sustainable technique for water purification due to their lower footprint, modularity, and scalability. In this work, polyvinyl ferrocene (PVF)–functionalized electrodes in a carbon nanotube (CNT) matrix were prepared for boron ion removal from an aqueous solution, and the properties of the PVF/CNT electrodes were investigated. The results showed that the optimum PVF/CNT ratio combined with ultrasonic irradiation exhibited the best coating of the electrode surface with a homogenous surface and the largest specific surface area, resulting in the highest boron adsorption efficiency. After that the electrosorption cell was designed for evaluating the performance of the electrodes and a continuous flow platform was fabricated by confining these PVF/CNT-coated electrodes in this cell. This electrochemical flow cell with symmetric redox-active electrodes revealed the occurrence of multilayer boron adsorption during electrochemical separation. In conclusion, it is possible to create an effective and environmentally beneficial electrochemical boron removal system with this approach.

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Keyword: *Polyvinyl ferrocene, Electrochemical separation, Boron removal*

ID: 289

Donor-Acceptor-Donor Type Conjugated Polymers and Their Usage in Electrochromic Devices

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Conducting polymers have been intensively investigated for decades; among them, donor-acceptor-donor (D-A-D) type polymers have received much attention due to their superior properties, such as lowering band gap, color tuning, adjusting pi-pi stacking, etc. During the application of the D-A-D approach, the target polymer can acquire some undesirable properties in addition to the desired ones. As a result, molecular design, or, in other words, molecular engineering, is very important at that point. This study summarized some observations made during the synthesis of thiadiazole, bisthiadiazole, thiadiazole quinoxaline acceptors, and thiophene; 3,4-ethylenedioxythiopehene; and 3,4-propylenedioxythiophene donors containing D-A-D-type polymers to tune band gap, color, and solubility. Also, D-A-D polymers can be utilized as electrochromic device materials. Also, the electrochemical and electro-optical characteristics (switching time, coloration efficiency, stability, etc.) of four novel dual electrochromic devices containing D-A-D conjugated polymers, changing colors from green to blue, were unveiled.

Keyword: *Conduncting polymers, Donor-Acceptor-Donor Approach, Electrochromism*

ID: 425

Advanced Nano-Polymeric Structures for Innovative Biosensors Development in Biomedical and Environmental Applications

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Integrating polymeric structures and nanomaterials has significantly advanced biomedical applications, particularly in developing biosensors [1]. This presentation will explore our experiences with advanced polymer-based nanomaterials, emphasizing their role in colorimetric and electrochemical biosensors for rapid, sensitive, and selective detection of biomolecules [2-3]. These sensors are essential in diagnostics, environmental monitoring, and point-of-care (POC) testing, offering real-time analysis with high precision and reliability. We will also discuss our recent work on the design and application of polymers and materials for environmental purposes, including air purification. By leveraging the unique properties of polymers alongside the functional capabilities of nanomaterials, we can create versatile platforms that address critical challenges in modern healthcare [2-3]. This presentation aims to provide insights into the evolving landscape of polymeric materials and nanotechnology, emphasizing their transformative impact and encouraging further exploration and innovation in the field.

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Keyword: *Polymers, Biosensors, Point-of-Care*

ID: 212

Artificial Intelligence Guided Design and Synthesis of Sequence-Controlled Polythiophene Polymers for Tailored Optical Properties

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This study presents an AI-guided approach for the design and synthesis of sequence-controlled polythiophene polymers with tailored optical properties. Leveraging computational algorithms, we generated sequences of polythiophene monomers adhering to specified structural constraints, ensuring efficient polymerization and desired electronic characteristics. The synthesized polymers were characterized using spectroscopic techniques to elucidate their optical properties, demonstrating the potential of AI-driven methodologies in precision polymer engineering for advanced applications.

ID: 172

Çevre Dostu, Biyobozunur PLA-PHB Karışımlarının Mekanik ve Termal Özelliklerinin İncelenmesi

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Son yıllarda petrol esaslı malzemelerin doğada birikmesi ile birlikte çevresel tehlikeyi önlemek amacıyla geleneksel polimerler yerine polilaktik asit (PLA) ve polihidroksibutirat (PHB) gibi biyo esaslı, çevre dostu ve biyobozunur polimerlerin kullanımı üretim teknolojilerinde önem kazanmıştır [1,2]. Bu çalışmanın amacı; PLA ve PHB temelli, mekanik açıdan üstün özelliklere sahip tamamen biyobazlı bir polimer karışımı elde ederek halihazırda kullanılan petrol türevlerine sürdürülebilir bir alternatif oluşturmaktır. Bu kapsamda, ekstrüzyon kullanarak PLA ve PHB polimerlerinin farklı oranlarda eriyik harmanlanması ile üretilen kompozitlerin mekanik ve termal özellikleri incelenmiştir. PHB'nin farklı oranlarda PLA'ya ilavesi, saf PLA ile karşılaştırıldığında, özellikle ağırlıkça 75/25 oranındaki karışımın mekanik özelliklerini ve termal kararlılığını önemli ölçüde iyileştirdiği gözlemlenmiştir. Saf PLA'nın kopma uzaması %4.15 iken PLA/PHB(75/25) karışımının kopma uzaması %7.86 mertebelerine yükselerek PLA'nın kırılganlığını azalttığı analiz edilmiştir. Buna ek olarak, saf PLA'nın darbe dayanımı 2.61 kJ/m2 iken PLA/PHB(75/25) karışımının darbe dayanımı 3.69 kJ/m2''ye yükselerek hem PLA hem de geleneksel PP kompoundlarından üstün özellikler elde edilmiştir. Bu sonuçlar, PLA/PHB karışımının homojen bir mikroyapıya sahip olarak etkin bir sinerji yarattığını göstermiştir. Ayrıca geliştirilen karışım, saf PHB'nin düşük termal stabilitesini iyileştirip yaklaşık 320°C'ye yükselterek grift şekilli komponentlerde kullanabilirliğini arttırmıştır. Sonuçlar dikkate alındığında, mekanik ve termal özellikler açısından en uygun PLA/PHB karışım oranının 75/25 olduğu görülmüştür. Bu karışımın, insan sağlığı açısından güvenli ve biyobozunur plastik uygulamalarında kullanılmasının yanı sıra, farklı modifikasyonlarla yaşam döngüsü uzatılarak dayanıklı tüketim ürünlerinde uygulanma potansiyeli öngörülmektedir.

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Keyword: *Biyobozunur, Biyobazlı, Karışım*

ID: 22

Kontrollü Salınımlı Gübre Teknolojisi için UV ile Kürlenebilir Biyopolimerlerlerin Sentezi ve Salınım Özelliklerinin İncelenmesi

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Gübre, bitkilerin büyümesine ve verimliliğine yardımcı olan kimyasal elementler içeren doğal veya sentetik bir besleyicidir. Bitkiler azotu; protein, klorofil gibi önemli bileşenlerin sentezinde kullanırlar. Makro besleyici olan N ihtiva eden gübrelerden dünya üzerinde en çok kullanılan 46% N içeriğine sahip üre gübresidir. Üre gübresi, toprağa uygulandıktan sonra buharlaşma ve akma gibi bazı dezavantajlara sahiptir. Bu durum bitkinin alabileceği azot verimini düşürürken aynı zamanda çevresel kirliliğe neden olmaktadır. Bu nedenle; kontrollü salınımlı gübreler son yıllarda standart tip gübrelerin yerini alarak, gübrenin kontrollü bir şekilde ve kontrollü konsantrasyonlarda salınımını sağlamaktadır[1].
Gübre granüllerini polimer esaslı membran ile kaplamak kontrollü salınım için etkili bir yöntemdir. Ancak polimer membranın biyobozunur olması önemli bir kriterdir. Kaplamada yaygın olarak sentetik polimerler, poliüretanlar, polisülfonlar ve bazı reçineler kullanılmaktadır. Petrol esaslı polimerler biyobozunur değildir ve çevre kirliliğine sebep olmaktadır. Bu nedenle, biyopolimerlerden yapılmış kaplamalara ilgi artmıştır. Kitosan, nişasta, selüloz, polihidroksibütirat, polilaktik asit gibi biyopolimerler kontrollü salınımlı gübre çalışmalarında kullanıldığı görülmektedir[2].
Bu çalışma kapsamında, üre granülleri akrilat/ metakrilat fonksiyonlu doğal polimerler (kitosan, nişasta) ile kaplandıktan sonra UV ile foto kürleme yapılmıştır. Polimer kaplı üre granüllerinin kontrollü salınım performansı su ortamında araştırılmıştır. Çapraz bağlı polimer membranların, yağmur ve yüksek nem gibi çevresel değişkenler için uzun süreli besin salınımı ve daha stabil özellikler sağlayacağı öngörülmektedir.

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Keyword: *Biyopolimer, kontrollü salınımlı gübre*

ID: 126

Effect of Preparation Methods on Morphological and Rheological Properties of PHBH/CNC Nanocomposites

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The development of biobased and biodegradable polymers as alternatives to petroleum-based polymers is one of the environmental concerns nowadays. Poly(3-hydroxybutyrate-co-3-hydroxyhexanoate) (PHBH) differs from other biopolymers thanks to its superior degradation and compostability properties. However, PHBH's lower mechanical properties compared to petroleum-based polymers, as well as poor rheological properties such as slow crystallization, are difficulties that prevent PHBH from being used more widely. One of the most common methods used to improve rheological and mechanical properties is producing nanocomposites by adding nanoparticles (e.g., CNC) to the PHBH matrix. In this study, PHBH nanocomposites with cellulose nanocrystals (CNC) were prepared through solution casting using four different solvents: tetrahydrofuran, chloroform, dimethylformamide, and dimethyl sulfoxide. As DMSO was found as the most effective solvent in dispersing CNC within the matrix, nanocomposites were produced with different PHBH grades (PHBH X151C, PHBH X131A, PHBH X331A) using DMSO, and the effects of PHBH molecular weight and HH comonomer content were explored. Finally, to determine the effect of CNC percentage, PHBH/CNC nanocomposites with 1%, 3%, and 5% CNC were compared. Rheological melt properties were examined to reveal the effect of solvent type, PHBH grade and CNC percentage on CNC dispersion in all samples. Furthermore, thermal and mechanical properties of PHBH/CNC nanocomposites were analyzed to examine the efficiency of each preparation method on CNC dispersion and PHBH/CNC nanocomposites properties.

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Keyword: *PHBH, biodegradable polymers, nanocomposites*

ID: 398

Using Blown Film Technology Biodegradable Polyethylene Film Production

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As Pelsan Tekstil, in order to bring sustainable solutions to the use of polymers in the world, we have developed the world's first biodegradation technology that can provide full microbial conversion of polyolefins in open environment. This technology can provide full biodegradation on PP & PE materials. The advanced catalytic system converts PP and PE materials into wax. Unlike oxo-degradation, no microplastics or toxic substances are left behind in the post-degradation stage, thanks to a bio-available wax that naturally occurring microorganisms can easily assimilate.
According to research, polymer use in the world is over 311 million tons. While the demand for polymers is projected to increase by 5.1% between 2020 and 2030, the recycling rate is only 14%. The non-recyclable portion accumulates as waste in soil and oceans.
Biodegradable polymers are biodegraded by various microorganisms and enzymes in nature and broken down into their natural components. Thus, they can be recycled into the natural cycle without leaving microplastics. However, they are considerably more expensive than non-biodegradable polymers. In addition, biodegradable polymers are very vulnerable to heat and are damaged during extrusion.
Therefore, our project goal is to make our product biodegradable by using an optimum amount of additives with our standard polyethylene film production formulation without making any changes in the technologies we already use. The biodegradation process is dominated by different factors including polymer properties, the type of organism and the nature of the pretreatment. Polymer properties such as the mobility of the polymer chains, crystallinity, molecular weight, the type of functional groups and substituents present in the structure, the plasticizers or additives present, all play an important role during degradation.
The additive has the ability to promote different chemical reactions upon the polymer structure simultaneously. Our individually formulated additive acts as an initial food-source for microbes to help boost the biodegradation in the early stages of decay. The technology is fully compatible with normal mechanical recycling processes. No adverse impact on the mechanical characteristics and optical aspect of recycled products when mixed into the standard recycled supply chain.

Keyword: *biodegradable, polyethylene, blown film*

ID: 325

LDPE/Kenevir Kompozitlerinin Hazırlanması ve Karakterizasyonu

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Petrol ve türevlerinden elde edilen ve günlük hayatta her alanda karşımıza çıkan plastikler toprak, hava ve su kaynaklarındaki temel kirliliğin en önemli sebeplerinden biridir. Biyobozunur olmadığı gibi çevrede varlıklarını uzun süre koruyan bu yapılar karada ve suda her geçen gün büyüyen ve önlenemeyen atık yığınlarının oluşumuna neden olmaktadır. Buna bağlı olarak çevresel birikim ve tahribat günümüzü ve gelecek nesillerimizi tehdit etmektedir. Bu nedenle doğal kaynakların kullanılması ile yenilenebilir ve biyobozunur hammaddelerin geliştirilmesi ve farklı alanlarda ürüne dönüşümleri için gerekli çalışmaların yapılması gerekmektedir.
Kenevir bazlı plastikler, çevresel faydaları ve sürdürülebilirlikleri ile dikkat çekmektedir. Ancak, aseptik kapaklarda yaygın olarak kullanılmaları için maliyetlerin düşürülmesi, performanslarının artırılması gerekmektedir. LDPE ise halihazırda bu alanda yaygın olarak kullanılan, güvenilir ve ekonomik bir malzeme olarak varlığını sürdürmektedir.
Bu çalışmada her iki malzemenin de özelliklerinden faydalanarak daha çevre dostu aseptik kapak üretimi için biyokompozitler hazırlanmış, karakterizasyonları ve üretim aşaması için optimizasyon çalışmaları gerçekleştirilmiştir. LDPE gibi hidrofobik yapılı bir polimer ile etkileşimlerini arttırmak üzere kenevir lifleri farklı yöntemler ile modifiye edilmiştir. Farklı oranlarda modifiye edilen kenevirler ile LDPE ekstrüderda karıştırılarak biyokompozitler hazırlanmıştır. Hazırlanan kompozitlerin yapısal özellikleri FTIR ile incelenirken, eklenen kenevir miktarının kompozitin termal ve mekanik özelliklerini nasıl etkilediği de incelenmiştir. Kenevir katkısı ile kompozitlerin yoğunluklarının azaldığı, termal ve mekanik dayanımlarının arttığı görülmüştür. LDPE/kenevir kompozitlerinin aseptik kapak üretiminde kullanılması, hem performans hem de çevresel sürdürülebilirlik açısından umut vaat etmektedir.

Keyword: *Biyobozunur malzemeler, Kenevir bazlı plastikler, LDPE*

ID: 363

Biyomedikal Uygulamalarda Kullanım Amaçlı Poli(laktik-ko-glikolik asit) (PLGA) Kompozitlerinin Geliştirilmesi ve Karakterizasyonu

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Biyobozunur polimerler özellikle biyomedikal uygulamalarda sıklıkla tercih edilmektedir. Gerek ilaç taşınım sistemlerinde gerekse diğer doku mühendisliği uygulamalarında vücut içine alınan polimerin herhangi bir cerrahi müdahale gerektirmeden kendiliğinden bozunması önemli bir avantaj sağlamaktadır. Bu çalışmada kullanılan poli(laktik-ko-glikolik-asit) (PLGA), polilaktik asit (PLA) ve poliglikolik asit (PGA) polimerlerinden oluşan biyobozunur bir kopolimerdir. Bu çalışmanın ilk aşamasında, doku mühendisliği uygulamalarında sıklıkla tercih edilen, laktit (L) ve glikolit (G) dimerlerinin kopolimeri PLGA polimeri sentezlenmiştir. Polimerin kimyasal yapısını doğrulamak için Fourier dönüşümlü infrared (FTIR) ve nükleer manyetik rezonans (NMR) spektroskopisi, termal özelliklerini belirlemek için termogravimetrik analiz (TGA) ve diferansiyel taramalı kalorimetre (DSC) analizleri, mekanik dayanımını için ise çekme testi yapılmıştır. Çalışmanın ikinci aşamasında geleneksel bir yöntem olan çözücü döküm/partikül uzaklaştırma yöntemi ile doku iskelesi üretimi yapılmıştır. Polimer içerisine farklı oranlarda silanlı 45S5 biyoaktif cam (BG) ve nanoselüloz (NC) ilavesi yapılarak PLGA'nın mekanik özellikleri ve kemik doku için gerekli apatit oluşumu iyileştirilmeye çalışılmıştır. Öncelikle ikili kompozitler elde edilip, karakterizasyon sonuçlarına göre optimum oranlar seçilerek PLGA/sBG/NC üçlü kompozitleri hazırlanmıştır. Elde edilen doku iskelelerinin taramalı elektron mikroskobu (SEM) ile morfolojik yapıları incelenmiş, gözeneklilik oranları hesaplanmış ve gözenek çap dağılımları belirlenmiştir. Basma testi sonuçlarına göre; her iki katkı maddesi için de oran arttıkça basma modülü ve dayanımı artmış ve hedeflenen süngerimsi kemik dokuya ulaşılmıştır. sBG katkısı arttıkça apatit oluşumunun; NC katkısı arttıkça ise hidrolitik bozunmanın arttığı görülmüştür. İki farklı hücre hattı kullanılarak üçlü doku iskelelerinin hücre kültür çalışmaları yapılmış ve hiçbir numunede sitotoksik etki görülmemiştir.

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Keyword: *Poli(laktik-ko-glikolik-asit), biyoaktif cam, nanoselüloz*

ID: 61

Isı Enerjisi Depo Eden Polimerik Mikrokapsüllerle İlgili Güncel Çalışmalar

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Polimerik mikrokapsüller ısı enerjisi depolama amaçlı olarak yaygın biçimde araştırılmasına rağmen henüz yeterince kullanılabilirlik düzeyine ulaşmamıştır. Ülkemizde bu konuda yapılan çalışmalarda Tokat Gaziosmanpaşa Üniversitesinde yer alan polimer araştırma laboratuvarında gerçekleştirilen ısı enerjisi depolama amaçlı mikrokapsüllerin çeşitli boyutlarını içeren çalışmalar önemli yer tutmaktadır. Faz değişim maddelerinin kapsüllenmesi konusundaki çalışmalar artık kapsüllenen faz değişim maddesi dolayısı ile elde edilen ısı enerjisi depolama yoğunluğu ve çalışma sıcaklığı kadar kapsül yapısı dolayısıyla sahip olunan fonksiyonellik üzerine de yoğunlaşmıştır. Bu nedenle ortaya yanmazlık, kolay yapışabilirlik ya da kimyasal bağlanabilirlik, sıcaklık sensör özelliği, manyetik duyarlık ve ışık duyarlılığı gibi uygulamalar konusundaki çalışmalarla devam etmektedir. Son yıllarda bor kabuklu mikrokapsülenmiş yapılarla üretilen malzemelerin mekanik ve ısıl etkilere daha dayanıklı olması ve yanmaz özelliğe sahip olması hedeflenmiştir. Üretilen kapsüllerde kabuk duvar yapısında metal biriktirme ya da nanometal parçacık yükleme sayesinde bu parçacıkların güneşten kendiliğinden ısı üretebilme özelliğine sahip olması da sağlanmıştır. Fototermal etki üzerine yapılan çalışmalar sentetik ve doğal yollardan elde edilen mikrokapsüllenmiş faz değişim malzemelerine uygulamalar üzerine şekillenmiştir. Ayrıca, yapılan çalışmalar mikrokapsüllerin daha kararlı veya daha kolay üretilebildiği metotsal çalışmalarla da devam etmektedir. Bu çalışmalarda atık polimerlerin değerlendirilmesi üzerinde de durulmaktadır. Mikrokapsüllenmiş yapılar teksil ve inşaat uygulamaları için de değerlendirilmektedir. Isı enerjisi depo edebilen mikrokapsüllenmiş yapılarla ilgili özel sektör uygulamaları ise uygulanabilirlik ve fonksiyonel özellikler üzerine devam etmektedir.

Teşekkür: Devam eden çalışmalarımıza maddi desteklerinden dolayı Tokat Gaziosmanpasa Üniversitesi Bilimsel Araştırma Projeleri Destekleme Ofisi'ne (TOGÜ-BAP Pr No: 2022/24) ve TUBİTAK 1001 (Pr No: 123Z039) ve 3501 (Pr No: 123M172) programlarına şükranlarımızı bildiririz.

Keyword: *Faz değişim malzemesi, Mikrokapsülleme, Isı enerjisi depolama*

ID: 345

Poli Oleik Asit Bazlı Makro-RAFT Ajanı Kullanılarak Tersinir Katılmalı/Ayrışmalı Zincir Transfer (RAFT) Polimerizasyonu Yoluyla Poli(Stiren)-g-Poli(Oleik Asit) Graft Kopolimerlerinin Sentezi

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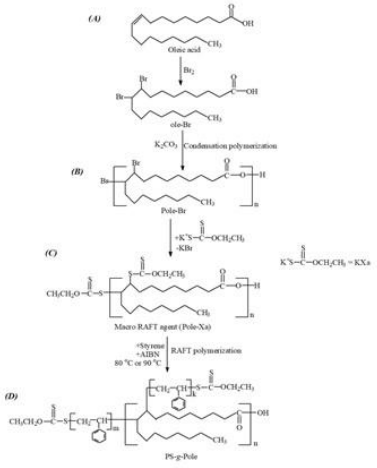
Tersinir Katılmalı Ayrışmalı Zincir Transfer Polimerizasyonu (RAFT) yaşayan/kontrollü radikal polimerizasyon teknikleri arasında en son bulunan ve yakın bir geçmişe sahip bir teknik olup Rizardo ve ekibi tarafından öne sürülmüştür [**1**]. Kondenzasyon polimerizasyonu, genellikle –OH, -NH_2, -COOH, türü taşıyan fonksiyonel gruplar taşıyan moleküller arasında olur. Kondenzasyondan polimer elde edebilmek için en az iki noktadan kondezasyona katılabilecek kimyasal maddeler gerekir. Kondenzasyon bu noktalardan ard arda ilerlemesiyle polimer zinciri (polikondenzasyon) oluşmuş olur [**2**]. Bu çalışmada, bir poli(stiren)-g-poli(oleik asit) aşı (graft) kopolimeri üretmek için yeni bir polimerik oleik asit türevi makro katılmalı/ayrışmalı zincir transfer ajanı (RAFT) kullanıldı. Oleik asidin çift bağı başlangıçta brom ile doyuruldu ve karboksilik asit ile bromür arasındaki yoğunlaşma polimerizasyonu, asılı bromür gruplarına sahip poli oleik asitle sonuçlandı. Ksantat grupları, poli(oleik asit) makro RAFT ajanını (Pole-Xa) elde etmek için bromür gruplarıyla yer değiştirdi. Poli(stiren)-g-poli(oleik asit) (PS- g -Pole) aşı (graft) kopolimerleri, stirenin tersinir katılmalı/ayrışmalı zincir transferi (RAFT) polimerizasyonu yoluyla sentezlendi ve reaksiyon, polimerizasyon kinetiği açısından değerlendirildi. Polimerizasyon sıcaklığı ve reaksiyon süresinin aşı kopolimer verimi, dönüşümü ve molekül ağırlığı üzerindeki etkileri araştırıldı. Stirenin RAFT polimerizasyonunda hız sabiti (k), 80 °C ve 90 °C polimerizasyon sıcaklıkları için sırasıyla $1.83x10^{-3}$ L mol^{-1} dk^{-1} ve $7.27x10^{-4}$ L mol^{-1} dk^{-1} olarak bulunmuştur. Elde edilen ürünlerin yapısal özellikleri ve termal özellikleri FT-IR, ^{1}H -NMR, GPC, TGA, DSC ve SEM-EDX kullanılarak karakterize edildi. Senteze ait reaksiyon aşamaları ve sentez mekanizmalar Şema 1'de gösterildi.



Şema 1: Brom uçlu oleik asit (ole-Br) **(A),** Pole-Br'nin sentez mekanizması **(B),** makro RAFT ajanının kimyasal sentez reaksiyonu (Pole-Xa) **(C),** PS-g-Pole graft kopolimerlerinin sentez mekanizması **(D).**

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Saçak, M., Polimer Kimyası, 9. baskı , 2010, Gazi Kitabevi ,Ankara

Keyword: *Brom uçlu oleik asit; graft kopolimer, polimerik oleik asit; polimerizasyon kinetiği*

Dipeptit Yan Gruplar İçeren Polimerlerin Klik Kimyası ile Modifikasyonu ve Elektriksel Özelliklerinin İncelenmesi

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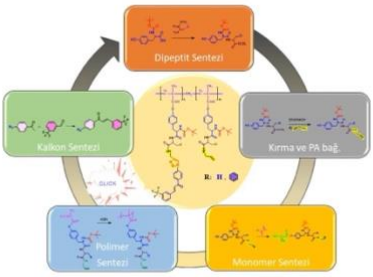
Bağlı olan sübstitüe gruplara göre çok farklı özellikler kazanmaları ve ileri teknolojik malzemeler olarak da kullanılmaları nedeniyle yeni fonksiyonel polimerlerin elde edilmesine ve uygulama alanlarının belirlenmesine yönelik çalışmalar önem arz etmektedir. Fonksiyonel polimerler organik yapılı polimerler olarak da adlandırılmaktadır. Organik polimerler, yarı iletken malzemeden enerji alanına, sensör uygulamalardan biyomedikal uygulama alanlarına kadar çok farklı özellikler gösterebilme potansiyeline sahiptir. Peptit bileşikleri polimer elde etmek için fonksiyonel grup olarak kullanılan yapılardan biridir. Bu çalışmada bir metakrilat ana zincirine dizili tirozin bazlı alanin ve fenilalanin içeren dipeptit yan gruplu yeni metakrilat polimerleri sentezlenmiş ve klik reaksiyonu kullanılarak kalkon bileşikleri ile modifiye edilmiştir. Böylece, π-konjuge sistemin uzunluğunun artması optik yanıtı artırabilecek ve ayrıca ışık uyarımı altında π-elektronlarının delokalizasyonuna katkıda bulunma potansiyeline sahip modifiye-polimer yapıları elde edilmesi ve elektriksel özelliklerinin incelenmesi amaçlanmıştır. Burada ana zincir olarak metakrilat grubunun seçilmesi optik şeffaklık, yüksek ışık geçirgenliği ve termal kararlılık özelliklerinden dolayıdır. Elde edilen bileşiklerin yapıları spektroskopik metotlarla (FT-IR, ^{1}H,^{13}C NMR) karakterize edilmiştir.



Polimerlerin dielektrik ve elektriksel özellikleri, 1-200 kHz frekans aralığında frekansın bir fonksiyonu olarak araştırıldı. Sabit sıcaklıklarda artan frekans değerleri ile dielektrik sabitinin azaldığı görülmektedir. Frekans arttıkça dielektrik sabitinin ve dielektrik kaybının azaldığı, daha yüksek frekans değerlerinde ise sabit kaldığı gözlemlenmiştir. Ayrıca homopolimerin dielektrik sabiti klik ile modifiye edildikten sonra önemli derecede artış göstermiştir. Dielektrik sabitinin artmasındaki neden klik reaksiyonu ile oluşan triazol halkasının ve yapıya eklenen konjuge kalkon yapısının elektrik alan altında daha çok polarize olmasından kaynaklandığı düşünülmektedir. Benzer davranış alternatif akım iletkenlik değerlerinde de gözlenmştir.

Teşekkür
Bu çalışma Türkiye Bilimsel ve Teknolojik Araştırma Kurumu tarafından **1919B012219332** (TÜBİTAK-2209-A) nolu proje ile desteklenmektedir. Projeye verdiği destekten ötürü TÜBİTAK'a teşekkürlerimizi sunarız.

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[1] Zhang, W., Tu, Z., Snehashis J., Lynden C., Lu, A. 2018. Design Principles of Functional Polymer Separators for High-Energy, Metal-Based Batteries, Nano-micro small, 14, 1703001, (1-21). [2] Chen, L., Yan, C., Zheng, Z. 2018. Functional polymer surfaces for controlling cell behaviors, Materials today, 21, 38-59. [3] MacFarlane, L., Shaikh, H., Garcia-Hernandez, D., Vespa, M., Fukui, T., Manners, L. 2020. Functional nanoparticles through π-conjugated polymer self-assembly, Nature Reviews M

Keyword: *Dipeptit, elektriksel özellik, kalkon, klik kimyası, polimer sentez*

Tirozin Bazlı Metakrilat Polimerlerinin Kumarin Bileşikleri ile Klik Reaksiyonları, Diyot/Fotodiyot Özelliklerinin İncelenmesi

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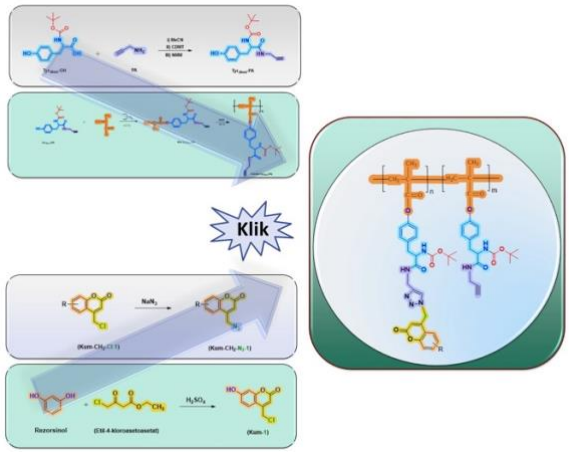
Son yıllarda yapılan çalışmalarda bilim dünyasında fonksiyonel polimerler üzerine birçok araştırma bulunmaktadır. Yapılan bu araştırmalarda yeni bileşiklerin sentezlenmesi kadar bu yapıların kullanım alanlarının belirlenmesi de önem taşımaktadır. Kullanım alanının özelliklerine göre yeni bileşik grupları tasarlanıp sentezlenmiş ve halen sentezlenmeye devam edilmektedir. Bu çalışmada alkin uç grupları içeren tirozin yan gruplu polimelerin azit uç gruplu kumarin yapıları ile klik yöntemi kullanılarak fonksiyonelleştirilmesi ile yeni fonksiyonel polimerlerin elde edilmesi amaçlanmıştır. Klik yöntemiyle bağlanan kumarin bileşiklerinin seçilmesinin en önemli nedeni ise sensör özelliklerinden iletken ve yarı iletken özelliğe, fotodiyot özelliklerden organik ışık yayan diyotlara kadar geniş bir uygulama alanına sahip olmalarındandır.
Tirozin bazlı alkin yan zincirli homopolimerin serbest radikalik polimerizasyon yöntemi ile elde edilmesi ve faha sonra azit uç gruplu kumarin bileşiklerinin klik yöntemi ile bağlanması ve bu yapıların elektriksel özelliklerinin incelenmesi amaçlanmıştır. Bileşiklerin yapıları spektroskopik ve termal metotlarla (DSC, ^{1}H,^{13}C NMR, FT-IR) karakterize edilmiştir.



Hem homopolimerin hem de kumarin-modifiye polimerin dielektrik ve elektriksel özellikleri frekansın bir fonksiyonu olarak incelendi. Sabit sıcaklıklarda artan frekans ile dielektrik sabitinin iki polimerde de azaldığı görülmektedir. Frekans arttıkça dielektrik sabitinin ve dielektrik kaybının azaldığı, daha yüksek frekans değerlerinde ise sabit kaldığı gözlemlenmiştir. Dielektrik sabitinin artmasındaki neden klik reaksiyonu ile oluşan triazol ve yapıya ilave edilen fonksiyonel ve π-konjuge kumarin yapısının elektrik alan altında daha çok polarize olmasından kaynaklandığı düşünülmektedir. Ayrıca modifiye edildikten sonra polimerin ac iletkenlik değerlerinde de benzer artış gözlendi bu durumun kumarin yapısındaki π -elektronlarının haraketinden kaynaklanmaktadır.

Teşekkür
Bu çalışma, Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından 1919B012327625 Numaralı proje ile desteklenmiştir. Projeye verdiği destekten ötürü TÜBİTAK'a teşekkürlerimizi sunarız.

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Keyword: *Tirozin, elektriksel özellik, kumarin, klik kimyası, polimer sentez*

ID: 177

Yeni Nesil Şişirici Gaz Varlığında Farklı Katalizörlerin Kullanımının Sert Poliüretan Köpük Özellikleri Üzerine Etkisi

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Sert poliüretan köpükler, üstün termal yalıtım özelliklerine sahip kapalı hücreli malzemelerdir. Sert poliüretan köpük sistemlerinin hazırlanmasında teşvik ettikleri ana reaksiyona göre 'jel', 'şişirme' ve 'trimerizasyon' olarak sınıflandırılan katalizörler kullanılmaktadır. Bu katalizörlerin farklı kombinasyonları ile sert poliüretan köpüğün termal ve mekanik özelliklerini optimize etmek mümkündür [1]. Bunun yanı sıra, sert poliüretan köpük sisteminde kullanılan şişirici ajan da nihai ürünün morfolojisini ve termal özelliklerini etkilemektedir. Yaygın olarak kullanılan şişirici ajanlara kıyasla daha düşük ozon tüketim potansiyeline ve daha düşük termal iletkenliğe sahip ve yeni enerji düzenlemeleri doğrultusunda daha çevre dostu yeni şişirici ajan sistemlerinin geliştirilmesi gündemdedir [2].

Bu çalışmada, yeni nesil şişirici gaz hidroklorofloroolefin (HCFO) varlığında farklı katalizör türleri (şişirme, jel ve trimerizasyon) farklı oranlarda kullanılarak sert poliüretan köpüklerin üretimi ve bu köpüklerin termal, mekanik ve morfolojik özelliklerinin kapsamlı analizleri gerçekleştirilmiştir. Deneysel çalışmalarda, reaksiyon profillerinin gözlemlenmesinin yanı sıra sert poliüretan köpüklerin termal iletkenlik, mekanik dayanım ve boyutsal kararlılık gibi kritik özellikleri ve hücre yapısı, yoğunluğu ve kapalı hücre oranları gibi morfolojik özellikleri incelenmiştir. Şişirme katalizörü miktarının artmasının reaksiyonu hızlandırdığı ve hücre boyutlarını %25 oranında küçültüp termal iletkenliği düşürdüğü saptanmıştır. Jel katalizörü miktarının artması ise; polimerizasyon reaksiyon süresinin kısalmasına, %20 daha küçük hücrelerin oluşmasına ve termal iletkenlikte azalmaya neden olurken köpüğün yoğunluğunu artırarak mekanik özelliklerini iyileştirmiştir. Trimerizasyon katalizörü miktarının artması ile köpük malzemede yoğunluk artışı, mekanik özelliklerde iyileşme ve termal iletkenlikte artış belirlenmiştir. Sonuçlar, farklı katalizör kombinasyonlarının, poliüretan köpük malzemenin istenen özelliklerini optimize etmek için kullanılabileceğini göstermektedir. Bu çalışmadan elde edilen sonuçlar, endüstriyel uygulamalarda enerji verimli yalıtım malzemelerinin geliştirilmesi için yeni yaklaşımlar sunmaktadır.

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Keyword: *Sert Poliüretan Köpük, Katalizör, HCFO*

ID: 397

Syntheses of Isocyanate-Containing Polymers and Their Post-Modifications

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The isocyanate group reacts quickly and effectively with amine-containing molecules without the need for any additional catalyst. [1,2] It also reacts with thiols and hydroxyls in the presence of a catalyst. However, despite being known as a highly reactive functional group, isocyanate is rarely seen in the literature for the preparation of reactive polymers for further modification, mostly because of its high sensitivity to water. In recent years, we have reported our works on the syntheses of polymers, hydrogels, and cryogels containing isocyanate groups. In our works, we demonstrated the synthesis of polymers with pendant isocyanate groups in organic solutions, their functionalization, and subsequent coating onto glass surfaces [3], the preparation of three-dimensional smooth [4] and patterned hydrogel [5] coatings on surfaces, and also the synthesis of cryogels. It has been shown that isocyanate groups were stable during the synthesis and the amount of isocyanate groups in the obtained materials can be controlled. Biomolecular immobilization studies, including enzyme immobilization, were performed on these materials. As a result, new platforms and three-dimensional polymeric materials that can be used for the immobilization of molecules/biomolecules containing thiol or amine groups have been prepared.

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Keyword: *isocyanate-amin, functionalization, bioimmobilization*

ID: 374

Gelecek Vaat Eden Alternatif Enerji Kaynağı Olarak Hidrojenin Üretiminde Hiper Çapraz Bağlı Polimer Katalizörlerin Performansları

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Fosil yakıtların çok uzun yıllardan beri yoğun kullanımı günümüzde kontrolü ve çözümü oldukça zor olan küresel ısınma gibi ciddi çevre felaketlerine yol açmıştır. Fosil yakıtlardan kaynaklı bu çevresel problemlerin önüne geçmekteki en temel yaklaşım, kullanımlarını azaltma, sınırlama ya da sonlandırmadır. Bu ise ancak fosil yakıtların yerini alabilecek alternatif enerji kaynakları ile başarılabilir. Bu açıdan hidrojen, fosil yakıtlardan yenilenebilir enerji kaynaklarına geçişin gerçekleştirilmesinde ümit verici bir alternatif enerji kaynağıdır. Rüzgâr ve güneş enerjisine kıyasla hidrojen enerjisi daha yeni bir teknolojidir. Dolayısıyla hidrojenin verimli üretimi, depolanması, dağıtımı ve son kullanımıyla bağlantılı birçok zorluklar yaşanmaktadır. Geçtiğimiz yıllarda, sodyum borohidrürün ($NaBH_4$) alkolizi, özellikle metanolizi, yanmazlığı, toksik olmaması ve reaksiyon sisteminin soğuk koşullarında kullanım potansiyeli nedeniyle büyük ilgi görmüştür.

Katalizörler, aktivasyon enerjisini düşürerek ve hidrojen üretim oranlarını artırarak $NaBH_4$ metanolizinin verimliliğini arttırmada çok önemli bir rol oynar. Son çalışmalar, hiper çapraz bağlı polimerlerin (HCP'ler) bu reaksiyon için etkili katalizörler olduğunu göstermiştir. HCP'ler yüksek yüzey alanı, ayarlanabilir gözeneklilik ve kimyasal stabilite sunarak onları kataliz için ideal kılar. Bu özellikler aktif bölgelerin artmasına, kütle transferinin artmasına ve reaksiyon ara ürünlerinin stabilizasyonuna neden olarak hidrojen üretiminin artmasına neden olur.

Sonuç olarak, $NaBH_4$'ün metanolizi yoluyla hidrojen üretiminde HCP'lerin, katalizör olarak sürdürülebilir hidrojen ekonomisine ciddi katkılar sunabileceği anlaşılmaktadır. Dolayısıyla bu tip katalizörlerin ticarileştirilebilmesi için potansiyellerinin artırılması konularında daha fazla araştırmaya ihtiyaç vardır. Bu bilgilerin ışığında, bu çalışmada grubumuz tarafından sentezlenen HCP'lerin $NaBH_4$'ün metanolizindeki potansiyellerinin literatürle kıyaslamalı olarak sunulması amaçlanmıştır.

Keyword: *Hidrojen üretimi, HÇP, NaBH4*

ID: 68

Işık Destekli Yenilikçi Yöntemlerle Sentezlenen Konjuge Polimerler ve Uygulamaları

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Konjuge yapıda bir polimerin elektronlar üzerinden elektriği iletebileceği ilk kez 1970'li yıllarda Heeger, McDiarmit ve Shirakawa tarafından öngörülmüş ve ilgili bilim insanları yaptıkları bu çalışmalarla 2000 yılında Nobel Kimya ödülüne layık görülmüşlerdir [1]. Konjuge polimerler o yıllardan sonra büyük aşama katederek günümüzde, organik fotovoltaikler, ışık yayan diyotlar, piller, elektro-kromik cihazlar ve sensörler gibi çeşitli elektronik ve elektro-optik cihazların üretimindeki uygulamaları nedeniyle ilgi görmektedir [2]. Bu polimerlerin sentezi için yaygın olarak uygulanan stratejiler arasında oksidatif polimerizasyon, elektro-polimerizasyon, Suzuki, Stille ve Yamamoto bağlanma reaksiyonları gibi geçiş metali içeren prosesler kullanılmaktadır [3]. Uygulanan sentez metodolojisine bağlı olarak, farklı morfolojilere ve dolayısıyla farklı fiziksel ve kimyasal özelliklere sahip polimerler elde edilebilse de özellikle ilgili yöntemlerle sentezlenen polimerlerde metalik katalizörlerin kullanılması hem maliyet hem de çevresel açıdan büyük handikap yaratmaktadır. Bu sebeple son yıllarda metal içermeyen ve sadece radikal başlatıcı varlığında ışık destekli yapılan polimerizasyon tepkimeleri ön plana çıkmaktadır [4].

Yapılan bir dizi çalışmada özellikle yapısında karbazol içeren polimerlerin difeniliyodonium hegzaflorofosfat gibi çevreci bir başlatıcı varlığında ışık destekli polimerizasyonları gerçekleştirilmiştir [5]. Bu çalışmalardan elde edilen polimerlerden elektrokromik cihaz ve süperkapasitör gibi uygulamalarda oldukça başarılı sonuçlar elde edilmiştir [6]. Bunun yanında sentezlenen allil ve vinil gibi yan gruplar içeren polimerler tetratiyol bazlı çapraz bağlayıcı varlığında film yüzeyine kaplanarak yüzeyde 366 nm ışık varlığında gerçekleşen tiyol en çıt çıt reaksiyonu sonucunca çapraz bağlı ve desenli elektroaktif filmler ve membran sistemleri konusunda çalışmalar da gerçekleştirilmiştir. Sonuç olarak elde edilen bu çapraz bağlı filmler ve membran sistemleri ile foto-elektrokatalitik karbondioksit indirgenmesi ve hidrojen üretimi gibi stratejik uygulamalarda da oldukça umut verici sonuçlar elde edilmiştir.

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Keyword: *Chemistry of Materials*

ID: 301

Development of Polymer Electrolyte Membranes for Fuel Cell Applications

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Fuel cell (FC) technologies have significantly advanced over recent decades, emerging as a critical technology for clean and efficient energy systems, comparable to batteries. FCs are electrochemical cells that convert chemical energy into electrical energy and are classified based on the electrolyte and fuel used, highlighting the importance of the electrolyte. Among these, Polymer Electrolyte Membrane Fuel Cells (PEMFCs) are the most widely known and commercialized type, utilizing pure hydrogen gas as fuel and a polymer electrolyte membrane.

The membrane's properties vary depending on the FC type, fuel, operating temperature, and whether it is alkaline or acidic. For PEMFCs and other types, Nafion® membranes, composed of a perfluorinated backbone and a sulfonated functional end group, are commonly used due to their high ionic conductivity and chemical and mechanical stability. However, recent research focuses on developing cheaper, non-fluorinated alternatives, especially for high-temperature PEMFCs and direct liquid fuel cells where Nafion® performs poorly.

This study explores the development of polymer electrolyte membranes, emphasizing their role and performance across various fuel cell types, including PEMFCs, direct methanol fuel cells (DMFCs), and alkaline anion exchange membrane fuel cells (AAEMFCs). Key advancements in membrane materials, such as perfluorosulfonic acid (PFSA) polymers, non-fluorinated hydrocarbon polymers, and composite membranes, are discussed. These advancements highlight improvements in ionic conductivity, chemical stability, and mechanical properties. The study examines the optimization of membrane characteristics to enhance fuel cell efficiency, durability, and cost-effectiveness, focusing on novel synthesis methods, functionalization strategies, and hybrid material integration.

Challenges and future directions in PEM development are also addressed, emphasizing the need for low-cost, high-performance membranes suitable for various environmental conditions. This research underscores the significance of ongoing advancements in PEM technology as a pivotal component for sustainable and versatile fuel cell applications. Additionally, it highlights the importance of membrane development, polymer selection, functionalization routes, and blending and composite approaches, supported by recent literature and studies from our laboratories.

Keyword: *Polymer Electrolyte Membrane (PEM), Ionic Conductivity, Fuel Cell Technology*

Green Synthesis of Multifunctional Ag/SPION-POSS Hybrid Nanoparticles for 4-Nitrophenol Degradation in Wastewater

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Water is one of the most indispensable resources in the world for the continuity of nature, people, and life. Since the production of industrial products such as painkillers, fungicides, pesticides, and dyes cause the release of large amounts of wastewater containing phenol and its derivatives, it is necessary to ensure environmental safety and protect nature and people from the adverse effects of industrial waste. The rehabilitation of wastewater has become an engineering problem today[1]. Recently, hybrid materials have been developed for the catalytic or photocatalytic degradation of phenol compounds in wastewater[2]. However, while using these hybrid materials solves the main problem, the disposal of harmful organic solvents and wastes used in producing or synthesizing these materials also creates new problems for the sustainable environment. That is why research on developing hybrid wastewater treatment technologies, biochemical catalysts, and reactor technologies for a clean and circular economy is becoming increasingly important.

In this project multifunctional hybrid nanoparticles will be obtained using green synthesis techniques with metal (Ag) nanoparticles on magnetic-POSS hybrid nanoparticles. The particles will be characterized via SEM, FTIR, XRD and VSM. The resulting hybrid nanoparticles will be used for the first time for the degradation of 4-nitrophenol, which is seen in industrial and agricultural wastewater, is not biodegradable, and has a very high solubility in water (15600mg/L at 25 °C) and will be capable of being used repeatedly. The catalytic degradation reaction performance will be investigated by varying the catalyst amount and concentration of 4-nitrophenol.

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Keyword: *Hybrid nanoparticles,, catalyst,, POSS*

ID: 82

Effect of Binder System on Corrosion Resistance in Powder Coatings

Aslı Dal
İba Powder Coatings

Exposure to oxygen and water, among other environmental variables, can corrode metal materials. The degradation that results from a chemical reaction on the surfaces of metal materials following these environmental interactions is known as corrosion. On metal surfaces, corrosion results in rust, stains, and decay, which compromises the surfaces' integrity and impairs their use. Because of this, the materials used to coat the metal surface need to be able to withstand corrosion and stop material deterioration. Electrostatic powder coating is commonly used to color and protect materials used in high-corrosion settings, such as those with high humidity and saltwater contact. The polymer structure of the binder system is a major determinant of corrosion resistance in electrostatic powder coating applications. Certain factors influence these effects. The most important of these are factors such as chemical resistance and UV resistance of the polymer used. The more difficult it is for the coated surface to deform in undesirable conditions, the higher the polymer's chemical resistance. Furthermore, corrosion resistance increases and UV-induced degradation decreases as a polymer's UV resistance increases. In this study, the effect of different polymeric binder systems on the corrosion resistance of powder coating was investigated. Powder coating formulations based on polyester, epoxy, epoxy-polyester hybrid, and polyurethane were developed, and the EN ISO 12944-4 standard was used to determine each formulation's corrosion resistance. After up to 1440 hours of being exposed to a salt spray cycle, the powder-coated surface rust advancement was examined and the corrosion classes were identified. Furthermore, tests were conducted on mechanical properties such as impact strength by ISO 6272-2 standard and cylindrical bending by ISO 1519 standard. Additionally, using the ISO 19403-2:2017 standard, the surface contact angle was measured to evaluate the adhesion between the powder coating and the surface.

Keyword: *corrosion, electrostatic powder coatings, binder system*

ID: 352

Bio-Nanocomposite Films Derived from Potato Peel Waste: Synthesis, Characterization, and Optimization

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Increasing concerns about environmental safety and the search for sustainable materials have enabled further investigation of the production of biodegradable biopolymer-based materials. In recent years, efforts have been made to produce bionanocomposite or nanocomposite films by combining biopolymers and nanomaterials, especially those obtained from food-borne and agricultural wastes. However, owing to the weak mechanical and barrier properties of biopolymer materials, the demand for active and smart bionanocomposite films prepared by strengthening them with nanoparticles is increasing daily. This study aims to synthesize and characterize potato peel waste (PPW)-based bionanocomposite films to create biodegradable, environmentally friendly, and sustainable alternatives. Chia seed mucilage and zein were added to improve the mechanical and barrier properties of the PPW-based composite film solution produced by the solvent casting method. Silver nanoparticles (AgNPs) synthesized via a green method were characterized for their morphological properties using transmission electron microscopy (TEM), revealing spherical particles with a diameter of approximately 10 nm. These AgNPs were subsequently utilized in combination with alizarin to impart antimicrobial properties and introduce pH-sensitive characteristics into nanocomposite films. The films were characterized according to color, moisture content, water solubility, texture, and antibacterial activity. The antibacterial activities of composite and bionanocomposite films were determined using the disc diffusion method. According to the results, no antibacterial effects were detected against the test bacteria in the composite film obtained using PPW. However, varying degrees of antibacterial effects were observed in the bionanocomposite films with Ag nanoparticles. The best antibacterial properties of the films were optimized by response surface methodology according to the Ag nanoparticle concentration (0, 5%, and 10%) and alizarin amounts (0.5, 1, and 1.5%). In the presence of 0.5% alizarin, optimum Ag nanoparticles were found as 7.27% for *Listeria monocytogenes* ATCC 19115, 7.37% for *Staphylococcus aureus* ATCC 6538, *Salmonella enterica* subsp. *enterica* serovar *Typhimurium* ATCC 14028, and *Pseudomonas aeruginosa* ATCC 9027, and 7.47% for *Escherichia coli* ATCC 8739. Antibacterial effect of the amount of alizarin on the films was not statistically significant ($P > 0.05$).

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Keyword: *Potato peel waste, bionanocomposite, Ag nanoparticle, optimization, antibacterial*

ID: 23

Biomedical Application of PHB and Derivatives

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Our research has focused on biomedical application of Polyhydroxybutyrate (PHB), a biocompatible and biodegradable polyester that can be synthesized from different bacteria. We have used Alcaligenes eutrophus (DSM 545) to synthesize PHB, with glucose as the carbon source. Structural characterization of the PHB was performed using 1H-NMR and ATR-FTIR. In 2014, we produced and characterized PHB from Bacillus megaterium Strain A1, using sucrose as a carbon source [1]. Additionally, we loaded etoposide into magnetic PHB nanoparticles and examined their effects on the HeLa cell line [2]. We have received a national patent on bacterial PHB production, no: TR 2013 15639 B, and in 2019, we produced and characterized PHB using Geobacillus kaustophilus [3]. Our research has also focused on the application of PHB in tissue engineering, including the fabrication of a fibrillar PHB membrane by electrospinning for use in bladder tissue engineering [4]. We further modified the surface of the fibrillar PHB membrane with polyethylene glycol (PEG) and ethylenediamine (EDA) by plasma polymerization and tested the effect of positive and negative charge on cell adhesion and proliferation [5]. Polyhydroxybutyrate-co-valerate (PHBV) is a valerated copolymer of PHB that we have also studied extensively. In 2014, we cultured A. eutrophus in a medium containing propionic acid, valeric acid, or butyric acid to produce PHBV. We then fabricated tubes from oriented fibrillar membranes and tested their effect on the perional nerve recovery of rats. In another study, in 2017, we produced etoposide-loaded PHBV nanoparticles for use in bone cancers and tested their effectiveness in cell culture [6]. In 2018, we formed tubes from oriented PHB fibrillar membrane and reinforced the tubes with chitosan for perional nerve recovery. We tested the effect of it in a rat perional nerve injury model [7]. Finally, in a study completed in 2023, we prepared dexamethasone-loaded PHB-stearic acid blend nanoparticles for uveitis. We created a uveitis model in rabbits and tested the pharmacodynamic effect.

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Keyword: *PHB, biodegradable scaffold, nanoparticle*

ID: 55

Biyobazlı Poli(gliserol levulinat-ko-gliserol malonat) Kopoliesterlerin In vitro Bozunması

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Bugün, sınırlı petrol rezervleri, petrole bağımlılık ve petrol bazlı plastiklerin neden olduğu çevresel sorunlar, biyobazlı yenilenebilir polimerlere olan ilgiyi artırmıştır. Dünya Ekonomik Forumu'na göre, döngüsel ekonomi için biyobazlı plastikler, 2019 yılında en önemli 10 yeni teknoloji arasında birinci sırada yer aldı. Biyokütle, fosil kaynaklardan elde edilen aynı veya daha fazla kimyasal yapı taşlarını sağlayabilme potansiyeline sahiptir ve bu yapı taşları, yüksek performanslı, dayanıklı malzemelerin üretilmesi için gereklidir.
Bu çalışmada, gliserol, levulinik asit ve malonik asit kullanılarak sentezlenen tamamen biyobazlı rastgele/blok kopoliesterlerin in vitro bozunmasının araştırılması amaçlanmaktadır. Çift bağlara sahip yenilenebilir kaynaklardan elde edilen bir başka biyobazlı monomer olan itakonik asit, çapraz bağlı bir yapı elde etmek için kullanılmıştır. Sonuçlar, kopoliesterlerin bozunmasının nispeten zincir mikro yapısına bağlı olduğunu göstermiştir. Sekiz haftalık bir dönem sonrasında, en az kütle kaybı (%10.44) üç aşamalı yöntemle sentezlenen blok kopoliesterlerde gözlemlenmiştir. Daldırma çözeltisinin pH değişimi de değerlendirilmiştir. Ayarlanabilir bozunma özelliklerine sahip levulinik asit bazlı kopoliesterler, biyomedikal uygulamalarda ticari stentler için daha sürdürülebilir bir alternatif olarak umut vadetmektedir.

Bu çalışma, TÜBITAK (Proje No: 220M112) tarafından finansal olarak desteklenmiştir.

Keyword: *Kopoliesterler, Biyobazlı Polimerler, Levulinik Asit*

ID: 292

Portakal Kabuğundan Biyoplastik Film (PM Bioplastic)

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Biyoplastik filmler, petrol bazlı plastiklere sürdürülebilir bir alternatif olarak öne çıkmaktadır. Bu filmler, yenilenebilir kaynaklardan elde edilen polimerlerden yapılmış olup, geleneksel plastiklere göre daha çevre dostudur. Bu çalışma, ülkemizde bol miktarda bulunan portakal kabuğu pektini, kitosan ve gliserol kullanılarak biyoplastik filmlerin üretimini ve bunların endüstriyel uygulamalar için uygunluğunu değerlendirmektedir. Portakal kabuğu pektini (%42.5), dolgu malzemesi olarak yüksek potansiyele sahiptir. Gliserol, higroskopik özelliği sayesinde filmin nemi tutmasına yardımcı olur. Kitosan, polar ve apolar moleküller arasında köprü görevi görerek filmin homojen olmasını sağlar. Biyoplastik filmler, kitosan/gliserol karışımı ile portakal kabuğu pektininin homojen bir şekilde karıştırılmasıyla üretilmiştir. Elde edilen filmlerin mekanik, fiziksel, optik ve kimyasal özellikleri detaylı bir şekilde incelenmiştir. Sonuçlar, portakal kabuğu pektin bazlı biyoplastik filmlerin üretilebileceğini ve bu filmlerin endüstriyel uygulamalar için potansiyele sahip olduğunu göstermektedir. Bu araştırma, atık malzemelere değer katarak biyoplastik film üretimine katkıda bulunarak sürdürülebilir bir geleceğe katkı sağlayacaktır.

Keyword: *orange peel, pectin, bioplastic*

ID: 97

The Impact of π-bridge Moieties on Photodegradation of D-π-A Type Conjugated Polymers Based on Benzooxadiazole and Benzodithiophene

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The stability of conjugated polymers in different application domains, which is a crucial factor for market penetration, is a key topic that has not been well addressed in the literature. Despite attempts to address stability concerns through measures such as using air-stabilized electrode materials, inverted organic solar cell structures, and improved encapsulation techniques, the lifespan of CPs is still primarily determined by the stability of the active components [1,2,3]. The study of the oxidative degradation of the polymer's lifespan has attracted attention because of its substantial influence on the durability of the CPs. Conjugated polymers experience photo-oxidation upon exposure to light in the presence of oxygen. When light energy is absorbed, it activates the polymer chains, creating excitons that react with oxygen to generate reactive oxygen species (ROS) like singlet oxygen, superoxide anions, and hydroxyl radicals. Reactive oxygen species (ROS) can disturb the primary structure of a polymer by inducing chain breakage and generating oxidation byproducts [4,5]. The stability of the conjugated system is crucial, since any degradation can interrupt the conjugation, resulting in a decrease in electrical properties, diminished device functionality, and compromised mechanical strength.
In this study, donor-acceptor (D-A) type conjugated polymers were produced via Stille coupling. All polymers consist of a Benzo[c][1,2,5]oxadiazole (BOz)-based acceptor group and a benzo[1,2-b:4,5-b']dithiophene (BDT)-based donor group, which are connected by different π-bridge groups. The polymer's main chains were modified by incorporating thiophene, selenophene, and thiazole as π-bridge groups. The purpose of this study is to elucidate the impact of these bridge units on the photochemical stability of polymers in normal environmental circumstances, as well as their optical and electrochemical characteristics.

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Keyword: *π bridge, Photodegradation, Conjugated Polymers*

ID: 209

TPD-Based Conjugated Polymers and Their Biosensor Applications

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Herein, a series of three thieno[3,4-c]pyrrole-4,6-dione (TPD)-based conjugated monomers, modified with electron-rich selenophene, 3,4-ethylenedioxythiophene (EDOT) or both building blocks (Se-TPD, EDOT-TPD, and EDOT-Se-TPD) were synthesized, electrochemically polymerized and their electrochromic properties and glucose sensing applications have been discovered. The influence of structural modification on electrochemical, electronic, optical, and biosensing properties were investigated. In biosensing applications, the biosensor sensitivity was revealed by calculating the values of the limit of quantification (LOQ) and limit of detection (LOD) utilizing the associated equations. The GE/poly(EDOT-TPD)/GOx showed a LOD value of 0.018 mM and a LOQ value of 0.054 mM with a sensitivity of 65.765 $\mu AmM^{-1}cm^{-2}$. The performance of the designed biosensor was further characterized by reproducibility, repeatability tests, and shelf-life experiments. The selectivity of the designed biosensor towards glucose was also evaluated. Cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and scanning electron microscopy (SEM) were used to evaluate the electrochemical and surface characteristics of the biosensor, respectively. According to results, selenophene-containing polymer showed markedly lower performance specifically in signal intensity and stability, which was attributed to improper localization of biomolecules on the polymer surface. Overall, we demonstrated that relatively small changes in the structure had a significant impact on both optoelectronic and biosensing properties for TPD-based donor-acceptor polymers.

Keyword: *3,4-ethylenedioxythiophene (EDOT), thieno[3,4-c]pyrrole-4,6-dione (TPD), optoelectronic and biosensing properties*

ID: 135

Electrochemical Synthesis and Properties of Poly-o-phenylenediamine

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Electrochemical sensors using conductive polymers have gained significant interest due to their ease of preparation, low cost, and high selectivity, among other advantages. In particular, the use of Poly-o-phenylenediamine (P-oPD) in molecular imprinting applications is becoming increasingly widespread [1,2]. Molecular imprinting involves the polymerization of monomer molecules around a template molecule in a suitable environment. In the second stage, the template molecule is removed from the structure using an appropriate eluent. The analysis is performed by binding the template molecule, or the analyte, to the created cavities.
The synthesis of P-oPD in different supporting electrolyte environments, at various pH levels, and under different electrochemical conditions is important factors. However, changing these parameters can alter the physical and chemical properties of the polymer, including its chain structure [3,4]. In this study, P-oPD was synthesized on a graphite electrode at pH 5.2 using an acetate buffer. The electrochemical properties of the polymer were investigated using voltammetry and electrochemical impedance spectroscopy.

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Keyword: *Polymer, MIP sensor, Physical chemistry*

ID: 113

Solid Polymer Electrolytes: A Molecular Dynamics Study of Structure and Ionic Conductivity

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Despite extensive research, no solid polymers have been found that reliably surpass the conductivity of poly(ethylene glycol) (PEG), attributed to its beneficial combination of a low glass transition temperature (Tg) and moderate salt solubility. Efforts to improve lithium-ion conductivity in PEO-based polymers have primarily focused on reducing polymer crystallinity and lowering the Tg. However, even the most advanced PEO-based solid polymer electrolytes (SPEs) have limited ionic conductivity at ambient temperatures. Exploring alternative polymer architectures presents new opportunities to enhance ionic conductivity by modifying ion-polymer and polymer-polymer interactions, making these architectures promising candidates for next-generation SPEs[1, 2]. Molecular dynamics (MD) simulation is a powerful computational method for predicting material behavior at the molecular level, serving as a complementary tool to experimental techniques in the study of ionic transport in polymer electrolytes. Traditional methods, such as many-body polarizable force fields and ab initio MD based on quantum chemistry, provide detailed insights but are computationally expensive. Thus, developing new force fields that offer reliable results is crucial. In this study, we investigated and compared the structure and ionic conductivity behavior of novel polymer electrolytes with PEG using molecular dynamics simulations. Our novel electrolyte has a Tg lower than room temperature, as polymers exhibit low diffusivity in the glassy state. Lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) was used as the mobile salt. Radial distribution function (RDF) and mean square displacement (MSD) analyses were conducted to compare these polymer electrolytes at four different temperatures.

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Keyword: *Energy Storage, Ionic Conductivity*

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Photo- and Electro-Active Conducting Polymers: Morphological, Electrochemical, and Solar Thermal Fuel Properties

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Photoinduced structural changes in organic molecules and polymers provide an exciting possibility for controlling matter at the nanoscale level. In this work,photo/electroactive monomers were synthesized combining azobenzene group with the electroactive molecules. Fine-tuning morphological and optical properties of conducting polymer was achieved using electropolymerization of photo/electroactive monomers stimulated with varied UV irradiation times. The azobenzene isomerization mediated by UV irradiation of the monomer also enhanced the optical properties of the conducting polymer, such as optical contrast and switching time. In this study, a simple way was proposed to obtain conductive polymer films with the desired morphology and optical properties by photoinduced changes in monomer structures. Furthermore, solar thermal fuel properties of monomer and conducting polymer have been investigated [1].

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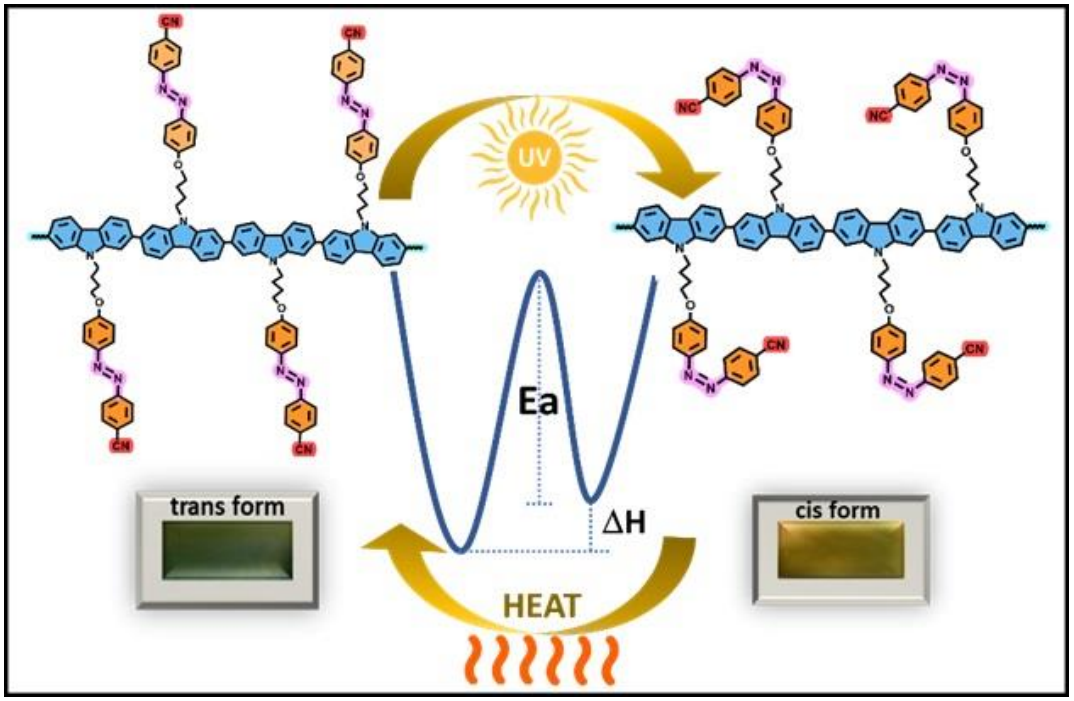

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Keyword: *conducting polymers, photoswitches, azobenzene*

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Faz Değişimi Yoluyla Isıl Enerji Depolayan Polimerlerde Yapı Özellik İlişkileri

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Polimerlerin doğrudan ısıl enerji depolaması, uygun sıcaklıklarda ısı enerjisi depo edebilen polietilen glikoller ve benzerleriyle ve katı-katı faz geçiş özelliğine sahip polimerlerle mümkündür. Bu çalışmada, ısı enerjisi depo eden polimerlerde yapısal özelliklerle ısıl performansların ve gerekli diğer fiziksel özelliklerin değişimleri üzerinde durulmuştur. Eriyip katılaşarak ısı enerjisi depo edebilen polimerler poli(etilen glikol)ler, politetrahidrofuranlar ve yüksek yoğunluklu polietilen polimerleridir [1]. Genel olarak bunlarda molekül ağırlığı ile çalışma (depolama-salma) sıcaklığı ve enerji depolama yoğunluğu değişmektedir. Genel olarak polimerlerin erime sıcaklığında bu nedenle kullanılamamalarının nedeni çoğu polimerin erime sıcaklığında belli oranda bozulmaya uğramasıdır. Katı-katı faz geçiş özelliğine sahip polimerlerin üretiminde genellikle iki ucu hidroksil gurubu olan poli(etilen glikol)lerden faydalanılmaktadır. Bu polimerler, polimer omurgasında sarkaç veya zincirleri birbirine bağlayan çapraz bağlayıcı olarak da değerlendirilmiştir [2]. Az sayıda polimer yapıda yağ asitleri ve yağ alkolleri de sarkaç durumunda değerlendirilmiştir. Blok, aşı ve çapraz bağlı polimerlerde ısı depolama özelliği sağlayan grupların çeşitli etkileri grup uzunluğuna ve polimer yapıya katılma oranlarına göre değişiklik gösterir.

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Keyword: *Isıl enerji depolama, faz değişim maddesi, katı-katı faz değişimi, ısı enerjisi depolayan polimerler, kompozit*

ID: 291

Metalik ve Metalik/Grafen Oksit Nanoparçacıkları İçeren Polimerik Nanokompozitlerin Sensör Özelliklerinin İncelenmesi

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Polimer kompozit malzemeler son yıllarda ileri teknoloji uygulama alanlarında sıklıkla karşımıza çıkmaktadır. Günümüzde bu tip yeni malzemeler hazırlanırken sadece mekanik özelliklerin geliştirilmesinden farklı olarak bu malzemelerin ilave özelliklerini keşfetmeye yönelik çok yönlü stratejiler geliştirilmiştir. Bu malzemelerin yeni teknoloji alanlarında kullanımlarına; anti-bakteriyel kaplamalar [1], korozyona dirençli kaplamalar [2], hidrofobik/hidrofilik kompozitler [3] ve sensör özellikli polimer kompozitler [4] gibi çalışma alanları örnek verilebilir. Sensörler farklı malzeme türlerinden hazırlanabilecek olsa da sensörlerin tasarımında kullanılacak malzemenin seçimi sensörün performansı ve seçiciliği açısından kritik bir öneme sahiptir. Bu amaçla kullanılabilecek en önemli malzeme sınıflarından biri polimerik nanokompozitlerdir. Çünkü polimerik nanokompozitler metal ve metal oksit nanoparçacıklar, inorganik ve karbon türevli nanomalzemeler gibi farklı yapıdaki iletken sensör malzemesini yalıtkan bir polimer matris içerisinde barındırarak yarı iletken bir malzeme özelliği gösterebilmektedir. Polimerik nanokompozit bazlı sensörler, daha geniş etkileşim bölgeleri nedeniyle analit moleküllerine maruz kaldığında direnç, iletkenlik, kapasitans gibi elektriksel parametrelerde yüksek yanıt sergileyebilmektedir [5].
Bu çalışmada, sensör uygulamaları için in-situ fotokimyasal yöntemle hazırlanan (i) polimer nanokompozitler ve (ii) çözelti içinde sentezlenmiş nanoparçacıklar kullanılmıştır. Polimer nanokompozit malzemeler fotobaşlatıcı varlığında, PEG bazlı akrilatlar, fotoindirgenmiş metal/metal oksit nanoparçacıklar ve metal/metal oksit nanoparçacıklar/grafen oksit (GO) kullanılarak hazırlanmıştır. Çözelti içerisinde in-situ fotokimyasal nanoparçacık sentezi, fotobaşlatıcı varlığında, metal tuzları ve metal tuzları/GO ile gerçekleştirilmiştir. Nanoyapıların morfolojik ve boyutsal özellikleri, polimerik nanokompozit malzemelerin ise termal, morfolojik ve elektriksel özellikleri araştırılmış olup sensör özellikleri incelenmiştir.

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Keyword: *fotopolimerizasyon, sensör, nanokompozit*

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İn-situ Fotokimyasal Yöntem ile Metal/Metal Oksit/Bimetalik Nanoparçacık İçeren Epoksi ve Üretan Akrilat Bazlı Nanokompozit Malzemelerin Sentezi ve Özelliklerinin İncelenmesi

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Fotopolimerizasyon, ultraviyole (UV) ve/veya görünür (Vis) ışığın kullanılmasıyla kimyasal olarak çapraz bağlı polimerik yapılar oluşturmak için kullanılan hızlı ve çevre dostu bir yöntemdir. Polimerizasyon işlemi üzerinde hem mekansal hem de zamansal kontrol ile üniform dağılım sağlanmasına olanak tanır. İn-situ fotopolimerizasyon tekniğinde; monomer/oligomer ve nanoparçacık (NP) oluşturacak öncü formülasyonda, başlatıcı moleküller varlığında aydınlatma ile eş zamanlı olarak polimerizasyon başlar ve NP'lerin oluşumu sağlanır [1]. Sonuçta, polimerik nanokompozitler elde edilir. Bu teknik ile nanokompozit malzemede homojen dağılıma sahip ve boyut kontrollü oluşturulan nanoparçacıklar nanokompozitin termal, elektriksel ve mekanik gibi çeşitli özelliklerinin iyileşmesine neden olur [2].

Polimerik nanokompozitlerin üretiminin kolay, esnek ve yapı olarak hafif olmalarının yanı sıra, korozyon dirençleri, özellikle gaz ve elektromanyetik dalgayı tespit edebilmeleri ile absorplayabilmeleri teknolojik uygulamalarda kullanımlarını arttırmıştır. Uçak, otomotiv gibi birçok makinenin üretim maliyeti, yüksek mukavemet/ağırlık oranının olduğu kompozitler kullanılarak azaltılabilir. Kompozitlerin diğer özellikleri arasında düşük kurulum maliyeti, düşük toksisite ve karmaşık parçaların tek parça halinde üretilebilmesi yer alır [3]. Bu özellikleriyle havacılık alanında devrim yaratarak büyük öneme sahip olan hayalet uçakların imalatında radar absorplayıcı malzemeler (RAM'ler) olarak kullanımları literatürde yer almaktadır [4].

En çok rapor edilen RAM'ler göz önüne alındığında, farklı özelliklere sahip bileşenlerin polimer matris içerisinde homojen olarak karıştırılması ve bunun sonucunda da homojen dağılımı büyük bir sorun yaratmaktadır [5]. Bu nedenle çapraz bağlı polimer ağ oluşumu ile eş zamanlı NP sentezini destekleyen fotokimyasal yöntemin avantajı kullanılarak I. Tip bir fotobaşlatıcı olan BAPO (Fenilbis(2,4,6-trimetilbenzoil)fosfin oksit) varlığında bir dizi epoksi ve üretan akrilat bazlı nanokompozit malzeme hazırlanmıştır. Gümüş, kobalt, çinko oksit, nikel metalik ve gümüş/kobalt, çinko oksit/nikel bimetalik nanoyapıları polimerik film oluşumuyla eş zamanlı olarak sentezlendiğinden, polimerik film boyunca düzgün bir dağılım ve boyut kararlılığı elde edilmiştir. RAM özelliklerinin incelenmesi hedeflenen bu nanokompozit malzemelerin termal, dielektrik, morfolojik ve mekanik özellikleri araştırılmıştır.

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Keyword: *Nanokompozit Malzemeler, Nanoparçacık Sentezi, Fotopolimerizasyon*

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Keyword: *CAS, SciFinder*

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Unlocking the Synergy Between POSS and Thermoplastics

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In recent years, the detrimental environmental impacts of conventional plastics have spurred a global movement towards developing and utilizing more sustainable materials. In response to this challenge, biodegradable polymers have emerged as a promising solution, representing a paradigm shift in how we approach material science and the production of everyday items. Polyhedral Oligomeric Silsesquioxanes (POSS) represent a fascinating hybrid nanomaterials class that has garnered significant attention in materials science and nanotechnology. The modular nature of POSS imparts a diverse range of properties, making them exceptionally versatile for applications in areas such as polymer science, nanocomposites, and surface modification. Smartly integrating Polyhedral Oligomeric Silsesquioxanes (POSS) into the formulation of bio-polymers presents a promising avenue for enhancing the performance of these compounds to meet the specific requirements of end users. In this lecture, the effects of the incorporation of versatile POSS structures into different biodegradable polymer formulations will be addressed. The challenges of biodegradable polymer formulations will be defined, and the possible solutions brought by (micro)compounding POSS will be elaborated. The structure-property relationship is explained through rheology (adapting different rheological models), dynamic mechanical properties, thermal properties, microscopy, and chemical analysis. The lecture will also involve examples of non-biodegradable polymer systems to demonstrate the locked potential of POSS additives in the applications where interfacial adhesion, flame retardancy, and crystal nucleation were addressed.

Keyword: *POSS, nanocompoiste, reactive compounding*

ID: 283

Ultrasonic Assisted Methods for Making Thermoplastic Lab-On-A-Chip Devices

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Thermoplastic-based microfluidic lab-on-a-chip devices are used for various applications, such as in vitro diagnostic kits or point-of-care test devices. These devices are often fabricated by injection molding for mass production. However, other processes like physical vapor deposition, whose cycle times are significantly longer than a typical injection molding process, are required when metal layers are needed. Here, we propose ultrasonic-assisted processes for making thermoplastic lab-on-a-chip devices that involve metal layers. A 600W ultrasonic welder with a stepped cylindrical 20mm circular-step type horn vibrating at 30kHz is utilized for the experiments.

We suggest fabricating microfluidic chips with closed-channel structures using ultrasonic embossing and ultrasonic welding. In ultrasonic embossing, an open channel is fabricated on polymethyl methacrylate (PMMA) substrate with the horn encompassing a pressure range of 0.8-2.7 MPa and a vibration time of 2-7 seconds using a mold that includes a channel structure that will be fabricated on PMMA. In ultrasonic welding, another blank PMMA substrate is welded on top of the embossed channel using the horn encompassing a pressure range of 0.85 to 2.55 MPa and a vibration time of 0.1 to 0.5 s to obtain a closed-channel structure. The results are examined using different tests such as visual inspection, capillary leakage, and burst pressure tests.

For the fabrication of metal layer production, gold nanopowder with an average particle size of 14 nm is used in the experiments. The gold nanopowder is deposited on a 20 mm diameter circle PMMA that has a stenciled area that is the place where gold nanopowders were deposited in the middle with the horn encompassing a pressure range of 0.8-2.7 MPa and a vibration time of 2-7 seconds using ultrasonic sintering.

As a result, we combined processes of ultrasonic sintering to obtain a metal surface on a thermoplastic, ultrasonic embossing to fabricate the microfluidic channels, and ultrasonic welding to seal the channels within a very short time; as a showcase, we fabricated a SERS substrate enclosed in a microfluidic channel for detection of IgG and IgM from saliva, that can be used for rapid point of care testing.

Keyword: *Ultrasonic embossing, Ultrasonic sintering, Ultrasonic welding*

The Effect of PEGylation Components on Drug Release Behavior of Targeted Reduced Graphene Oxide Based Drug Delivery System

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Reduced graphene oxide (rGO), a restored version of graphene oxide (GO) with properties akin to graphene, faces challenges in biomedical applications due to its low solubility. In drug release applications, the stronger π-π interactions of rGO compared to GO often lead to poor drug release, requiring innovative enhancement strategies. A recent method, PEGylation, uses a copolymer with adjustable PEG chain length and density to PEGylate and simultaneously reduce GO to water-dispersible, biocompatible rGO-based nanoplatforms. This copolymer incorporates functional monomers, improving treatment options [1,2]. In this study, we examined how PEGylation components and their incorporation order affect rGO's drug release behavior. A series of copolymers, (P(PEGMA-co-AzPMA-co-MMA-co-PMA), with varying PEG brushes and azide groups, were synthesized using atom transfer radical polymerization. We studied the impact of PEG brush length as coating layers or diffusion barriers in drug release by comparing 500 or 2000 Da PEG brushes. Additionally, we compared azide-containing and azide-capped copolymers to evaluate their impact on drug release (Figure 1) [3]. The findings indicated that drug release profiles from rGO surfaces with 500 or 2000 Da PEG brushes differed, likely due to the varying PEG coating density, which sometimes blurred the effects of azide groups. Incorporating the targeting peptide before drug loading proved to be optimal. pH-dependent release profiles showed 49% and 44% release from rGO surfaces for shorter and longer PEG brushes, respectively. Further tuning of the PEGylation components may influence the drug release behavior.

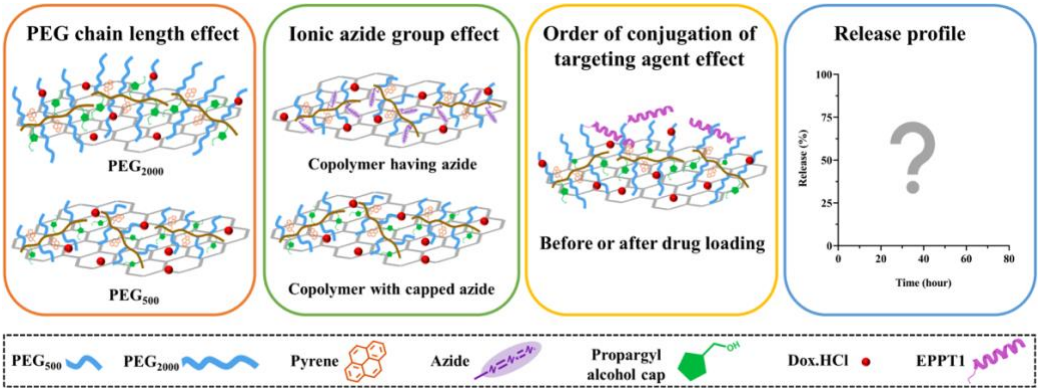

Figure 1: Effect of PEG chain length, ionic azide group, and order of targeting agent conjugation on Dox release.

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Keyword: *PEGylated and Doxorubicin-loaded Graphene Oxide, Targeting Drug Delivery System, Drug Release*

Smart Industrial Hemp Dispersions

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Industrial hemp has gained an important attention during last decade due to not only natural and environmentally friendly qualities but also possessing fibres geometry and high stiffness. The components of industrial hemp are mainly cellulose, hemi-cellulose, lignin and pectin. Cellulose was reported to be a smart material and showing reversible electric field induced viscosity enhancement which is called electrorheological (ER) activity. Thus, it was predicted that natural industrial hemp should also exhibit ER activity. Experiments carried out on hemp/silicone oil dispersion systems showed strong ER effect as expected due to its cellulose component. To improve the smart behaviors of industrial hemp, it was treated with a base solution and characterized with various techniques. After optimizing the materials, dielectric, electrokinetic, electrorheological, creep-recovery and vibration damping measurements were carried out. It was concluded that, industrial hemp exhibits a superior ER effect with an electroactive vibration damping ability.

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Keyword: *Industrial Hemp, Electrorheology, Vibration Damping*

ID: 91

Design and Development of Advanced Dual-Actuated Hybrid Micro Robot

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In recent years microrobots have become particularly important in the field of drug delivery, due to their ability to navigate aqueous solutions with great mobility. Microrobots can be stimulated and activated by a variety of external sources, including magnetic force and light [1]. The aforementioned control abilities enable microrobots to be employed as a suitable system for a variety of applications, including drug delivery, environmental studies and numerous other fields. In this study, an anisotropic, biocompatible microstructure was designed comprising polymer and lipid compartments. Polypyrrole was included in the particle formulation, as it is a high NIR light-absorbing agent with high photothermal conversion efficiency under NIR light irradiation. Furthermore, magnetic nanoparticles were added to the particle composition, as they impart catalytic activity and enable the particle to respond to an externally applied magnetic field. This structure has the potential to be used as a microrobot due to the presence of polypyrrole nanoparticles, which have been shown to have thermophoresis effect, and magnetic nanoparticles, which respond to magnetic fields within their structure. The incorporation of both polypyrrole nanoparticles and magnetic nanoparticles within the system enables the microrobot to respond to multiple stimuli simultaneously. This results in a structure that is capable of more effective and controllable movement in a liquid environment particularly in dynamic fluids such as blood, cell membranes and mucosa. In vitro studies were conducted to investigate the response of the obtained particles to a range of stimuli in different concentrations of polymer and magnetic particles. Furthermore, the response of the structures to multiple stimuli and the ability to apply an on/off mechanism were also tested. The findings of this study demonstrate the potential of the hybrid multi-stimuli responsive microrobot for a diverse range of applications, including targeted delivery and biosensors.

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Keyword: *microrobot, multistimuli responsive, polymer-lipid hybrid microstructures*

Computational and Experimental Investigation of Drug-Loaded Nanocone Clusters for Nanoparticle-Mediated Histotripsy

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Histotripsy is a non-invasive, non-thermal ultrasound ablation technique that uses very short, focused, high-pressure ultrasound pulses to generate dense cavitating bubble clouds, mechanically ablating tissues. Traditional histotripsy requires large negative pressures (≥28 MPa) to induce cavitation in target tissues[1,2]. Recently, nanoparticle-mediated histotripsy has been developed to reduce cavitation pressure. Perfluorocarbon (PFC) filled nanodroplets (NDs) have been employed as cavitation nuclei due to their ability to lower the cavitation threshold. The next generation of NMH agents, nanocone clusters (NCC), addresses the limitations of NDs, offering smaller size aggregates, detectable PFC amounts, and more stable long-term storage by simply mixing FDA-approved cyclodextrins (CD) with suitable PFCs[3,4]. However, the complete eradication of tumors in a single histotripsy session may not be feasible due to various factors inherent to the complexity and nature of tumors[5]. Therefore, a synergistic treatment can be achieved by removing a large part of the tumor tissue with histotripsy and killing the remaining ones with the anticancer agent that is locally delivered to the tumor tissue, increasing the success of tumors. This study explores the development and evaluation of drug-loaded NCCs for NMH applications to address residual cancer cells, thus paving the way for more effective cancer treatments. Computational and experimental investigations were conducted to understand the interactions between CD, PFC, and doxorubicin (Dox) within the NCCs. The tripartite system of CD-Dox, CD-PFH (perfluorohexane), and Dox-PFH interactions was analyzed to identify the dominant interactions necessary for effective NCC formation. Selected CD derivatives, including βCD, HMβCD, HPβCD, γCD, and HPγCD, were evaluated for their affinities with Dox and PFH, with βCD and γCD emerging as promising candidates for NCC formation. The incorporation of Dox into NCCs was systematically studied, with evaluations of stability, size, drug loading efficiency, drug release, and histotripsy efficacy. Dox-loaded NCCs successfully lowered the cavitation threshold, demonstrating potential as dual-functional particles for tumor ablation and subsequent treatment of remaining cancer cells through chemotherapy. The study showed that βCD is the most effective derivative for forming NCCs with the hydrophobic derivative of Dox (dDox), which exhibited superior properties compared to Dox.HCl.

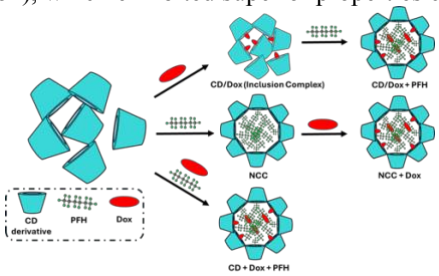

Figure 1. Strategies to load Dox into NCC.

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Keyword: *Nanoparticle-Mediated Histotripsy, Doxorubicin-loaded Nanocone, Cyclodextrin*

ID: 405

High Performance Polymer Electrolyte Membranes for Fuel Cells and Electrolyzers

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In recent years, hydrogen technologies have become central to discussions about the future of energy. Hydrogen is a potentially ideal energy carrier, fuel, and feedstock for various industries. However, several key challenges must be addressed for hydrogen to be widely used in a sustainable energy future. Electrolysis, which involves the electrolytic decomposition of water to produce hydrogen and oxygen, shows great promise for green hydrogen production, but it faces several challenges. Polymer Electrolyte Membrane Fuel Cells (PEMFC) are attractive energy conversion systems for stationery and transport applications due to their high-power density, low-temperature operation, and compact system design. Despite significant progress in PEMFC technology, challenges remain in terms of performance, durability, and cost. Similarly, while polymer electrolyte membrane water electrolyzers (PEMWE) are promising for green hydrogen production, they also face issues related to performance and durability.

The polymer membrane, functioning as both the electrolyte and separator, is one of the most critical components for PEMFC and PEMWE. Nafion® membranes have been extensively used as commercial membranes due to their good chemical and mechanical stability and excellent ionic conductivity under fully humidified conditions. However, their high cost and inadequate conductivity at lower humidity levels necessitate new strategies, such as replacing them with cost-effective alternatives.

In our research group, we have been developing alternative polymer membranes, to enhance the efficiency and performance of PEMFC and PEMWE systems. Our approach is to produce new generation membranes with improved performance and significantly higher durability using sustainable and affordable materials by radiation-induced grafting [1-3] and electrospinning methods [4,5]. Radiation grafted membranes are promising candidates since the method employs inexpensive materials, is readily controlled, and allows for the fabrication of membranes in film form. Additionally, we have been employing electrospinning to create nanofiber composite and hybrid membranes with organic/inorganic constituents. Electrospinning technique is considerably attractive due to long-range organization of hydrophilic and hydrophobic parts in the nano scale. Herein, we summarize our work on radiation grafted membranes and electrospun membranes, respectively. Furthermore, we will discuss the challenges faced by both fuel cells and electrolyzers and provide a summary of our work on the components of these systems. We will showcase various projects we have been involved in, including the Graphene Flagship, Turkey's first hydrogen valley project (HYSouthMarmara) and several others.

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Keyword: *polymer membrane, fuel cells, electrolyzers*

ID: 261

Superparamagnetic Nanoparticles Decorated Polymeric Microparticles

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Superparamagnetic nanoparticles such as superparamagnetic iron nanoparticles (SPION) or cobalt ferrite ($CoFe_2O_4$) are of great interest in biomedical research due to their unique magnetic properties and potential applications in targeted drug delivery, magnetic resonance imaging (MRI), and hyperthermia therapy[1]. In traditional techniques employing core-shell structures such as silica or carbon-based shells with superparamagnetic iron nanoparticle (SPION) cores[2], the magnetic effect has often been observed to decrease. In this study, we propose an innovative approach by decorating carboxyl-functional microparticles with different superparamagnetic nanoparticles in different concentrations. This method capitalizes on the synergistic effects between superparamagnetic and template particles by avoiding conventional core-shell configurations, which tend to diminish magnetic responsiveness. The superparamagnetic decorated particles are characterized by scanning electron microscopy (SEM), energy-dispersive X-ray analysis (EDAX), vibrating sample magnetometry (VSM), X-ray diffraction (XRD), and Fourier-transform infrared spectroscopy (FTIR).
Through comprehensive characterization and experimental validation, we demonstrate the efficacy of this approach in achieving superior magnetic effects while maintaining the desired properties of the nanoparticles. This advancement holds significant promise for many applications, including catalysts, antimicrobial agents, targeted drug delivery, magnetic resonance imaging, and magnetic hyperthermia therapy.

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Keyword: *magnetic nanoparticle,, organic-inorganic,, hybrid, composite microparticles*

ID: 243

Reactivity of Silanes in Free-Radical Polymerization

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Silane-ene polymerization attracts attention as one of the research topics as an alternative to thiol-ene polymerization due to its disadvantages like storage problems and distinct odor [1]. Silane-ene polymerization is considered a promising mechanism because the bonds formed by silicon are more durable than the bonds of the sulfur atom and do not have the disadvantages of thiol-ene polymerization[2]. In this study, reactivity analysis of silanes was performed by modeling many reactions involving silyl radicals and silanes. Theoretical methods such as M062X, wB97xD, CBS-QB3, and MP2//DFT were used to determine the best cost-effective modeling strategy. While M062X could better predict the reactivity trend for a series of reactions, results closer to the experimental energy and kinetic data were obtained with wB97xD level calculations. With wB97xD, more accurate results are obtained mainly in hydrogen transfer reactions. Consequently, DFT methods generally give satisfactory energy and kinetic results compared to a more precise composite method such as CBS-QB3.

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Keyword: *DFT, Ab-initio, Silane-ene polymerization*

ID: 92

Novel Carboxylic Acid Functionalized Conjugated Microporous Polymer-Based Electrorheological Fluids

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Electrorheological (ER) fluids are heterogeneous intelligent systems of polarizable semiconducting particles dispersed in an insulating carrier fluid. When a sufficiently large electric field (E) is applied to an ER fluid, the randomly dispersed particles are polarized and orientated to the direction of the E, resulting in the rapid transformation of a liquid-like state to a solid-like state. For decades, various ER-active particles, from extrinsically polarizable materials to intrinsically polarizable materials, have been developed and introduced [1]. Polyaniline (PAni)-based materials have attracted considerable attention among intrinsically polarizable materials. The three-dimensional equivalents of PAni, conjugated microporous polymers (CMP), can be utilized as ER active materials with their adjustable structure, pore size, chemical functionalities, low density, and appropriate conductivity to obtain high-performance ER fluids [2, 3].
In this study, we aimed to design a CMP with a greater polar porous surface to obtain higher polarizability, appropriate conductivity without any dedoping process, longer dispersion stability, and, as a result, enhanced ER performance. For this purpose, carboxylic acid functionalized polytriphenylamine (PTPA-COOH) was synthesized by the Buchwald-Hartwig cross-coupling method. The structural, morphological, electrical, microstructural, and surface characterizations revealed the successful preparation of PTPA-COOH with mesoporous and irregularly shaped granular structures. The ER behaviors of the dispersions of PTPA-COOH in silicone oil at various concentrations were investigated in a controlled shear rate mode and by oscillatory measurements under various E. It was observed that the ER behavior closely matched the conduction model, where the behavior was predominantly influenced by the conductivity difference between the particles and the dispersion medium. PTPA-COOH exhibited excellent dispersion stability and repeatable and reversible electric field response without any leakage current during the measurements, showing potential application prospects as ER fluids owing to more rapid achievable polarization of incorporated polar groups in the structure.

Acknowledgments
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Keyword: *Conjugated microporous polymers, Electrorheological fluids, Stimuli responsive materials*

ID: 274

Termal Enerji Depolama Uygulamaları İçin Bakır Sülfat İçeren Poli(etilen Glikol)ler

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Polietilen glikol (PEG) polimerleri ısı enerjisi depolamak için sıklıkla kullanılan malzemelerdir[1]. Molekül ağırlıklarına bağlı olarak değişen faz değişim sıcaklıklarına ve çok yüksek gizli ısı değerlerine sahip olmalarından dolayı bazen tek başına, bazen de polimer modifikasyonları için değerlendirilebilirler[2]. Bu özelliklerinden dolayı farklı uygulamalara yönelik PEG'ler üzerinde çalışmalar devam etmektedir. Çalışmamız, PEG yapısına koordinasyon bağları yapabilen, ışık ve ısı üreten bir malzeme elde etmek için bakır tuzunun eklenmesiyle ısı enerjisi depolama özelliklerindeki değişimi gözlemlemeyi amaçlamaktadır. Ayrıca artan ısıl iletkenlik nedeniyle aşırı soğuma davranışı azaltılmış ve ayarlanabilir, ısı enerjisini depolayabilen malzemeler oluşturmak da hedeflenmiştir. Yaptığımız çalışmalarda bakır sülfat kolaylıkla PEG türlerine ayrıştırılabilmektedir[3]. İlave edilen bakır sülfat miktarına bağlı olarak ısıl enerji depolama sıcaklığı ve entalpi değerlerinde önemli değişiklikler gözlenmiştir. Fototermal etki ile doping yöntemiyle üretilen yapıların ısı üretme özelliklerinin belirlenmesiyle çalışmalarımız devam etmektedir. Bakır sülfat ilavesi sonrasında PEG1000, PEG4000 ve PEG10000' nin entalpilerindeki azalma sırasıyla; 7, 33, 28 J/gr dır. Aynı sırayla aşırı soğumada meydana gelen sıcaklıktaki azalmalar; 2,49, 1,31 ve 2,75 ^{o}C şeklinde ölçülmüştür.

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Keyword: *Polietilen glikol, Bakır Sülfat, gizli ısı*

ID: 293

Synthesis of Microencapsulated Phase Change Materials and Polyurethane Applications

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One of the most important topics in today's conditions is energy saving. Due to population growth, technical and technological studies are being conducted to ensure the proper use of resources. Efficient use of energy plays an important role in energy saving. Efficient use of energy plays a crucial role in achieving energy conservation. In this context, various types of energy storage systems are popular subjects in scientific publications. In recent years, thermal energy storage systems have been among the most studied technologies. A thermal energy storage system can be described as storing energy in the form of heat by heating, cooling, melting, freezing, evaporating, or using thermochemical methods. Thermal energy can be stored in three different ways: as latent heat, sensible heat, and thermochemical energy. Among the thermal energy storage options, energy materials that allow for latent heat storage, known as Phase Change Materials (PCMs), can absorb and store a certain amount of energy in the form of latent heat during the phase change of the material. When appropriate conditions are met, the stored energy can be released back into the environment through phase change.
In our project, it is aimed to create a system by microencapsulation of the phase change materials (organic fatty acid esters) in a polyurethane-urea shell. We aim for the prototype of the microencapsulated conventional and new organic phase change materials to provide solutions for reducing carbon emissions, particularly in polyurethane systems, automotive, white goods, construction, textile, and coating industries where energy conservation is needed.

Keyword: *Phase Change Materials, Microencapsulation, Polyurethane*

ID: 167

Nano-TiO_2 Particle Containing Arylate Emulsion in Paint Applications

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Emulsion-type paints are gaining pace to limit the use of solvent-based products and to control volatile organic compounds due to climate change, the effect of which has been felt dramatically in recent years. Hovewer, it is known that the main argument in favor of using solvent-type paint is its film properties are typically better than those of emulsion-type paint [1]. Nanocomposite emulsions are paying attention to improve film properties of emulsion-type paint. As a nanoparticle, titanium dioxide (TiO_2) attracts much attention due to its many properties [2]. However, because nano-TiO_2 has a large surface area and high surface energy, it has a strong tendency toward agglomeration [3]. These factors limit the application of nano-TiO_2 to a large extent. In order to enhance compatibility with the organic polymer matrix and the dispersion capability, some types of low-molecular silane-coupling agents were commonly used to modify TiO_2 surfaces [4]. Inspiring from literature, it was aimed at fabricating emulsion-type paint with improved film properties in this study, and it was supported by Tübitak as 2218-National Postdoctoral Research Fellowship Program. TiO_2 was synthesized with the sol-gel method and calcinated at 400 ^oC. According to XRD analysis, anatase-form TiO_2 was obtained. Then, it was modified with methacrylfunctional silane. The modified particules were characterized by FTIR. The modified TiO_2 was used in emulsion polymerization in the range of 1 wt% in all acrylic monomer compositions. The average particle size was 135 nm when measured via DLS. The morphology of the composite latex particles was also investigated by SEM and TEM, and dispersion of the nano TiO_2 in latex was achieved after many experiments, according to the images. Finally, the emulsion-type paint was applied to a wind energy composite. Coating properties such as corrosion, moisture and QUV resistance were tested according to ASTM B117, ASTM D4585-07, and ASTM D4587-01, respectively. In conclusion, nanoparticle dispersion was the most important factor enhancing coating performance. In the case of the agglomeration of modified TiO_2, it was observed that the film properties worsened rather than improved. For the well-dispersion of the nano-TiO_2 in latex, coating properties will be given in the presentation.

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Keyword: *Nano-titanium dioxides, composite emulsion, acrylic paint*

ID: 99

Tek Kullanımlık Kompozit Torbalar Yerine %100 Geri Dönüştürülebilir Özellikte Mono Yapıya Uygun Malzeme ve Tasarımların Araştırılması

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Piyasada yer alan mevcut ambalaj yapılarının iç katmanlarında genellikle neme dayanıklılığı, gıdaya temas uygunluğu ve ısıl yapışma özelliği nedeniyle polietilen bir yapı tercih edilmekte, orta ve üst katmanlarda; optik özellilği, baskı görselindeki canlılık, rotogravur baskı tekniğine uygunluk ve termal dayanım kabiliyetlerinden dolayı polietilen tereftalat (PET) gibi geri dönüştürülemeyen yapılar kullanılmaktadır. Mevcut pazarda dik duran torbalar 3 katlı (PET/METPET/PE) ya da 2 katlı (PET/PE) yapıya sahip olup, yapılan bu çalışma kapsamında 2 katlı (POF/POF) film yapısında ambalaj ürünü üretilmiştir ve mono malzeme yapısı ile ambalajın geri dönüşüm sürecinin daha etkili bir şekilde gerçekleşmesi sağlanmıştır. Tüm bu çalışmalar yapılırken blown film üretim prosesinde MDO teknolojisi, baskıda ise PET filme uygulanan rotogravür baskı teknolojisi kullanılmıştır. Laminasyon prosesi esnasında ise PU bazlı tutkallar kullanılmıştır. Ayrıca torba kesim makinesindeki kaynak performansının artırılması ve PET'in termal dayanımının yeni formda tolore edilebilmesi için elastomer yapılı polimer hammaddelerin kullanıldığı özel bir laminasyon alt filmi tasarlanmıştır. PET gibi geri dönüştürülemeyen malzemelerin kullanımı bu torbaların atık yönetimi ile döngüsel ekonomiye geri kazanımını zorlaştırmakta ve çevresel etkisini artırmaktadır. Geliştirilen mono poliolefin yapıda %100 geri dönüştürülebilir dik durabilen körüklü torba ile; geri dönüştürülemeyen yapıya sahip ambalajların, mono poliolefin yapıyla POF/POF %100 geri dönüştürülebilir olması sağlanmış olup gerek mekanik gerek termal gerekse de optik olarak dezavantajlı bir durumda kalınmamıştır. Böylece, kullanım ömrü sona eren kompozit atık haline gelen ambalajlara geri dönüştürülebilir, döngüsel ekonomiye katkı sunan, sürdürülebilir ve çevre dostu bir form kazandırılmıştır. Ayrıca; enerji verimliliği artışı, çevre dostu ürün üretimi, karbon ayak izinin azaltılması, doğal kaynakların etkili kullanımı sağlanmıştır. Geri dönüştürülemeyen ve doğadaki çevresel atık miktarını artıran plastik malzemelerin kullanımı azaltılarak, ülkemiz ambalaj sektörünün ekonomik kazancına katkı sağlanmıştır.

Keyword: *Mono Yapili Polimer Malzemeler*

Water Reducible Silicone Modified Polyester Resin for High Temperature Resistant Coating Applications

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High temperature resistant coatings are designed to allow for exposing extreme heat or rapid temperature changes. They provide protection to surfaces by forming a protective layer withstanding high temperatures over time, retaining against thermal degradation, corrosion, and other detrimental effects of extreme heat, while also enhancing chemical stability[1]. Heat-resistant coatings serve multiple purposes, including protecting automotive engine components, industrial equipment, aerospace parts, cookware, building materials, and electrical components from heat damage[2]. As coating materials providing these properties, solvent-based polyester resins, solvent-free silicone resins or resins in emulsion form are used frequently. Solvent-based resins have drawbacks like environmental harm, flammability, health risks, and challenges in application on rough surfaces. Solvent-free silicone resins also face application challenges, prolonged drying times, and poor adhesion properties. The aim is to develop a water reducible resin for paint or varnish with superior mechanical and chemical resistance compared to emulsion-based resins[3].

The aim of this study is overcoming the problems caused by solvent based resin, emulsion form of resin and solvent-free silicone resin that traditionally used high temperature resistant coatings. Water reducible silicone modified polyester was designed to provide both thermal and mechanical resistance low VOC emissions, improved adhesion and flexibility, and have curable properties at low temperatures. In this regard, synthesized flexible polyester backbone containing free acidic functional groups to be water reducible was modified polysiloxane having methoxy functional groups. In line with the design targets of the project, silicone-modified polyester resin with 65±2% solid content (w/w), viscosity value range of 1000-2000 mPA.s and acid number range of 40-45 mg KOH/g was synthesized[4]. FTIR characterization was achieved to chemical structural analysis of synthesized resin. Water-based varnish produced with the synthesized resin was coated by dipping on the wire surfaces in smoke evacuation engines and cured at 200°C for 15 minutes to test thermal resistance of resin. Surfaces were tested within the scope of IEC60851-6 standard Test 9[5]. They were exposed to temperatures of 300°C and 400°C for 2 hours. A salt water test was used to check whether there was any breakage in the wires coated with varnish. The test results were successful.

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Keyword: *silicone modified resins, water reducible polyester resins, synthetic resins*

ID: 440

Sustainability in Tire Industry

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Total life cycle management is the commonly accepted strategy of the circular economy today. Reuse and recycling of rate of plastic waste will be reaching 50 % by 2030 while it was just 16 % at 2016 according to 2018 reports. The share of chemical recycling within total will be growing which makes it popular commercial scale feedstock to produce virgin polymers. How to utilize it for rubber and its chemicals production is one of the hot subjects for tire producers. Although the reports published in 2018 says waste plastic recycling ratio will be increasing from 16 % to 50%, recent data is different. For 2023 it is just 10 % at recent reports which is quite behind the forecast. The reason is the higher growth rate of plastic waste and no investment in recycling of it during pandemic period. Now it is a big problem of the world and at the same time it is a huge potential power for scientists and industry due to the size of the problem. Recent reports show that many global technology developers are investing in thermal treatment for feedstock production to be used for virgin polymer. According to McKinsey report landfills and unmanaged share of plastic waste will be decreasing from 59 % to 19 % for 2016 to 2030 respectively. In end-of-life tire (ELT) case it is quite different than the waste plastic as reported by ETRMA. In the EU region only 3% of ELT is unmanaged and land filled. In this case the improvement area is the ratio of ELT send to energy recovery which is 41% in overall EU. Whereas some west EU countries decreased this ratio up to 2%. Which means 98% of ELT utilized in material recovery in best case. The issue for the future is more value-added products from ELT. Municipal solid waste (MSW) is another potential source for material recovery. Although a big portion of MSW is sent to recovery facilities a very limited amount of it turn back to virgin material replacement. Only metal, hard plastics, bottles and paper segregated. The rest is sent to composting and landfill most of the time. Biogas from the composting and landfill site is utilized for electricity and/or heat production if the investment is done. Industrial scale feasible technology development is necessary to utilize the MSW biogas as feedstock for plastics and elastomers. One of the good examples is LanzaTech technology to convert MSW to EtOH with the help of biochemistry. Like MSW, Bridgestone and LanzaTech is cooperating for virgin polymer production from ELT and waste plastics. For the ELT another initiative that Bridgestone driving is the pyrolysis and further processing of it to the virgin elastomer production. Success of the initiation will depend on scalability and end-to-end sustainability of the supply chain. All other global tire producers have a similar approach to Bridgestone for ELT. Agricultural and forestry type bio-waste is also potential renewable feedstock for plastics and elastomers. But their technological readiness level is relatively low compared to pyrolysis of ELT and waste plastics. In polyester side mainly PET widely used at tire production as reinforcing cord. For the sustainable recycling of it several methods are popular including alcoholysis, aminolysis, hydrolysis and enzymatic depolymerization. The White cycle project co-founded by EU is just one of examples for the scalable and sustainable industrialization of recycled PET. About the reinforcing fillers like carbon black and silica there are some available solutions to decrease CO_2 emissions. Rice husk ash is very useful sustainable feedstock to produce precipitated silica. There are variety of chemicals used in tire productions like ZnO, StAc, wax, resin, sulfur, antidegredants, etc... Bio-EtOH and lignin as by product of paper industry are just two popular examples of sustainable feedstock.

Almost all global tire producers have already announced 2030 and 2050 sustainability targets as 50% and 100% sustainable production. Those are very challenging targets but still achievable by collaboration of industry with academy.

Keyword: *Sustainable tire, municipal solid waste, plastic waste, end-of-life tire, pyrolysis and biogas,*

ID: 57

DC Conductivity and the Flame Retardant Properties of Multifunctional Polyvinylpyrrolidone Nanofibers Containing Boric Acid

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Electrospinning is one of the most common method for the production of polymeric nanofibers. Nanofibers have unique properties such as large specific surface area, high porosity, small and controllable pore size and very small fiber diameter[1].

Polyvinylpyrrolidone (PVP) a common hydrophilic and synthetic polymer has good film formation properties which makes it popular for electrospun nanofibers[2]. It exhibits the properties of viscosity enhancement, low chemical toxicity and biocompatibility[3].

In this study, Multifunctional polyvinylpyrrolidone/Boric acid (PVP/BA) nanofibers were produced with electrospinning. Effect of boric acid concentrations (% 5, %10, %15) of DC Conductivity and flame retardant properties was investigated flame retardant properties of all the produced nanofibers were examined by vertical flammability tests. Electrical conductivity of nanofibers was measured by four point probe electrical conductivity measurement technique.

Nanofibers and nanoparticles can be applied in medicine, high-performance air filters, military and medical protective textiles, sensors, advanced composites, photo storage cells, and separation membranes. This study will show the effect of BA for three different concentrations.

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Keyword: *Boric acid, Polyvinylprolidone, Nanofiber, Flame Retardant, Conductivity*

ID: 47

Piridin Temelli Poliimid-Ag_2O Nanokompozit Yapılarının Sentezi, Karakterizasyonu Ve Optik özelliklerinin İncelenmesi

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Poliimidler alifatik veya aromatik diamino veya dianhidritlerin polikondenzasyonu ile sentezlenen ve yapısında heterohalkalı imid ünitesi taşıyan ısıl kararlı polimerlerdir [1]. Poliimidler, yapılarının kendilerine kazandırdığı yüksek termal kararlılığa ek olarak olağanüstü yüksek radyasyon direnci, üstün yarı iletken özellikler, yüksek mekanik dayanım ve kimyasal kararlılık gösterirler. Sahip oldukları yüksek kimyasal kararlılık nedeni ile pek çok biyomedikal uygulamada tercih edilirler. Yüksek inertlik ve esneklik özellikleri nedeni ile vücut içi elektronik implantlarda devre elemanı, sensör materyali ve yalıtkan kaplamalar gibi alanlarda kullanılmaktadır. Poliimid yapılar ayrıca mikroelektronik, otomotiv, paketleme ve uzay sanayi gibi ileri sanayi dallarında yaygın olarak kullanılmaktadırlar [1-2]. PI'nın potansiyel uygulamalarını genişletmek için inorganik nano dolgularla güçlendirilmesi büyük ilgi görmektedir. Nano dolguların nano etkisi nedeniyle, polimer nanokompozitler, az miktarda nano dolgu maddesiyle olağanüstü özellikler sergiler. Geleneksel nano dolgularla karşılaştırıldığında, Ag_2O nanopartiküllerin yaklaşık 1.2 eV bant boşluğu değerine [3] sahip olması bir p-tipi yarıiletken olarak polimer matrisli kompozitlerin özelliklerini geliştirmek için önemli bir nano dolgu maddesi haline getirmektedir. Bu çalışma kapsamında geniş bir ısıl çalışma aralığına sahip pridin temelli poliimid yapıları pridin üniteleri taşıyan monomerik yapılardan sentezlenerek Ag_2O nanopartiküllerinin katkılanması ile kompozit yapılara dönüştürüldü. Bu kompozit yapıların karakterizasyonları Elementel analiz ve FTIR spektroskopisi ile yapıldı. Morfolojik özellikleri SEM ve AFM teknikleri ile gerçekleştirildi. Ayrıca termal kararlılıkları, bozunma ve camsı geçiş sıcaklıkları DTA, TGA ve DSC teknikleri ile gerçekleştirldi. Özellikle optik özellikleri detaylı olarak belirlendi.

Sonuç olarak çalışmada farklı yapı ve morfolojide dört farklı poliimid yapısı piridin temelli monomer karışımlarından hazırlandı. Optimum yapı belirlenerek Ag_2O nanopartikül yapısı %1, %3, %5 ve %10 olarak katkılandı. Elde edilen yapıların saf PI yapısına götre Tg değerinin 50°C kadar azalmasına rağmen termal kararlılığının 150°C kadar arttığı ve optik geçirgenliklerinin %90 civarında olduğu belirlendi.

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Keyword: *Poliimid, Isı Kapasitesi, Ag2O nanopartikül*

ID: 395

Biyosensörlerde Nanolif Matrislerinin Kullanılması

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Biyolojik ve biyokimyasal süreçler; tıbbi uygulamalar, gıda kalite ve atık su kontrolü gibi alanlarda çok önemli bir role sahiptir. Bu nedenle biyosensörler geniş bir şekilde araştırılmış olup, yüksek hassasiyet, seçicilik ile ölçüm yapabilen biyosensörlere olan ilgi ve ihtiyaç hızla artmaktadır. Biyosensörler arasında elektrokimyasal biyosensörler; elektrokimyasal biyosensörler arasında da amperometrik biyosensörler düşük tespit sınırı, kullanım kolaylığı gibi avantajları sebebi ile en çok araştırılan biyosensörlerdir. Son yıllarda yapılan çalışmalar, düşük maliyetli, seri üretimi kolay, yeni elektrokimyasal algılama platformlarının geliştirilmesinin ve sensör performanslarının iyileştirilmesinin, biyoreseptörlerin immobilizasyonun için uygun bir matris hazırlanması ile yakından ilişkili olduğunu ortaya koymuştur. Bizim ve diğer araştırma gruplarının son yıllarda yaptıkları çalışmalar, biyoreseptörlerin immobilizasyonu için nanolif yapılı matrislerin kullanımının geniş yüzey alanı ve gözenekli yapıya sahip olmaları sebebi ile biyosensör performansına olumlu yönde etki ettiğini göstermiştir. Bu bildiride nanolif matris içeren biyosensörlerin genel değerlendirmelerin yanı sıra söz konusu matrislerin üretiminde kullanılan polimer, karbon nano bileşen, medyatör, redoks aktif nanoparçacık türünün çeşitli enzimatik amperometrik biyosensörlerin performansları üzerine etkileri ile ilgili grubumuzca elde edilen veriler paylaşılacaktır.

Keyword: *Biyosensör, Nanolif, İmmobilizayon matrisi*

ID: 349

Industrial Polylactic Acid Production by Synthesis of New Generation Catalysts

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The use of polymer-based products is increasing exponentially worldwide due to global growth and increasing urban population. The production of classical polymers causes depletion of natural resources. They are produced using fossil fuels and crude oil and pose a serious problem because they do not break down in nature and are permanent. The accumulation of synthetic non-biodegradable polymer waste in our ecosystem is a matter of great concern [1]. There are some traditional methods applied for the separation and purification of polymer-based waste materials, but they cause the release of toxic gases and hazardous metabolites. Therefore, an environmentally friendly, sustainable, cost-effective approach with appropriate polymer waste management option is an urgent requirement [2]. Recently, many researchers have been working on new, green and sustainable alternatives to traditional petroleum-based polymers, called biodegradable polymers [3]. In this study, firstly, lactic acid synthesis was carried out from molasses, which is a sugar waste. Later; For catalyst synthesis, metallocene-based Schiff base metal complexes attached to reduced graphene support were prepared. Graphene-supported ligands with different properties and various transition metal complexes of these ligands have been synthesized based on the ferrocene molecule. In the last stage; Dehydration of lactic acid was carried out using a laboratory type reactor at a certain pressure and temperature. Dehydrated lactic acid was collectively oligomerized with 1% graphene-supported ferrocene-based Schiff base metal complex as a catalyst to obtain a prepolymer with a degree of polymerization (DP) between 8-12. First, lactide was obtained through the reactive distillation process and PLA was synthesized in a glass reactor by crystallizing it to 99.9% purity. The molecular weight and polymerization degrees of the obtained PLA were calculated.

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Keyword: *polylactic acid, catalyst*

ID: 51

SiO_2 Partikül Bazlı Polimerik Süperhidrofobik Kaplamaların Geliştirilmesi

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Son yıllarda yüksek su itici özelliğe sahip süperhidrofobik yüzeyler, güneş panelleri, metal ve otomobil sanayisi gibi pek çok sektörde yaygın kullanım alanı kazanmıştır. Süperhidrofobik yüzeylerin su temas açıları 150° den büyüktür ve bu özelliği sayesinde su damlaları yüzeyde kolayca yuvarlanarak tozu ve kiri kendi kendine temizleyebilir[1,2]. Bu yüzeylerin tasarımında temel olarak iki ana etken mevcuttur. Bu etkenler düşük yüzey enerjisine sahip moleküller ile modifikasyon ve mikro-nano ölçekte düzenlemiş pürüzlü katmanların eldesidir[4]. Pürüzlü yapıların eldesinde elektrokaplama, , plazma aşındırma, kimyasal aşındırma, litografi ve nanoparçacık biriktirme gibi iyi bilinen yöntemler arasındadır. Bu yöntemler arasında mikro partikül yardımıyla biriktime tekniği ekonomik ve kolay uygulanabilir olması sayesinde yaygın olarak kullanılmaktadır[3]. Bu çalışmada, hidrofobik olarak modifiye edilen silika partiküller (SiO_2), poliglisidil metakrilat -poliperflorametakrilat (PGMA-PFMA) kopolimer çözeltisi içerisinde dağıtılarak yüzeye sprey kaplama yöntemiyle püskürtülerek kaplandı. RAFT polimerleşme tekniği ile sentezlenen PGMA-PFMA kopolimerin kimyasal karakterizasyonu ^{1}H-NMR ve FTIR spektroskopisi ile gerçekleştirildi. Farklı partikül oranları kullanılarak elde edilen pürüzlü yapılar SEM görüntüleri , su itici özellikleri ise su temas açıları ölçülerek karakterize edildi. Kaplamaların mekanik dayanımı zımpara sürtme; kimyasal dayanımı ise farklı çözücülere daldırılarak test edildi.

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Keyword: *Süperhidrofobik kaplama, RAFT polimerizasyonu, Partikül*

ID: 323

Liken Ekstraktı ile Zenginleştirilmiş Antioksidan Özellikli Elektro Eğrilmiş Yara Örtülerinin Geliştirilmesi

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Oksidatif stres, serbest radikallerin artmasına neden olarak hücrelere zarar verir. Bu stres yara iyileşmesini geciktirebilir ve komplikasyonlara yol açabilir [1]. Antioksidanlar ise serbest radikalleri etkisiz hale getirerek oksidatif hasarı önler. Yara iyileşmesi açısından bakıldığında antioksidanlar; inflamasyonu azaltır, hücre proliferasyonunu destekler ve yeni damar oluşumunu teşvik eder [2]. Dolayısıyla antioksidan aktiviteye sahip yeni nesil yara örtü malzemelerinin geliştirilmesi önem arz etmektedir. Bu noktada doğal ve biyouyumlu malzemelerden olan likenler, usnik asit gibi antioksidan özelliğe sahip değerli ikincil metabolitleri de içermesiyle potansiyel aktif ajanlar olarak karşımıza çıkmaktadır [3, 4]. Bu çalışmada antioksidan aktiviteye sahip yeni nesil yara örtü malzemelerinin geliştirilmesi hedeflenmiştir. Yara örtülerinin geliştirilmesinde yüksek yüzey alanı, kontrollü gözenek yapısı, esneklik, aktif madde entegrasyon kolaylığı, kolay üretim ve ölçeklenebilirlik gibi avantajları nedeniyle elektroeğirme yöntemi kullanılmıştır. Nanofiber membranların üretilmesinde biyouyumlu ve biyobozunur polimerlerden olan polivinil alkol (PVA) kullanılmıştır. Antioksidan özelliğin sağlanması için üretilen nanofiber membranlara liken ekstraktı damlatma yoluyla yüklenmiştir. Elde edilen nanofiber membranların kimyasal yapısı Fourier Dönüşümlü Kızılötesi Spektroskopisi (FT-IR) ve morfolojisi Taramalı Elektron Mikroskobu (SEM) ile karakterize edilmiştir. Antioksidan aktivitenin belirlenmesinde sıklıkla kullanılan 2,2-difenil1-pikrilhidrazil (DPPH) antioksidan kapasite tayin yöntemi kullanılmıştır. Karakterizasyon sonuçları, nanolifli yapıda liken ekstraktı yüklü yara örtü malzemelerinin başarılı bir şekilde üretildiğini doğrularken, DPPH antioksidan kapasite testi liken ekstraktının yüklenmesinin geliştirilen nanofiberlerin antioksidan aktivitesinde belirgin bir artış sağladığını göstermiştir. Yapılan çalışmalar neticesinde antioksidan aktiviteye sahip, biyouyumlu, biyobozunur nanolifli yapıda yeni nesil yara örtü malzemelerinin geliştirilmesi sağlanmıştır.

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Keyword: *Elektroeğirme, PVA, Antioksidan aktiviteli yara örtüsü*

ID: 367

Fonksiyonel Pektin Mikrojelleri ve Uygulama Çalışmaları

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Doğal bir polimer olan pektinden ters misel mikro emülsiyon polimerizasyonu ile çapraz bağlı (3B) mikrojeller sentezlenmiştir. Çapraz bağlayıcı türü ve miktarı, emülsiyon ortamı, pektin konsantrasyonu, reaksiyon süresi gibi parametrelerin pektin-mikrojel boyutu ve verimi üzerine etkisi incelenerek optimizasyon çalışmaları yapılmıştır. Seri üretimi yapılan pektin-mikrojellere post modifikasyon ile uygulamalarda performansı artıracak ve spesifik uygulamalara özgü yeni fonksiyonel gruplar (-NH_2, -SO_3H vb.) eklenmiştir. Ayrıca mikrojellere manyetik özellik kazandırılmıştır. Pektin mikrojelleri ve modifiye formlarının karakterizasyonunda taramalı elektron mikroskobu (SEM), termal gravimetrik analiz (TGA), zeta potansiyel (ZP) ölçümü, fourier dönüşümlü kızılötesi (FT-IR) spektroskopisi kullanılmıştır. Sentezlenen yapıların, antioksidan aktivite ve biyouyumluluk testleri yapılmıştır. Mikrojellerin ilaç taşıyıcı sistem olarak kullanımı test edilerek biyomedikal alanda uygulama potansiyelleri ortaya konulmuştur. Pektin bazlı mikro boyutlu 3B polimerik yapılar amaca özgü dizayn edilebilmesi, uygulamaya özgü performans arttırıcı özelliklerin post modifikasyon ile yapıya kazandırılabilmesi ve biyouyumlu olması dolayısıyla bu mikrojellerin özellikle sağlık sektöründe biyosensör, biyoaktif türlerin taşınmasında taşıyıcı sistem, kanser tedavisi vb. uygulamalar için uygun olacağı kanaatindeyiz.

Acknowledgement
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Keyword: *Pektin, Mikrojel, İlaç taşıyıcı sistem*

ID: 26

The Role of Geometry and Elasticity in Mucus-Penetrating Particles for Nose-to-Brain Drug Delivery

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In recent years, drug delivery from nose to brain (N2B) has come to the fore to improve quality of life and patient survival rates. The N2B mechanism has been extensively explored to develop agents in an appropriate carrier system that improves brain targeting and overcomes difficulties [1,2]. Large surface area, moderate stiffness (i.e., semi-elasticity), asymmetric geometry (aspect ratio>1), and low mucoadhesion of nanoparticles are the main properties that reach the brain by penetrating the nasal mucosa. In our study, a new application has been presented for using multifunctional nanoparticles with controllable size and geometry as an N2B delivery system by changing the proportions of polymer and lipid compartments and other operating conditions. Multifunctional nanoparticles draw considerable attention owing to their functional and smart advantages like controllable morphology and adjustable size. To bring to light the N2B application of multifunctional nanoparticles, the results are presented in comparison with solid lipid nanoparticles and polymer nanoparticles, which are frequently used in other studies in terms of biopharmaceutical aspects: mucoadhesion and permeability through the nasal mucosa. Although all nanoparticles demonstrated penetration across the epithelial barrier of the nasal cavity, the best increase in penetration was observed with asymmetric and semi-elastic multifunctional nanoparticles, which have low interaction ability with the mucus layer compared with traditional spherical formulations. As a result, a new field of application is demonstrated to be a promising and multifunctional system suitable for N2B delivery, not only for treating brain tumors but also other central nervous system diseases.

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Keyword: *elasticity, mucus penetration, nose-to-brain delivery*

ID: 299

Second Generation Nanodroplets as Histotripsy Agent with Detectable Perfluorocarbon Content

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Histotripsy is a non-invasive ultrasound technique, that employs intense, short-focused pulses to initiate a dense cavitating bubble cloud for tissue ablation. Typically, this method demands high negative pressures (25MPa-30MPa) to induce cavitation within the targeted tissues. Lately, nanoparticle-mediated histotripsy (NMH) has been investigated to significantly lower the cavitation pressure by combining histotripsy with acoustically active perfluorocarbon (PFC) loaded nanodroplets (NDs) or nanocones. NDs were initially developed as cavitation nuclei addressing the limitation of histotripsy by lowering the cavitation threshold. However, first-generation NDs face challenges in their practical application due to their complexity in synthesis, limited long-term stability, and indeterminate PFC concentrations[1-3].

To confront this, a pioneering development has emerged in the form of PEG-fluoroalkyl NDs as a novel agent for histotripsy. These NDs are formed by the self-assembly of PEG-fluoroalkyl chains that encapsulate perfluorohexane (PFH), a highly effective PFC derivative for histotripsy. Current research innovatively proposes that the greater the number of fluorine groups in the fluoroalkyl chains, the better the encapsulation of PFH within the ND's core, and eventually a more stable structure. For validation, a library of eight ND's variants was synthesized using two poly(ethylene glycol) (PEG_{550} and PEG_{2000}) as the hydrophilic block along with four distinct fluoroalkyl chains (pentafluoropropanoic acid, heptafluorobutyric acid, perfluoropentanoic acid, undecafluorohexanoic acid) as hydrophobic block encapsulating PFH. These NDs were synthesized as self-assembled PEG-fluoroalkyl chains demonstrating a straightforward production, with <200nm size, measurable PFH content (PEG_{550}'s NDs), enhanced stability, biocompatibility, and a significant reduction in the cavitation threshold. The results upheld that the presence of fluoroalkyl chains enhanced the encapsulation of PFH in NDs compared to their alkyl chain analogous. Further, blood compatibility, biocompatibility, and the cellular internalization of the NDs were investigated to demonstrate their behavior in blood circulation.

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Keyword: *Nanoparticle-Mediated Histotripsy, PEG-Fluoroalkyl chains, cavitation threshold*

ID: 441

Functional Polymer-based Surfaces for Sensor and Motor Applications

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Electrochemistry is a sub-discipline that carries out very important studies in terms of functional surface preparation. In general, it depends on processes based on oxidation and reduction reactions, which are also called redox reactions. Electrochemical techniques are commonly and efficiently utilized for determining important analytes or sensing, electroplating, deposition of polymeric films or nano/microparticles, metal processing, separation, organic/anorganic synthesis, material characterization, understanding the reversibility of a chemical process and identifying redox potentials [1-3]. For this reason, it has an important place in fields such as biomedicine, energy, food and environmental control, and corrosion. It is also known that this importance increases day by day [4,5].

The aim of this talk is to focus on some of the main applications of modified electrodes and micro/nanomotors prepared by the help of electrochemical means to address the biomedical field. The first part of the talk covers polymer-based electrodes for electrochemical sensor and actuator studies. In these studies, especially neurotransmitter and drug determination, and also the stimuli responsiveness property with the polymer coated electrodes will be explained. The second part of the talk focuses on polymer-based motor studies. In these motor applications, the potential use of motors in drug release and cell recognition will be specifically described. These aforementioned studies demonstrate the effectiveness of electrochemistry in the preparation of polymer-based surface functionalization and modification. In addition, the polymeric surfaces prepared in these studies are promising for sensor and drug delivery technologies.

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ID: 430

Redox-responsive Polymers: Tailoring Degradation of Nano and Bulk Biomaterials

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Stimuli-responsive polymeric materials such as nanogels, microgels, and bulk hydrogels are attractive platforms for addressing many challenges in conventional diagnostics and therapies. Moreover, the ability to tune the properties of gels using exogenous or endogenous stimuli expands their application areas. The talk will report our approaches to fabricating novel stimuli-responsive nanogels, microgels, and bulk hydrogels that are fabricated, functionalized, or degraded using the thiol-disulfide exchange reaction. Fabrication techniques ranging from self-assembly, microfluidics, and cryogelation will be discussed. Applications related to on-demand protein/cell capture and release and delivery of therapeutic agents in a stimuli-responsive manner will be presented. In particular, the talk will highlight using simple yet powerful organic transformations to tailor functional polymeric materials for target applications.

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Keyword: *Stimuli-responsive, Redox-responsive, Hydrogel*

ID: 81

Antibacterial and Antifungal Activity of Pullulan-Graft-Poly(N-Vinyl Imidazole)

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In this study, antifungal and antibacterial activities of synthesized novel water soluble copolymer pullulan-graft-PNVI have been successfully proven. To this end, water solubility, FTIR, elemental analysis, TGA, Hydrogen NMR analysis, and GPC are conducted, and their results showed that pullulan based cationic copolymer formed by grafting PNVI chains into neutral pullulan backbone. Pullulan-graft-poly(N-vinylimidazole) gave nanoparticles in the aqueous acidic medium upon complexation with sodium tripolyphosphate and sodium citrate. A set of systematic tests were performed to demonstrate that the presence of amine groups of NVI monomer on the pullulan backbone imparts antifungal and antimicrobial properties to the product.

Antifungal activity of the copolymer samples with various grafting percentages is analyzed on Candida albicans fungi, and the lowest concentration of antimicrobial agent (MIC) is studied on S.aureus and E.coli bacteria. Observations indicated that antifungal activity increases with increasing grafting yield at grafting values above the threshold value of 190%. Increasing NVI content on the pullulan backbone resulted in better antifungal activity. Samples with higher grafting yields have lower molecular weights as per GPC results. Higher grafting also gives rise to higher branching and lower viscosities. These factors contributed to easier polymer diffusion through the agar, showcasing better antifungal properties. The MIC result of the antimicrobial test was 20.025 mg/mL for S.aureus bacteria and 40.15 mg/mL for E.coli bacteria. The results provided reasonable potential application of this novel copolymer in biomedical and drug development industries, which could shed light on an alternative approach to gene or drug delivery.

Keyword: *Pullulan PNVI copolymer, Antifungal, Antibacterial*

ID: 50

Functionalized Porous Materials for CO_2 Capture and Conversion

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Economic growth is intricately tied to greenhouse gas (GHG) emissions, particularly carbon dioxide (CO_2) resulting from fossil fuel combustion. With the atmospheric concentration of CO_2 currently at 425 ppm, it has become the most significant contributor to global GHG emissions.[1] Consequently, there is a pressing need for research and technological advancements in capturing, storing, and converting CO_2 into high-value chemicals. Promising materials in this field are porous organic polymers (POPs), specifically conjugated microporous polymers (CMPs). CMPs possess advantageous properties, including π-conjugated structures, permanent porosity, as well as thermal and chemical stability.[2,3] Among CMPs, polytriphenylamine (PTPA) networks represent an intriguing class owing to their adjustable characteristics, such as redox activity and conductivity.[4] These polymers hold potential for catalytic applications, enabling the capture and conversion of CO_2 into valuable products. Furthermore, the incorporation of heteroatoms and functional groups into their framework structures can enhance the ability of these materials to adsorb and convert CO_2. Notably, the inclusion of carboxylic acid functional groups demonstrates promise, as they exhibit high binding capabilities of CO_2 molecules.[5]
In this study, we present a novel class of carboxylic acid functionalised PTPAs synthesised by the Pd-catalyzed Buchwald-Hartwig cross-coupling reaction. We successfully obtained a series of polymers with moderate surface areas and CO_2 uptake capacities. The synthesised materials exhibit excellent catalytic efficiency (up to 99% conversion) in CO_2 fixation reactions with epoxides, producing cyclic carbonates without the need for any additives or solvents. Moreover, our preliminary investigations utilising these networks as heterogenous catalysts for the electrochemical reduction of CO_2, reveal promising electrocatalytic activity for formate production.

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Keyword: *CO_2 Capture, CO_2 Conversion, Functionalised Porous Materials*

ID: 445

Layer-by-Layer Assembled Functional Polymer Films and Microcapsules

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Layer-by-layer (LbL) self-assembly technique is a widely used thin film fabrication technique for preparation of ultra-thin polymer multilayers due to its simplicity, relatively low cost and suitability for large-scale implementation. It is based on alternating deposition of interacting polymers onto a solid substrate. Besides polymers, a wide range of building blocks can also be incorporated into the multilayers. One of the main advantages of LbL technique is the possibility of tuning film properties by controlling the assembly and/or post-assembly conditions. Owing to these advantages, LbL films find use in various applications, e.g. biomedical engineering, food engineering and sensing. LbL self-assembly technique can also be applied to micrometer- and
submicrometer-sized colloidal particles such as silica, polystyrene, and calcium carbonate. This presentation will provide examples on use of ultra-thin LbL coatings as a platform for encapsulation of bacteriophages and potential of such multilayer film as an antibacterial coating for food packaging applications. Furthermore, use of LbL hollow capsules as stimuli-responsive microreactors for cascade enzymatic reactions will be presented

Acknowledgements
The study on bacteriophage containing layer-by-layer films was financially supported by METU Scientific Research Projects (ODTÜ BAP) (TEZ-YL-103-2021-10642).
The study on layer-by-layer microcapsules was financially supported by The Scientific and Technological Research Council of Turkey, TUBITAK (Grant number: 219Z329).

Keyword: *Layer-by-layer self-assembly, functional films, hollow capsules*

Tirozin ve Kumarin Grupları İçeren Yeni Metakrilat Polimerlerinin Teorik Hesaplamaları ve Fotodiyot Özellikleri

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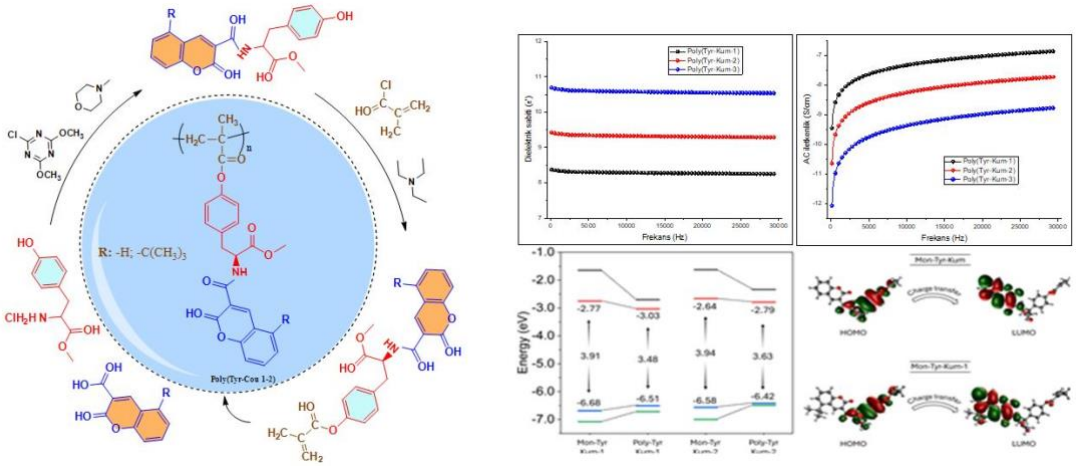
Kumarinler güçlü floresan özellikleri ve biyomedikal uygulamalar için geniş potansiyelleri ile tanınırken, amino asitler biyouyumluluk ve spesifik biyomolekül etkileşimleri sağlar. Kumarin içeren polimerler ve amino asit yapıları üzerine çalışmalar floresan özellikleri ve biyomedikal uygulamalarda kullanılabilirlikleri açısından büyük ilgi görmektedir. Ayrıca, yarı iletken özellikler sergileyen bu tür polimerler diyotlar ve fotodiyotlar gibi optoelektronik cihazlarda önemli bir potansiyel sunmaktadır. Dolayısıyla bu çalışmada elde edilen bulgular polimer kimyası ve malzeme biliminde yeni bilgiler sunarak literatüre katkı sağlayacaktır.

Bu çalışmada sentezlenen homopolimerlerin termal, dielektrik ve yarı iletken karakteristikleri ile diyot ve fotodiyot özellikleri incelenmiştir. Bu amaçla, bileşiklerin AC iletkenliği, dielektrik sabiti ve dielektrik kayıp faktörü gibi elektriksel parametreleri belirlenmiş ve DC iletkenlik ölçümleri yapılmıştır. Ön bulgular, kumarin üzerine bir ter-bütil grubunun eklenmesinin dielektrik sabiti değerlerinde (8.33'ten 9.38'e) bir artışa yol açtığını göstermiştir.



Ayrıca bu polimer yapılarından silisyum wafer yüzeyinde ince film ile yeni tip diyotlar hazırlandı ve bunların doğrultma özellikleri ile ışığa karşı fotodiyot özellikleri araştırıldı. Fotodiyot özelliklerinin belirlenmesinde, diyotun arayüzey kapasitansı, direnci ve iletkenliği, çeşitli ışık yoğunluklarında (20 mW/cm² - 100 mW/cm²) güneş ışığı altında test edilerek farklı voltaj aralıklarında analiz edildi. Böylece diyotların karakterizasyonları detaylı bir şekilde ortaya konmuştur.

Teşekkür
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Keyword: *Fonksiyonel polimer, Kumarin, Teorik hesaplama, I-V karakterizasyon*

ID: 6

Polymer Effect on Borderline Pumpability Temperature of Different Types of Base Oils

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Polymers have a wide range of application areas in lubricants. Polymers can be used as pour point depressants, viscosity index improvers, tackiness agents and water resistance improvement agents in lubricants. In this study we have been investigated effect of different polymer types on borderline pumpability temperature of different types of base oils. We have been used group 1,group 2, group 3, group 4 and group 5 type base oils. We have been studied with two different types of polymers to investigate the effect on borderline pumpability temperature of different types of base oils. We have been reported base oil type via polymer effect in borderline pumpability temperatures of different base oils with different types and ratio of polymers. It is known that there is an optimum effect of polymers in pour point of lubricants. In this study we have been also investigated the optimum ratio effect of polymers on borderline pumpabilitiy temperature of lubricants. We have been also investigated the optimum ratios of different polymers on different base oil types and reported.

Keyword: *polymer, base oil, borderline pumpability temperature*

ID: 297

Effects of Acrylic-Urethane Dispersion Coating on Stain Resistancy

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This study investigates the impact of polyurethane and acrylic hybrid coatings on stain resistance in various applications. Polyurethane and acrylic coatings are widely used for their respective advantages in durability, flexibility, and ease of application. By combining these polymers, the hybrid coatings aim to leverage the strengths of both materials to enhance overall performance, particularly in resisting stains. Through a series of laboratory tests and real-world applications, the hybrid coatings were evaluated against common staining agents such as coffee, wine, oil, and various chemicals. The results demonstrated a significant improvement in stain resistance compared to pure acrylic coatings alone. The hybrid coatings exhibited superior adhesion, reduced permeability, and enhanced durability, making them suitable for a wide range of surfaces, including wood, metal, and plastics. This study concludes that polyurethane and acrylic hybrid coatings offer a promising solution for industries seeking enhanced protective finishes with improved stain resistance properties on wood.
In this study, a polycarbonate-based waterborne polyurethane dispersion (WPUD) was synthesized using the prepolymer method. The particle size, contact angle, rheological properties, and mechanical properties of the synthesized WPUD were investigated. The compatibility of WPUD with acrylic was examined, and the technical properties of the resulting hybrid polymer were evaluated. Acrylic and acrylic-urethane dispersions were applied as self-sealers on wood panels. The coated wood panels were dried at room temperature, forming a thin film layer on the surface. Resistance to household stains such as coffee, water, ethanol, and oil was tested in accordance with the BS EN 12720:2009 standard. Additionally, water resistance was assessed using the immersion method following the ASTM D870 standard, and adhesion tests were conducted according to the ASTM D3359 method. Initial results indicated that the performance of the acrylic-urethane hybrid dispersions improved compared to pure acrylics, demonstrating high performance in both water and stain resistance.

Keyword: *Waterborne polyurethane, Coating, Acrylic-Urethane*

Chemical Recycling Technologies for Tire Cord Applications

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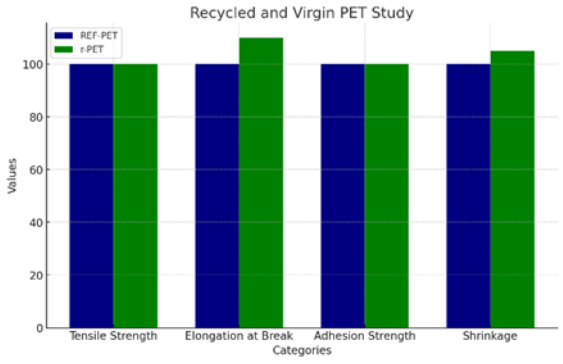
Kordsa Teknik Tekstil A.Ş

In recent years, the automotive industry has made significant progress toward environmental accountability, where sustainability goals have become increasingly significant. As a result, the emphasis on recycling and using recycled materials has grown substantially. Achieving the sustainability targets is crucial for reducing environmental impact, conserving resources, and promoting circular economy practices.

One key area is the use of recycled materials in tire cords. These cords are crucial for tire construction, providing strength and durability. Polyethylene terephthalate (PET) and Polyamide 66 (PA66) are two primary polymers utilized in tire cord constructions.
This project focuses on the chemical recycling of PET and PA66 polymers. The scope of work includes the development and optimization of chemical recycling technologies, characterization of recycled products, and comparison with virgin reference materials. Additionally, polymerization using the recycled monomers is conducted, and the resulting polymers are compared with conventional virgin polymers.
Firstly, an evaluation of microwave-assisted chemical recycled of PA 66 and its monomers were performed. The following steps were undertaken; optimization of the reactor (100ml) for recycled monomers, characterization of recycled and virgin monomers based on appearance, GC-MS, and concentration analysis, evaluation of impurity levels in recycled adipic acid and hexamethylenediamine compared to virgin ones, and validation of PA66 synthesized from recycled monomers recovered from a lab-scale microwave-assisted depolymerization reactor.
Secondly; recycled PET samples obtained using methanolysis and glycolysis methods from different suppliers have been compared with virgin PET. In general, FTIR, DSC, GPC, and TGA methods were used to characterize the polymers. Additionally, for PA 66, relative viscosity (RV) and amine end group analyses were performed, and for PET, intrinsic viscosity (IV), and carboxyl end group (CEG) were conducted. A critical issue identified is the presence of impurities such as isophthalic acid (IPA) and diethylene glycol (DEG), which can severely impact the performance of technical textile fibers, particularly during the spinning process.
This study, will highlight the applicability of recycled PET and PA 66 in tire cord application and suggest strategies for optimizing their recycling processes to mitigate their adverse effects.



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Keyword: *recycled polyester, recycled polyamide 66, tire cord, sustainability*

ID: 128

Mechanical Properties of Flax Fabric/PLA Biodegradable Composites

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Due to environmental issues, demands for biodegradable and environmentally friendly materials are rising in all sectors. Thus, there is also a search for biodegradable composites to replace traditional composites. For this purpose, natural fiber products based on flax have been created, especially for automotive interiors. Although technical textiles made from flax fiber can be used with conventional thermoset resins or thermoplastics, new studies concentrate on biodegradable polymers like polylactide (PLA) to meet environmental needs with fully green materials. However, PLA is highly brittle, so its composites deal with brittleness. Also, it is a non-polar polymer with a hydrophobic nature, leading to difficulties in forming interfacial bonding with fiber, causing lower strength in its composite. To improve these mechanical problems, multilayer flax woven fabrics were treated with polyethylene glycol (PEG), a hydrophilic polymer with high polarity. Two PEGs with a molecular weight of 1500 and 6000 were used at various concentrations through solution in water. Flax fabrics were dipped into the PEG solutions, and hot compressed within semi-crystalline PLA films after drying. Tensile, bending and impact tests were performed to evaluate mechanical properties. It was deduced that strain and toughness values significantly improved by incorporating PEG onto flax fabrics.

Keyword: *Flax fabric, polylactide, biodegradable composite*

ID: 224

Modifiye Silika Nanoparçacık Katkılı Polisülfon Membranların Elektro Üfleme ile Üretimi ve Yağ-Su Ayrımında Kullanılabilirliklerinin Araştırılması

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Yağlı atık sular, dünya genelinde ekonomik ve ekolojik olarak kritik bir çevresel sorundur. Membran teknolojisi geleneksel teknolojilerle karşılaştırıldığında, yüksek verimlilik ve enerji tasarrufu gibi avantajlarıyla yağ-su ayrımı için en çok umut vadeden yöntem olarak kabul edilmektedir. Özellikle yüksek akı ve seçicilik değerleri özelliklerinden dolayı polimer bazlı nanolif membranlar yağlı atık su arıtımında kullanılan temel membran malzemeleridir. Mikro ve nano yapılı fiberlerin üretim yöntemlerine eriyikten eğirme, eriyikten üfleme, elektro eğirme ve çözelti üfleme yöntemleri örnek olarak verilebilir [1]. Eriyikten üfleme ve elektro eğirme sistemlerin birleştirildiği elektro üfleme (EBS) yöntemi lif oluşumu için basınçlı havayı kullanırken aynı zamanda elektrostatik alandan da faydalanır. Tüm bunlar göz önüne alındığında EBS yöntemiyle daha küçük çaplı, düzgün gerilmiş ve homojen dağılmış nanolifler elde edilebilir [2]. Polisülfon (PSU), kimyasal, mekanik ve termal karalılık, yüksek camsı geçiş sıcaklığına (Tg <170°C) sahip olma, belirli bir sıcaklık ve konsantrasyon aralığında asit-baz ortamlarına karşılık yüksek direnç gösteren bir polimer olması gibi özellikleri ile dikkat çekmektedir [3].

Literatür çalışmaları, oleofobik/hidrofilik ve oleofilik/hidrofobik özelliklere sahip membran yapılarının tasarımıyla etkin bir yağ-su ayrımının sağlanabileceğini ifade etmektedir [4, 5]. Bu çalışmanın amacı, modifiye edilmiş silika nanoparçacıklar içeren dayanıklı, uzun ömürlü süperhidrofobik/oleofilik kompozit membranlar geliştirmek ve bu membranların yağ-su ayırma performansını değerlendirmektir. Silika nanoparçacıkları solgel yöntemi ile silan ajanı kullanılarak süperhidrofobik silika nanoparçacıklarına modifiye edilmiştir. Bunun için, 1 g silika (Aerosil 380, Evonik Industries) 40 mL toluen içerisinde dağıtıldıktan sonra, çözeltiye optimizasyon sonrası belirlenen miktarda feniltrietoksisilan (PTES, Sigma Aldrich) ilave edilmiştir. Reaksiyon 24 saat 40 derecede gerçekleştirilmiştir [5]. Elde edilen reaksiyon çözeltisi 3500 rpm'de 15 dakika santrifüj edilmiştir. Santrifüj sonrası nanoparçacıklar (M-SNP'ler) 70°C vakum fırınında 12 saat kurutulmuştur.

Ağırlıkça %13 PSU/DMF çözeltisi kullanılmıştır. M-SNP katkılı eğirme çözeltileri hazırlanırken polimer katkısının ağırlıkça yüzde 1, 3, 5, 7'si olacak şekilde M-SNP'ler DMF ile ultrasonikasyon işlemine tabi tutulmuştur. Daha sonra, toplam konsantrasyon %13 olacak şekilde PSU granülleri çözeltiye eklenmiştir. M-SNP katkılı PSU nanolif membranlar EBS yöntemiyle üretilmiştir.

Üretilen nihai membranlar FTIR, SEM-EDX, temas açısı (WCA), çekme testi ile karakterize edilmiştir. Yapılan çalışmada PTES katkılı membranların yağ-su ayırma uygulamalarında kullanılabilmesi için gelecek vaat ettiğini gösteren sonuçlar elde edilmiştir.

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Keyword: *nanosilika, superhidrofobik-oleofilik membran, yağ-su ayırma*

ID: 121

Development of Flexible TPU-BiSn Composites for Wearable X-Ray Shielding with Enhanced Mechanical and Antimicrobial Properties

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The increasing use of low-energy X-rays in clinical diagnostics has raised significant concerns regarding radiation exposure for patients and healthcare professionals [1]. While lead-based shielding materials have traditionally been used due to their high density and atomic number, they present considerable challenges related to toxicity and substantial weight [2]. This study introduces a novel approach to radiation protection through the development of flexible and wearable materials incorporating liquid metal-derived bismuth-tin (BiSn) core-shell particles within a thermoplastic polyurethane (TPU) matrix [3]. We conducted an extensive investigation into the structural and mechanical properties of TPU-BiSn composites. The integration of liquid metal particles (LMPs) effectively maintained the inherent flexibility of the TPU matrix. Additionally, the oxide shells of these particles significantly enhanced the tensile strength of the composites by approximately 15% at the break point. These mechanical improvements did not compromise the material's flexibility, making it highly suitable for wearable applications. The TPU-BiSn composites demonstrated exceptional X-ray attenuation properties. For 5 mm thick sheets, the attenuation efficiency exceeded 90%, making them particularly effective for mammographic diagnostics within the 20–30 kVp energy range. Furthermore, we observed that increasing the particle loading improved the shielding efficiency across higher energy ranges (40–90 kVp), with predictive modeling extending efficacy to the 90–120 kVp range. These findings indicate that the composites meet ASTM standards for radiation attenuation gloves, broadening their potential use in various medical applications. In addition to their outstanding radiation shielding capabilities, the composite sheets exhibited contact-active antimicrobial properties. This dual functionality enhances their appeal for use in healthcare settings, where both radiation protection and antimicrobial activity are critical. The materials used in these composites are readily available, and the production methods are practical and feasible. This indicates a significant potential for real-world implementation of these TPU-BiSn composites in radiation protection applications. Our findings suggest that these composites offer a safer and more practical alternative to traditional lead-based materials, addressing the need for innovative solutions in the field of radiation shielding.

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Keyword: *X-ray shielding, liquid metal, bismuth-tin*

ID: 415

Environmentally sensitive polymer design, production and their use in the production of many new nano/micro particles

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Polymer-based materials are the most intensively used material types in our daily lives. In order to produce new value-added products in this field, it is necessary to design the polymer structure well and control its relationship with stimuli or environmental conditions in the areas of use. Polymer structures that can respond to environmental conditions are called "stimulus-responsive" or "environmentally sensitive" polymers. In such polymers, when a selective region in the polymer chain responds to environmental effects, new structures (spherical/cylindrical micellar nanoparticle formations, gelation, precipitation, etc.) are observed with “self-assembly”. There are two ways to produce such structures/materials that are sensitive to environmental stimuli such as pH, temperature, ionic strength, radiation, and magnetic fields. The first is polymer synthesis by selecting monomers containing functional groups suitable for sensitivity, and the second is polymer synthesis by using precursor monomers whose sensitivity can be provided by additional reactions. In the second process, after polymer synthesis, appropriate functionality is provided to the relevant comonomer segments in the polymer chain by “post-modification”.

In our studies, we focus on reaching usable structures in many areas by utilizing many environmentally sensitive (co)polymers and their “self-assembly” behaviors in both ways. These types of polymers act as new types of surfactants, enabling the production of micelles/termicelles (cylindrical, core-shell, onion-type structures) with different structures, and cross-linked nanostructures from micelles (core cross-linked, middle layer cross-linked, outer layer cross-linked micelles). Each layer of these nanostructures can be transformed into more functional structures with different post-modifications, and they enable new approaches for the production of new hybrid systems and carrier/release systems, especially in the biotechnological field. These types of polymers offer significant potential with their sensitivity in areas such as drug delivery and releasing technology as controlled releasing systems, nanometal-containing hybrid structure technology (based on micelles, reverse micelles, schizophrenic nanostructures, cross-linked micelles, hydrogels, microgels), nano-thin film coatings, precipitants, collectors, flocculants, stabilizers (emulsion agents, dispersants).

ID: 302

Engineering Castor Oil-Based Nanoparticles for Biomedical Applications

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The increase in environmental pollution and the exhaustion of petroleum resources, renewable resources have been preferred in polymer synthesis. Plant oils are good alternatives as renewable resources because they are easily available, less expensive and biocompatible. This study focuses on developing polymer nanoparticles from plant oil-based monomers for drug delivery applications. Acrylated methyl ricinoleate and maleinated castor oil monomers were synthesized from castor oil, and they copolymerized with polyethylene glycol (PEG4000) to produce polymer nanoparticles. Characterization studies of these nanoparticles, including thermal stability, particle size distribution, and surface charge measurements, drug loading studies and in vitro cell viability assays were successfully performed. The particle sizes were found to vary between 100-300 nm. The chemical composition was characterized using Fourier-transform infrared spectroscopy (FTIR). In addition to the physical and chemical characterization, the potential biomedical applications of these nanoparticles were explored. Drug release tests were conducted by encapsulating the chemotherapeutic agent, Doxorubicin, within the nanoparticles. Furthermore in vitro cell viability assays were performed to assess biocompatibility, and the results confirmed that in healthy cells, cell viability was higher with encapsulated doxorubicin compared to free doxorubicin, whereas no significant difference was observed in cancer cells.

As a result, the development of these polymer nanoparticles from plant-based monomers represents a significant advancement in the field of sustainable biomaterials. The ability to encapsulate chemotherapeutic agent further enhances the utility of these nanoparticles in therapeutic contexts, particularly in the targeted delivery of cancer drugs. The synthesis of AMR and MACO from castor oil not only provides a renewable source of raw materials but also aligns with global efforts to reduce reliance on petroleum-based products.

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Keyword: *cancer treatment, polymer nanoparticles, renewable resources*

ID: 120

Polymeric Hybrid Micro-Structures Based on Superparamagnetic Nanoparticles for Biomedical and Environmental Applications

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Cancer represents one of the most significant challenges to global human health due to the low specificity of conventional approaches to its treatment. These approaches inevitably result in damage to normal tissues, thereby causing significant adverse effects. Consequently, the development of tumor-targeted therapeutic approaches is a necessity. The use of magnetic nanoparticles to deliver agents to specific locations within the body represents a promising approach to treating cancer. This approach, known as magnetically-guided drug targeting, has the potential to enhance the efficacy of chemotherapy. Furthermore, magnetic nanoparticles are widely used not only for their magnetic manipulation ability but also for the catalytic activity properties of the magnetic nanoparticles, which come from the Fenton reaction-forming capability. The application of Fenton reactions within the tumor microenvironment represents a significant feature of chemodynamic therapy (CDT), a promising cancer therapy approach. This approach generates reactive oxygen species (ROS) for tumor-specific treatment, which is a significant advantage over other cancer therapies. Here, the superparamagnetic nanoparticles, which are encapsulated within a biocompatible polymeric hybrid microstructure, promote the Fenton reaction with hydrogen peroxide. This reaction leads to the formation of abundant hydroxyl radicals (•OH) and reactive oxygen species (ROS) to ultimately kill cancer cells via the catalytic activity of superparamagnetic nanoparticles [1]. Meanwhile, these polymeric hybrid microstructures with unique catalytic activity also have the potential to promote the effective removal of organic contaminants via oxidation using hydroxyl radicals (•OH) to create CO_2 and water in wastewater treatment. To further understand the catalytic activity of polymeric hybrid structures, the synthesized polymeric hybrid structures were subjected to degradation of methylene blue at varied time intervals, both with and without hydrogen peroxide. Furthermore, the effect of the temperature of the Fenton reaction condition and various radical scavengers on the decolorisation efficiency and reusability of the degradation of methylene blue were extensively investigated and demonstrated by EPR analysis. In conclusion, the biocompatible and environmentally benign polymeric hybrid microstructures offer a broad perspective for tumor-targeted therapeutic approaches, MRI imaging, and environmental water treatment due to the presence of magnetic nanoparticles.

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Keyword: *Polymer Hybrid Structures, Catalytic Activity, Chemodynamic Therapy*

ID: 136

Improving the Antimicrobial Properties of Polypropylene Meshes Used in Hernia Surgeries with Amine-Functional Polymer Coatings

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Polypropylene (PP) meshes utilized in hernia surgeries are prone to infection-related complications due to their inherent susceptibility to bacterial colonization. This study focuses on developing a method to functionalize PP meshes with specific amine-functional polymers (Poly(2-(dimethylamino)ethyl methacrylate) and poly[(dimethylaminoethyl methacrylate)-co-(ethyleneglycol dimethacrylate)]) to enhance their antimicrobial properties. The aim is to introduce positively charged amino groups onto the mesh surface, facilitating interaction with bacterial cell membranes, leading to bacterial cell death, and imparting antibacterial characteristics. The modified PP meshes were characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-ray Photoelectron Spectroscopy (XPS), Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Scanning Electron Microscopy (SEM), and Water Contact Angle (WCA) measurements. Antimicrobial activity of poly-DMAEMA and poly-DMAEMA-EGDMA (quaternary amine) coated PP meshes will be assessed using the agar diffusion method against both Gram-positive (Escherichia coli) and Gram-negative (Staphylococcus aureus) bacteria. This approach offers a promising solution to enhance postoperative healing by augmenting the antimicrobial properties of meshes employed in hernioplasty, thereby minimizing the risk of postoperative infections.

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Keyword: *Polypropylene mesh, Antibacterial, Amine*

ID: 152

Development and Characterization of Versatile Injectable Hydrogels using Dynamic Covalent Bond Chemistry for Tissue Engineering Applications

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Injectable hydrogels have gained tremendous interest in tissue engineering applications due to their minimal invasiveness and mouldability to irregularly shaped tissues. Dynamic covalent bond chemistry allows the development of injectable hydrogels without requiring additional crosslinkers or external stimuli[1]. Thus, the potential toxicity to living cells arising from the presence of additional crosslinkers or the demand for external sources to initiate polymerization is eliminated. In this study, injectable and self-healing hydrogels were formulated using sodium alginate and polyethyleneimine (PEI) or polyethyleneimine-methoxy polyethylene glycol (PEI-mPEG) copolymer. Periodate oxidation of sodium alginate was confirmed by Fourier transform infrared spectroscopy (FTIR) after which the amount of generated functional groups was determined by the hydroxylamine hydrochloride titration method[2]. To improve the biocompatibility of the injectable hydrogels, PEI was grafted with methoxy PEG using amine-isocyanate coupling[3]. The dynamic imine bond formation between oxidized sodium alginate (OAlg) and PEI or PEI-mPEG polymers resulted in hydrogel formation under physiological conditions. The rheological properties of the OAlg/PEI and OAlg/PEI-mPEG hydrogels were investigated to evaluate the potential of the developed hydrogels as cell delivery matrices or bioinks. Macroscopic self-healing and injectability experiments showed the ability of hydrogels to heal intrinsically. Finally, the biocompatibility of OAlg/PEI and OAlg/PEI-mPEG hydrogels was evaluated on fibroblast cells revealing the improvement of cell biocompatibility upon introduction of PEG into hydrogel composition. All in all, our study shows the potential of OAlg/PEI-mPEG hydrogels as cell delivery matrices for cell transplantation and bioinks for three-dimensional printing.

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Keyword: *dynamic covalent bond, injectable, self-healing*

ID: 286

Staphylococcus Aureus Enfeksiyonlarıyla Mücadele İçin Olası Bir Aday: HF-18 Yüklü Fonksiyonelleştirilmiş PLGA Nanopartikülleri

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S. aureus, nüfusun yaklaşık %30'unu asemptomatik olarak kolonize eden [1] ve sayısı dünyada hızla artan hastane kaynaklı enfeksiyonların en yaygın nedenlerinden biridir [2]. S. aureus ile ilişkili enfeksiyonlar uzun yıllar antibiyotikler gibi geleneksel tedavilerle tedavi edilmiştir ancak aşırı ve gelişigüzel antibiyotik kullanımı nedeniyle S. aureus'un virülansı artmış ve antibiyotiklere dirençli suşları ortaya çıkmıştır. Dolayısıyla küresel halk sağlığı için büyük bir endişe haline gelmiştir [3]. Nanosistemler, artırılmış çözünürlük, iyileştirilmiş stabilite, biyoyararlanım, ilaç yarı ömrünün uzatılması, doku hedeflemesi ve minimum yan etki dahil olmak üzere geleneksel yaklaşımlara göre birçok avantaj sağlar [4]. Ek olarak, nanopartiküllerin yüzeyi konak hücrelerine veya bakteri yüzeylerine olan afinitesini artırmak için çeşitli ligandlarla işlevselleştirilebilir ve böylece aktif hedefleme desteklenebilir [5]. Bu çalışmada, antibakteriyel özellikteki HF-18 peptidini biyouyumlu ve biyobozunur poli (laktik-ko-glikolik asit) (PLGA) nanopartiküllerine enkapsüle ederek ve P6.2 peptidini bu nanopartiküllerin yüzeyine konjuge ederek nanopartiküllerin S. aureus hücre membranına seçici olarak hedeflenmesinin sağlanmasıyla yüksek biyolojik aktivite elde edilmesi amaçlanmıştır. HF-18 peptidi PLGA nanopartiküllerine ikili emülsiyon çözücü buharlaştırma yöntemi ile enkapsüle edilmiştir. HF-18'in PLGA nanopartiküllerine enkapsüle edilmesinde minimum partikül boyutu ve polidispersite indeksi (PDI) değerinin elde edilebilmesi için birincil su fazı hacmi, organik faz hacmi ve ikincil su fazı hacmi bağımsız parametreler olarak seçilerek 3 faktörlü 3 seviyeli bir Box Behnken tasarımı kullanılmış ve bağımsız parametrelerin değişimi ile partikül boyutu ve PDI arasındaki ilişki modellenmiştir. Belirlenen optimum proses koşullarında nanopartiküller (OPT-NP) üretilmiştir. Üretilen OPT-NP'lerin S. aureus hücrelerine yönlendirilebilmesi için yüzeyine hedefleyici ajan olarak Peptid 6.2 (P6.2) peptidi 1-etil-3-[3-dimetilaminopropil] karbodiimid hidroklorid (EDC) çapraz bağlayıcısı ile konjuge edilerek hedefli nanopartiküller (P6.2-OPT-NP) elde edilmiştir. Sonuçlar HF-18'in nanopartiküllere yüklenmesinin kontrollü salım sağlayarak antibakteriyel aktivitesini arttırdığını, P6.2 modifikasyonunun ise nanopartiküllerin S. aureus bakteri hücrelerine hedeflenmesine olanak sağladığını göstermiştir. Tüm nanopartiküllerin antimikrobiyal aktivite gösterdikleri dozlarda biyouyumlu olduğu bulunmuştur. Son olarak hedefli nanopartiküller ağırlıklı olarak S. aureus hücreleri tarafından alınırken, negatif kontrol olarak kullanılan E. coli hücreleri minimum düzeyde alım göstermiştir. Ayrıca ortak kültür çalışmaları, P6.2-OPT-NP'nin S. aureus tarafından büyük ölçüde alındığını gösterirken, fibroblast hücrelerinde hiçbir içselleştirilmiş nanopartikülün görselleştirilmemesi, bakteri hücrelerinin P6.2-OPT-NP tarafından aktif olarak hedeflendiğini göstermiştir. Bu bulgular, S. aureus hedefli bir formülasyonun geliştirildiğini göstermekte olup, gelecekteki terapötik uygulamalar için ümit verici beklentiler sunmaktadır.

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Keyword: *antimikrobiyal peptid, konjugasyon, polimerik nanopartikül*

ID: 227

Effects of the Size of Silica Nanoparticles on The Properties of SiO_2-GO Nanohybrid Reinforced Epoxy Coatings

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Polymeric protective coatings play an important role in protecting material surfaces from environmental factors and find extensive use across various industrial applications. In metallic surface coatings, epoxy, acrylic, alkyd, vinyl, and polyurethane resins serve as common polymer matrices, each chosen based on specific application requirements [1]. Corrosion loss, resulting from chemical and electrochemical reactions with the environment [2], motivates extensive research into polymeric and polymer matrix composite coatings [3]. Thermoset coatings are favored for their cost-effectiveness and ease of application, but curing process can create micro-pores that allow corrosive electrolytes to reach the metal surface [4]. Adding nanoparticles like SiO_2, TiO_2, ZnO, Al_2O_3, and Fe_2O_3 to these coatings blocks these pores and prevents corrosion. Silica is especially valued for its abundance and the ease with which its properties and dimensions can be controlled. Silica and graphene oxide nanohybrids form a network that significantly enhances corrosion resistance [5].
In this study, the effect of silica nanoparticle size in silica-graphene oxide nanohybrids on the surface properties and anti-corrosion properties of the epoxy matrix coating was investigated. For this purpose, anti-corrosive coating materials reinforced with silica-graphene oxide nanohybrids containing silica nanoparticles with the sizes of 20 ± 5, 35 ± 5, 50 ± 5, 70 ± 5, and 90 ± 5 nm (produced by modified Stöber method) were prepared. Silica-graphene oxide nanohybrids were characterized by Fourier-transform infrared spectroscopy (FTIR) analysis, zeta potential analysis, particle size analysis and scanning electron microscopy (SEM) analysis. The anti corrosive properties of silica-graphene oxide nanohybrid reinforced (0.5% wt.) epoxy coating which was applied on steel substrate were characterized by potentiodynamic polarization test. Coating material's surface properties were charactized by contact angle analysis, morphological properties were characterized by field emission scanning electron microscopy (FE-SEM) analysis,.

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Keyword: *nanocomposite coatings, silica-graphene oxide nanohybrids, anti corrosion*

ID: 444

Nanostructured Networks from Bottlebrush Copolymers

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Nanoporous networks are characterized by continuous interconnected pore domains that allow orientation-independent transport through the material. Self-assembly of various small molecular and polymer building blocks have been explored for the construction of nanoporous networks with different pore length scales. In this work, we present different methods for producing materials with nanostructured network morphologies from bottlebrush copolymers by covalent and non-covalent assembly. Bottlebrush copolymers are highly branched macromolecules with a comb-like architecture that can serve as tunable polymeric building blocks with cylindrical molecular shape and high persistence length. Materials with nanostructured domains are typically prepared from bottlebrush copolymers with at least two different types of side chains that are distributed along the backbone in a statistical, Janus, core-shell or blocky arrangement. Ordered network materials were prepared by self-assembly of bottlebrush copolymers with a gradient distribution of side chains along the backbone. Alternatively, bottlebrush copolymer networks were produced by covalent assembly of end-reactive and peripherally-reactive bottlebrush copolymers that allowed for the replication of molecular dimensions of the bottlebrush copolymer building blocks and the preparation of nanoporous materials with BJH pore sizes as low as 4 nm. The incorporation of thermally cross-linkable comonomers in the solvent produced highly thermally robust materials that maintained their high surface areas and pore dimension at temperatures above 300 ºC.

Keyword: *Nanoporous networks, polymer*

ID: 205

Electrospun Fiber Based Interlayers for Long Cycle Life Li-S Batteries

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Lithium-sulfur (Li-S) batteries offer a promising energy storage solution due to their high theoretical energy density and low cost [1]. However, the commercialization of Li-S batteries is significantly hindered by the polysulfide shuttling effect, which leads to poor cycle stability and low Coulombic efficiency [2]. To address this challenge, we propose the use of polymer-based electrospun fibers as interlayers to minimize polysulfide migration.

In our study, a hydrophobic polymer, polyvinylidene fluoride (PVDF), and a hydrophilic polymer, polyethylene oxide (PEO) polymers were utilized to fabricate electrospun fibrous mats. These polymer interlayers were further functionalized with MXene and MXene-transition metal oxide (MXene-TMO) structures to enhance their catalytic properties. Another route for diminishing the shuttling effect is designed as spraying the PVDF/PEO solutions with MXene/MXene-TMO structures on top of the Celgard separator. Hot pressing method was applied to polymer-based interlayers and sprayed samples of PVDF-PEO with MXene/TMO structures so that compactibility and distance between fibers and catalysts shorten and promote the catalyst activity of MXene catalyst. Interlayers are supposed to entrap polysulfides in between fibers by polar-polar interactions, slowing the shuttling effect [3]. The introduction of MXene-based catalysts aims to improve the redox kinetics of polysulfides, thereby reducing their diffusion and dissolution within the electrolyte [4].

Electrochemical performance tests reveal that the MXene and MXene-TMO modified interlayers significantly enhance the cycling stability, capacity retention, and rate capability and decrease the resistance of Li-S cells. Specifically, the PVDF/Mxene-TMO structured interlayers demonstrated a superior ability to trap and catalytically convert polysulfides, leading to a marked reduction in shuttle effects. Our results indicate that these novel interlayer materials could be a viable solution for developing high-performance, long-lasting Li-S batteries.

This research highlights the potential of combining electrospun polymer fibers with advanced catalytic materials to tackle one of the most critical challenges in Li-S battery technology, paving the way for their practical application in energy storage systems.

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Keyword: *polymeric nanocomposites, electrospinning method for polymers, energy applications of polymers*

ID: 221

Effect of Halloysite Nanotube on Reducing Undesirable Odor Emission in Polypropylene Based Wood Plastic Composites

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The growing worldwide concern about the environment has led countries to plan sanctions for the implementation of sustainable materials and to increasingly encourage their usage. Wood-Plastic Composites consisting of Wood Fiber (WF) and Polypropylene (PP) are among these sustainable materials; however, undesirable odor emissions that emerge while their production and in daily life usage limit their use in interior applications In order to find a solution to this odor problem, we investigated the effectiveness of using Halloysite Nanotube (HNT) in reducing Odorous Volatile Organic Compounds (VOCs) that produce these emissions at high temperatures in this study. Although there are commercial additives and materials used for this purpose in the literature like zeolites and carbon derivatives, HNT was preferred due to its advantages of nano size, lumen structure and specific surface properties as an alternative material to others. For this purpose, Wood-Plastic Composites (WPCs) containing 30% Wood fiber in the Polypropylene matrix were produced in order to compare the contributions of the materials added into them. Commercial odor absorbing additives with odor absorption and odor reduction mechanism used in industry; Struktol® RP17, Struktol® RP53 and Tego® Sorb PY 88 TQ containing zinc ricinoleate were included in the WPC formulation at a rate of 2%. Halloysite Nanotubes (HNT), which have both properties as odor absorbers and adsorbers, were added into WPC at 2% and 5% rates. Mechanical (tensile strength), morphological (SEM imaging), thermal (DSC and TGA) and spectroscopic (FTIR) and, specifically to the subject of this research, odor analysis (Jar and HS GC-MS) material characterizations of all composites obtained, and their performances were investigated.

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Keyword: *Halloysite nanotube, Volatile Organic Compounds, Odor, Wood-Plastic Composites, Polypropylene, Wood Fiber*

ID: 258

Ferrosen Bazlı Yeni Fonksiyonel Polimerin Moleküler Tasarımı ve Organik Schottky Diyot Olarak Elektriksel Özelliklerin Araştırılması

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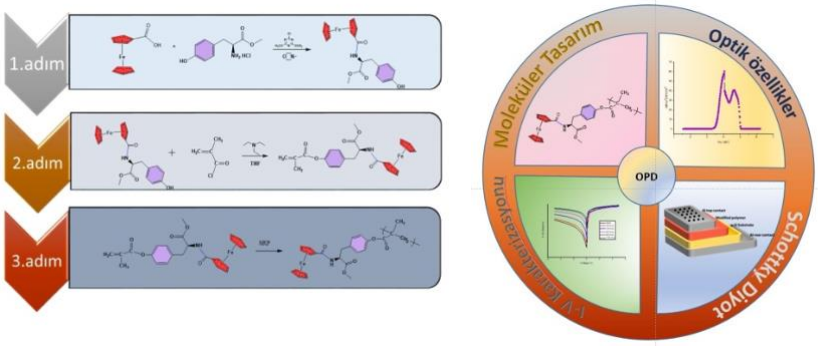
Fonksiyonel polimerlerin modifikasyonu, istenilen amaca ve kullanılacakları ortama uygun özelliklere sahip fonksiyonel polimerlerin üretilebilmesi gibi özelliklerinden dolayı yaygın olarak kullanılmaktadır. Işığa duyarlı fonksiyonel gruplara sahip polimerlerin sentezi, yüksek teknoloji uygulamaları için modifiye edilebildiklerinden polimer biliminde aktif bir araştırma alanı olmuştur. Işığa duyarlı gruplara sahip polimerler, holografik ekranlar, enerji değişim malzemeleri, sıvı kristal ekranlar ve doğrusal olmayan optik malzemeler gibi gelişmekte olan alanlarda geniş bir uygulama yelpazesine sahiptir. Ferrosenin tüm türevlerinin çok yönlü reaksiyon kimyası, yapısal özellikleri, teorik çalışmaları bu molekülleri, özellikle stereoselektif ve asimetrik dönüşümler, elektrokimya, yeni malzemeler (polimer kimyası dahil) ve diğer uygulamalarda birçok açıdan tercih edilen moleküller olmasını sağlamıştır. Ferrosen içeren polimerler, ferrosenin benzersiz özellikleri ve yüksek kimyasal kararlılığı nedeniyle büyük ilgi gören metal içeren polimerlerin önde gelen bir ailesidir. Kovalent bağlanma yoluyla ferrosen yapısını polimere dahil etmek için iki farklı yol kullanılabilir. Bunlardan ilki ana zincire dahil etmek, ikincisi ise ferrosenil birimlerini polimer omurgasına bitişik gruplar olarak eklemektir.



Bu çalışmada polimer zincirinin yan gruplarına bağlanan ferrosen bileşiği ile malzemeye daha iyi elektriksel özellikler kazandırmak ve ışık uyarımı altında π-elektronlarının delokalizasyonuna katkıda bulunmak için π-konjuge sisteminin uzunluğunu arttırma potansiyeline sahip polimer yapısı elde edilmesi planlanmıştır. Ana zincir olarak metakrilat grubunun seçilmesi, optik şeffaflığı, yüksek ışık geçirgenliği ve termal kararlılığından kaynaklanmaktadır.
Al/ferrosen-polimer/p-Si heteroeklem diyotu termal buharlaştırma ve kaplama tekniği ile üretildi. Üretilen diyotun elektriksel ve fotoelektrik karakterizasyonları I-V ölçümleri kullanılarak incelenmiştir. I-V ölçümlerine göre diyotun iyi doğrultucu ve fotodiyot özelliklerine sahip olduğu gözlendi. Elde edilen bu sonuçlara göre polimer ince filmin optoelektronik uygulamalar ve güneş pilleri için iyi bir potansiyele sahip olduğu görülmektedir.

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Keyword: *Ferrosen, Schottky diode, Elektriksel özellik, Polimer sentez*

ID: 63

Non-Near Infrared Light Absorptive Pigment Incorporation into Thermoplastic Polyolefins to Create Black Cool Surface

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Climate change and global warming cause higher temperature increases in urban areas and indoor spaces resulting in excessive air-conditioning usage and energy consumption. Especially, indoor temperature increase in vehicles is commonly caused by the absorption of the near-infrared (NIR) region of the solar irradiance spectrum of the sunlight by the black or dark-colored inner plastic parts such as dashboards, door panel arm sets, etc. A possible solution for this problem can be considered as obtaining cool black surfaces that decrease the surface temperature of these parts by preventing the absorption of the NIR region of the solar irradiance spectrum. For that purpose, cool black pigments, that have NIR reflective or NIR transparent properties, were incorporated into thermoplastic olefins (TPOs) which are the commonly used polymeric materials to produce these parts. Using these cool black pigments either separately or in a mixture resulted in a promising decrease in the surface temperature of black surfaces. An optimum TPO compound having a cool black surface was obtained with a sample that demonstrated 28.2% cooling compared to samples with carbon black, 9.04 MPa tensile strength, 1200% elongation at break, and mold shrinkage values of 0.61% and 0.11% at directions parallel and perpendicular to flow respectively.

Keyword: *dyes/pigments, thermoplastic olefins, mechanical, thermal and optical properties*

ID: 255

Li İyon Pilleri İçin Poli (2-Etil-2-Oksazolin) ve Kitosan Bazlı Elektrolitlerin Geliştirilmesi

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Taşınabilir elektronik cihazlar hayatımızda önemli bir yer tutmaktadır ve bu cihazlar için taşınabilir enerji depolama sistemlerine ihtiyaç duyulmaktadır. Lityum iyon piller (LIP), en yaygın kullanılan enerji depolama sistemidir. Son otuz yıldır yapılan geliştirmelere rağmen, LIP'lerin hâlâ bazı dezavantajları bulunmaktadır. Bunlar arasında düşük güç yoğunluğu, yüksek maliyet, güvenlik endişeleri, yüksek sıcaklıklarda bozulma, aşırı şarj-deşarj sonucunda kapasitede düşüş ve termal bozunma yer almaktadır [1].

Bu çalışmada, LIP'lerin daha yüksek güç yoğunluklarında ve güvenli bir şekilde kullanılabilmesi için poli(2-etil-2-oksazolin) (PEOX) ve kitosan (KT) polimerleri ile elektrolitler (JPE) geliştirilmesi ve performans testleri incelenmiştir. PEOX amid gruplarına sahip, tuz çözme kapasitesi yüksek bir polimerdir ve ısıl değişikliklere de tepki verebilmektedir [2]. Kitosan ise, amin gruplarına sahip bir polisakkarittir [3]. PEOX/KT karışımlarında oluşacak hidrojen bağlarının karışımı kararlı hale getirmesi ve elektrolit çözeltisini parçalanmadan tutması beklenmektedir. PEOX ve KT polimerleri içerisinde lityum tuzlarının iletkenlikleri incelendi. PEOX/KT ve PEOX/KT/Tuz karışımları tuzlu organik çözücüler (EC/DMC) eklenerek oluşturulan jelimsi numunelerin CR2032 hücrelerinde, EIS ve CV testleri yapıldı. İyonik iletkenliğin 10^{-5} S/cm seviyesi üzerinde olan polielektrolitler elde edildi. PEOX/KT ve PEOX/KT/Tuz bileşenli pil hücrelerinin performansı literatürdeki benzer tasarımlarla karşılaştırıldı.

Bu çalışma, "Pil Uygulamaları İçin Poli(Etil Oksazolin) Bazlı Polimer Elektrolitlerin Geliştirilmesi" başlıklı TÜBİTAK 1001 projesi (Proje no: 122Z577) kapsamında desteklenmiştir.

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Keyword: *Lityum iyon pil, Jel elektrolit, Poli(2-etil- 2-oksazolin), Kitosan, İyonik iletkenlik.*

ID: 427

Exploring the Potential of Bio-based Hydrocolloids in 3D Bioprinting Applications

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The success of the 3D structure to be created by 3D bioprinting technology depends on the properties of the bio-ink to be used. Hydrogel and hydrocolloid materials commonly used as bio-inks since they have the necessary rheological properties for bioprinting. Hydrocolloids are being increasingly recognized for their significant roles in advanced biomaterial applications, particularly in 3D bioprinting. These materials are characterized by their unique properties, including biocompatibility, biodegradability, gel forming ability and remarkable swelling capacity, which make them potential biomaterial for a wide range of tissue engineering and regenerative medicine applications. Polysaccharide-based hydrocolloids are one of the largest subclass of natural polymers and are commonly used in food industry, drug release and tissue engineering applications with their gelling and biocompatibility properties.

Hydrocolloids obtained from the seeds of some plants are among the promising natural materials in tissue engineering applications and the development of new generation bio-inks. Among the various hydrocolloids, quince seed hydrocolloid (QSH) and psyllium seed hydrocolloid (PSH) are particularly prominent due to their distinctive properties and functional advantages, and as a pivotal bioink component in 3D bioprinting they exhibit potential for the fabrication of complex tissue structures that possess improved mechanical characteristics and biological functionality.

Here we report development of a new generation polysaccharide-based bio-ink for 3D bioprinting applications. The bioink was obtained through "from waste to the bench-top" approach by utilizing quince seed and physillium seed as a raw material. Hydrocolloid derived from quince seeds is promising bioink by its excellent gel-forming potential and high swelling capacity, which are critical for the creation of stable 3D bioprinted construct. Its natural origin and compatibility with biological systems make it an attractive material to be used as bioink in 3D bioprinting applications. Similarly, the hydrocolloid extracted from psyllium seeds provides exceptional gelation properties and increased viscosity, which are beneficial for sustaining structural integrity and promoting cell growth in 3D bioprinted tissues. Overall, the ability of these materials to form biocompatible microenvironment as a bioink is critical in supporting cell viability and facilitating tissue regeneration, which addresses fundamental challenges in the development of functional tissue constructs.

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ID: 62

Flame Retardant Effect of Boron Compounds in Polymeric Materials

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Scientific researches have been focused on finding halogen-free solutions as effective as halogenated ones owing to environmental and health problems in recent years. This fact is the main driving force for upcoming academic works in the flame retardancy field. Boron compounds, are high potential flame retardant additive in polymer based materials owing to their low toxicity, molecular diversity, and various ways of flame retardant action. They have been used solely or as an adjuvant in combination with mineral fillers, intumescent systems, phosphorus, halogen, nitrogen, silicone and carbon containing additives. This presentation provides a comprehensive description of the flame retardant effect of boron compounds with general flame retardant mechanisms in natural polymers, biocomposite applications, thermoplastics, elastomers, and thermosets as well as the synergistic effect studies with other flame retardant additives.

Keyword: *boron compounds, Flame retardant, mineral fillers*

ID: 240

Utilization of Coloured Polymeric Encapsulation Films for C-Si Photovoltaic Applications

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Photovoltaic systems offer a relatively high land use efficiency, particularly when integrated into existing structures or combined with other land uses. Advances in technology and innovative deployment strategies continue to improve this efficiency, making solar energy an increasingly viable option for sustainable energy generation. Introducing a wider range of colours to PV systems can make solar modules serve a dual purpose, functioning both as energy generators and integral components to enhance the aesthetic appeal of the panels. Therefore, it is essential to develop cost-effective methods for adding colour without decreasing the efficiency. One potential solution is to incorporate colour into the polymeric encapsulant materials. The coloured encapsulant films can be produced by a polymer extrusion process which is suitable for the high-volume manufacturing process as are typical solar encapsulant like POE (polyolefin elastomer) or EVA (ethylene vinyl acetate).
In this study, the coloured polymeric films (light green and red terracotta) were sandwiched inside monocrystalline silicon modules, as a quasi-drop in the fabrication process of solar modules to produce the desired coloured appearance. The mini modules were fabricated in the structure of glass/ light green TPO/M10 PERC cells/black TPO/backsheet and, glass/ light green TPO/M10 PERC cells/ black TPO/backsheet respectively. The full-size PV modules were manufactured in the glass/glass structure.The electrical properties of the produced modules were investigated by means of current-voltage (I-V) characteristics measurements under standard test conditions. The application of two different colour based polymeric encapsulants on the front side with the same amount of colour coverage implicates different electrical behaviour of the fabricated modules. The efficiency of light green TPO containing mini modules was found as 17.74% and the efficiency of red terracotta TPO based mini modules was calculated as 16.95%.

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Keyword: *Coloured encapsulant, PV module*

ID: 112

The Structural and Ionic Conductivity Analysis of Solid Polymer Electrolytes by Using Molecular Dynamics Simulations

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Polyethylene glycol (PEG) is a polymer that exhibits super ionic conductivity in gel polymer electrolytes, crucial for solid-state battery technology. This property is influenced by structure of PEG, which allows for the reversible transport of ions, essential for energy conversion in batteries [1]. The glass transition temperature (Tg) of PEG is a critical factor that affects its ionic conductivity. Below Tg, rigid state of PEG hinders ion movement, while above Tg, increased chain flexibility and free volume facilitate ion transport, enhancing conductivity [2]. Polymers that have low Tg value around room temperature can show similar properties at operational temperatures. This study introduces a novel polymer with a Tg value to near room temperature, optimized for use in solid-state batteries. Molecular Dynamics (MD) simulations are instrumental in studying ion transport mechanism which provides atomic-level insights into ionic mobility and the effects of temperature on ionic conductivity. An amorphous cell was built consisting of novel polymer and lithium bis(trifluoromethane)sulfonimide (LiTFSI) to predict ionic conductivity and structural properties of novel electrolyte. We performed an analysis of the ionic conductivity, coordination behaviour, and radial distribution function (RDF) to assess the performance of novel polymer electrolyte at four different temperatures.

Acknowledgments

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Keyword: *Ionic Conductivity, Molecular Dynamics Simulation, Polymer Electrolyte*

ID: 83

Conjugated Porous Polymers for Energy Related Applications

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Conjugated porous polymers (CPPs) are the hypercrosslinked members of conjugated polymers (CPs) providing high surface area along their electron rich and hydrothermally stable backbone.[1] Their synthesis slightly differs from the ordinary CPs since at least one of their building blocks should be rigid and angled (i.e. a crosslinker) in order to produce the pores. Such crosslinking not only results in the porosity, but also leads to high dimensionality, which is very desired for organic electronics.[2] Moreover, groups such as long alkyl chains are avoided in order to keep the accessibility of the formed pores.

Due to the high rigidity and lack of alkyl chains, CPPs are non-soluble. Despite the disadvantages caused by such property like lack of uniform film formation via conventional techniques based on solution-processing (e.g. spin-coating, drop-casting), the non-soluble backbone provides great advantages for many applications.[3] For example, the non-solubility allows them to be utilized as highly durable organic electrode materials in batteries since the soluble organic compounds leach after a while during operation.[4] Moreover, in case of catalysis, those non-soluble compounds can easily be separated from the media via simple filtration or centrifugation, and reused, whereas the soluble (i.e. homogeneous) catalysts require complex separation techniques such as column chromatography.[5]

In this presentation, applications of CPPs in electrochemical energy storage and photocatalytic hydrogen production will be demonstrated. Briefly, performance of CPPs based on p-type (i.e. electron donating) phenothiazine building blocks for electrochemical energy storage will be shown. Additionally, efficiency and surface properties of novel CPPs for photocatalytic hydrogen production will be discussed. The presentation will be interesting for those who work on synthesis of electron rich monomers and conjugated systems for wide range energy and environmental applications.

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Keyword: *Porous Organic Polymers, Batteries, Photocatalytic Hydrogen Production*

ID: 390

Yıldız Şekilli Mimariden Oluşan Yeni Bir İletken Polimer Tasarımı, Sentezi ve Elektrokromik Cihaz Uygulamaları

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Bilim ve teknolojideki gelişmeler, ileri malzemelerin tasarımına ve sentezine olan ilgiyi her geçen gün artırmaktadır [1]. Bu tür malzemelerin kullanımının ve kapsamının geliştirilmesi için yoğun çalışmalar yürütülmektedir. Malzeme biliminde kullanılan çeşitli stratejiler arasında, yıldız şekilli donör-alıcı tipi moleküller yapı ve işlevsellik açısından oldukça dikkat çekmektedir. Bu simetrik mimariye sahip moleküller, yapıya sadece üç boyutlu elektrik iletkenlik sağlamaz, aynı zamanda olağanüstü optoelektronik özellikler de kazandırmaktadır [2,3]. Tüm bunlar göz önüne alındığında, bu tür polimerlerin elektrokromik cihazlarda (ECD) kullanılma potansiyele sahip olduğu öngörülmektedir.
Burada, akıllı cam teknolojilerinde kullanılmak için yüksek performanslı multielektrokromik malzeme elde etmeye yönelik kolay ve etkili bir strateji sunulmaktadır. Bu kapsamda, ilk olarak amid sübstitiye ditiyenil pirol (SNS) ve triazin içeren donör-akseptör tipi yıldız şekilli yeni bir monomer (kısaca T3SNS) sentezlenmiştir. Elde edilen monomerin yapısı FT-IR, UV-Vis ve NMR spektroskopik teknikleri ile karakterize edilmiştir. Monomer belirlenen optimum şartlarda elektropolimerize edilerek polimer film oluşturulmuş ve elde edilen polimer filmin elektrokimyasal ve optik özellikleri detaylı olarak incelenmiştir. Yapılan analizler sonucunda PT3SNS polimeri gelişmiş elektriksel ve optik performanslar göstermiştir. Polimerin yapı-özellik-performans bakımından üstün özellikler sergilemesinden dolayı, teknolojik uygulamalarda kullanım potansiyeli araştırılmıştır. Bu kapsamda, polimerin poli(3,4-etilendioksitiyofen) (PEDOT) ile elektrokromik cihaz tasarımı gerçekleştirilmiştir. Kurulan elektrokromik cihazın yüksek optik kontrast, hızlı anahtarlanma süresi, kararlı açık devre belleği ve uzun vadeli döngüsel kararlılık sergilediği analiz edilmiştir. Elde edilen sonuçlar ışığında, bu yıldız şekilli iletken polimer yeni nesil ECD'ler için ideal bir aday olarak gösterilebilir.

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Keyword: *donor-akseptör, SNS, triazin*

ID: 387

Designing Bifunctional Polymers: Electrochemical Copolymerization of Indole-7-Carboxylic Acid and EDOT for Enhanced Supercapacitor and Electrochromic Applications

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Electrochemical capacitors (ECs), also known as supercapacitors, have garnered significant attention due to their high specific power density, fast charge and discharge rates, long durability, and environmental friendliness[1]. Conducting polymers (CPs) have been extensively studied as pseudocapacitor electrode materials for their electrochemical reversibility, fast switching, high conductivity, mechanical flexibility, low toxicity, and low cost[2]. Among CPs, polyindole stands out for its thermal stability, blue photoluminescent properties, and stable redox activity. Adding a carboxylic substituent to polyindole, especially at the C7 position, enhances nanowire formation due to hydrogen bond interactions, leading to higher capacitance and better cycling stability compared to unmodified polyindole[3]. However, its relatively weak electrochromic properties limit its potential in applications requiring color change.

To address this limitation, we copolymerized indole-7-carboxylic acid (In7Ca) with 3,4-ethylenedioxythiophene (EDOT), known for its superior electrochromic properties. This approach aims to enhance the overall performance of the copolymer, leveraging the strengths of both components. The electrochromic properties of the homopolymer (PIn7Ca) and copolymer P(In7Ca-co-EDOT) were characterized using cyclic voltammetry (CV), spectroelectrochemistry, and kinetic methods. While color of PIn7Ca changes between yellow and green in neutral and doped states, the P(In7Ca-co-EDOT) copolymer exhibits multichromic behavior, displaying purple, grey, green, and blue colors.

Additionally, the supercapacitor properties of the obtained polymers were investigated through CV, galvanostatic charge-discharge (GCD), and electrochemical impedance spectroscopy (EIS). Fourier-transform infrared spectroscopy (FTIR) and UV-Vis spectroscopy analyzed the chemical structures and optical properties, while surface characterization was performed using scanning electron microscopy (SEM) and atomic force microscopy (AFM). The supercapacitor characteristics of the homopolymer and copolymers were compared, demonstrating that copolymerization is a promising approach for developing bifunctional materials with improved electrochromic and supercapacitor properties. These enhanced materials are suitable for advanced applications in energy storage and smart window technologies.

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Keyword: *Conducting Polymers, Supercapacitor, Electrochromism*

ID: 365

Functionalizable Polymeric Coatings via Host-Guest Supramolecular Interactions

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Functionalizable polymeric surface coatings with desired functional molecules and ligands have become attractive for preparing bio-interfaces necessary for biomedical applications such as sensing and biomolecule immobilization, analyte detection, and cellular adhesion.[1] Herein, we report the design of a polymer-based platform amenable to such functionalizations via supramolecular host-guest interaction. The interaction between cyclodextrin (CD) and adamantane (Ada) has been used to obtain various polymeric functional materials such as nanoparticles,[2] nanogels,[3] and functional surfaces.[4] Adamantane-containing surface attachable copolymer was synthesized, and silicon surfaces were coated with obtained copolymer. After preparing and characterizing the Ada-containing polymeric surface, functionalization of the polymeric surface was demonstrated by immobilizing fluorescent dyes, proteins, and protein-coated inorganic nanoparticles. We also showed regeneration and reusability in specific applications via catch and release cycles. Finally, after modifying it with a cell-adhesive peptide, we demonstrated that the polymeric coating was suitable for cellular attachment and proliferation. The unique design of this kind of polymeric platform allows for the fabrication of functional devices for various applications through supramolecular functionalization.

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Keyword: *Polymeric coatings, supramolecular interactions, cyclodextrin*

ID: 72

Polimerik Malzemeler ve Eklemeli İmalat Uygulamaları: Geçmişten Günümüze Eğilimler ve Gelecek Görüngeleri

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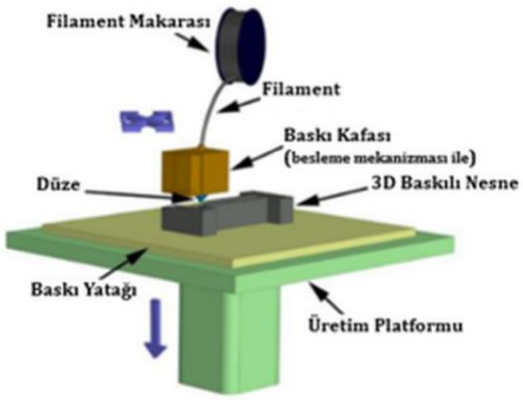
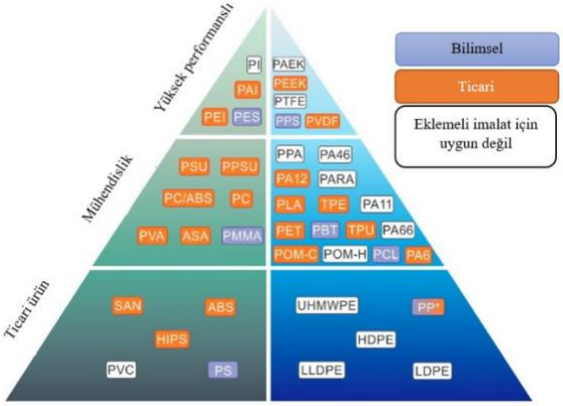
Bir akıllı üretim sistemi olarak kabul gören eklemeli imalat teknolojisi, çeşitli uygulamalar için karmaşık, verimli ve etkin polimerik parçalar geliştirmek için yaygın şekilde kullanılmaktadır. Bu işlemlerde özellikle filament malzemesi olarak tercih edilen polimer çeşitleri, istenilen yüzey, yapışma ve mekanik özellikleri sağlamaları açısından sınırlı sayıdadır. Üç boyutlu yazıcılarda kullanılan mevcut polimerik malzemelere ek olarak, eklemeli imalat yöntemine entegre edilen yeni nesil polimer kompozitler, medikalden yapı malzemelerine kadar birçok endüstriyel alanda kullanım alanı bulmuştur. Her geçen gün yenilikçi uygulamalar geliştirilen ve geleceğin imalat teknolojisi olarak öngörülen eklemeli imalat işlemlerinin teknolojik gelişimine, yazıcı cihazı parçası ve filament malzemesi olarak kullanılacak özgün polimerik malzemelerin üretimi ivme katma potansiyelindedir. Gelişen teknoloji ile birlikte daha uygun fiyata sahip hale gelecek olan eklemeli imalat süreçlerinin mevcut endüstriyel işlemlere ve insan yaşamına adapte olmaya devam edeceğine dair birçok çıkarım mevcuttur. Son yıllarda ilgili yaptırımların artması, yeşil kompozit olarak da adlandırılan çevreye uyumlu polimerik filamentlerin kullanımına ilginin yoğunlaşmasına neden olmuştur. Bu bağlamda, yenilikçi ve çevresel döngüye uyumlu üç boyutlu yazdırılmış parçaların imalatı gerçekleştirilerek performans özellikleri ortaya konmuştur. İlgili eğilimin gelecekte de giderek artış göstermesi beklenmektedir. Bu gelişmelere ek olarak, özellikle robotik, süperkapasitör, giyilebilir tekstil ve biyomedikal alanlarındaki yeni nesil uygulamalarda eklemeli imalat teknolojisine ilgi katlanarak artmaktadır. Sonuç olarak, teknolojideki ilerlemelerinin yanı sıra ilgili polimerik malzemelerin geliştirilmesiyle birlikte hızlı prototipleme alanındaki uygulamaların katlanarak büyümesi öngörülmektedir.





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Keyword: *eklemeli imalat, polimer kompozitler, akıllı üretim*

ID: 434

High Performance Semitransparent Organic Solar Cells with SAMs

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Semitransparent solar cells have several applications like building integrated PV (BIPV) and Agro PV applications. Organic solar cells are the only the only technology suitable for transparent solar cells.

In this study, semitransparent solar cells based on commercially available polymer donors and non-fullerene acceptors were fabricated with the device architecture of ITO/ SAM/ Active layer/ Cathode interlayer /Au /Ag. J-V characteristics of semitransparent organic solar cells were tested under illumination of solar simulator. Average visible transmittance values of the semitransparent cells were calculated from transmittance vs. wavelength measurements.

Power conversion efficieny of 12.82% were achieved with PM6:Y6 incorporated semitransparent solar cells. J_{SC} (short curcuit current) values were verified with external quantum efficiency measurement.

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Keyword: *Organic solar cells, Semitransparent devices*

ID: 46

Development and Performance Analysis of Novel High Performance PAN-Based Separator for Lithium-Ion Batteries

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A novel porous poly(acrylonitrile) PAN membrane prepared through electrospinning method is utilized as a separator for lithium-ion batteries (LIBs) to improve thermal and mechanical characteristics of the membrane when compared to commercial PE and PP based separators. First the produced PAN separator has been thoroughly characterized in terms of morphology, thermal stability and porous structure, and wettability, resulting in its suitability as a separator for battery applications. Having characterized the required membrane properties, we assembled coin cells with NMC811 cathode, Li metal anode, and PAN membrane.Furthermore, the results of the electrochemical experiments showed similar initial discharge specific capacity of 170 $mAhg^{-1}$ at C/3 and C/10 with respect to those employing commercial Celgard seperators, confirming the promising characteristics of the PAN separator to be alternative as a thermally and mechanically reliable separator for the Lithium-ion battery applications. The research will be conducted with coin cells to optimize the cell performance based on separator as well as pouch cells (up to 1 Ah) to investigate the possibility of commercialization.

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https://doi.org/10.3390/ma15217527

Keyword: *Separator, polyacrylonitrile, nanofiber*

ID: 134

Superhydrophobic and Multi-Liquid Repellent Polydimethylsiloxane Based Coatings

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Artificial polymeric superhydrophobic surfaces have attracted much attention, since the "lotus effect" has been reported in 1997 [1], due to their excellent water repellent properties. These surfaces have potential to apply in areas such as self-cleaning, anti-fogging, corrosion protection, drag reduction, drop transport and so-on. We have successfully grown polysiloxane nanofilaments on glass surfaces and on polymeric coatings prepared by emulsion or solution polymerization without the application of any activation step [2,3]. Superhydrophobic polysiloxane nanofilament coatings were also prepared by the growth of volatile fluorine-free organosilanes on activated glass slides via gas phase reactions under controlled humidity environment by a simple and environment-friendly method. [3] The obtained surfaces were characterized by contact angle measurements, scanning electron microscopy (SEM) and UV- vis transmittance spectrometer to analyze their wettability, morphology and transparencies. The prepared coatings showed excellent water repellency properties having very high advancing contact angles (~170°) with a very low contact angle hysteresis (CAH ~7°).
Slippery liquid-infused porous surfaces (SLIPS) are an emerging class of bio-inspired materials attracting researchers due to their good anti-fouling, anti-icing, and self-cleaning performance. The fluorinated lubricants which are used in the preparation of multi-liquid repellent SLIPS are not suitable for practical applications because of the lubricant losses by evaporation and water drop cloaking and also they cause environmental and health problems. By infusing silicone oil into the polysiloxane based coatings mentioned above, multi-liquid repellent property (SLIPS) was also introduced to these superhydrophobic surfaces. These surfaces were highly transparent and show excellent liquid repellency, very low contact angle hysteresis for long durations and maintain its water repellency after heating up to 80 °C for 6 days and also after exposure to continuous water droplet flow up to 2 h. [4] The lubricant-infused coated splints significantly attenuated plasma and blood clot formation and prevented bacterial adhesion and biofilm formation for up to 7 days, the typical duration for which intranasal splints are kept. [5] Multi liquid repellent, heat and chemically stable SLIPS were also prepared via layer by layer assembled PDMS based multilayers without any pre-or post-modification. [6]

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ID: 10

Sürdürülebilir ve Yenilenebilir Doğal Dolgu Takviyeli Kompozitlerin Geliştirilmesi

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Çevre kirliliğinin büyük bir parçası olan plastik atık sorununun gün geçtikçe artması ve tükenebilir kaynakların ileride yaratabileceği ham madde sıkıntısı gibi sorunlar nedeniyle sürdürülebilir ve yenilenebilir doğal takviyeli kompozitlere olan ilgi artmıştır. Bu artış sadece tükenebilir enerji kaynakları ve çevre duyarlılığı ile sınırlı değildir. Doğal takviyeli kompozitlerin sentetik elyaflı kompozitlere kıyasla düşük aşınma, düşük yoğunluk gibi endüstriyel kullanıma uygun özelliklere sahip olması ve termal olarak geri dönüştürülmesi çevreci uygulamalara yönelen sektör için ikame ürün fırsatı sağlamıştır. Doğal dolguların kullanımı özellikle otomotiv, beyaz eşya, gıda ve oyuncak gibi sektörlerde öne çıkmaktadır. Otomotiv sektöründe özellikle iç döşemelik ve kapı panelleri gibi uygulamalarda kullanılmaya başlandığı görülmektedir. Çalışma kapsamında yüksek akışkanlıklı homopolipropilen (PPHP) ile dört farklı tipte doğal dolgu (ceviz kabuğu tozu, kayın tozu, pirinç kabuğu tozu, odun talaşı) kompound edilmiştir. Besleme oranı %30 olarak belirlenmiştir. Besleme yüzdesi %30'un üzerine çıkarıldığında ekstrüzyon fitillerinde kopma gözlenmiş ve granül elde edilememiştir. Deneme sonuçları %30 mineral içeren referans ile karşılaştırıldığında mekanik sonuçların tolerans aralığında geldiği görülmüştür. Referans ile karşılaştırıldığında doğal dolgulu nihai ürünlerde minimum %10 hafiflik avantajı elde edilmiştir. Doğal dolgulu denemelerin termal dayanım sonuçları incelendiğinde 75°C - 85°C aralığında olduğu görülmüştür. Elde edilen tüm veriler referans ile karşılaştırıldığında, diğer doğal dolgulara kıyasla daha küçük parçacık boyutuna sahip olan odun talaşı ile en iyi sonuçların elde edildiği görülmüştür.

Keyword: *doğal dolgu, polipropilen, sürdürülebilirlik*

ID: 193

Preparation of Crosslinked Coatings by Dual (Chemical and UV) Curing of Bio-Based Chemical Structure Containing Cyclic Carbonate Units

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The decline in the availability of fossil fuels and their derivatives, coupled with their detrimental impact on the environment and public health, has underscored the growing necessity for the exploration of alternative sources of sustainable, non-toxic, and renewable bio-based raw materials. Glycerin is obtained primarily as a byproduct of biodiesel production. Following purification, glycerol has a variety of applications in many different industries, including the food, pharmaceutical, and cosmetics industries. Additionally, glycerin serves as a precursor for the synthesis of various chemical compounds, given its three hydroxyl groups. Glycerin carbonate is produced through a reaction between glycerin and dimethyl carbonate [1]. Glycerin carbonate, which contains a ring carbonate group, is utilized in a multitude of sectors, including concrete, agriculture, cosmetics, and polymers [2]. At room temperature, the cyclic carbonate group in the chemical structure of glycerol carbonate exhibits reactivity with amine groups [3]. Itaconic acid is a trifunctional biobased monomer obtained through the fermentation of sugar. In recent years, it has attracted considerable attention in the polymer industry due to its distinctive chemical composition, comprising two dibasic acid groups and a vinyl group [4].

In this study, the synthesis of Glycerin carbonate-Itaconic acid (GC-IA) was achieved through the esterification reaction of the hydroxyl functional group in the glycerin carbonate structure and the diacid groups in the itaconic acid structure by carbodiimide catalyst. Following purification, the compound was characterized by ATR-FTIR and ^{1}H NMR spectroscopy. The initial process of the resulting GC-IA monomer was conducted by reacting the cyclic carbonates groups present in glycerol carbonate with amine groups. The amine groups that will react with glycerin carbonate in the process are molecules containing -di and -tetra amine groups. The resulting product was applied to the metal surface in a coating. Subsequently, the second curing process was initiated by UV-curing the vinyl group in the itaconic acid structure. Following the completion of the curing studies, an examination was conducted of the physical, thermal, and mechanical properties of the product that had been coated on the surface. According to the results, dual curing process enhanced the mechanical properties of the coatings.

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Keyword: *Bio-based polymers, functional polymers, Dual cure systems*

ID: 149

Kemilüminesans Bir Bileşiğin Sentezi, Elektropolimerizasyonu ve Metal İyonu ve Kan Tespitinde Kullanımı

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Kemilüminesans bileşikler, geniş uygulama alanları ve yüksek duyarlılıkları nedeniyle, analitik kimya ve adli tıp alanlarında ilgi odağı olmuştur. Bu çalışmada, 5,7-di(selenofen-2-il)-2,3-dihidrotiyeno[3,4-d]piridazin-1,4-dion (S_2T-Lum) adlı yeni bir kemilüminesans bileşiğin sentezi, karakterizasyonu, polimerizasyonu ve kullanım alanları hedeflenmiştir. S_2T-Lum'un yapısı, Nükleer Manyetik Rezonans (NMR), Fourier Dönüşümlü Kızılötesi Spektroskopisi (FTIR) ve Yüksek Çözünürlüklü Kütle Spektrometresi (HRMS) teknikleriyle doğrulanırken hidrojen peroksit ile alkali bir çözeltide (0.1 M NaOH(aq)) gerçekleştirdiği kemilüminesans tepkimeleri, çeşitli metal iyonları ve kan örneklerinin varlığında araştırılmış ve sonuçlar luminol ile karşılaştırılmıştır. Çalışmalar sonucunda S_2T-Lum'un, bakır(II) ve demir(III) iyonlarına karşı yüksek hassasiyet gösterdiği ve özellikle demir iyonu duyarlılığı sebebiyle adli tıpta kan tespitinde bir belirteç olarak kullanılabileceği görülmüştür. Diğer bir taraftan S_2T-Lum'un elektropolimerizasyonu başarılı bir şekilde gerçekleştirilmiştir. Sentezlenen monomer ve elektroaktif polimeri sınıfının ilk selenofen esaslı kemiluminesans monomeri ve polimeridir. Sonuç olarak luminol tipi bileşikler ve polimerler ailesine yeni üyeler başarılı bir şekilde kazandırılmış ve bu malzemelerin metal iyonu ve kan teşhisinde kullanılabilecek potansiyele sahip oldukları görülmüştür.

Keyword: *Kan bulgusu, Kemilüminesans, Selenyum*

Electropolymerization of Methylene Blue Inclusion Effect On the Electrochemical Features of Zeolitic Imidazolate Framework-8

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Zeolitic Imidazolate Frameworks (ZIFs) gain high attraction due to owning high surface areas, tailored pore sizes, ultralow density, and post-synthetic modifications. Among ZIFs materials, ZIF-8 (formed by Zinc ions with the linkage of 2-methylimidazole) comes to the forefront with outstanding features such as large surface area (BET, 1413 m^2 g^{-1}), thermal stability, and significant chemical resistance to boiling alkaline water and organic solvents. Recent studies remark that especially for photocatalytic applications, ZIF-8 can be considered an alternative to traditional metal oxide. Moreover, ZIF-8 composed materials particularly show better performance to degrade Methylene Blue (MB) dye. MB is a type of phenothiazine redox dye that can electrochemically polymerize and has a redox nature on the changed surface. Poly(methylene blue) (PMB) is a prominent electroactive polymer with oxidation and reduction peaks at low potentials, making it suitable for applications in sensors . Furthermore, the production of PMB via electropolymerization is straightforward and quick. Herein, we developed a novel, innovative approach to profit ZIF-8 and MB reaction effect to enhance the electrochemical performance of ZIF-8 as a cathode material for supercapacitors (SCs). The results revealed that when pristine ZIF-8 has the specific capacitance of 178 F g^{-1} at the current density of 1 A g^{-1}, which improved to 1862 F g^{-1} **(**~10.5 x pristine ZIF-8) with the addition of 2ml /500 ppm MB to the 2M KOH electrolyte. With this innovative approach, we ably benefit electropolymerization of MB to enhance energy productivity.

Keyword: *Electropolymerization, Methylene Blue, Supercapacitors*

ID: 163

Stimuli-Responsive Polydopamine Coated ZIF-8-Decorated Nanoparticles for Synergistic Therapy

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In recent years, there has been a critical reconsideration of the design and development of drug delivery systems, emphasizing versatility. This encompasses the provision of synergistic therapeutic effects and sustainability. This study employed a redox-active ferrocenyl surfactant, ($FcN+(CH_2CH_3)_3(CH_2)_{10}CH_3$, $Fc(C_{11})$), along with polydopamine (PDA) coated pH-responsive Zeolitic Imidazolate Framework-8 (ZIF-8) structures to create multifunctional assemblies (Rhb@ZIF-8/PDA/AOT-$Fc(C_{11})$). The vesicles prepared using AOT-$FC(C_{11})$ serve as the core of the structure. The ferrocene group is located in the molecule structure in close proximity to the head group. This allows the surface of the vesicles to be decorated with the ferrocene group, which can act as a catalyst for the Fenton reaction. PDA-coated ZIF-8 was used to decorate the surface of the core structure, thereby creating a unique structure. The addition of NIR-responsive properties upon PDA coating enables the assembled structure to be used for photothermal therapy applications. The properties of this designed system have been studied under NIR-laser irradiation at different pH levels, and the results demonstrate that it has the potential to display a triple chemodynamic/photothermal/chemotherapeutic effect. In conclusion, these assemblies will have potential applications in various fields, including drug delivery.

Keyword: *Polydopamine, Zeolitic imidazolate framework-8, Synergistic Therapy*

ID: 312

Foto-Termal ve Isı Depolama Özellikli Hindistan Cevizi Yağı/Jelatin/Arap Zamkı/ZnO Mikrokapsül Üretiminde Duvar Yapısına Kaplanan Metal Oksit Nanopartikül Konsantrasyonunun Etkisi

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Kompleks koaservasyon yöntemi, doğal biyouyumlu ve biyobozunur polimerik malzemeler kullanımına imkan sağlamasıyla ısı enerjisi depolayan mikrokapsüllerin üretiminde sıklıkla tercih edilen bir yöntemdir (Tözüm vd., 2023; Huo vd. 2018; Wu vd., 2017; Demirbağ ve Alay Aksoy, 2016). Bu çalışmada literatürden farklı olarak mikrokapsüllerin üretimi ekolojik özellikleri ile ön plana çıkan kompleks koaservasyon yöntemine yine ekolojik özellikleri ile ön plana çıkan pickering emülsiyonun entegre edilmesi ile gerçekleştirilmiştir. Hindistan cevizi yağı içerikli jelatin/arap zamkı duvarlı mikrokapsüller çinko oksit (ZnO) pickering stabilizatörü kullanılarak pickering emülsiyon kompleks koaservasyon yöntemi ile üretilmiştir. Çalışmada üretilen mikrokapsüllerin duvar yapısına nano metal parçacıklarının biriktirilmesine ve elde edilen mikrokapsüllerin bulundukları ortamda foto-termal etki ile ısı enerjisi üretmesi üzerine odaklanılmıştır. Bu amaçla, farklı konsantrasyonlarda ZnO nano malzemeleri mikrokapsüllerin duvar yapısına depozito olması sağlanmış ve depozito edilen ZnO nano malzeme konsantrasyonunun mikrokapsüllerin ısı depolama ve foto-termal dönüşüm performansları üzerine etkisi araştırılmıştır. Üretilen mikrokapsüllerin kimyasal yapısı (FT-IR), ısı depolama özellikleri diferansiyel taramalı kalorimetre (DSC), morfolojileri taramalı elektron mikroskobu (SEM) ile araştırılmıştır. Ayrıca kapsüllerin foto-termal dönüşüm performansları UV lamba ve termal kameradan oluşan deney düzeneği kullanılarak araştırılmıştır. Çalışmamız mikrokapsüllerin duvar yapısına metal oksit nanopartikülleri tutturularak ışığın öncelikle ısıya dönüştürüldüğü ve sonrasında mikrokapsül içerisinde bulunan faz değişim malzemesi ile depolanması için kullanılabilen yapıları ortaya çıkarmıştır.

Teşekkür
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Keyword: *Mikrokapsül, faz değişim malzemesi, foto-termal dönüşüm, enerji depolama, tekstil*

ID: 146

Development of pH-Responsive Nanogels from Renewable Resources for Biomedical Applications

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In recent decades, gene therapy has emerged as the ideal choice for treating various types of cancer. Finding a biocompatible and efficient gene carrier, however, continues to be a significant obstacle in the battle against cancer cells. Owing to the acidic nature of the tumor environment, pH-responsive nanocarriers are growing as the most promising approach for efficiently delivering therapeutic gene agents to cancer cells. Nevertheless, the high cytotoxicity, and potential to form aggregates with negatively charged serum proteins severely restrict their applications.

In this work, we developed a pH-responsive cationic nanogel using acrylated methyl ricinoleate (AMR) which is a renewable monomer derived from castol oil. AMR was cross-linked with the cationic monomer 2-Aminoethyl methacrylamide hydrochloride (AEMA) by photopolymerization process in the presence of N,N'-Methylenebisacrylamide (MBA). Three nanogel formulations with varying AMR/AEMA monomer molar ratios (45/5, 25/25, and 5/45, respectively) were successfully synthesized. The particle size distribution, Zeta potential, and pH responsiveness of the nanogels were investigated. The particle sizes ranged between 100 and 270 nm, and all nanogels exhibited notable size changes when incubated in a pH 6.5 buffer. Additionally, all nanogels had surface Zeta potentials higher than +40 mV, enabling efficient encapsulation of genetic materials (plasmid DNA). Encapsulation studies of plasmid DNA were conducted using electrophoresis in 1% agarose gel. Furthermore, in vitro cytotoxicity highlighted the nanogels' biocompatibility and the fact that they hadn't any significant cytotoxic effects on cells exhibiting cell viability varying from 80 to 100%. These results strongly suggest that these polymeric nanogels might serve as an advantageous vector for cancer gene therapy applications.

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Keyword: *smart nanogel, renewable resources, pH-responsive*

ID: 100

CNT Dispersibility in PBAT and the Corresponding Rheological, Electrical Conductivity, and Electromagnetic Interference Shielding Effectiveness Responses

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As the demand for sustainable and electrically conductive materials increases, biopolymer nanocomposites with electrically conductive nanofillers become promising candidates. This study explores the effects of melt processing conditions (i.e., screw rotation speed, temperature, and mixing time) on the dispersion ability of carbon nanotube (CNT) in poly(butylene adipate-co-terephthalate) (PBAT) and the corresponding melt rheological properties, electrical conductivity, and electromagnetic interference shielding effectiveness of the processed nanocomposites. Small-amplitude oscillatory shear (SAOS) rheological experiments were conducted to analyze the melt viscoelastic behavior of nanocomposites. Electrical conductivity, dielectric permittivity, and dielectric loss as well as electromagnetic interference (EMI) shielding effectiveness of the nanocomposites were measured to reveal the CNTs dispersion quality on the noted functional properties. All these analyses were also used to determine the CNT percolation threshold after processing. The effect of CNT dispersion quality on the crystallization behavior of PBAT was also conducted using differential scanning calorimetry. Results indicated that the processing conditions significantly influenced the dispersion level of CNT. Although the increase in processing temperature could have reduced the shear forces during the mixing, the decreased PBAT viscosity with temperature seems to facilitate the interdiffusion of PBAT molecules among the CNT nanoparticles. The increase mixing rpm also helped the dispersion of CNTs although further increase in rpm could have expedited the mechanical degradation of both PBAT molecules and CNT nanoparticles. The increase in mixing time didn't play a role but rather could have caused thermal degradation of PBAT molecules.

Keyword: *poly(butylene adipate-co-terephthalate), carbon nanotube, electrical conductivity*

ID: 404

Polymer Functionalized or Polymer-Based Smart Nanoporous Membranes with Multifunctional Nanopore Activities

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Bioinspired, stimuli-responsive, polymer-functionalized multi- and nanoporous membranes are promising platforms for precisely regulating nanopore transport toward applications in water management, iontronics, catalysis, sensing, drug delivery, or energy conversion.[1] Chemical modifications of these nanoporous membranes have been inspired by the nanopore activities of the cell membranes, such as selective (ligand-) binding between different metal ions and the membrane receptors regulating the immune reactions, signaling, and opening/closing the ion channels.[2] After their pore functionalizations, the smart membranes get responsive against various stimuli, such as environmental pH, applied pressure, or osmotic pressure, to control the permselectivity of different cargoes, such as DNA or ions. Despite all these technological advantages, the nanoporous membrane field still needs new methods to (i) tune gradually (beyond on/off) the transport of both cations and anions; (ii) provide multi-functionality to the nanopores beyond the ionic permselectivity; and (iii) explain the fundamental role of analyte-nanopore interactions on nanopore transport of these analytes.
In this contribution, first, I will present how Ca^{2+} ions (act as ligand) interact with phosphate-bearing metal-ion responsive polymer brushes in silica mesopores under different conditions to gradually control the transport of both anions and cations at the pores.[3] Our hybrid membranes act as a novel sensing platform for valency number selective metal-binding at sub-µM concentrations with a memory. Second, I will show how we electropolymerized homogeneous polydopamine (PDA) films inside insulating silica nanopores to bring multi-functionality to the nanoporous membranes.[4] PDA is known to be a zwitterionic polyelectrolyte, but, at the same time, it is responsive against light, temperature, moisture, and pH. In the last part of my talk, I will explain our research activities in Bologna, focusing on the photophysical characterization of activities inside polymer (polycarbonate)-based nanopores. I will show the role of how the cationic luminescent analyte ($Ru(bpy)_3^{2+}$) interacts with negatively charged polycarbonate nanopores during a concentration-driven (ΔC) transport and how this interaction regulates the pH-dependent nanopore transport. Finally, I will discuss our recent analyte engineering activities aiming to tune the cationic nature of the Ru-based dyes to regulate nanopore-analyte interactions.

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Keyword: *pH-responsive polymers, ionic nanopore transport, nanoporous and mesoporous membranes*

Effects of Chain Extenders Chemical Structures on the Surface Properties and Scratch Profile of Polyurethane-Urea Coatings

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Metal surfaces covered with polyurethane coatings have been used extensively in a variety of applications. There is a huge increase in the study of coating systems in which curing process is done in moisture to develop high-performance coatings and address environmental issues. To study the effect of structural changes of chain extenders on the surface properties and scratch behavior of moisture curable polyurethane-urea coatings, two types of polyurethane-urea coatings using p-phenylene diamine and piperazine as a chain extender were prepared in this work. The scratch behavior is significantly influenced by changing the structure of chain-extender, so it is important to understand how their structure affects stability behavior. Effects of structural changes of chain-extenders on physical and mechanical properties of the resulted polyurethane-urea coatings were investigated. The chemical structure of the polyurethane-urea coatings was analyzed by Fourier transform infrared spectroscopy. Optical profilometer was used to analyze the scratch behavior and surface roughness of the coatings. Scanning electron microscopy (SEM) was used to observe the surface morphologies of coatings. Thermogravimetric analyzes were performed to evaluate the thermal behavior of the coatings.

Keyword: *polyurethane, polyurea, chain-extender*

Hybrid Sol-Gel Coatings Doped with Cerium to Improve the Physical and Corrosion Properties of Hot Dip Galvanized Steel

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Organic-inorganic hybrid coatings were prepared by a sol-gel method. Initially, hybrid sols were prepared from a mixture of the silane precursors tetraethyl orthosilicate (TEOS) and glycidoxypropyltriethoxysilane (GPTMS). The aim of the present study was to evaluate the effect of the addition of cerium on hot dip galvanised steel surfaces. Cerium was added in the form of cerium (IV) oxide.

Hybrid sol–gel coatings were coated on hot-dip galvanised steel via a spin coating process, with and without the addition of cerium.

The sol-gel reactions were studied by Fourier Transform Infrared (FTIR) spectroscopy. Hybrid coatings were deposited by the spin-coating route and subsequently characterised using attenuated total reflectance infrared spectroscopy (FTIR-ATR), contact angle measurements and scanning electron microscopy (SEM) and physical properties. Finally, the corrosion protection mechanism of the various coatings was discussed in detail.

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Keyword: *Hybrid coatings, sol-gel, corrosion*

ID: 245

Polyoxazolines with Imidazole End-Group as Thermal Latent Curing Agents for One-Component Epoxy Resins

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Polymer matrix composites are the most widely used composite materials today due to their low density, high mechanical performance, and ease of production. Epoxy resins are preferred as matrix materials in composite materials in aerospace, automotive, and defense industry applications. Commonly utilized two-component epoxy resin systems have drawbacks due to difficulties in their process, short shelf life, and poor end-product quality. On the other hand, one-component epoxy resins (OCERs) have a longer shelf life, higher end-product quality, ease of processing, and energy efficiency since their curing temperature can be controlled. In these systems, extending the shelf life and adjusting the curing temperature is critical. Therefore, latent curing agents are used to improve stability problems in OCERs. Thermal latent curing agents (TLCs) and catalysts are commonly preferred due to their ease of use. In this study, various types of polyoxazolines (POZs) were synthesized and terminated with imidazole curing agent to obtain polyoxazoline-imidazole (POZ-Im) TLCs. To create OCERs, diglycidyl ether bisphenol A (DGEBA) resin was combined with POZ-Im TLCs. The TLCs were characterized using FTIR, ^{1}H NMR, GPC, TGA, and DSC techniques. DSC, rheometry, and optical microscopy were used to investigate the curing behavior and stability of the prepared OCERs. This work investigated the effects of the POZ's hydrophilicity on the stability, homogeneity, and thermal latency behavior in OCERs. The results indicated that OCERs prepared with POZ-Im TLCs show better latency in curing.

Keyword: *Polyoxazoline, Thermal Latent Curing Sytems, One-Component Epoxy Resins*

ID: 184

Antibiyotik Konjugasyonlu Antibakteriyel İmplant Yüzeylerin Hazırlanması

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İmplante edilebilir malzeme yüzeylerinde patojen bakterilerin çoğalması ve biyofilm oluşumu birçok tıbbi tedavinin olumsuz şekilde sonuçlanmasına ve enfeksiyona sebebiyet vermektedir. Sidal ürünlere karşı direnç kazanan bakterilerin yüzeylere tutunmasının engellenmesi, bakteriyel enfeksiyonları azaltmada ve biyofilm oluşumunu azaltılmasında/önlenmesinde önemli bir seçenektir [1].Ayrıca, yüzeylerde kovalent konjugasyonun yanı sıra ilaç salınımı ile bakterisit olarak adlandırılan antibiyotikler, antimikrobiyal peptit ve katyonik polimerlerin fiziksel adsorpsiyonu/tutulması ile bakterilerin yüzeye yapışmasını engellemesinin yanı sıra biyofilm oluşumunun da önüne geçmektedir [2]. Antibakteriyel yüzey tasarımına yeni bir yaklaşımla polimer fırçalara antibiyotik yüklenmesi ve kovalent konjugasyonu bakterilerin implanta yakınlaşmasına engel olarak antibakteriyel kapasitenin artmasına imkân sağlayabilir[3-4].Bu çalışmada model implant yüzeylerde özellikle son yıllarda başlatıcı olarak kimyasal bir bileşen kullanılmadığı, oksijene toleranslı ve metal içeriği barındırmayan ara-yüzey vasıtalı Fotoindüklenmiş Elektron Transferi Tersinir Katılma Ayrılma Zincir Transfer Polimerleşmesi (PET-RAFT) polimerleşmesi ile antibiyotik konjugasyonu ve depolanması çalışmaları yapılmıştır . Antibiyotik temelli implant yüzeylerin hazırlanması için implant yüzeyler aktifleştirildi. Daha sonra bu yüzeylere 4-((((2-karboksietil)tio)karbonotiyoil)tio)-4-siyanopentanoik asit (CTP, RAFT ajanı) kovalent olarak bağlandı. Yüzeydeki RAFT ajanı modifikasyonu ile Poli(di(etilen glikol)metil eter metakrilat) (PDEGMA) fırçalar PET-RAFT polimerleşmesi tekniği sentezlendi ve kinetik çalışmalar yapıldı. PDEGMA fırçaların karboksilik asit uç fonksiyonel grubundan antibiyotik konjugasyonu gerçekleştirildi. Aynı zamanda, PDEGMA'nın sıcaklık duyarlı özelliğinden faydalanarak antibiyotik salım çalışmaları da yapılmıştır. Her iki durum için de implant-bakteri etkileşimi incelendi. Elde edilen yüzeyler bakteri ve hücre uygulamalarında kullanabilme potansiyeli taşımaktadır.

Teşekkür: Bu çalışma, Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından 222Z102 Numaralı proje ile desteklenmiştir. Projeye verdiği destekten ötürü TÜBİTAK'a teşekkürlerimizi sunarız.

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Keyword: *Polimer fırça, PET-RAFT, antibakteriyel*

ID: 168

ATRP Yöntemiyle Sentezlenen Blok Kopolimerin İlaç Salımında Etkinliğinin İncelenmesi

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Sıcaklık, pH, çözücü gibi dış faktörlere duyarlı olan ve akıllı polimerler olarak da adlandırılan polimerlerin bu özellikleri sayesinde literatürde birçok alanda uygulama alanı bulmuştur [1]. Özellikle amfifilik blok kopolimerlerin ilaç kapsülleme ve kontrollü salım etkinliği, hidrofilik ve hidrofobik ilaçlarla çalışma imkanı tanıması, biyouyumluluk, düşük maliyet, kolay hazırlık aşaması gibi avantajları sayesinde ilaç salım sistemlerinde de yaygın olarak tercih edilmektedir [2]. Bu avantajlarının yanı sıra bu tür polimerlerin misellerinin vücut sıvısı gibi ortamlarda ilaç sızdırması ve yapısının bozulması uygulama zorluğu oluşturabilmektedir. Bu zorluğun üstesinden gelebilmek amacıyla farklı stratejilerle misellerin yapısal kararlılığının arttırılması gerekmektedir. Bu bağlamda, miselin herhangi bir katmanında (çekirdek veya kabuk) çapraz bağlama işlemi yapılarak misellerin stabilitesinin ve uygulamalardaki etkinliğinin artırılması son yıllarda sıklıkla tercih edilen bir yaklaşımdır [3].
Bu çalışmamızda, atom transfer radikal polimerizasyon yöntemiyle, metoksipolietilen glikol (MPEG) makro-başlatıcı olarak kullanılarak, poli[(etilen glikol)metil eter]-blok-poli[(tert-bütilmetakrilat)-co-(diethylamino)etil metakrilat] [MPEG-b-P(BuMA-co-DEA)] blok kopolimerleri sentezlenmiştir. Ardından ikinci blokta yer alan BuMA birimleri metakrilik asite dönüştürülmüş ve ikinci bloğu zwitteriyonik yapıda olan [MPEG-b-P(MAA-co-DEA) kopolimeri elde edilmiştir. Bu kopolimerin misel çözeltisi hazırlanarak, çekirdekte yer alan MAA'ler üzerinden çapraz bağlanmış ve çekirdeği çapraz bağlı miseller elde edilmiştir. Çapraz bağlı misellere (pH= 7,4) hidrofobik dipiridamol (DIP) model ilacı yüklenerek in-vitro ilaç salım çalışmaları yapılmıştır.

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Keyword: *Çapraz-bağlı misel, Zwitteriyonik, Amfilik blok kopolimer*

ID: 9

Mekanik ve Elektriksel Özellikleri Artırılmış Çevre Dostu ve Sürdürülebilir Kablolar

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Bakır; yüksek iletkenliği, esnekliği ve dayanıklılığı gibi özelliklerinden dolayı elektrik kabloları için ideal bir malzeme haline gelmektedir. Bakır kabloları oluşturan bakır iletkenlerinin yüksek maliyetli olması, korozyona uğraması ve üretim sırasında ortaya çıkan olumsuz çevresel etkileri nedeni ile kablolarda alternatif bir iletken arayışını doğurmaktadır. İletken polimerler, organik bileşiklerden oluşan ve elektrik akımını iletebilen yapısal özelliklere sahip malzemelerdir. Bu polimerler genellikle esnek bir yapıya sahiptir ve farklı şekillerde kolayca işlenebilmektedir. Kimyasal olarak dayanıklı olma ve çeşitli çevresel koşullara karşı stabil kalabilme özellikleri sergilemektedirler. Özellikle polianilin (PANI), korozyon kontrolü için araştırılan başlıca iletken polimerlerdir. Grafen, tek atom kalınlığında bir nanomalzemedir. Tek karbonlu atomik kalın grafen levhalar, geniş yüzey alanına, yüksek termal kararlılığa, yüksek mekanik mukavemete, üstün elektriksel iletkenliğe ve olağanüstü optik geçirgenliğe sahiptir.

Bu çalışmada, bakır metalinin üretimi esnasında oluşan yüksek enerji tüketimi ve hava kirliliği gibi çevreyi olumsuz etkileyen faktörler, bakır iletkeninin miktarının düşürülmesi ile azaltılması ve kullanılacak grafen ve PANİ'nin sahip olduğu olumlu çevresel etkiler ile yeşil dönüşümü destekleyen ürün üretimi gerçekleştirilmesi amaçlanmaktadır. Bu yaklaşım sayesinde, üretim sürecinde gerçekleşen enerji tüketiminin azaltılması, buna paralel olarak sera gazı emisyonlarının düşürülmesi sağlanarak çevresel etkilerin azaltılması, yüksek performanslı yenilikçi malzemelerin kullanılması ile doğal kaynakların korunmasına katkıda bulunulurken sürdürülebilirlik ilkesine uygun üretim gerçekleştirilmesi ve düşük maliyetle yüksek iletkenlik elde edilmesi ile yeşil dönüşüm çalışma ve uygulamalarına katkı sağlanması öngörülmektedir.

Keyword: *Grefen, PANİ, PVC, Kablo*

ID: 407

PVC/PMMA/CNT Nanokompozitinde CNT Katkısının Spektroskopik Termal ve Elektriksel Özelliklere Etkisi

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Farklı oranlarda CNT katılmış PVC (Poli (vinil klorür))/PMMA (Poli(metil metakrilat)/CNT (karbon nanotüp) nanokompoziti, çözücüden dökme yöntemiyle hazırlanmıştır. PVC/PMMA'nın %50:50 karşımı THF (Tetrahidrofuran) ile çözülmüştür. Bu çözeltiye THF içinde disperse edilmiş % 0, 0.1, 0.5, 1 oranlarında CNT katılmıştır. Hazırlanan nankompozitlerde spektroskopik, termal ve elektrik özelliklerin incelenmesi amaçlanmıştır. SEM görüntülerinde CNTlerin polimer matrisle iyi etkileştikleri ve homojen bir dağılım sergiledikleri gözlenmiştir[1]. XRD analizinde genel olarak amorf bir yapı gözlenmiş buna karşılık saf PMMA'nın kristalliğinden daha yüksek bir kristallik hesaplanmıştır. Artan CNT miktarıyla kristallikte bir artış gözlenmektedir. Camsı geçiş sıcakları ile CNT miktarı arasında anlamlı bir ilişki gözlenmemiştir. CNT katkısı ile blendin ve nanokompozitin camsı geçiş sıcaklıklarının saf polimerlerin camsı geçiş sıcaklıklarına göre daha düşük olduğu görülmüştür[2]. TGA verilerinde CNT katkısının belirgin bir fark yaratmadığı görülmüştür. DTG verilerinde CNT katkısının düşük miktarlarda bozunma hızını saf blende göre yükselttiği, buna karşılık artan miktarlarda düşürdüğü gözlenmiştir. Elektriksel iletkenlik ölçümü ve eğrisi, CNT'nin katkılanmasıyla ideal perkolasyonun elde edilebildiğini ve yarı iletkenlik bandı sınırına ulaşıldığını göstermiştir.

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Keyword: *Poli (vinil klorür), poli (metil metakrilat), karbon nanotüp*

ID: 406

Numerical modelling and CFD simulation of a Polymer Electrolyte Membrane (PEM) Fuel Cell

Not presented

ID: 403

Su Ürünleri İşleme Atıklarından Biyobozunur Polimerik Jel Gübre Eldesi ve Özelliklerinin Araştırılması

Buğrahan Özdemir*, Zehra Betül AHİ, Beyza Çay, Ayşegül Uzuner Demir, Saeid Chobdar Rahim, Mihriban Aydoğan Gemici

Kazlı Çeşme Deri Ürünleri Ar-Ge San. Tic. Ltd. Şti.

Günümüzde artan nüfus ile gıdaya olan talepte her geçen gün artmaktadır. Özellikle su ürünleri endüstrisi alanında gelişmiş ülkelerin üretimlerinin artmasıyla atık olarak açığa çıkan balık derisi, pulu ve kılçığı gibi ürünler düşük katma değerleri olarak balık unu veya yemine dönüştürülmektedir. Sunulan çalışmada, doğal ve biyobozunur bir polimer olan kolajen, su ürünleri işleme atığı olarak ortaya çıkan balık derisi ve pulundan ekstrakte edilerek biyostümülant özellikte gübre üretiminde kullanılmış ve özellikleri değerlendirilmiştir. Özellikle süper absorbans özellik gösteren ve kütlesinin 1000 katına yakın oranlarda su tutma kapasitesine sahip olan kolajen hidrojeller hem biyostimülant gübre görevi görürken hem de aynı zamanda içerisine hapsettiği suyu zamanla toprağa vererek toprağında sürekli nemli olmasını sağlamaktadır. Bu kapsamda fiziksel ve kimyasal karakterizasyon testlerinin yanı sıra su tutma kapasitelerinin ölçülmesi çalışma için önem arz etmektedir. Çalışmada, uygun koşullarda enzimatik hidrolizasyon yöntemi ile ekstrakte edilen kolajen hidrolizat, hidrojel formuna dönüştürülmesi için başlatıcı olarak amonyum persülfat (APS), çapraz bağlayıcı olarak N,N metilen bisakrilamit (NMBA) ve monomer olarak akrilamit (AAm) kullanılarak reaksiyona sokulmuş ve hidrojel üretimi gerçekleştirilmiştir. Ardından hem hammadde kaynağı olan kolajen hidrolizatın hem de reaksiyon sonucu elde edilen kolajen hidrojellerin karakterizasyon çalışmaları için fiziksel ve kimyasal analizlerin yanı sıra su tutma kapasiteleri ölçülmüştür. Son olarak domates bitkisi üzerinde bitki büyümesi ve özellikleri üzerine olan etkileri incelenmiştir. Sonuçları kısaca özetlemek gerekirse atıklardan elde edilen kolajen hidrolizatların FTIR ve SDS-PAGE sonuçları kolajenin istenilen şekilde ve özelliklerde ekstrakte edildiği, herhangi bir denatürasyona uğramadığı tespit edilmiştir. Ardından kolajenin kimyasal modifikasyonu ile elde edilen hidrojellerin yapısal karakterizasyonu için de FTIR analizi gerçekleştirilmiştir. Ayrıca hem kolajen hidrolizatların hem de hidrojel formlarının gübre maddesi olarak kullanımı açısından etkili olduğunun gösterilmesi için toplam protein, toplam azot ve toplam organik madde testleri de yapılmış olup içerdikleri değerler açısından bitki besin maddesi olarak kullanıma elverişli olduğu tespit edilmiştir. Hidrojellerin mekanik karakterizasyonları için basma testi ve şişme kapasitelerinin belirlenmesi içinde su tutma testi uygulanmıştır. Sonuç olarak hem balık derisinden hem de puldan elde edilen kolajenler kullanılarak elde edilen hidrojel gübrelerin ortalama %85 ve üzeri toplam protein, %35 ve üzeri toplam organik karbon, %80 ve üzeri toplam organik madde ve toplam %15 ve üzerinde toplam azota sahip oldukları, kül miktarlarının ise %1 ve altında kaldığı tespit edilmiştir. Bu özellikleri ile bitki besini olarak kullanıma uygun olduğu anlaşılmıştır. Şişme testi sonucunda %1300 gibi su tutma kapasitelerinin olduğu belirlenmiştir.

Keyword: *Kolajen, Akrilamid, Hidrojel*

ID: 402

Bio-based New Benzoxazine Resins: Synthesis and Characterization

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Heterocyclic chemicals known as benzoxazine compounds are of immense importance in pharmacology, material science, and polymer chemistry. The 1,3 benzoxazines have been recognized as high-performance phenolic resins in polymer chemistry [1]. Benzoxazine resins represent the next generation of phenolic resins (resole and novolac) that possess improved attributes. The most commonly employed synthesis technique for 1,3 benzoxazines is Mannich condensation. In this method, a primary amin, phenolic compound, and paraformaldehyde engage in a three-component condensation reaction to produce one molecule of 1,3 benzoxazine [2].
Recently various substituents have been added to the structure leading to the synthesis of new benzoxazine derivatives [1]. Once thermally polymerized these 1,3 benzoxazine find uses across different industries due to their unique properties. Because of their excellent chemical resistance, low water absorption, flame retardancy, and heat resistance, benzoxazines resins are widely used in adhesives, corrosion-resistant coatings, and the automotive, electronics and aerospace sectors [3].
In this work, the structures of the new 1,3 benzoxazine derivatives synthesized from renewable starting materials have been used to determine the spectroscopic methods. Moreover, these monomers' thermal characteristics will be compared with known 1,3 benzoxazines.

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Keyword: *renewable polymers, benzoxazine*

ID: 383

Investigation of the Effects of Mica Modified with Silicone Resin on Water-Based Exterior Paints

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Silicones are surface treatment agents for the functionalization of extenders. This process helps in proper dispersion of inorganic materials in a polymer matrix and also helps in improving the properties of the polymeric matrix. Extenders; thanks to the hydroxyl groups on their surfaces, can react with the alkoxy groups in silicone resins and form covalent bonds.This surface modification not only improves dispersion and compatibility in the polymer matrix but also ensures a durable chemical link between two otherwise incompatible phases through the formation of chemical and physical interactions with the polymer matrix [1,2,3] . Mica, which has a plate structure, can create a barrier effect on polymeric structures and also contributes to the physical properties of the polymeric structure. In this study; Mica, whose surface was modified by using various amounts of silicone resin, were tested in water-based exterior paint formulations. Water absorption values, water vapor permeability and contamination tendencies of paint formulations were evaluated. Water contact angle measurements and UV-VIS spectrophotometric analysis were performed on the paints surface. While a decrease in surface energy values is observed in paint formulations using mica modified with silicone resin; An increase was observed in water vapor permeability values.

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Keyword: *Mica, Silicone Resin, Exterior Paint*

ID: 375

Functionalizable Polymer Brush Coated Iron Oxide Nanoparticles Using "Graft To" and "Graft From" Approaches

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Due to their small size, superparamagnetic properties, non-toxicity, and high biocompatibility, magnetic iron oxide nanoparticles (IONPs) are highly desirable in various fields as drug delivery agents, in hyperthermia treatments, as contrast agents in MR imaging, for magnetic labeling of cells.[1–3] Although, the application of pristine IONPs is limited, polymer coatings, besides small molecule coatings, can impart desired characteristics to IONPs and may reduce or eliminate unwanted features such as solubility issues, which can be resolved with hydrophilic coatings, thereby expanding their application areas. In this study, magnetic IONPs were coated with furan-containing poly(ethylene glycol)-based copolymers obtained via reversible addition-fragmentation chain transfer polymerization using "graft to" and "graft-from" approaches. Synthesis of polymer-coated nanoparticles, their characterization, subsequent functionalization, and applications will be presented.

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Keyword: *Magnetic nanoparticles, Polymer brush, Diels-Alder reaction*

ID: 371

Preparation and Characterization of Polyglycine Based Polymeric Micromotors

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Micro/nanomotors are artificial tools, which mimic natural motors have the ability to perform variety of tasks such as cargo and drug delivery, medical imaging and environmental remediation. The most important feature of micro/nanomotors is their motion ability. Micro/nanomotors are usually chemically powered or externally powered. While chemically powered motors use chemical and biological fuels, external power sources can be light, ultrasound, acoustic field, electrical field and magnetic field [1-3]. This study reports the synthesis and characterization of polyamino acid based catalytic (chemically powered) micromotors. Conically shaped polycarbonate (PC) membrane-assisted polyglycine catalytic micromotors were electrochemically synthesized. Subsequently, the velocity profiles of the micromotors were established. To understand the effect of fuel concentration and surfactant on velocity of the micromotors, their motion in different hydrogen peroxide concentrations and surfactant types were investigated. The synthesized micromotors were characterized using optical microscopy, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX) and electrochemical impedance spectroscopy (EIS).

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Keyword: *Functionalized micromotor, polymeric micromotor, polyglycine*

ID: 366

Kompozit Karbon Küreleri: 4-Nitrofenolün Katalitik İndirgenme Çalışmalarında Katalizör Olarak Kullanımı

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Bu çalışmada nano/mikro boyutta karbon küreleri hidrotermal (dehidratasyon) proses ile nişasta ve selülöz gibi doğal polimerlerden sentezlenmiştir. Nano/mikro ebatlı karbon kürelerinin karakterizasyonunda Termal Gravimetrik Analiz (TGA), Fourier Dönüşümlü Kızılötesi (FT-IR) Spektroskopisi, Taramalı Elektron Mikroskobu (SEM), Zeta Potansiyel (ZP) ölçümü gibi teknikler kullanılmıştır. Sentezlenen partiküllerin kullanım potansiyelini arttırmak ve yeni özellikler kazandırmak için bu partiküller metal nanopartikül hazırlanmasında kalıp olarak kullanılmış ve Cu ve Ag içeren yeni kompozit yapılar hazırlanmıştır. Hazırlanan kompozit katalizörler 4-NP'nin 4-AP'ye indirgenmesinde katalizör olarak kullanılmıştır. Kompozit sistemler (metal katalizörler) Geçirimli Elektron Mikroskobu (TEM) ile görüntülenmiş, metal miktarı tayini ise İndüktif Eşleşmiş Plazma Kütle Spektrometresi (ICP-MS) ile yapılmıştır. Model bir reaksiyon olan 4-NP'nin 4-AP'ye dönüşümü için aktivasyon parametreleri (30-50 °C) hesaplanmıştır. 4-NP indirgenmesi için selülöz karbon küresi-Cu katalizörüne ait aktivasyon parametreleri, Ea=33,23 kJ.mol^{-1}, $\Delta H^{\#}$=30,63 kJ.mol^{-1} ve $\Delta S^{\#}$=−165,64 J.mol^{-1}.K^{-1} olarak hesaplanmıştır. Nişasta karbon küresi-Ag katalizörüne ait aktivasyon parametreleri ise Ea=49,39 kJ.mol^{-1}, $\Delta H^{\#}$=46,79 kJ.mol^{-1} ve $\Delta S^{\#}$=−113,58 J.mol^{-1}.K^{-1} olarak hesaplanmıştır.

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Keyword: *Hidrotermal sentez, Kompozit karbon küreler, 4-NP indirgenmesi*

ID: 361

Polymeric Micelles Functionalized via Supramolecular Interactions

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Within the nanomedicine field, biodegradable polymeric assemblies provide various approaches to targeted therapy. Herein, we report the fabrication of micelles using diblock copolymers obtained from dendronized and hydrophilic monomers as building blocks. After the micelle formation, they were functionalized via cyclodextrin-adamantane based host-guest supramolecular interactions for imaging, targeting, or protein capture applications. The cyclodextrin-adamantane interaction has been utilized to obtain various functional materials such as nanoparticles for protein separation[1], nanogels[2], and biofunctionalizable interfaces.[3] Obtained micelles were characterized for their critical micelle concentration, stability, drug loading, and drug release profiles. Moreover, their ability to form a host-guest supramolecular interaction was also confirmed using UV-Vis spectroscopy. The unique design of this kind of modular micelle allows for the fabrication of a nanocarrier that can be tailored for various applications through supramolecular functionalization.

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Keyword: *Supramolecular interactions, Micelle, Cyclodextrin*

ID: 358

Polymer Brush Coated Magnetic Nanoparticles: Fabrication and Functionalization for Cellular Targeting

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In recent years, the utilization of nanomaterials composed of polymeric and inorganic components has increased significantly in biomedical applications. Various smart hybrid biomaterials have been developed for drug delivery, theranostics, bio-sensing, and bio-imaging by combining inorganic and polymeric materials. Polymer-coated magnetic nanoparticles are widely utilized in many biomedical applications that benefit from the intrinsic magnetic properties of the nanoparticles.[1–3] There are many examples of polymer-coated magnetic nanoparticles in the literature for such applications, but most lack responsiveness to endogenous stimuli. In this study, we report the fabrication of iron oxide nanoparticles coated with a stimuli-responsive polymer brush. A cleavable linkage containing a chain transfer agent was installed on the nanoparticle surface so that polymeric brushes could be cleaved from the surface of nanoparticles under mild conditions. Polymer brushes containing fluorescent dye were synthesized from nanoparticle surfaces to understand the cleavage kinetics. The fluorescent dye also acts as a model hydrophobic drug, which gains solubility upon grafting within the hydrophilic coating on the nanoparticle surface, indicating that the system is suitable for use as a drug carrier. Finally, targeting groups were conjugated onto the nanoparticles to expand the applicability of such a system. Results disclosing the synthesis, characterization, and functionalization of polymer brush-coated nanoparticles will be reported.
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Keyword: *stimuli-responsive, polymer coating, magnetic nanoparticle*

ID: 357

Photothermally Triggered Protein Release from rGO-Embedded Hydrogels

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Stimuli-responsive hydrogel platforms developed in the past decade incorporate attractive features such as the ability for on-demand release of therapeutic agents with spatiotemporal control. The highly porous network of crosslinked hydrogels makes them attractive candidates for controlled delivery/release of biomacromolecules. The tunability of the properties of hydrogels using exogenous or endogenous stimuli enhances their applications. Herein, a new approach for fabricating stimuli-responsive hydrogels for protein release is disclosed. In particular, free radical polymerization is utilized to obtain furan-containing copolymers. Using a bismaleimide precursor, the Diels-Alder reaction is used to install thermoreversible maleimide groups, which are used for subsequent crosslinking using a thiol-ene reaction. Utilization of reduced graphene oxide (rGO) during fabrication imparts these hydrogels with photothermal properties. Synthesis of hydrogels, their characterization, and stimuli-responsive protein release studies will be presented.
This project was supported by The Scientific and Technological Research Council of Türkiye (TUBITAK) (Project number: 118Z790).

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Keyword: *Hydrogel, Reduced Graphene Oxide, NIR-light responsiveness*

ID: 353

Development of Aerogel/Epoxy Composite Materials for Thermal Protection Systems

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Spacecrafts are exposed to aerodynamic heating due to the change of kinetic energy into thermal energy as a result of compression and friction. Thermal protection system materials play a fundamental role for the entire aerospace industry. Depending on the hyperthermal environment in which these materials must work, many types of formulations have been developed. Polymer-based composites are widely used in these thermal protection systems because of their ablative properties. Ablative systems protect the vehicle through thermo-chemical phenomena. In ablative systems, thermal energy is expended by sacrifice of material and thereby absorbing a considerable amount of thermal energy. In industry, aerospace vehicle structures are usually required to have low weight, high mechanical performance, and thermal protection and heat insulation characteristics. In literature, there are several studies on design of ablative materials that possess low thermal conductivity, low density, high strength and higher heat shock resistance [1]. Aerogel-based thermal protection materials have been used in layered structures in the industry.

Within the scope of this study, aerogel/epoxy composite materials were prepared with varying concentrations of aerogels. Morphologies of the materials were studied using BET and SEM analyses. Thermal properties of the composite materials were characterized with thermogravimetric analysis and thermal conductivity measurements. As the amount of aerogel increased, the thermal conductivity of composite material decreased from 0.206 W/mK to 0.096 W/mK. The densities of the composites were found to decrease from 0.864 g/cm^3 to 0.667 g/cm^3. Additionally, aerogel-based materials were tested in an oxy-acetylene test infrastructure. During the tests, temperature measurements were taken from the back surfaces of the materials. It was observed that the back-surface temperature of the composites significantly decreased with aerogel loading. As a result of this study, it was observed that aerogel/epoxy composite materials have a better performance compared to neat epoxy to be used for thermal protection materials in high temperature applications.

Keyword: *aerogel/epoxy composite*

ID: 350

PVC Kompountlarda DOTP Plastifiyanın Farklı Oranlarda Kullanımının Mekanik, Termal ve Morfolojik İncelemeleri

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Polimerlerin esnekliğini ve işlenebilirliğini geliştirmek için kullanılan plastikleştiriciler poli (vinil klorür) (PVC) kablo sektörü için önemli katkı maddeleri arasında yer almaktadır. PVC kompound üretiminde maliyet açısından genellikle ftalat esaslı plastikleştiriciler tercih edilmektedir. Literatürde, PVC kompoundlar için çok fazla plastikleştirici çalışılmasına rağmen kablo uygulamaları için yapılan çalışmalarda plastikleştirici katkı maddelerinin kullanımının sınırlı olduğu görülmüştür. PVC kompound üretimindeki en önemli bileşenlerden birisi de **plastikleştiricilerdir.** Bir malzemenin plastisitesini (istenilen şekli alabilme özelliği) değiştiren ya da viskozitesini değiştiren katkı maddelerine plastikleştirici (**plastifiyan)** denir. Plastikleştirilmiş PVC daha iyi çekme mukavemetine ve yanıcılığa sahiptir. Ancak, PVC ile karşılaştırıldığında fren noktasında daha düşük uzamaya sahiptir (Imiela vd., 2019). Ayrıca plastikleştirilerin PVC/fiber bazlı polimer kompozitlerde iyi elektrik direnci gösterdiği tespit edilmiştir (Aravindh ve Gopalan, 2023). Hafifliği, basit üretim süreci, mükemmel yalıtımı, maliyet etkinliği, yüksek mukavemet ve sertlik özelliklerine sahip olan plastik, elektrik endüstrisinde yaygın olarak kullanılmaktadır (Chauhan vd., 2019; Gilbert, 2017).

Bu çalışmada, Polivinil klorür (PVC) granül kompountlarda DOTP gibi plastikleştirici miktar değişiminin PVC polimerin fizikokimyasal özelliklerine etkisi mekanik, termal ve morfolojik açılardan ele alınmıştır. PVC granül üretimi için pilot denemeler yapılmıştır. Miksere 100 kg PVC (K-70), 50 kg kalsit, 3 kg stabilizatör ve 0,3 kg stearik asit konulduktan sonra 145-150 ^{o}C granül ekstruder sıcaklığında 10 farklı numune için plastikleştirici (DOTP) farklı oranlarda 35, 40, 45, 50, 55 ve 60 kg) ile ayrıca epoksi soya (ESO, 5 kg), ile parafin (5 kg) bazı denemelerde ikincil plastikleştirici olarak DOTP ile sinerji etkisinin incelenmesi açısından eklenmiştir. Elde edilen en yüksek çekme mukavemeti tekrarlanabilirlik ve ortalama 5 denemede 18,30 N/mm2, kopmada uzama miktarı en fazla olan %240,77 ile 1. numuneden (100 kg PVC, 50 kg kalsit, 3 kg stabilizatör, 0,3 kg stearik asit ve 45 kg DOTP plastikleştirici kullanımı ile elde edilmiştir. Ayrıca her bir örneğim yoğunluk, yüzey morfolojisi analizi için SEM ve termal dayanım için TGA-DTA analizleri de gerçekleştirilmiştir. Sonuç olarak plastifiyanın kullanım yeri ve maliyet / performans plastifiyanı ticari olarak öne çıkarmaktadır.

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Keyword: *plastifiyan, PVC, POLİMER*

ID: 340

Investigation of Corona Decay After Metalization of Biaxially Oriented Polypropylene (BOPP) Films

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Adhesion is a tendency of dissimilar surfaces or materials to cling the each other. Therefore, surface modification is necessary to develop a strength between different materials, structures such as polymer to poylmer, polymer to metal, polymer to inks, etc. Accordingly, Corona treatment is the common technique to modify the suface of the material such as polymers. However, after Corona treatment, treatment values are found to decrease with time from the moment is complete. This has been found in all of the treatment methods employed to date. There are several effects to decrease the Corona values. Some of these effects are Corona treatment level, migration the additives to the surface, oxidation, storage conditions i.e. temperature, humidity and etc. All these are the facts that of cause the decrease surface energy of the material.
In this study, we observed that the corana values reduces gradually after metal coating onto the BOPP film and root cause has been studied in detail. Therefore, several trials with different possible parameters have been investigated. It is determined that the selection of the skin layer raw materials is as critical as the storage conditions of the metal coated BOPP films.

Keyword: *BOPP Films, Metallized films, Corona decay*

ID: 338

Kablo Sektörüne Yönelik Silan Çapraz Bağlanabilir Polietilen (XLPE) Geliştirilmesi

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Son 30 yılda, silan çapraz bağlama (XLPE) teknolojisi, kablo ve boru üretiminde polietileni çapraz bağlamanın en ekonomik yöntemi olarak kendini kanıtlamıştır. Peroksit veya radyasyon ile kürleme gibi diğer çapraz bağlama teknolojileri ile karşılaştırıldığında, organofonksiyonel silanlar aracılığıyla çapraz bağlama önemli avantajlar sunmaktadır. Bu yöntemle polimer ilk aşamada kimyasal olarak modifiye edilir; genellikle bu işlem, polimer zincirine az miktarda peroksit ile vinilsilan aşılanarak gerçekleştirilir. Aşılamadan sonra polimerler hala termoplastik özelliklerini korur ve farklı şekillerde kullanılabilir. Çapraz bağlama işlemi ekstrüder dışında gerçekleşir ve su banyosu, buhar odası veya ortam koşullarında su ile başlatılır [1]. Bu yöntem, XLPE boruları, alçak gerilim kabloları ve belirli orta gerilim kablolarının üretiminde yaygın olarak kullanılır. Yöntem aynı zamanda, mevcut ekipmanlarda büyük değişiklikler yapmadan veya yeni makinelere yatırım yapmadan üretim yapma olanağı sağlamaktadır.
Projemizde en yaygın silan çapraz bağlama yöntemi olan Sioplas® methodu kullanılmaktadır. Bu methodla yapılan çalışmalarda, erimiş polietilene silan ve peroksit karışımı eklenir ve klasik bir serbest radikal zincir reaksiyonu olan silan aşılama reaksiyonu gerçekleştirilir. Bu işlem, ekstrüderin sürekli etkili bir reaktör olarak kullanıldığı reaktif ekstrüzyon ile erimiş polietilen içinde gerçekleştirilir. Ekstrüderde 140-240ºC sıcaklık aralığında aşılama reaksiyonu çok hızlı gerçekleşir ve bu, endüstriyel işlemler için en uygun üretim yöntemi olarak kabul edilmektedir. Malzemenin üretiminde genellikle, eş yönlü çift vidalı ekstrüderler kullanılmaktadır. Aşılanmış polimer granül hale getirilir ve kuru bir yerde, sızdırmaz vakumlu torbalarda saklanır. Nihai ürün üretimi sırasında, katalizör masterbatch ile karıştırılarak eritilir ve ürün ekstrüde edilir. Çapraz bağlar, ürünün 70-90ºC sıcaklıklarda suya veya buhara maruz bırakılmasıyla oluşturulur. Bu yöntemin avantajları arasında yüksek çıktı oranları, düşük hurda maliyeti ve geleneksel ekstrüzyon ekipmanlarının kullanımı yer almaktadır. İşleme parametreleri arasında besleme miktarı, sıcaklık profili, vida konfigürasyonu ve kovanda kalma süresi bulunmaktadır.

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Keyword: *Silan Aşılama, Silanla Çapraz Bağlanabilir Polietilen, XLPE*

Lateks Katkılı PHEMA Hidrojellerinin Hazırlanması ve Hazırlanan Hidrojellerin İlaç Salım Sisteminde Kullanılması

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Hidrojeller, yüksek miktarda su veya biyolojik sıvıyı absorplama yeteneğine sahip, fiziksel veya kimyasal bağlarla çapraz bağlanmış yapılardır. Yapılarındaki çapraz bağlar nedeniyle suda çözünmezler; ancak hidrofilik grupların etkisiyle şişme eğiliminde bulunmaktadırlar. Yapılarında büyük miktarda su barındırdıkları için yumuşak ve esnek bir yapıya sahip olan hidrojeller şişme öncesinde ve sonrasında orijinal şekillerini koruyabilmektedir [1, 2]. Son zamanlarda endüstriyel alanların hızlı bir şekilde geliştirilmesi kauçuk malzemelerin önemini giderek arttırmıştır. Günlük hayatta kullanımı oldukça yaygın olan doğal kauçuk, işleme kolaylığı ve mekanik özellikleri nedeniyle son yıllarda endüstri için sıklıkla tercih edilen önemli bir hammaddedir [3]. Lateks ise beyaz sütsü bir kıvamda olan doğal kauçuktur ve farklı işlemlerden geçirilerek kullanılmaya hazır hale getirilebilir [4].

Bu çalışmada, lateks ve hidrojel yapıları birlikte kullanılarak hibrit hidrojel sentezlenmiştir. İlk olarak poli(2-hidroksietil metakrilat) (PHEMA) hidrojel sentezi gerçekleştirilmiştir daha sonra emülsiyon polimerizasyon yöntemiyle poli(stiren-glisidil metakrilat) (PSGMA) lateksi sentezlenmiştir. Son olarak elde edilen PSGMA lateks, hidrojelin sentez aşamasında ortama ilave edilerek hibrit hidrojel sentezi gerçekleştirilmiştir. Farklı çözelti pH değerlerinde (3, 7 ve 10) hidrojellerin şişme çalışmaları yapılmış ve PSGMA lateksinin etkinliği ortaya konulmuştur. Hazırlanan hidrojellerin ilaç yükleme ve kontrollü salım çalışmaları yapılarak PSGMA lateks katkılı hibrit hidrojelin etkinliği incelenmiştir. PSGMA lateksin partikül boyutu ve boyut dağılımı dinamik ışık saçılım cihazı ve taramalı elektron mikroskobu (SEM) ile belirlenmiştir. Ayrıca SEM ile hidrojel yapıları görüntülenmiştir. Elde edilen yapılar IR spektroskopisi ve TGA ile aydınlatılmaya çalışılmıştır. Kontrollü salım çalışmaları UV-vis spektrofotometre ile gerçekleştirilmiştir.

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Keyword: *PHEMA hidrojel, Lateks, İlaç salım sistemi*

Investigation the Influence of Using a Defoamer on HTPB-Based Propellant Properties

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Hydroxyl-terminated polybutadiene (HTPB) based propellants typically consist of HTPB polymer as the binder, combined with powdered metals, oxidizers, plasticizers, curing agents and other additives. These type of propellants are widely used in various rocketry applications, including military missiles and satellite launch vehicles due to their stable performance.[1] In order to improve the performance of the HTPB-based propellant, research continues via optimizing the propellant formulations.[2] During the manufacturing processes such as mixing, casting or curing, foam or formation of bubbles can be observed. These bubbles can cause uneven propellant density that affects the performance and safety of the rocket motor. Defoamers can be new additives in propellant formulation to reduce or prevent the formation of bubbles. In this study, the aim is to investigate the effect of defoamer additives on the rheological, mechanical and ballistic properties of the HTPB/AP/Al based solid propellant.

Defoamers typically contain surfactants or silicon-based compounds that disrupt foam formation by lowering surface tension or breaking up existing bubbles.[3] Basic propellant (SP1), propellants containing silicone (SP2) and non-silicon deformers (SP3) were prepared in this study to verify the applicability of the defoamers used in the propellants. The rheology results indicated that the addition of silicone containing defoamer increased doubly the viscosity of the SP2 propellant at 0,01 1/s shear rate while the nonsilicone containing propellant SP3 exhibited the similar viscosity with the basic propellant SP1. The rupture stress of SP2 decreased by 26% with an increase of 8% rupture strain at room temperature. However, any drastic difference on the mechanical properties observed for SP3 compared to SP1. The ballistic properties of the propellants were also studied using ultrasonic measurement test. The results showed that the ultrasonic burning rate of the SP2 were increased by 23% and SP3 were decreased by 8%. A drastic increment of burning rate were obtained for SP2 due to the addition of polysiloxane containing defoamer. Therefore; the viscosity, mechanical and ballistic properties of the propellant revealed that the non-silicone defoamer can be more applicable than the silicone defoamer. The research continues for the proper percent usage of the defoamer in the HTPB/AP/Al based propellant.

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Keyword: *Propellant, Defoamer, Propellant Rheology*

ID: 310

Yeni Nesil Şişirme Ajanlarının Poliüretan Sandviç Panel Üzerindeki Etkilerinin İncelenmesi

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Çevre kirliliğinin artması ile çevre dostu malzemelere olan talebi de arttırmıştır. Poliüretan köpükte yardımcı kimyasal olarak kullanılan şişirme ajanları köpüklerin hücre oluşumuna katkı sağlamaktadır. Gaz ve sıvı şişirici maddeler söz konusu olduğunda şişirme maddelerinin çözünürlüğü önemli bir parametredir. Köpürme işleminde yer alan dört adım vardır. Gaz halindeki üfleme maddeleri tarafından köpürtme işleminin aşamaları özetlenecek olursa gaz ve poliol çözeltisi, çekirdeklenme, hücrelerin büyümesi ve hücre stabilizasyonudur.

Pentanın köpüklerde sağladığı düşük ısıl iletkenlik değerleri ve farklı şişirme oranları sağlamasının yanı sıra yanıcılığın çok yüksek olmasıyla depolama alanı zorluğunun olması gibi olumsuz tarafları da bulunmaktadır. Yanıcılığının çok yüksek olmasından dolayı tehlikeli sınıfa giren pentan %1,4'ün üstünde hava ile karışımı oldukça patlayıcıdır. Isı, kıvılcım ve alevden uzak tutulmalıdır. Pentanın bu dezavantajlarından dolayı alternatif bir şişirme ajanı arayışı vardır.

Yeni nesil bir şişirme ajanı olan gliserol-1,2-karbonat bazlı yeni nesil şişirme ajanı içeriğinde ODP ve GWP bulundurmamaktadır. Gliserol-1,2-karbonat bazlı yeni nesil şişirme ajanı çapraz bağlanma miktarını arttırarak güçlü bir ısı açığa çıkarmaktadır. Isı açığa çıkmasıyla yapıdaki su miktarı artmakta ve çapraz bağlanma kontrolü sağlanmaktadır. 400 hidroksil miktarına sahip olduğu için MDI miktarını ve indeksini arttırmaktadır.

Gliserol-1,2-karbonat bazlı yeni nesil şişirme ajanı toksik değildir. Zayıf yanıcılığa sahip olan bir ürün olduğu için kullanım kolaylığı sağlamaktadır. Gliserol-1,2-karbonat bazlı yeni nesil şişirme ajanı HCFC-141b gibi mükemmel termal iletkenlik ve küçük hücreler sağlamaktadır. Bu proje ile gliserol-1,2-karbonat bazlı yeni nesil şişirme ajanının poliüretan sandviç panel üzerindeki etkileri incelenecektir.

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Improvement of thermal insulation for polyurethane foam by the conversion of carbon dioxide to an organic carbonate compound T Hashiday, T Uenoy, H Nakamotoz and M Suzukiy y Matsushita Electric Industrial Co., Ltd, Human Environmental Systems Development Center, 3-1-1 Yagumo-nakamachi, Moriguchi, Osaka 570-8501, Japan z Matsushita Refrigeration Company, Refrigeration Research Laboratory, 4-2-5 Takaida-hondori, Higashi-osaka, Osaka 570-8501, Japan
EFFECTS OF CALCIUM CARBONATE OF DIFFERENT COMPOSITIONS AND PARTICLE SIZE DISTRIBUTIONS ON THE MECHANICAL PROPERTIES OF FLEXIBLE POLYURETHANE FOAM Ganiyu K. Latinwo*1, David S. Aribike2, Layioye O. Oyekunle2, Akpoveta A. Susu3 „ Semiu A. Kareem4 1. Department of Chemical Engineering, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Nigeria. 2. Department of Chemical Engineering, University of Lagos, Nigeria. 3. Department of Chemical and Polymer Engineering, Lagos State Universit

Keyword: *Poliüretan Köpük, Poliüretan Köpük Sandviç Panel, Poliüretan Köpük Şişirme Ajanı*

ID: 309

Eco-Friendly Phytic Acid Based Organic-Inorganic Hybrid Coatings with Flame Retardant Features

Not Presented

ID: 308

Polikaprolakton Esaslı Sorbentlerin Organik Kökenli Kirliliklerin Gideriminde Kullanımı

Not Presented

ID: 307

Su Ürünleri İşleme Atıklarından Biyobozunur Polimerik Jel Gübre Eldesi ve Özelliklerinin Araştırılması

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[2] Halavet Gıda San. A.Ş.

Günümüzde artan nüfus ile gıdaya olan talepte her geçen gün artmaktadır. Özellikle su ürünleri endüstrisi alanında gelişmiş ülkelerin üretimlerinin artmasıyla atık olarak açığa çıkan balık derisi, pulu ve kılçığı gibi ürünler düşük katma değerleri olarak balık unu veya yemine dönüştürülmektedir. Sunulan çalışmada, doğal ve biyobozunur bir polimer olan kolajen, su ürünleri işleme atığı olarak ortaya çıkan balık derisi ve pulundan ekstrakte edilerek biyostümülant özellikte gübre üretiminde kullanılmış ve özellikleri değerlendirilmiştir. Özellikle süper absorbans özellik gösteren ve kütlesinin 1000 katına yakın oranlarda su tutma kapasitesine sahip olan kolajen hidrojeller hem biyostimülant gübre görevi görürken hem de aynı zamanda içerisine hapsettiği suyu zamanla toprağa vererek toprağında sürekli nemli olmasını sağlamaktadır. Bu kapsamda fiziksel ve kimyasal karakterizasyon testlerinin yanı sıra su tutma kapasitelerinin ölçülmesi çalışma için önem arz etmektedir. Çalışmada, uygun koşullarda enzimatik hidrolizasyon yöntemi ile ekstrakte edilen kolajen hidrolizat hidrojel formuna dönüştürülmesi için başlatıcı olarak amonyum persülfat (APS), çapraz bağlayıcı olarak N,N metilen bisakrilamit (NMBA) ve monomer olarak akrilamit (AAm) kullanılarak reaksiyona sokulmuş ve hidrojel üretimi gerçekleştirilmiştir. Ardından hem hammadde kaynağı olan kolajen hidrolizatın hem de reaksiyon sonucu elde edilen kolajen hidrojellerin karakterizasyon çalışmaları için fiziksel ve kimyasal analizlerin yanı sıra su tutma kapasiteleri ölçülmüştür. Son olarak domates bitkisi üzerinde bitki büyümesi ve özellikleri üzerine olan etkileri incelenmiştir. Sonuçları kısaca özetlemek gerekirse atıklardan elde edilen kolajen hidrolizatların FTIR ve SDS-PAGE sonuçları kolajenin istenilen şekilde ve özelliklerde ekstrakte edildiği, herhangi bir denatürasyona uğramadığı tespit edilmiştir. Ardından kolajenin kimyasal modifikasyonu ile elde edilen hidrojellerin yapısal karakterizasyonu için de FTIR analizi gerçekleştirilmiştir. Ayrıca hem kolajen hidrolizatların hem de hidrojel formlarının gübre maddesi olarak kullanımı açısından etkili olduğunun gösterilmesi için toplam protein, toplam azot ve toplam organik madde testleri de yapılmış olup içerdikleri değerler açısından bitki besin maddesi olarak kullanıma elverişli olduğu tespit edilmiştir. Hidrojellerin mekanik karakterizasyonları için basma testi ve şişme kapasitelerinin belirlenmesi içinde su tutma testi uygulanmıştır. Sonuç olarak hem balık derisinden hem de puldan elde edilen kolajenler kullanılarak elde edilen hidrojel gübrelerin ortalama %85 ve üzeri toplam protein, %35 ve üzeri toplam organik karbon, %80 ve üzeri toplam organik madde ve toplam %15 ve üzerinde toplam azota sahip oldukları, kül miktarlarının ise %1 ve altında kaldığı tespit edilmiştir. Bu özellikleri ile bitki besini olarak kullanıma uygun olduğu anlaşılmıştır. Şişme testi sonucunda %1300 gibi su tutma kapasitelerinin olduğu belirlenmiştir.

Keyword: *Kolajen, Akrilamit, Hidrojel*

ID: 303

Coumarin-Based Fluorescent Magnetic-Silica Nanoparticles as Novel Adsorbents for Heavy Metal Removal from Water

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In today's modern world, pollution created by heavy metals is a serious environmental problem due to the demands for heavy metal resources being included in the manufacturing of chemicals, paints, and coatings, as well as from mining, extraction metallurgy, and other industries. In the last few decades, scientists have been concerned about the removal of these ions for environmental health issues and therefore focused on the issues of various treatment processes. Adsorption is most promising in terms of its feasibility, high removal efficiency, regeneration ability, and low cost [1].

Nowadays, nanomaterials play an important role in metal ion separation studies owing to their special physical and chemical properties. Mesoporous silica prepared using sol–gel chemistry is of particular interest to researchers in this field and is being studied as a versatile platform for adsorption processes due to its tunable pore size, good stability, and large specific surface area [2]. On the other hand, magnetic nanoparticles (MNPs), especially iron oxide nanoparticles, have attracted attention because of their unique physical properties: easy production, low toxicity, increased specific surface area, and easy extraction. While an inorganic or organic structure is usually placed on the core of MNPs as a surface modifier, a silica layer such as 3-aminopropyltriethoxysilane (APTES) is a good hydrophilic inorganic modification forming a core-shell structure. Significantly, APTES is a well-functionalized structure to immobilize some useful materials, such as Schiff bases, on a magnetic surface [3]. Nanoparticles based on Schiff's bases–metal complexes, which are important materials in organic and organometallic chemistry, contribute to the development of novel and eco-friendly catalytic systems offering new synthesis routes [4].

Although there have been several attempts to report Schiff base nanoparticles for the detection and adsorption of metal ions, to the best of our knowledge, there are only a few cases of a fluorescence receptor immobilized on magnetic silica nanoparticles. In this study, inspired by the coumarin compound, which is an important fluorescence dye, we report on the preparation of new Schiff-base magnetic-silica nanoparticles based on coumarin fluorophore considering its excellent biocompatibility, environmentally friendly, and conjugated planar character as well as unique photochemical properties.

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Keyword: *Schiff-base, coumarin, magnetic-silica nanoparticle*

Highly Selective Recovery of Heavy Metals from Electroless Nickel Plating Wastewater Using Magnetic Perlite-Based Adsorbent

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To enhance the properties of material surfaces subjected to high mechanical forces and corrosive environments, and to protect them against abrasion, corrosion, thermal effects, and similar external factors, the electroless nickel plating (EN plating) technique has been extensively applied in the automotive, aerospace, plastic, machinery, packaging, and electronic computer industries. Electroless nickel plating is a widely adopted commercial method for depositing nickel coatings on suitably treated surfaces via the controlled chemical reduction of nickel ions. Particularly in the rapidly growing electronics industry, this technique is utilized to metallize the surfaces of plastic or glass components to enhance functionality or achieve decorative effects, as seen in cell phone casings. The physical properties of the resulting coated surfaces, such as coating uniformity, corrosion resistance, wear resistance, lubricity, and ductility, are comparable to those of electroplated nickel surfaces and offer greater economic efficiency for industrial applications. However, the EN plating process generates substantial quantities of spent wastewater containing high concentrations of nickel ions and phosphites. Like other potentially toxic metals, nickel cannot be decomposed, and its toxicity increases over time due to accumulation in living organisms and subsequent biomagnification within the food chain, potentially leading to cancer.

Therefore, this research aimed to design a new bio-adsorbent to enhance the simultaneous removal and recovery of nickel and phosphorus from the electroless nickel plating wastewater. On this basis, alginate-based magnetic perlite containing environmentally friendly adsorbents with high porosity and biocompatibility have been developed. To explore the adsorption performance of this novel bio-adsorbent, the effects of several parameters, including initial ions concentration, temperature, contact time and pH, have been investigated with batch experiments. The possible adsorption mechanism was further elucidated by different kinetic and isotherm studies.

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Keyword: *electroless nickel plating wastewater, adsorption, magnetic perlite*

ID: 296

Fonksiyonel Polidimetilsiloksanların Sentezi ve Poliüretan Köpük Oluşumundaki Etkilerinin İncelenmesi

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Poliüretan köpükler bugün birçok sektörde farklı uygulamalar ile karşımıza çıkmaktadır. Beyaz eşya sektöründe buzdolabı örneğinde olduğu gibi termal izolasyon ile mekanik dayanım gerektiren köpüklere ihtiyaç duyulurken yatak sektöründe de visko-elastik veya konfor esaslı süngerlere ihtiyaç duyulmaktadır. Otomotiv koltukları ve bulaşık süngerleri de benzer uygulamalardır. Poliüretan köpük eldesinde poliol karışımı ve poliizosiyanat reaksiyona girerken oluşan hücrelerin birbirine benzemesi, tek tip olması, son derece önemlidir. Köpük oluşurken ortamın yüzey gerilimini düşüren ve hücreleri stabilize eden silikon esaslı polimerik sürfaktanlar da bu anlamda eşsiz malzemelerdir.

Bu çalışmada, poliüretan köpük üretiminde stabilizatör olarak kullanılmak üzere comb-like polietilen oksit, polipropilen oksit ve trigliserid modifiye polisiloksanlar sentezlenmiştir. PDMS modifiye trigliserid yapıları ilk defa poliüretan köpük uygulamaları için kullanılmıştır. Bu yönde çalışmalarımız devam etmekle birlikte köpük stabilizasyonunda ümit verici sonuçlar elde edilmiştir.

Keyword: *Trigliserid Modifiye Polisiloksan, Modifiye Polisiloksanlar, Poliüretan Köpük Stabilizatör*

ID: 294

Characterization of Multilayer Anti-Reflective Coatings Created Using TiO_2, SiO_2, and CNT in PVAc

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Anti-reflective coatings play a crucial role in various industries including optics, flexible displays, bioengineering, energy generation, solar panels, camera lenses, and pharmaceutical and food packaging [1]. Commonly used materials such as TiO_2 and SiO_2 are preferred for their broad wavelength range transparency and varying refractive indices [2]. While single-layer anti-reflective coatings are effective within specific spectral ranges, multi-layer structures are necessary for broadband anti-reflective coatings due to interference effects. In this study, TiO_2 (Ti), nano-sized SiO_2 (Si), and carbon nanotubes (CNT) were individually dispersed in a polyvinyl acetate binder (PVAc) and applied as coating materials. The coatings of TiO_2, nano-sized SiO_2, and carbon nanotubes were characterized in single, double, and triple layers. Changes in surface free energy of the coatings were evaluated through UV-A and UV-B aging. Chemical transformations induced by UV aging on the coating surfaces were analyzed using FTIR spectroscopy. Furthermore, reflectance, absorbance, and transmittance analyses were conducted over a range of 180-2000 nm. Gloss measurements in the visible spectrum at 20, 60, and 85 degrees were performed using a glossmeter. The PVAc-CNT, PVAc-Ti, and PVAc-Si multilayer coatings exhibited the lowest gloss values.

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Keyword: *Anti-Reflective Coating, CNT, PVAc*

ID: 284

The Effect of Functional Urethane Acrylates on the Adhesive Performance of Acrylic Latexes

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This study examines the effect of functional urethane acrylate oligomers on the adhesive performance of hybrid acrylic polymers. Specifically, urethane acrylate oligomers with functionalities of 2, 3, and 3.5 were tested at varying concentrations of 0.5%, 1.5%, and 3.25% s/m. The polymers were synthesized through emulsion polymerization and subsequently evaluated for their peel strength and crosslinking density. The results demonstrate that the type, functionality, and concentration of urethane acrylate oligomers significantly influence these properties. These findings highlight the potential of using urethane acrylate oligomers to enhance the performance of hybrid acrylic polymers in adhesive applications, providing valuable insights for future material development and optimization.

Keyword: *emulsion polymerization, Urethane Acrylates, Adhesive*

ID: 281

Simultaneous Detection of Multi-Analytes Based on Copper Nanostructures-Poly(L-Lysine)-Reduced Graphene Oxide Modified Electrochemical Sensor

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Ascorbic acid (AA), dopamine (DA), and uric acid (UA) play essential roles in physiological processes and human metabolism biological systems (1-2). Excessive concentrations of these molecules have been associated with the development of various disorders and diseases. Thus, the simultaneous and sensitive determination of AA, DA, and UA is of great significance for their physiological signal processing and diagnostic applications (3). Electrochemical sensors are capable of detecting multiple biological components in real time, making the development of new sensors for multi-analyte determination a crucial area of research for the early diagnosis of numerous diseases.

In this study, a sensitive sensing platform was developed using a glassy carbon electrode (GCE) to determine AA, DA, and UA simultaneously. The Cu nanostructures, the poly-L-lysine (p(L-Lys)), and the electrochemically reduced graphene oxide (ERGO) were employed to modify the electrode surface. The Cu was electrodeposited on a GCE, and the ERGO-p(L-Lys) hybrid structure was electropolymerized. The simultaneous determination of AA, DA, and UA was performed with a GCE/Cu@ERGO-p(L-Lys) electrochemical sensor. The developed GCE/Cu@ERGO-p(L-Lys) sensor was characterized by scanning electron microscopy (SEM), electrochemical impedance spectroscopy (EIS), and cyclic voltammetry (CV) techniques. The potential effects of interfering compounds, the reproducibility and repeatability of the developed sensor, and its applicability to real samples were evaluated during this study.

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Keyword: *simultaneous detection, electrochemical sensor, poly(L-Lysine)*

ID: 280

Antibacterial Properties of Bacteriophage Containing Multilayer Films

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Layer-by-layer self assembly is a thin film fabrication method which is based on sequential deposition of interacting polymers onto solid substrates. The driving forces for film growth are electrostatic, hydrogen bonding, host-guest interactions, and metal-ligand coordination bonds. This method is utilized to prepare surfaces with anticorrosive, antibacterial, and flame retardant properties, and to construct polymer nano-platforms for drug delivery, wound dressing, food packaging, and tissue engineering applications. In this study, we investigated the influence of self-assembly and post-assembly conditions on the physicochemical and antibacterial properties of LbL films containing bacteriophages. Furthermore, we explored the potential of such multilayer films for surface functionalization of food packaging materials.

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Keyword: *Layer-by-Layer Self Assembly,, Stimuli-responsive, Bacteriophages*

ID: 268

Kurşun Çekirdekli Kauçuk Deprem İzolatörü LRB

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Yapıların planındaki düzgün olmayan kütle dağılımı, deprem hareketi sırasında yapıda burulma momentlerine neden olur. Bu burulma, yapının düşey taşıyıcı elemanlarında ilave kesme kuvvetleri oluşmasına sebep olur.Bu tür yapıların depremsel davranışı, yapısal kontrol mekanizması kullanılarak iyileştirilebilir bir durumdur ve yapılardaki depremsel hasar oluşma riski en aza indirililir. Özellikle, betonarme ve çelik yapıların depremin zarar verici ve yıkıcı etkilerini önlemek amacıyla geliştirilen ve binaların ve köprülerin kolonları ve kirişleri altına yerleştirilerek taban yalıtımı yapımında kullanılan "Elastomer Esaslı Deprem İzolatörlerinin" kuvvet ve gerilme analizlerinin yapılarak geliştirilmesi çalışılmıştır.[1]
LRB birimleri, düşük sönüm kapasitesine sahip elastomer katmanların ortasına ekstra rijitlik, uniform şekil değiştirme ve sönüm özelliği kazandırmak adına bir veya birden fazla kurşun çekirdek saplanan mesnet tipidir. Kurşun çekirdeğin boyutları özellikle başlangıç rijitliğine ve yalıtım birimine gelen yükün büyüklüğüne göre sistemin ihtiyaç duyduğu şekilde belirlenir. Kurşun, enerji sönümleme özelliği sayesinde yalıtım biriminin yatay hareket miktarını azaltır ve sistem prensip olarak histeretik sönümleyici elemanlar gibi davranır.Kurşun çekirdekli elastomer yalıtım birimlerinin sönümlendirdiği enerji miktarı, yükleme esnasındaki ve yüklemenin kaldırılması ile oluşan elips biçimli döngüsel alana eşittir. Kurşun, plastik davranış gösterdiği için döngüsel davranış nedeniyle yüksek sönüm oluşmaktadır.[2]
Binalarda kullanılan izolatör sayısını sınırlayıcı bir durum olmadığında 0,6 G modülünde LRB karışımı yeterli gelmektedir. Ancak köprü gibi daha az izolatör kullanılarak daha fazla yük taşınması gerektiğinde 0,6 G modülüne uygun karışım yetersiz kalmaktadır. Böyle projelere 0,9 G modülüne sahip LRB karışımları geliştirme ihtiyacı doğmuştur.EN 15129 standardına uygun karışım üretebilmek için hammadde belirleme ve literatür çalışmaları yapılmıştır.Laboratuvar tipi 5 litre hacimde 0,9 G modülüne sahip LRB karışım reçeteleri hazırlanmıştır. ASTM 4014 standartına uygun olarak shear modül ölçümleri şirket bünyesinde yapılmış, EN 15129 şartnamesi esaslarına uygunluk sağlanmıştır. Nihai karışım elde edildikten sonra büyük ölçekli üretim yapılarak ürün denemelerine başlanmıştır. Deneme son ürün üretirken oluşan karışım kaynaklı problemler değerlendirilerek gerekli düzenlemeler yapılmış ve son karışım elde edilmiştir.

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Esra ALASAF, Yüksek Lisans Tezi; Sismik izolatörlü yapıların tasarımına etki eden faktörlerin incelenmesi, Sakarya Universitesi,2023

Keyword: *lrb, deprem izolatör, Kurşun Çekirdekli Kauçuk Deprem İzolatörü*

ID: 265

Çoklu Uyaranlara Yanıt Verebilen (2-Dietilamino Etil Akrilamid) Esaslı Çapraz Bağlı Jellerin Sentezi ve Karakterizasyonu

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Hidrojeller, su veya biyolojik sıvıları büyük miktarlarda emebilme ve tutabilme kapasitesine sahip, üç boyutlu polimer ağ yapılarıdır. Çevresel uyaranlara (sıcaklık, pH, ışık, manyetik alan, elektrik alan vb.) karşı fiziksel ve kimyasal özelliklerinde değişiklikler göstererek adaptif ve dinamik yanıtlar verebilen hidrojeller ise akıllı malzeme sınıfında tanımlanmaktadır [1]. Teknolojinin doğadan ilham alarak nasıl evrilebileceğinin en güzel örneklerinden biri olan akıllı hidrojeller sahip oldukları bu özellikleri sayesinde, biyomedikal mühendislikten çevresel temizliğe kadar çeşitli alanlarda devrim niteliğinde çözümler sunarlar [2,3]. Sıcaklık veya pH değişikliklerine tepki olarak ilaç salınımını kontrol edebilen akıllı hidrojeller, tedavi süreçlerini optimize ederek tıp uygulamalarında büyük bir potansiyele sahiptir. Ayrıca, kendi kendini onarma yetenekleri ve çevresel duyarlılıkları ile sürdürülebilir teknoloji ve akıllı malzeme tasarımında önemli bir rol oynarlar [2,3].

Poli(2-dietilamino etil akrilamid) (PDEAEAM), sıcaklık, pH ve CO_2'ye duyarlı olan akıllı bir polimerdir ve literatürde Alt kritik çözelti sıcaklığı (LCST) sıcaklığının 36°C olduğu belirtilmiştir. Bu polimerin en büyük avantajlarından biri, LCST sıcaklığının insan vücut sıcaklığına yakın olmasıdır. Bu durum DEAEAM hidrojellerin biyomedikal uygulamalarda, özellikle vücut içi kullanımda, uyumlu olmasını sağlayabilir. PDEAEAM polimerinin NIPAAm ile rastgele kopolimeri ve RAFT polimerizasyon tekniği ile CO_2 ve sıcaklığa duyarlı blok kopolimerlerinin sentezlenip karakterize edildiği çalışmalar literatürde mevcuttur. Ancak, DEAEAM monomeri kullanılarak çapraz bağlı hidrojel sentezine dair literatürde herhangi bir bilgiye rastlanılmamıştır [4,5].

Bu çalışmada 2-dietilamino etil akrilamid (DEAEAM), N-izopropil akrilamid (NIPAAM) ve/veya akrilik asit (AAc), monomerleri kullanılarak çoklu uyaranlara yanıt verebilen hidrojeller sentezlenmiştir. Hidrojellerin farklı sıcaklık, farklı pH ve NaCl çözeltileri içindeki şişme/büzüşme davranışları test edilerek, morfolojik ve kimyasal yapıları sırasıyla taramalı elektron mikroskobu (SEM) ve kızılötesi spektroskopisi (FTIR) kullanılarak karakterize edilmiştir. Şişme/büzüşme testleri sonrasında DEAEAM monomerinin hidrojellerin şişme davranışını arttırdığı gözlemlenmiştir. Sentezlenen hidrojellerin sıcaklık ve pH'a karşı duyarlı olduğu tespit edilmiştir. SEM analiz sonuçlarında, çapraz bağlayıcı miktarının artması ile genellikle gözeneklerin küçüldüğü, yapıya AAc katılması ile hidrojellerin gözenek duvarlarının inceldiği gözlemlenmiştir.

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Keyword: *Çapraz bağlı jeller, Akıllı hidrojel, Poli(2-dietilamino etil akrilamid), Kontrollü ilaç salımı, Duyarlı hidrojeller.*

Savunma Sektöründe Kullanılan Polimerlerin Yaşlandırma Testleri: Güvenilirlik ve Dayanıklılık Değerlendirmesi

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Savunma sektörü, yüksek performans ve dayanıklılık gerektiren uygulamalar için polimer malzemeleri yaygın olarak kullanmaktadır. Polimerlerin hafiflik, korozyon direnci, esneklik ve yüksek mukavemet gibi üstün özellikleri, zırh sistemleri, havacılık, denizcilik ve silah sistemleri gibi birçok alanda tercih edilmesini sağlamaktadır. Ancak, bu malzemelerin uzun vadeli güvenilirliği ve dayanıklılığı için yaşlandırma testleri büyük önem taşır.

Yaşlandırma testleri, polimerlerin çevresel ve mekanik koşullar altında maruz kaldığı değişiklikleri değerlendirmek için kullanılır. Başlıca test türleri arasında termal yaşlandırma, nem ve su emme testleri, UV ışınları ve hava koşulları testleri, kimyasal yaşlandırma ve mekanik yaşlandırma testleri yer alır. Bu testler, Hızlandırılmış Yaşlandırma Protokolleri (Accelerated Aging Protocols) kullanılarak gerçekleştirilir.

Bu çalışma kapsamında, CES bünyesinde formüle edilmiş özel kompozitlerin (CES-NSH-1 ve CES-VRM-1 numuneleri) performansları, Arrhenius ve TTS (Time-Temperature Superposition) yöntemleri ile yapılan yaşlandırma testleri ile değerlendirilmiştir. CES-NSH-1 ve CES-VRM-1 numuneleri, hızlandırılmış yaşlandırma koşullarında test edilerek, bu malzemelerin zaman içindeki mekanik ve kimyasal özellikleri analiz edilmiştir. Arrhenius yöntemi ile, yüksek sıcaklıklarda gerçekleştirilen testlerden elde edilen veriler kullanılarak malzemelerin kullanım ömrü tahmin edilmiştir. TTS yöntemi ile ise, farklı sıcaklıklarda elde edilen veriler birleştirilerek, malzemelerin uzun vadeli performansı ve dayanıklılığı değerlendirilmiştir.

Keyword: *Yaşlandırma Testi, Savunma Sektörü, Polimer*

ID: 251

Yeni Nesil Yüksek Performanslı Ekolojik Furan Reçinesinin Geliştirilmesi

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Yüksek tonajlı dökme demir ve çelik alaşımlarının dökümünde, yüksek kalıp dayanımı ve yüksek boyut hassasiyeti gibi önemli avantajlara sahip furan reçineleri ön plana çıkmaktadır. Yeni nesil ekolojik Fenol-Furan reçineleri, gelişmiş sfero ve yüksek kaliteli çelik dökümlerin imalatı için tasarlanmış kalıp ve maçaların üretimi için yüksek performansla geliştirilmektedir.

Furan reçinelerinin tarihsel gelişimine bakıldığında, ilk jenerasyon furan reçineleri Fenol-Formaldehit kullanılarak sentezlenen pre-polimerin Furfuril Alkol (FA) ile belirli yüzdelerde fiziksel karışımları olarak elde edilmiştir. Günümüzdeki çalışmalar incelendiğinde, FA'nın polimerizasyon reaksiyonuna monomer olarak katıldığı gözlemlenmektedir. Gerçekleştirilen bu çalışma esnasında hem fenol-formaldehit reaksiyonu hem de elde edilen hidroksimetilfenol yapısının FA ile polimerizasyonu için çeşitli mol oranları ve farklı asit-baz katalizörleri çalışılmıştır. Sentezlenen reçinelerin reaksiyon verimi ve mekanik performans değerleri ölçülerek optimizasyon yapılmıştır. Fenol-Formaldehit'in eklenme reaksiyonu sonucu elde edilen Hidroksimetilfenol yapısının FA ile asidik koşullarda kopolimerizasyonu gerçekleştirilerek yeni nesil ekolojik furan reçinesi elde edilmiştir.

Geleneksel furan reçinelerinin içerdiği yüksek oranda FA, reçinenin reaktivitesinin ve performans özelliklerinin belirlenmesinde temel değişkendir. Ekolojik furan reçineleri, geleneksel furan reçinelerine kıyasla, yüksek FA miktarının reçine yapısına dahil edilmesi sonucu ciddi oranda azaltılmış serbest FA içeriği (serbest furfuril alkol içeriği $\leq$ 25) barındırmaktadır. Düşük serbest FA içeriği sayesinde, reçinenin uçucu organik bileşik (VOC) emisyonları azaltılarak hem çevre hem de insan sağlığı açısından daha güvenli bir ürün elde edilmesi sağlanmaktadır. Aynı zamanda % 25'ten fazla serbest FA içeren furan reçineleri Malzeme Güvenlik Bilgi Formunda "zehirli" sembolü ile işaretlenmekte, daha düşük seviyelerde serbest FA içeren furan reçineleri zararlı olarak kabul edilmektedir. Bu sayede düşük FA içerikli reçinelerin sağlık üzerindeki etkileri azaltıldığı kanıtlanmıştır.

Yeni nesil ekolojik furan reçineleri, modern teknolojiler ile çevre ve insan sağlığı göz önünde bulundurularak, güncel Reach ve Avrupa Birliği regülasyonlarına uygun şekilde, yenilikçi bir anlayış doğrultusunda Çukurova Kimya A.Ş Ar-Ge Merkezi laboratuvarlarında geliştirilmektedir.

Keyword: *Furan Reçinesi, Ekolojik Furan, Furfuril Alkol*

ID: 246

Preparation of Formaldehdye-Free Decolarant

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Wastewater treatment is one of the most significant process for protecting ecosystem, which is polluted by the discharge of untreated industrial pollute to the environment [1]. There are several methods that can be used for wastewater treatment, such as physical methods, chemical methods, etc. Filtration and sedimentation methods can be represented as physical methods of wastewater treatment, and, coagulation/ flocculation is the common and essential chemical method for wastewater treatment to remove suspended particles and dyes from the water [2]. Coagulation is a process where suspended particles accumulate to form precipitates [2]. Inorganic coagulants, generally Al and Fe based salts, widely used in water treatment applications, but due to the environmental issues, Al residue is believed to be toxic to the ecosystem [2]. Organic coagulants have lots of applicable advantages in terms of less pH dependence, less required dosage and less sludge production [3]. However, formaldehyde usage for organic coagulants increases the risk of the environmental toxicity. In order to increase the performance of the coagulant without harming the environment, formaldehyde free hybrid coagulants play important role.
In this study, we have prepared a hybrid coagulant which can be used for treatment of reactive dye, which consist of organic coagulant and inorganic coagulant to increase the performance of coagulation processes without formaldehyde.

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Keyword: *Formaldeyde free decolarant, hybrid coagulant, reactive dye treatment*

ID: 394

UV/Vis Absorption and Fluorescence Spectroscopy Study of Symmetrical Coumarin Derivatives as High-Performance Photosensitizers for Photopolymerization Systems

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The photopolymerization process, which can be carried out through a radical or an ionic reaction, has significant advantages such as area control, high production efficiency, and low energy consumption. Photoinitiators are very important for photopolymerization as they are responsible for converting light energy into chemical energy [1]. Although photopolymers produced by radical processes are generally characterized by high cure rates, this type of system is subject to the problem of oxygen inhibition and quite high shrinkage during the polymerization. Light-induced cationic polymerization process offers attractive properties that promote excellent adhesion, low shrinkage, and insensitivity to oxygen under the air [2].

Coumarins are an important class of organic heterocyclic molecules containing the benzopyran moiety, and represent useful and different activities, often depending on the substituents. They have high electron transfer quantum yields, the capability of their excited states to react as electron donors or acceptors, extended spectral ranges, and good solubility. The fluorescence of coumarins has been widely used as a research tool in polymer science for the use of their various structures in photoinitiator systems, for the prediction of material solvent effects, and for the preparation of polymeric fluorescent solar collectors [3].

In this study, novel bis-coumarin-type photosensitizers are introduced for photopolymerization systems. The chemical structures of bis-coumarins: Coumarin-PDA and Coumarin DPDA were designed by incorporating two coumarin moieties of phenyl extended natures in which Schiff base condensation reactions between coumarin-6-carbadehyde and p-phenylenediamine and 4,4′-diaminodiphenylmethane, respectively. Thus, each coumarin dimer comprised of two coumarin units linked by an azomethine bridge is the first example of polarized bis-coumarin units linked together. The idea of linking two coumarin moieties by the originated phenyl ring(s) is to extend the absorption and emission wavelength range by increasing the electron-conjugated system and to achieve the most efficient fluorescence due to the symmetrical structures. In this route, the photophysical and photochemical properties of Coumarin-PDA and Coumarin DPDA have been investigated by UV/Vis absorption and fluorescence spectroscopies for this study after their chemical structures were confirmed by ^{1}H and ^{13}C NMR and FT-IR spectroscopies.

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Keyword: *photopolymerization, photosensitizer, coumarin*

Synthesis and structural characterization of a novel modified poly(maleic anhydride-co-vinyl acetate)/folic acid conjugate

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Polymer-based drug delivery systems are considered a promising class of biomaterials as they allow controlled release of therapeutic agents in fixed doses with improved bioavailability, lower toxicity, and also higher pharmaceutical efficacy. The aim of this study is the conjugation and characterization of maleic anhydride-vinyl acetate copolymer (MAVA), which acts as a drug carrier, with the bioactive folic acid compound. The MAVA copolymer was synthesized via a radical polymerization reaction using a radical initiator benzoyl peroxide (BPO) in the presence of an organic solvent methyl ethyl ketone (MEK) at 80 °C. Folic acid, known as vitamin B9, plays an important role in cell growth, cell division and repair processes. Maleic anhydride-vinyl acetate/folic acid conjugate (MAVA/FA), which is formed as a result of the reaction of MAVA copolymer with folic acid (FA), was produced by conjugating the copolymer with FA agent in the presence of triethylamine (TEA) catalyst in dimethylformamide (DMF) organic solvent at 80 °C [1,2]. The structural characterization of the copolymer and the MAVA/FA conjugate was performed using spectroscopic analyzes such as attenuated total reflection Fourier Transform Infrared spectroscopy (ATR-FTIR) and Nuclear Magnetic Resonance (^{1}H-NMR) spectroscopy [3]. The surface morphological properties of the samples were visualized by scanning electron microscopy (SEM). According to the ATR-FTIR and ^{1}H-NMR results as well as SEM images, it was observed that the characteristic spectrum data of the copolymer was converted to other functional groups in the MAVA-FA conjugate, proving the successful synthesis of the conjugate. In light of the results obtained, it can be said that the newly synthesized MAVA/FA conjugate, which has the potential to be used as a drug carrier in biomedical applications, can directly contribute to increasing the bioavailability of free folic acid.

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Keyword: *Maleic anhydride copolymers, Copolymer modification, Acriflavine*

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Redox-Responsive Hydrogels for Tunable Protein Release

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Stimuli-responsive hydrogels have emerged as an attractive class of biomaterials for several biomedical applications, including delivery of biomolecular therapeutics. In particular, hydrogels containing disulfide linkages offer several advantages, particularly their ability to undergo degradation in response to changes in redox conditions within the body. In this study, poly(ethylene glycol)-based hydrogels cross-linked via thiol-disulfide exchange reaction were obtained in phosphate-buffered saline at pH 7.4. The hydrogels were loaded with fluorescent dye-labeled bovine serum albumin, and the passive release of the molecule was examined in aqueous media. It was observed that the release kinetics could be adjusted by varying the polymer chain length in the network. Upon treatment with a disulfide reducing agent at physiological temperature and pH, the hydrogels exhibited rapid degradation and triggered release of the payload. Synthesized hydrogels were found to be biocompatible through in vitro cell experiments. Overall, synthesized hydrogels are found to be promising candidates for various biomedical applications.

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Keyword: *Hydrogels, Protein encapsulation, Stimuli-responsive*

ID: 386

Synthesis and Characterization of Castor Oil-based Thermoresponsive Hydrogels for Controlled Antibiotic Release

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Hydrogels are defined as hydrophilic polymer networks that can absorb large amounts of water. They can be constructed using synthetic or natural polymers.[1] Temperature-sensitive hydrogels belong to the class of "smart" hydrogels that respond to external stimuli.[2] They can reversibly change their conformation based on external temperatures. In this research, thermoresponsive hydrogels were synthesized using renewable resources for controlled antibiotic release. The hydrogel synthesis was carried out using the photo-initiated free radical polymerization method. Acrylated methyl ricinoleate, derived from castor oil, was used as hydrophobic monomer and polyethylene glycol acrylate, N-Isopropylacrylamide were employed as hydrophilic monomers. N, N′-Methylenebis(acrylamide) was used as crosslinker. Several thermoresponsive hydrogels were produced and characterized FTIR spectroscopy. Swelling profiles of the hydrogels were investigated both at room temperature and 37°C. Additionally, ciprofloxacin was loaded into the hydrogels, and antibiotic release studies were conducted. Antibiotic release has crucial importance for prevention and treatment of infections. Also, controlled antibiotic release systems decrease side effects, reduce drugs resistance, and increase the effectiveness of antibiotics.

The development of this hydrogel provides a potential solution for wound treatment by offering infection control and thermoresponsive antibiotic release. This innovative approach aims to provide an effective solution for wound treatment by using eco-friendly and biocompatible raw materials. Further research is needed to evaluate its efficacy and safety in clinical applications.

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Keyword: *Hydrogel, castor oil*

ID: 385

Investigation of a Supercapacitor Electrode Based on Conductive Polymer, Carbon Material, and Metal Oxide

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Energy storage technologies are gaining more and more importance due to the increasing energy demand in recent years. The energy crisis and the harmful effects of fossil fuels on the environment have led to the development of new technologies for highly efficient, easily manufactured, and low-cost energy storage devices. Supercapacitors are ideal energy storage devices because of their high-power density, high charge/discharge rates, long cycle life, and excellent cycle stability. The supercapacitor electrode active material can consist of various conductive polymers, carbon materials, and metal oxides [1]. Conducting polymers are used as electrodes in supercapacitors due to their high capacitance, good electrical conductivity, stability under environmental conditions, low cost, and easy production [2]. Carbon materials are used in supercapacitors because of their high conductivity and electroactive areas [3]. Metal oxides are also used to provide strong faradaic reactions by exhibiting low internal resistance [4]. This study chemically synthesized supercapacitor active material using polyaniline, graphene, and metal oxide. The modified active material was characterized using FTIR and SEM techniques. Graphene/conducting polymer/metal dioxide supercapacitor device performance was evaluated by cyclic voltammetry, galvanostatic charge-discharge, and electrochemical impedance spectroscopy techniques.

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Keyword: *supercapacitor, conductive polymer, nanocomposites, energy storage*

ID: 384

Yeni Nesil Akrilik Kauçukların Geleneksel Kauçuklara Göre Özelliklerinin Değerlendirilmesi

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Otomotiv sanayi uygulamalarında kullanılan kauçuk esaslı malzemelerin, kullanıldıkları uygulama alanlarına göre farklı sıcaklık bölgelerinde mekanik ve dinamik performans göstermesi, farklı sıvılara karşı kimyasal olarak dayanıklı olması gibi ayırt edici beklentilere cevap vermesi beklenmektedir. Bununla birlikte, geniş sıcaklık aralığında yüksek dayanım, kimyasal direnç ve uzun ömür gerektiren kauçuk esaslı malzemelere olan talebin her geçen gün artmasıyla birlikte, tüm bu özellikleri sağlayabilecek malzemelerin geleneksel kauçuklarla sağlanamayacağı anlaşılmakta ve zorlu malzeme beklentilerinin tamamını karşılayabilen malzeme seçeneklerinin sınırlı olduğu görülmektedir [Nakano ve arkadaşları, 2020; Zhonglin ve arkadaşları, 2021; Koga ve arkadaşları, 2005]. Pratik uygulamalarda ve literatürde bu amaçla çoğunlukla, mekanik dayanım ve esneklik özellikleri bazı uygulamalarda yetersiz kalan, ya da üretim sistemlerinin tamamen izole olması gerektiği durumlarda endüstriyelleşme aşamasında engellerle karşılaşılan florokarbon elastomerler (FKM) ve florosilikonlar (FVMQ) gibi oldukça yüksek maliyetli kauçukların kullanımına rastlanmaktadır. Söz konusu eksikliği giderebilecek poliakrilatlar (ACM), etilen akrilik (AEM) ve DENKA ER gibi üstün özellikleri nedeniyle son yıllarda kullanım alanları giderek genişleyen yeni nesil akrilik kauçuklar; FKM, FVMQ ve silikon kauçuk (VMQ) gibi ısıya dayanıklı kauçuklara alternatif olarak geliştirilmiştir. Akrilik kauçuklar, çevre dostu ve yüksek performanslı özellikler sunarak, flor içerikli kauçukların yerine geçebilecek potansiyele sahiptir. Bununla birlikte; DENKA ER ticari adıyla bilinen yeni nesil akrilik kauçuklar ise, AEM ve ACM'nin birbirlerine alternatif olarak kullanılabileceği uygulamalarda, her iki kauçuğun da eksikliklerinin giderilmesi amacıyla etilen, vinil asetat ve akrilik asit ester kopolimerine dayalı olarak geliştirilen bir hammaddedir. Bu özel akrilik kauçuk, AEM ve ACM'den farklı olarak yapısında bulunan vinil asetat ile ısı, yağ ve yanma direncinde üstün özellikler sergilemektedir. Ek olarak; çalışma kapsamında çalışılan ve çok yakın zamanda piyasaya sürülen DENKA ER'nin uygulama alanlarına yönelik ticari dokümanlara rastlanabilmekle birlikte, literatürde, bu kauçukların savunma sanayinde ihtiyaç duyulan spesifik gereksinimleri karşılayabilirliği hakkında fikir veren çalışmalar son derece sınırlıdır [Denka, 2015; Caruso H., 2001]. Bu çalışmada, karma akrilat yapısında olan DENKA ER kauçukları ile, otomotiv sanayi gibi zorlu malzeme isterlerine sahip özel uygulamalarda kullanılabilecek, yüksek sıcaklık ve kimyasal dayanımı sergileyebilen, alternatif malzeme bileşimleri, geleneksel hamur hazırlama yöntemlerine göre laboratuvar mili kullanılarak hazırlanmış ve FKM, AEM ve ACM esaslı malzemeler ile karşılaştırmalı olarak değerlendirilmiştir. Hazırlanan malzemelerin reolojik, fiziksel, mekanik, termal yaşlanma, kimyasal yaşlanma ve yanmazlık özellikleri incelenmiştir. Tüm sonuçlar birlikte değerlendirildiğinde, DENKA ER esaslı alternatif malzeme bileşimlerinin, hedeflenen uygulamalarda başarılı bir alternatif olarak önerilebileceği sonucuna varılmıştır.

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Keyword: *Akrilik kauçuk, Isıl dayanım, Yağ ve yakıt dayanımı, Yanma direnci*

ID: 382

Electrochemical Drug Determination with Nanoparticles Decorated Polyarginine-Based Electrode

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Electrochemical methods are among the preferred and advantageous techniques for applications in the field of health which are directly related to public health. These techniques are sensitive, cost-effective, simple and suitable for on-site measurement. For these reasons, electrochemical techniques are coming to the fore in applications related to cancer diseases . Since cancer is a disease for which a full cure has not yet been found, research on this topic is considerable. One of the frequently used cancer treatment methods is chemotherapy, which is a drug treatment method [1-3]. In this treatment, it is aimed to prevent the growth and proliferation of cancerous cells. It is important to determine anticancer drugs for introducing their interaction mechanisms and side effects. In this study, electrochemical determination of Mitomycin C on polyarginine-based electrodes is presented. For this purpose, first the graphite electrodes were modified with carbon nanotubes. After modifying the graphite electrode with multi-walled carbon nanotubes, polyarginine was coated onto this modified electrode. Electropolymerization cycles and the concentration of the arginine were optimized. Following this, metal nanoparticles were deposited to provide improved electrochemical responses. Reproducible results with high sensitivity were obtained for the anticancer drug. Additionally, simultaneous determination with other analytes were also demonstrated. Characterization studies were elucidated using electrochemical impedance spectroscopy, cyclic voltammetry and scanning electron microscopy.

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Keyword: *Electrochemical drug determination, carbon nanotubes, polyarginine*

Preparation of New Corrole-Based Conjugated Polymer for Designing Affinity Interfaces

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Corrole compounds are macrocyclic molecules composed of four pyrrole rings linked together, and they exhibit remarkable properties due to this tetrapyrrolic structure. These structures have strong electron-donating capabilities and enable the formation of stable complexes with various metal ions. The unique structure of corroles makes them highly significant in biological and chemical processes, including catalysis, medical diagnostics, and environmental sensing. Their ability to bind metal ions and interact with biomolecules with high specificity and affinity underlies their importance in developing advanced materials and technologies in biomedicine and environmental monitoring. [1,2]
This study reports the synthesis and characterization of a novel polymerizable conjugated derivative of a corrole compound. The newly synthesized functional monomer was evaluated for its polymerization capabilities and potential applications as an affinity interface for heavy metal ions and proteins (Scheme 1). The results indicate that; (i) the monomer can be easily polymerized electrochemically, (ii) synthesized polymer exhibits significant affinity towards model proteins, with the degree of affinity varying depending on the presence or absence of metal chelation, and (iii) corrole-based polymers have promising potential for use in materials science.

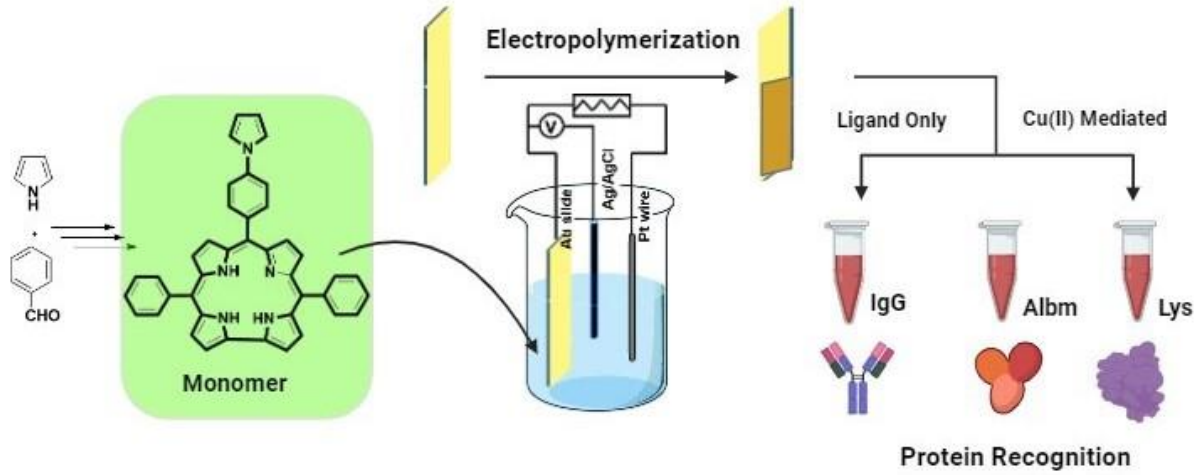

Figure 1. Schematic illustration of experimental procedure (created in Biorender.com)

Acknowledgements
Financial support from the Hacettepe University (BAP project number: FDK-2020-18588) is greatefully acknowledged.

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Keyword: *Corrole, Conducting polymer, Electrochemical detection*

Synthesis of Poly(imide ester)s via Imide-Yne Click Polymerization

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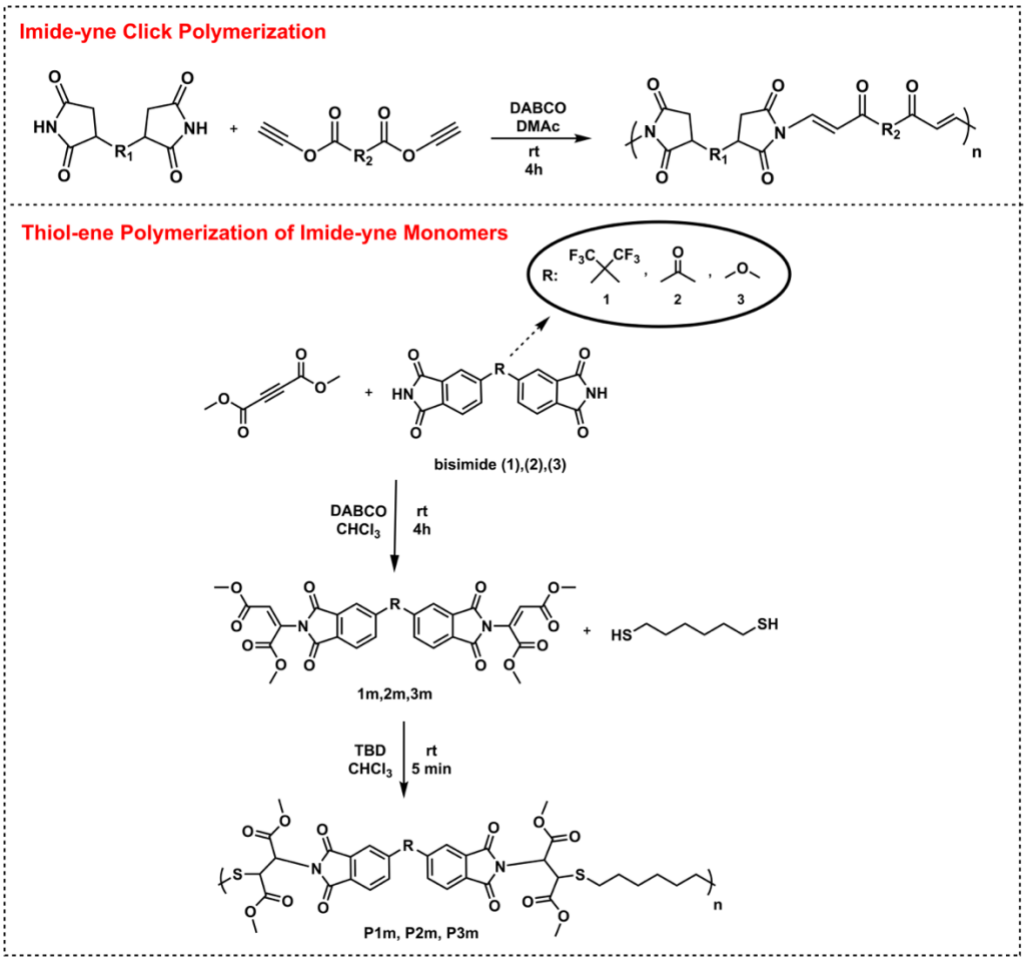
In this study, linear poly(imide ester)s were synthesized with bisimides and dipropiolates through imid-yne click polymerization in the presence of 1,4-diazabicyclo[2.2.2] octane (DABCO) at room temperature for 4 hours in N,N-dimethylacetamide (DMAc) as solvent. Bisimides were obtained through 2 different synthetic routes (heating dianhydride with urea or Michael reaction between maleimide and different thiols & piperazine). Dipropiolates were achieved via an esterification reaction between different diols and propiolic acid. After the polymerization, reactive vinyl groups on the main chain were further modified with 1-propanethiol using 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD) as the catalyst. Utilizing the mono-addition nature of imid-yne reaction, imid-yne monomers were also developed and poly(imide thioether)s were achieved through thiol-ene reaction with 1,6-hexanedithiol (HDT) using TBD as catalyst in DMAc in moderately short reaction times (5 min), at room temperature. All polymers were characterized by using ^{1}H, ^{13}C and ^{19}F NMR; GPC and DSC techniques. This work was supported by the Research Fund of the Istanbul Technical University (Project Number: TGA-2024-45713).



Keyword: *imide-yne, poly(imide ester)s, poly(imide thioether)s*

ID: 377

Poliester Sentezinde Kullanılabilen Laktit-Boc-Serin-OH Monomerinin Sentezi ve Poli(Laktit-Boc-Serin) Kopolimerinin Sentezinde Kullanılması

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Bu çalışmada; laktit(LD) ile boc-serin-OH(bS) amino asidin ester monomerleri hazırlanıp polimerleştirilmesi sonucu yan grubu boc-amin olan ardışık laktit-boc-serin (PLDbS) poliester sentezi amaçlanmıştır. LD/bS mol oranı üç olan karışımların THF çözücüsünde 24-48 saat ısıtılması sonucu LDbS, LD_2bS ve LD_3bS monomer (kısaca LD_xS) yapıların oluştuğu kaydedilen MALDI-TOF-MS spektrumunda 372,24, 516,37 ve 660,50 m/z $[M+Na]^+$ piklerinin gözlenmesiyle belirlenmiştir. LD_xbS monomer karışımın FT-IR spektrumunda; ester karbonili, uç karboksilik asit, üretan karbonili olmak üzere üç adet karbonil (C=O) grubu sırasıyla 1736, 1720 ve 1690 cm-1 dalga sayısında üçlü pik olarak gözlenmiştir. 1364 cm^{-1} ter-butiloksikarbonil(tbk) koruma grubunun metil ($-CH_3$) bükülme bandının spektrumda gözlenmesi sentez aşamasında koruma grubunun bozunmadan kaldığını açıklamıştır. LD_xbS monomerlerin ^1H-NMR spektrumunda tbk grubunun metil ve laktit metil protonları sırasıyla 1,47 ve 1,60 ppm kimyasal kayma gözlenmiştir. Monomer sentezinde, Laktit halkasının açılarak serinin hidroksi grubuyla ester oluşturduğu 4,00-3,70 ppm metilen ($-CH_2-$) protonlarının esterleşme sonucu 4,70-4,42 ppm değerine kayması ile belirlenmiştir.

Çalışmanın polimerizasyon aşamasında; sentezlen LD_xbS monomerlerin polimerizasyonu disiklohekzilkarbodiimit reaktifi kullanılarak kloroform çözücüsünde ve 0°C sıcaklıkta gerçekleşdirilmiştir. Elde edilen poli(laktit-boc-serin) (PLDbS) kopolimerleri MALDI-TOF-MS, FTIR çalışmaları ile karakterize edilmiştir. Kondenzasyon polimerizasyonu sonucu, monomer spektrumunda 3500-2500 cm^{-1} aralığıda gözlenen yayvan karboksil ve hidroksil hidrojen gerilme bandının polimerleşme sonucu oldukça azalması polimerin oluştuğunu açıklamıştır. LDbS, LD_2bS ve LD_3bS monomer karışımının doğrudan polimerizasyonu ile elde edilen örneğin MALDI-TOF-MS çalışmasından elde edilen spektrumda ağırlıklı olarak LDbS, LD_2bS monomerik birimlerin oluşturduğu oligomerik yapılar gözlenmiştir. Polimerin MALDI spektrumunda gözlenen en büyük pik 1696 m/z pikidir ve beş LDbS monomerin kondenzasyonu ile oluşan ardışık dizilimde LD-bS-LD-bS-LD-bS-LD-bS-LD-bS oligomerik yapının oluştuğunu açıklamaktadır. Yüksek molar kütleli PLDbS polimer sentezi çalışmaları devam etmektedir.

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Keyword: *Laktit, Serin, Serin fonksiyonel blok kopolimerler, Serbest amin grubu içeren kopolimerler.*

ID: 376

Flexible and Conductive Polymer Films Based on PDMS/PCz Composites

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Portable, independent, flexible, and foldable electronic devices are being produced through the development of a new class of technological materials known as plastic electronics. Polydimethylsiloxane (PDMS) composites, which are enhanced with metals, metal oxides, carbon compounds, and conducting polymers (CPs), are among the flexible materials used for this purpose. CPs have been used in the literature to synthesize structures such as poly(N-vinyl carbazole) (PNVCz)-PDMS[1] copolymers or to make composites by combining PDMS with polypyrrole (PPy) [2], poly(3,4-ethylenedioxythiophene) (PEDOT) [3], polyaniline (PANI) [4] and polyindole (PIN) [5]. The lowest and highest values of CP amount in these copolymers or composites are 0.8% and 93% respectively. The conductivity values of copolymers and composites are between $9.6x10^{-4}$ and 5.8 S/cm depending on the preparation methods and the amount of CP. In a similar vein, strain levels range from 0 to 50% when the mechanical characteristics of copolymers and composites are investigated. Despite the fact that polycarbazole (PCz) and PDMS were combined to prepare various composites, no research on PDMS/PCz composites that were produced by PCz polymerizing in-situ with PDMS curing has been done.

The purpose of this work was to create conductive PDMS/PCz composites-based flexible and conductive polymer films. Initially, the optimum amounts of PDMS, catalyst, carbazole (Cz), and cerium ammonium nitrate (CAN) were determined. Then, the polymers were characterized using SEM, FT-IR, TGA, mechanical testing, four-point prop conductivity and electrochemical measurements. PCz was also obtained at the optimum concentration of Cz and CAN and added to the PDMS mixture in order to comprehend the benefit of the in-situ approach. If a weight ratio of PCz is 34%, conductivity and strain values are $1x10^{-4}$ S/cm and 18% respectively. Similar results were obtained using a smaller amount of CP than the literature.

The combination of PDMS curing and Cz polymerization simultaneously and in a single step seems to be novel and advantageous in obtaining conductive and flexible composites.

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Keyword: *polycarbazole, polydimethylsiloxane, conductive composite*

ID: 370

Çok Yönlü Uygulamalar İçin Kazein Bazlı Kriyoboncuklar: Biyomedikal, Çevre ve Katalitik Uygulamaları

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Kriyojeller makrogözeneklere sahip üç boyutlu hidrojel türevi jellerdir. İstenilen malzemeden kolayca üretilebilmeleri, ayarlanabilir özellikleri ve gözenek boyutları sayesinde birçok uygulamada kullanıma uygundur. Bu çalışmada, kazein kriyoboncuklar kriyo-polimerizasyon ile sentezlenmiştir. Bu kazein kriyoboncuklar metal nanoparçacıkların hazırlanmasında kalıp olarak kullanılmış ve kazein-M (M: Co, Ni, Cu, Ag vb.) kompozit yapılar oluşturulmuştur. Kazein kriyoboncukların karakterizasyon çalışmaları, termal gravimetrik analiz (TGA), Fourier dönüşümlü kızılötesi (FT-IR) spektroskopisi, ultraviyole ve görünür ışık soğurma spektroskopisi, geçirimli elektron mikroskobu (TEM) ve taramalı elektron mikroskobu (SEM) gibi yöntemlerle gerçekleştirilmiştir.

Sentezlenen kriyojellerin kontrollü ilaç/biyomolekül taşınması ve salımında taşıyıcı olarak, organik kirleticilerin sulu ortamdan uzaklaştırılmasında adsorban olarak ve $NaBH_4$'ün hidroliz-metanolizinde katalizör olarak kullanıma uygun olduğu gösterilmiştir. Kazein kriyoboncuk/kompozitlerinin biyomedikal, çevre ve katalitik uygulamalar gibi birçok alanda kullanılabilecek çok yönlü ve yenilikçi malzemeler olduğu sonucuna varılmıştır.

Keyword: *Kazein kriyojel, Biyopolimer-kompozit, Biyomedikal/çevre/katalitik uygulamalar*

ID: 368

Jelatin Temelli Hidrojel/Kriyogel Sentezi ve Uygulamaları

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Sığır, domuz, balık veya tavuk gibi hayvanların kemik, kıkırdak, tendon, bağ ve derisinden üretilen hayvansal kökenli bir madde olan jelatin, et endüstrisinin bir yan ürünü olan kolajenden elde edilmektedir[1]. Jelatinin biyobozunur, biyouyumlu olması ve diğer maddelerle kolay çapraz bağlanması, kolay ulaşılıyor olması sebebiyle yüksek performanslı ve düşük maliyetli farklı formda yeni polimer türlerinin hazırlanmasına imkân tanımaktadır[2,3]. Bu çalışmamızda doğal bir polimer olan jelatin doğrudan kullanılarak kondenzasyon polimerizasyonu ile farklı formlarda (hidrojel, kriyojel vb.) 3B polimerler hazırlanmıştır. Bu polimerlere aljinat katkılanarak aynı zamanda iyonik jelasyon ile iç içe geçmiş (IPN) ağlar oluşturulmuştur. Bu yapılara manyetik özellik kazandırılmış ve jelatin-M (M= Co, Ni, Cu, Ag vb) kompozit formları hazırlanmıştır. Hazırlanan jelatin hidrojel ve kriyojellerin karakterizasyonları TGA, FT-IR, SEM ve TEM analizleri ile gerçekleştirilmiştir. Hazırlanan bu yapıların makro gözenekliliği, şişme özellikleri, esneklik, mekanik kararlılık gibi özellikleri de göz önünde bulundurularak organik kirleticilerin sudan uzaklaştırılması ve degredasyonu, ilaç/biyomolekül taşınması, ayırma/ saflaştırma, biyomürekkep olarak kullanımı değerlendirilmiştir.

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Keyword: *Jelatin hidrojel/kriyojel, Ayırma-saflaştırma, Kontrollü ilaç salımı*

ID: 360

Intratumoral Injection of Novel Drug-Loaded Starch Spheres into Pancreatic Cancer (PDAC) Tissue

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Pancreatic cancer (PDAC) is one of the most difficult cancers to treat and therefore has one of the highest mortality rates. The formation of desmoplasia in the tumor microenvironment and the lack of vascularization result in the ineffectiveness of chemotherapy. As a solution, methods such as intratumoral injection are used in the clinic. However, these methods have disadvantages such as the inability to control the release kinetics due to the drug being administered in solution form, the uncontrolled distribution of the drug to the application site, affecting healthy cells, and the associated difficulty in administering multiple doses. In order to address these problems in pancreatic cancer therapy, we designed amylase-sensitive smart starch hydrogel spheres cross-linked with calcium. For the first time in the literature, it has been demonstrated that starch obtained as spheres without the use of an organic or cytotoxic cross-linker is degraded by showing sensitivity to amylase. In addition, it was also observed that the drug-loaded gels released and showed high lethality on a pancreatic cancer cell line (PANC-1). Since the experimental data obtained and the planned setup were so compatible, intratumoral injection of the synthesized spheres with appropriate syringe tips was planned. In this way, it is thought that it will be possible to treat pancreatic cancer quickly, effectively and with minimal side effects.

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Keyword: *Pancreatic cancer, starch, calcium*

ID: 359

Yara İyileştirici Bir Malzeme Olarak Fonksiyonel Kompozit Hidrojel

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Deri veya doku bütünlüğünün dış etkenler nedeniyle bozulmasına yara denir. Yara iyileşmesi vücudun yaralanma sürecine verdiği doğal tepkidir. Tedavide en önemli nokta pansumanın yara tipine uygun olması ve ideal bir pansumandan beklenen tüm özellikleri karşılamasıdır. Mevcut yara örtüleri genellikle sentetik polimerlerden yapılır ve pasif, etkileşimli ve biyoaktif gibi çeşitli kategorilere ayrılabilir. İnteraktif yara pansumanları genellikle filmler, köpükler, hidrojeller vb. şeklinde mevcuttur. Yüksek düzeyde biyolojik uyumluluğa sahiptirler ve bozulmazlar veya toksik etkiler göstermezler. Bu özellikler biyoaktif yara örtülerini diğer yara örtülerine göre üstün kılmaktadır.
Bu çalışmada öncelikle heterojen polimerleşme sistemi ile fosfat bazlı mikropartiküller sentezlenmiştir. Sentezlenen mikropatiküller hidrojel filmlere katkılanmıştır. Bu filmlere yerinde (In-situ) metal nano partikül hazırlanması ile yara iyileştirici bir malzeme olarak polifosfat bazlı fonksiyonel kompozit hidrojel hazırlanmıştır. Bu yapıların karakterizasyonunda Termal Gravimetrik Analiz (TGA), Fourier Dönüşümlü Kızılötesi (FT-IR) Spektroskopisi, Taramalı Elektron Mikroskobu (SEM), Geçirimli Elektron Mikroskobu (TEM), Zeta Potansiyel(ZP) ölçümü gibi teknikler kullanılmıştır. Çalışmada elde edilen yapıların antimikrobiyal aktivite, sitotoksisite, ilaç taşıyıcı sistem olarak kullanımı test edilerek biyomedikal alanda uygulama potansiyelleri araştırılmıştır. Hazırlanan kompozit hidrojel filmin özellikle sağlık sektöründe yanık yaraları, trofik ülser ve diyabetik yaralar, yatak yaraları, cilt üzerinde herhangi bir enfeksiyon veya tahriş edici yaralar vb. uygulamalar için potansiyel vaat etmektedir.

Acknowledgments
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Keyword: *Kompozit hidrojel, Yara iyileştirici malzeme, Polifosfat bazlı hidrojel*

ID: 356

Yağ-Su Ayrımı İçin Üstün Alev Geciktirici Performansa Sahip Süperhidrofobik Kaplama

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Bu çalışmada çok işlevli kaplama geliştirilmiştir. Böylelikle temas açısını iyileştirerek verimli yağ-su ayrımını sağlarken alev geciktirici özelliklerini de sunarak çeşitli endüstriyel uygulamalar için umut vadeden bir seçenek haline getirmiştir.

Kaplamanın hidrofobi, yanmazlık ve yağ-su ayrımı özelliklerini geliştirebilmek için iki ayrı monomer sentezlenmiştir. İlk sentezde trimetoksi(oktadeasil)silan ve silikon dioksit (SiO_2) parçacıkları kullanıldı. İkinci sentezde ise 3-metakriloksipropiltrimetoksisilan, 9,10-Dihidro-9-oksa-10 -fosfafenantren-10-oksit (DOPO) ve SiO_2 kullanıldı. Polidimetilsiloksan, katalizör ve çapraz bağlayıcı ile hazırlanan baz formülasyona elde edilen iki monomer farklı oranlarda karıştırıldı. Dip-coating yöntemi ile bütün süngerler kaplandı. Kaplanmamış ve kaplanmış süngerler olmak üzere 5 farklı formülasyonda numuneler hazırlandı. Kaplanmış numunelerin su temas açıları (WCA'lar) Attension Theta Lite optik tensiometresi üzerinde oda sıcaklığında her numune için en az beş ölçüm olacak şekilde yapıldı ve ortalaması alındı. Kaplanmış bütün numunelerde yüksek temas açısı elde edilirken, en yüksek temas açısı baz formülasyon + birinci sentez monomer + ikinci sentez monomer ile hazırlanan numunede 155° olarak ölçülmüştür. Bunun yanında bütün numunelere yanma testi de uygulanmıştır. Pürmüz ile alev 4 saniye boyunca süngerlere tutulmuş ve geri çekilmiştir. Bütün kaplanmış numuneler en uzun 15 saniye en kısa 8 saniyede kendi kendine sönme özelliği göstermiştir. Yağ-su ayırma testi, kaplanan süngerleri 30 mL su ve 2 mL yağ dolu behere daldırıldıktan sonra bir şırıngaya konulup absorbe olan yağın sıkılması ve ölçülmesi ile yapılmıştır. Numuneler yağı sudan rahatlıkla ayırabilmektedir. Ayrıca, aynı kaplanmış sünger en az 10 kere ayırma işleminde başarı ile tekrar tekrar kullanılabilmiştir.

Tüm kaplanmış numuneler superhidrofobik olabilecek yüksek bir temas açısı artışı göstermiştir. Küllerin SEM görüntüleri, filmlerin kül tabakasında seramik benzeri bir yapının oluşumunu ortaya koyarak ısıya, oksijene ve diğer yanıcı gazlara karşı etkili bir alev kalkanı sağladığını göstermiştir. Kaplanmamış sünger etkisiz yağ emilimi gösterirken, kaplanmış süngerlerin yağı başarılı bir şekilde emdiği görülmüştür. Kaplanmış süngerlerin ayırma verimliliği %95'in üzerinde olmuştur. Bu formülasyonların endüstriyel uygulamalarda geniş kullanım alanı bulacağı öngörülmektedir.

Keyword: *alev geciktirici, süperhidofobik, yağ-su ayırma*

Curcumin-Loaded Cellulose Acetate Nanofibers Derived from Turmeric as Wound Dressing Material

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These days, polymeric nanofibers are quite popular use in wound healing. Curcumin-loaded cellulose acetate nanofibers derived from turmeric offer a promising solution as wound dressing materials. These nanofibers combine the beneficial properties of cellulose acetate, a biocompatible and biodegradable polymer, with curcumin, a natural compound known for its anti-inflammatory, antioxidant, and antimicrobial effects. This combination enhances the wound healing process, providing a more effective treatment option.

In this study, Firstly, curcumin extract was obtained from turmeric powder. Then, curcumin (0.1%, 0.3%, and 0.5% [w/v]) - loaded cellulose acetate nanofibers were successfully produced via electrospinning method.

The morphology of the produced nanofibers were analyzed by scanning electron microscopy (SEM). Structural characterization of electrospun nanofibers was analyzed on an ATR-Fourier-transform infrared spectrometer. The characteristic peak of curcumin appeared in the spectrum of curcumin-loaded PHBV nanofibers, confirming the conjugation of the drug to the nanofibers. The release profile of curcumin from curcumin(0.1%, 0.3%, and 0.5% [w/v]) - loaded cellulose acetate nanofibers was investigated in PBS at pH 7.4 ± 0.2, 37 ^{o}C. The released curcumin was measured using a UV spectrophotometer at 420 nm wavelength, and the amount of curcumin was calculated from the calibration curve. The results showed that as the amount of loaded curcumin increased, the release amount of curcumin also increased. In addition, tests on the toxicity, cell attachment, and cell proliferation of L929 fibroblast cells on cellulose acetate and curcumin-loaded cellulose acetate nanofibers are ongoing.

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Keyword: *curcumin, wound dressing, cellulose acetate*

ID: 342

Improving the Properties of Polyaspartic Ester Bio-Based Polyurea Coatings by Incorporating Silica and Titania

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Polyaspartic ester polyurea (PAE-PU) coatings are recognized for their environmentally friendly properties due to the absence of volatile organic compounds (VOCs), catalysts, and free isocyanates. These coatings have gained attention as a sustainable alternative both in academia and the coating industry. They are formulated using polyaspartic ester (PAE) and polyisocyanates as cross-linking agents. Achieving optimal performance requires meticulous attention to the precise combination of PAE and polyisocyanate. PAE-PU coatings are extensively applied on various concrete and metal surfaces, including marine applications, sports stadiums, bridge engineering, and rail cars, due to their high strength and chemical corrosion resistance [1,2]. While these coatings offer significant advantages to the industry by providing both flexibility and durability, achieving durability often requires the use of trimers with high NCO content. In such cases, applicators face challenges due to the notably short pot life of the formulation. Furthermore, traditional PAE-PU application systems commonly utilize petroleum-based polyisocyanates as the second component, which limits their classification as sustainable materials [3-5]. Given environmental concerns and the effort to find alternatives to petroleum-derived chemicals, it is crucial to explore the use of polyisocyanates derived from biobased monomers in PAE-PU coatings. In this study, bio-based polyisocyanates were employed in PAE-PU for the first time, thereby positioning them as sustainable alternatives without compromising their conventional properties. It was determined that the coating formulation had a convenient working time at room temperature. Pendulum hardness and contact angle measurements demonstrated that hydrophobicity with hard coatings were obtained with the addition of SiO_2 and TiO_2 particles without reducing the working time. Mechanical test results indicated a notable 37% increase in tensile strength with the addition of 3 wt% silica compared to the base coating, and a remarkable 43% increase when the coating contained an equal amounts of titanium and silica at the same concentration.

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Keyword: *Polyaspartic ester polyurea coatings,, Biobased isocyanates,, Silica and Titania*

Oda Şartlarında Kendi Kendine Çapraz Bağlanabilir Su Bazlı Tek Komponentli (1K) Akrilik Emülsiyonların Geliştirilmesi

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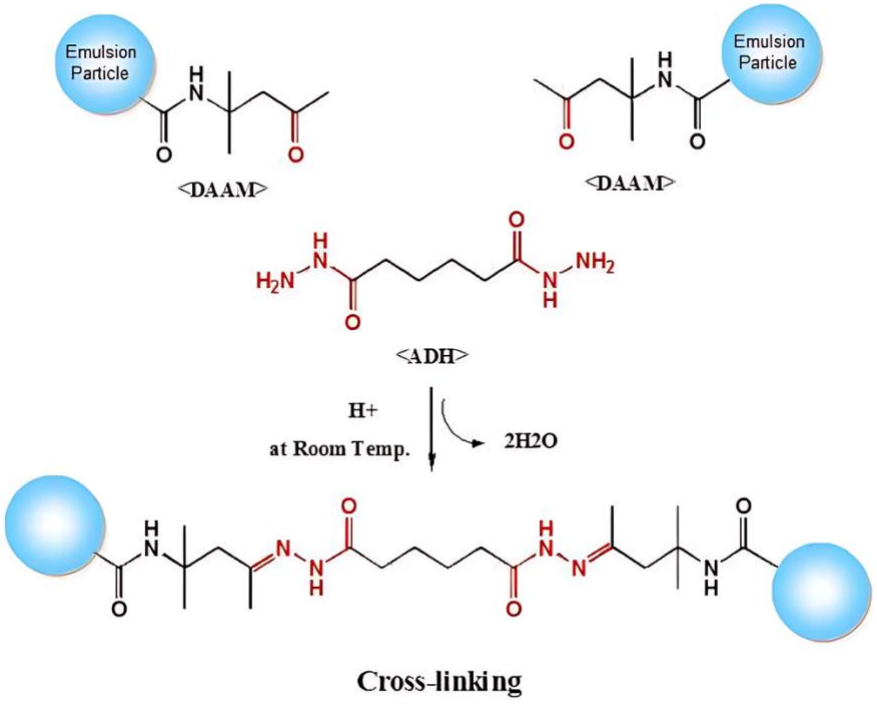
Son yıllarda, doğadaki uçucu organik emisyonu azaltmak için kaplama sektöründe su bazlı reçinelere olan ilgi artmaktadır. Doğayı tehdit eden bu uçucu organik emisyonu minimuma indirmek için araştırmacılar kaplama sektöründe su bazlı poliüretan ve poliakrilik gibi sistemlere yönelmiştir. Bu sistemlerin başında akrilik monomerlerin emülsiyon polimerizasyonu ile su ortamında polimerleşmesi gelmektedir [1].
Belirli bir sıcaklık, basınç, başlatıcı ve yüzey aktif malzeme varlığında akrilik monomerlerin polimerleşmesi ile oluşan bu akrilik sistemlerin avantajlarının yanı sıra dezavantajları da mevcuttur. Film oluşturması için sıcaklık gereksinimi, şeffaf olmayan mat filmler ve uygulanabilirlik açısından dezavantajları olan klasik su bazlı akrilik emülsiyonları zamanla sektördeki önemini kaybetmektedir. Son zamanlardaki akrilik emülsiyon polimerizasyonu üzerindeki araştırmalar ile birlikte, reaktif yüzey aktif malzeme kullanılarak yüzey aktif malzemenin polimerin yapısına katılması ile yüksek şeffaflıkta filmler oluşturulması sağlanırken oda şartlarında kürlenme imkânı sunan çapraz bağlayıcı sistemlerin kullanılması ile de enerji gerektirmeden hızlı film oluşturulması sağlanmaktadır [2].
Bu çalışmada, nonyonik-anyonik kombinasyonu reaktif yüzey aktif malzemeler ve DAAM (diaseton akrilamid) / ADH (adipik dihidrazid) çapraz bağlayıcı sistemi kullanılarak oda şartlarında kendi kendine çapraz bağlanabilir su bazlı tek komponentli (1K) akrilik emülsiyonlar geliştirilerek özellikle ahşap ve dekoratif kaplama sektöründeki problemlerin çözülmesi amaçlanmıştır.



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Keyword: *Akrilik kaplama, emülsiyon polimerizasyonu, su bazlı kaplamalar*

ID: 336

Optimization of Coating Application Process for Rubber Weather-Strip by Using Minitab

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Coatings are applied to weather-strips for various purposes, including preventing the surface from scratch and abrasion, enhancing aesthetic appearance, providing UV protection and improving noise performance. It is key to work with optimum process parameters to obtain the desired coating properties and steady results throughout serial production. Therefore, a statistical study was conducted on Minitab using variable process parameters and in accordance systematically collected coating thickness data. The mathematical model is obtained from the analysis of factors to determine the effects of the variables on the coating thickness. The process parameters were readjusted based on these results.
The aim of this study is to achieve the desired coating performance and recommend continuous monitoring of all input and output variables, during serial production. This provides the availability of all historical data to address potential issues effectively. In the study mainly focused on adjusting of the coating booth parameters (e.g. atomization pressure, and fan air) and robot properties (e.g. speed, and trajectory), specifically in zones where coating thickness was insufficient. Weekly results were collected. It was analyzed and presented using Minitab charts.
Despite encountering some initial challenges with poor results in certain areas, the overall improvements observed were substantial. As a result, this comprehensive approach not only improved the coating application performance but also ensured a method for process optimization and quality control, in that way contributing to the overall efficiency and reliability of the coating process.

Keyword: *coating, weather-strip, rubber*

ID: 335

A Novel Photoresponsive Diazo Containing Polymer: Synthesis, Photophysical and Photochemical Properties

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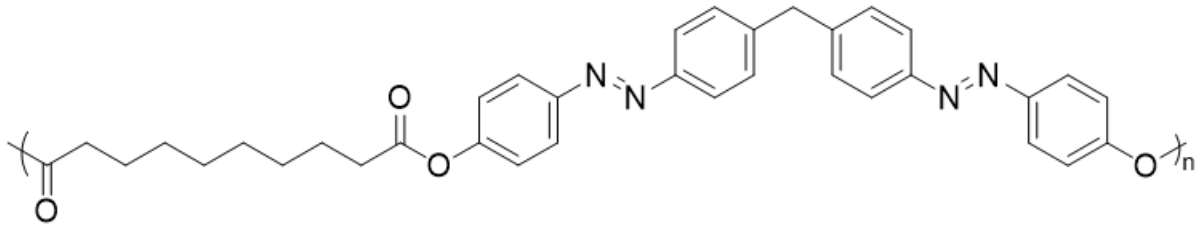
Photoresponsive polymers containing azobenzene derivatives are a promising area of materials science because of their capacity to change characteristics in reaction to light. The capacity of azobenzene to undergo reversible isomerization between its trans and cis forms upon exposure to specific wavelengths of light allows us to develop a more stable and linear product in the trans form and a less stable and bent state in the cis form. The trans form changes into the cis form when UV light (about 365 nm) is absorbed, and the cis form changes back into the trans form when visible light (about 450 nm) is absorbed or thermal relaxation occurs. When azobenzene moieties are incorporated to polymers, they contribute photoresponsive properties to the material. These polymers can display variations in their optical, mechanical, and chemical characteristics, as well as changes in shape and volume. With this in consideration, a novel polymer was developed with an azobenzene derivative in its backbone, that have structure of given below, starting from 4,4'-diamino diphenyl methane. In this study, the optical and chemical characteristics of this novel polymer were investigated.



Keyword: *Photoresponsive Polymers, Photoisomerization*

ID: 334

Synthesis and Characterization of Bioprintable Oxidized Alginate/Chitosan Hydrogels

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Tissue engineering requires a multidisciplinary approach for the successful repair and regeneration of damaged tissues, particularly via biomaterial scaffolds [1]. Hydrogels are a kind of material with soft structures consisting of a three-dimensional continuous network of polymers spanning the aqueous phase and have mechanical properties similar to those of biological tissues, which are considered to be a biofriendly adhesive material [2]. In recent years, various types of hydrogels, including environmentally friendly, self-healing, self-assembled conductive, shape memory and supramolecular hydrogels, have been developed and their properties have been studied and tested in a wide variety of applications in tissue engineering [3].

In this study, sodium alginate was oxidatively modified (OAlg) and cross-linked by using chitosan (OAlg/Chitosan). Also, different cross-linking agents as calcium chloride ($CaCl_2$), polyvinylalcohol (PVA) and oxalic acid was used to improve and compared for synthesis OAlg/Chitosan. In addition to swelling tests of hydrogels, SEM, TGA and FT-IR analyzes were performed. In the next stage, the obtained hydrogels will be printed as a scaffold for human aort valve with a 3D bioprinter and T/G HA-VSMC cell studies will be carried out.

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Keyword: *Hydrogel, Alginate, Chitosan*

ID: 328

Revealing the SECrets of Polysaccharides Using SEC/GPC with Advanced Detection Methods

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Size exclusion chromatography in combination with advanced detectors such as light scattering, viscometer and refractive index is a powerful tool for the comprehensive characterization of macromolecules like polysaccharides, proteins as well as synthetic (bio)polymers. This well-established technique can be applied to elucidate the structure/conformation and side-chain branching of polymers by providing their molecular sizes such as radius of gyration (R_g), hydrodynamic radius (R_h), and intrinsic viscosity. All these characteristics are inevitable to fully understand the chemical and physical properties of polymer chains in solution to develop their structure-property relationships.

This study will highlight the theory of triple detection SEC/GPC and its application for the analysis of polysaccharides in order to reveal the structural, conformational, and architectural properties.

Keyword: *SEC/GPC, Triple detection, intrinsic viscosity, branched polymers*

Epokside Doğal Kauçuk (ENR) Esaslı Yüksek Performanslı Lastik Tamir Hamuru

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Araç lastikleri kullanım ömürleri boyunca farklı çalışma şartlarından ve zarar verici dış etkilerden dolayı yaralanma, patlama, delinme, aşınma gibi çok farklı deformasyonlara maruz kalmaktadır. Bu deformasyonların boyut ve çeşitlerine göre tamir edilebilir olanları farklı tamir işlemleriyle giderilmekte ve lastik tekrar kullanıma döndürülebilmektedir. Bu işlemlerde tamir yamaları, tamir fitilleri ve tamir hamurları gibi farklı kauçuk esaslı malzemelerden faydalanılmaktadır. Doğal kauçuğun formik asit ile kimyasal modifikasyonu sonucunda üretilen yeni nesil yarı-sentetik bir kauçuk olan epokside doğal kauçuk (ENR), doğal kauçuğa benzer özelliklerinin yanı sıra nitril kauçuk gibi yağ/yakıt dayanımı ve bütil kauçuk gibi gaz geçirgenlik özellikleri sergilediğinden son yıllarda büyük bir ilgi görmektedir. Bu çalışmada, lastik tamir yamaları, tamir fitilleri ve tamir hamurlarında kullanılabilecek epokside doğal kauçuk (ENR) esaslı kauçuk esaslı tamir malzemesi bileşimi geliştirilmiştir. ENR oranının ve vulkanizasyon sistem etkinliğinin hamurların reolojik, dinamik ve akış özellikleri üzerindeki etkisi incelenmiştir. Hamurların değişken sıcaklık koşullarında pişme profilleri elde edilmiş, uygulama koşullarındaki akış özellikleri incelenmiş, vulkanizasyon sonrasında ise malzemelerin fiziko-mekanik özellikleri, yapışma ve yorulma dayanımları hamur bileşimi ile ilişkilendirilerek değerlendirilmiştir. Doğal kauçuk ve ENR'un 50/50 (%w) oranında kullanılmasıyla hazırlanan tamir hamurunda işlenebilirliğin geliştiği, fiziksel ve mekanik özelliklerin referans bileşimlere göre daha iyi olduğu, lastik tamir malzemelerinde kritik önemi olan yorulma dayanımının ise yaklaşık 3 katına çıkarılabildiği görülmüştür.

Keyword: *Epokside doğal kauçuk, Lastik tamir fitili, Lastik tamir yaması*

Investigation of the Effects of Recycled Powder HDPE on Fresh-Hardened Concrete with Polycarboxylate Based Admixture

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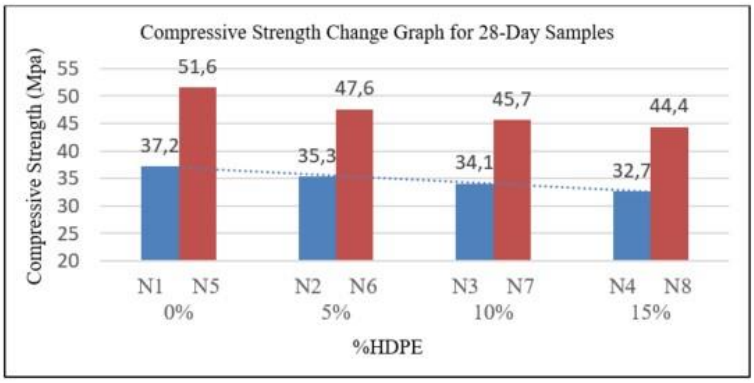
As of 2020, annual global plastic production was reported to be 450 million tons [1]. It is estimated that 19 to 23 million tons of plastic waste enter the ocean each year. Given the long natural decomposition time of plastic waste, addressing this issue through recycling and reusing plastic waste is essential [2]. One of the most common application areas for recycling waste materials and reintroducing them into the economy is the construction sector [3]. In Turkey, annual ready-mixed concrete production was 105 million cubic meters according to 2022 data. According to the 2022 data from the European Ready-Mixed Concrete Organization (ERMCO), while the total production volume of all EU member countries was 262 million cubic meters, Turkey alone produced 105 million cubic meters of concrete [4].
In this study, the effects of recycled high-density polyethylene (HDPE) in powdered form on fresh and hardened concrete were examined. Concrete mixes with varying proportions of HDPE substitution were prepared using natural sand as per the concrete design. Studies were conducted using the same concrete mix design and incorporating a polycarboxylate-based chemical additive to enhance the technical properties of concrete containing powdered HDPE. Eight different concrete mixtures were tested to evaluate workability and technical characteristics. Tests included slump, unit weight, and air content experiments. Compressive strength tests were performed to assess the mechanical properties of the concrete mixes. According to the study results, it was observed that the technical properties of concrete mixtures with recycled HDPE were superior compared to those of conventional concrete mixes, especially when a polycarboxylate-based chemical admixture was used. However, increasing the amount of HDPE led to higher air content in the concrete and reduced concrete strength. This highlights the need to investigate replacing HDPE with lightweight aggregates, particularly in concrete mixes requiring higher air content for freeze-thaw resistance.



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Keyword: *Concrete, Recycle, Polymer*

ID: 322

Benzoditiophene Based Polymers for Ternary Organic Solar Cell Application

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Organic solar cells exhibit significant potential within the solar energy industry due to their cost-effective production and capability to generate thin, flexible solar cells. Moreover, the ternary approach has been widely implemented to significantly enhance the power conversion efficiency (PCE) through the integration of the third component, which enhances light absorption, provides extra energy and charge transfer pathways and optimizes the morphology of the film. In this work ternary solar cells were fabricated by using Benzodithiophene based polymer BDTOX-F as donor material within Y6 and $PC_{71}BM$ acceptor materials in the active layer. The best performing device exhibits power conversion efficiency (PCE) of 11.4 %, short circuit current density (J_{sc}) of 22 mA/cm^2, open circuit voltage (V_{oc}) of 0.82 V and fill factor of 63%.

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Keyword: *Organic photovoltaics, Ternary OSC's, Benzoditiophene*

ID: 320

Drug Loaded Nanodroplets with Controlled Drug Release as Dual Functional Histotripsy Agent

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Second-generation nanodroplets (NDs) have emerged as a promising agent for nanoparticle-mediated histotripsy (NMH) to address the drawbacks of the first generation of NDs. Though the initial NDs successfully lowered the cavitation threshold, they encountered obstructions such as perfluorocarbon (PFC) content ambiguities and synthesis complexity[1-3]. Second-generation NDs were formulated by assembling of PEG-fluoroalkyl chains with perfluorohexane (PFH), facilitating detectable PFH content, tunable size, enhanced NMH performance, and structural stability. Histotripsy liquefies tumor tissue into an acellular homogenate, yet another concern arises due to the endurance of post-treatment undigested cancerous debris. This necessitates combinational therapy to prevent potential cancer regrowth and relapse[4].

This study investigates the development and evaluation of drug-loaded NDs for NMH applications by local delivery to tumor tissues, thus forging a path for tumor ablation and subsequent therapy for any traces of cancer. Incorporating doxorubicin (Dox), a hydrophobic anticancer drug, into second-generation NDs resulted in desirable size, compacted structure, quantifiable PFH content, optimal drug loading, and reduced cavitation threshold. Drug loading and release behavior of NDs formed using different lengths of fluoroalkyl-containing PEG chains were investigated. Results showed that the fluoroalkyl chain and the PEG chain length affect those behaviors. To achieve the negligible release during blood circulation and enhanced release during histotripsy application additional diffusion barriers were introduced while NDs were targeted for breast cancer cells. For this purpose, 10% of alkyne functional longer PEG chain (3KDa) and 90% of PEG-fluoroalkyl chains (comprising different PEG chain lengths) are utilized as building blocks of the dual-functional drug-loaded NDs.

Further, azide-EPPT1 peptide is introduced via “click reaction” to have controlled drug release and boost tumor targeting. These NDs were characterized by size, targeted percentage yield, and drug loading capacity. The results indicate that targeted drug-loaded NDs demonstrated slower controlled drug release and NDs with longer PEG chains enabled superior control over drug release than that of shorter ones. These findings highlight improved drug release profiles, enhanced targeting efficiency, and biocompatibility, underscoring the potential of these dual-functional NDs for effective synergetic treatment.

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Keyword: *Dual-functional Histotripsy Agent, Drug Loaded Nanodroplets, Controlled Drug Release*

ID: 313

Atık Polistiren Malzemelerden N-Oktadekan@PS Isı Depolama Amaçlı Mikrokapsüllerin Sentezlenmesi

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Günümüzde polimerlerde atık değerlendirme polimerlerin geri dönüştürülmesindeki zorluklar ve birtakım polimerlerin mikroplastiklere dönüşmek yoluyla insanlara ve çevreye vermiş olduğu zarar dolayısıyla gün geçtikçe daha önemli hale gelmektedir. Plastik atıkların kullanılabilir diğer ürünlere dönüştürülebilmesi için yapılan çalışmalarda öncelik plastiğin monomere dönüştürülmeden tekrar kullanılabildiği mümkün olduğunca katma değerli ürünlerin ortaya çıkarılmasıdır[1–4]. Bu çalışmada amacımız atık polistiren polimerinin uygun çözücü içerisine değerlendirilerek mikro partikül formunda ısı enerjisi depolama malzemesine dönüştürülmesidir. Bu sayede polistiren atıklar çoğunlukla kullanıldıkları ucuz malzemelere nazaran son derece yüksek fiyatlı olan daha nitelikli ve katma değerli ürünlere dönüştürülmüş olacaktır. Çözücü buharlaştırma tekniği olarak bilinen yöntemle gerçekleştirilen sentezle strafor köpük ve polistiren malzemeler ayrı ayrı değerlendirilerek n-octadecane ısı enerjisi depolama malzemesi kapsüllenmek için kullanılmıştır. Yaptığımız çalışmada polimerasyon ortamında senteze nazaran uygulanan teknikle elde edilen parçacıklar daha yüksek parçacık boyutuna ve parçacık dağılımına sahiptir (Ortalama parçacık büyüklüğü 150 µM). Ancak özellikle inşaat uygulamaları daha büyük parçacık boyutunu gerekli kılmakta ve parçacık büyüklük dağılımının daha geniş bir aralıkta ortaya çıkmasını sorun etmemektedir. Çalışmamızda %50 kapsülleme hedefimiz başarıyla gerçekleştirilmiştir. Üretilen kapsüller ısıl bakımdan kararlı ve tekrarlanan döngüler neticesinde sürekli kullanım açısından da kararlıdır. Bu çalışmanın sonunda plastik malzemelerin çözücü buharlaştırma tekniği ile yüksek katma değerli ürünlere dönüştürülmesinin mümkün olduğu ortaya konulmuştur. Çözücünün vakumlandığı durumlarda herhangi bir tehlikesi de söz konusu olmayacaktır. Kaldı ki, bu çalışmada kullanılan toluen bilinen diğer çözücülere göre daha az zararlıdır.

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Keyword: *Atık Polistiren, Isıl Enerji Depolama, Mikrokapsülleme*

ID: 311

Improving the Transparency of Aqueous Solutions of High Purity Grade Carboxymethyl Cellulose (CMC)

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Akkim Kimya Sanayi ve Tic. A.Ş.

The use of sodium carboxymethyl cellulose (CMC) has been rapidly increasing across various industries. It serves as a viscosifier in food, paint, adhesives, and the construction industry; as a binder in the paper and ceramic industries; as a film-forming agent in the textile industry; as an anti-redeposition agent in the detergent industry; and as a rheology controller in fluid systems for oil drilling. With advancements in the food and battery industries, the demand for high-purity (min 99.5%) CMC is rising. Traditional CMC specifications do not fully meet industry expectations in some specific applications. Transparency stands out as a critical technical specification.

This study aims to enhance the transparency of 1% aqueous solutions of CMC compared to AKKİM's standard food-grade CMCs with similar purity, degree of substitution, and viscosity range. This product is designed for sectors that require specific usage conditions and transparency, such as fruit juice, ice cream, and lithium-ion batteries.

The improved product was developed by adjusting the proportions of raw materials (sodium hydroxide, alcohol, and sodium monochloroacetate (SMCA) or monochloroacetate (MCA)). According to the glass tube transparency test, a minimum of 50 percent improvement in transparency was achieved. This enhanced CMC can significantly improve the visual and functional quality of products, such as clear beverages and high-performance batteries, highlighting its potential for broader adoption across industries requiring high-purity and transparent solutions.

Keyword: *Sodium Carboxymethyl Cellulose, Transparency, High-Purity*

ID: 300

Mekanik Direnci Yüksek ve Kimyasallara Karşı Deformasyona Dayanıklı Ateşleme Kablolarının Prototip Üretimi

Göktuğ Cenk Uysal
Başoğlu Kablo ve Profil San. ve Tic. A.Ş.

Kablo teknolojilerinde birçok uygulama ve endüstri bir araya gelmektedir. Otomotiv endüstrisi, araç elektronik cihazları ve motor başlatma (ateşleme) sistemleri gibi birçok kablo uygulama noktasına sahiptir.
Ateşleme (Buji) kabloları, temel olarak yüksek gerilimi bujiye iletip içten yanmalı motorun ateşlenmesi amacıyla tasarlanırlar. Motorun ateşlenmesinin sağlıklı bir şekilde gerçekleşebilmesi için ateşleme kabloları gerilim enerjisini kayıpsız bir şekilde iletmelidir, tekrarlanan gerilimlere ve dış etkenlere karşı dayanıklı olmalıdır.
Ateşleme Kabloları TS 1435 ve TS ISO 3808'e göre tasarım ve test aşamalarından geçer. TS 1435 kapsamında kablolar -veriler kısmında da yer alacağı üzere-; kıvılcım atlaması, kapasite, kodera (taç) etkisine karşı dayanıklılık, yüksek sıcaklıkta basınç, ısı altında büzülme, mekanik çekme/kopma dayanımı, alev yayılımına karşı dayanıklılık, yalıtım soyulması, yağa ve benzine karşı dayanıklılık ve ömür tayini testlerine tabi tutulur.
Silikon, inorganik ve polar organik kimyasallara karşı iyi direnci ve geniş çalışma sıcaklık aralığı (-50°C ila +180°C) nedeniyle ateşleme kablosu yalıtımında tercih edilir. En önemlisi de silikonun elektriksel özelliklerin
Proje kapsamında firma bünyesinde üç farklı tip kablo tasarımı geliştirilmiş olup, prototip üretim denemeleri yapılarak elde edilen prototipler üzerinde testleri gerçekleştirilmiştir.

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Keyword: *ateşleme kablosu, otomotiv, silikon*

ID: 295

Study of Cold Plasma in Deposition and Surface Functionalization of Polyester-Derived Biocomposite Scaffolds Using Mass Spectrometry and XPS

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This study focuses on advancing polymer materials used in additive manufacturing, particularly biomedical applications, to enhance biocompatibility, mechanical strength, and controlled biodegradation. This study also highlights the importance of the melt electrowriting(MEW) technique for its ability to precisely print polymers, particularly advantegeous for medical plastics due to its solvent-free melt processing capability. However, a limited number of polymers can currently be used effectively in MEW.
The aim of the study is to investigate the effect of cold plasma on the surface properties of scaffolds during the electrowriting of polycaprolactone and its copolymers suitable for tissue scaffold studies. Unlike conventional post-manufacturing plasma applications, integrating plasma during electrowriting has has the potential to provide more uniform surface functionalization. The hypotheses propose that applying cold plasma during the soft-solid phase of polymer deposition will result in more uniform surface modification compared to plasma treatment conducted after electrowriting. Analytical methods such as mass spectrometry and XPS chemical mapping will be utilized to asses chemical heterogeneity and surface modifications. Overall, the study aims to optimize biomaterial production processes by combining cold plasma modification with electrowriting, aiming for improved surface properties and reduced chemical heterogeneity in tissue scaffolds.

Keyword: *Melt electrowriting, Polycaprolactone, Mass Spectrometry*

ID: 288

A Novel Conjugated Polymer-TiO_2-Based Sensor to Detection of Butamirate Citrate

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Butamirate Citrate (BC), also known as 2-(2-diethylaminoethoxy) ethyl-2 phenylbutyrate dihydrogen citrate, is a commonly used central cough suppressant for ineffective coughs. The literature review indicates that the number of analytical methods that pertain to the substance is rather restricted. In this study, for the first time, a new sensor design was realized using polymer/TiO_2-modified glassy carbon electrode (GCE) for the rapid, sensitive, and selective detection of BC.
2,6-bis(3,3-didecyl-3,4-dihydro-2H-thieno[3,4–b][1,4]dioxepin-6-yl)-4,4-dioctyl-4H-silolo[3,2-b:4,5-b']dithiophene was synthesized according to the literature procedure via Stille Coupling reaction. This monomer was polymerized on the surface of a GCE by using cyclic voltammetry with 3.03×10^{-4} M monomer concentration in an ethanol/dichloromethane (10 mL/ 0.25 mL) solution with 0.1 $LiClO_4$ supporting electrolyte. By using this polymer and TiO_2, a novel sensor was designed to sense BC drugs. 1mg/mL TiO_2 solution was used for this purpose, directly dropped on the surface of the GCE, and the solvent was vaporized under normal atmospheric conditions. Four different surfaces were examined to sense the drug: (1) Bare GCE, (2) Polymer coated GCE, (3) TiO_2 was first dropped on the GCE, and polymerization was carried out, and (4) First polymer was coated on the surface of the electrode and TiO_2 was dropped. It was interesting that when the polymer is in its oxidized state, the sensor cannot sense the drug. As a result, in each step, the polymer should be neutralized. When the polymer was coated on the surface of the electrode, the signal of the drug was observed, however, the current was decreased. To increase current, TiO_2 was added to the system. In this study, different polymer thicknesses, the presence of TiO_2, and some other conditions were examined to construct a sensor based on a polymer, which can be a stable matrix.

Keyword: *Conducting polymer, Butamirate Citrate, Drug sensor*

ID: 285

Synthesis of Bio-Based and Hybrid Acrylic Copolymers at Low Temperatures and Their Coatings

Not Presented

ID: 278

In-situ and Green Synthesis of PEDOT-Polydopamine Through Photoinduced Electron Transfer (PET) Reactions

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Poly (3,4-ethylenedioxythiophene) (PEDOT) has been the predominant polymer in organics electronics such as solar cells, supercapacitors, electrochromic switches due to its excellent conductivity, superior electronic features, thermal/mechanical stabilities and due to its flexibility.(1) However, its poor adhesion to various surfaces limits PEDOT's standalone utilization in many technological devices. In order to improve the adhesion of PEDOT-based organic electronics, several research groups have previously incorporated polymers possessing strong adhesive properties into PEDOT. Since the pioneering work of Messersmith's group,(2) polydopamine (PDA) has been the material of choice for applications that require strong adhesion since PDA is one of the simplest yet most versatile material that can adhere to virtually any surface. While there have been few studies which combined PEDOT with PDA, (3,4) best to our knowledge, none of these works reported an in situ method for the synthesis of PEDOT-PDA mixture. In this work, we report the in situ and sustainable photopolymerization of EDOT and dopamine (DA) using an organic photoinitiator and a green solvent (ethanol). The photochemically obtained PEDOT-PDA polymer was then thoroughly characterized spectrally (IR, UV-Vis and NMR) and microscopically (SEM, TEM, AFM). PEDOT-PDA exhibited excellent adhesion to several surfaces (metal, glass and plastic) optoelectronic features with promising use in electrochromic switches. Ultimately, the reported method possesses several advantages over the previous synthetic methods in terms of sustainability (green solvent and no toxic chemicals) and due to the spatiotemporal control which can open the path for the fabrication of other PEDOT-based cathechols with desired architecture.

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Keyword: *Conductive polymers, PEDOT-Polydopamine, Photoinduced electron transfer*

ID: 273

EPDM Kauçuk Esaslı Sünger Yapılı Kompozit Malzemelerin Üretimi

Not Presented

ID: 270

Sülfonil Radikalinin Kimyası

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Sülfür tabanlı ve sülfür içeren organik serbest radikaller, biyolojik ve biyokimyasal süreçlerde artan bir ilgi odağı haline gelmiştir. Bu çalışma, kuantum kimyasal araçlar kullanarak sülfonil radikali türevlerinin kimyası araştırıldı. Bu radikallerin reaktivitelerini incelemek için, radikal kararlılık enerjileri (RSE'ler), katılma tepkimeleri, ve sülfonil klorür moleküllerinden α-Hidroksil ve α-Alkil radikallerine Cl atomu transferi tepkimeleri incelendi (Figure 1). Geometri optimizasyonları, frekans ve enerji hesaplamaları M06-2X/6-31+G(d) ve WB97XD/6-31+G(d) düzeyinde gerçekleştirildi. Sülfonil radikallerinin enerjik ve kinetik hesaplamaların sonucu deneysel verilerle karşılaştırıldığında oransal olarak benzerlik göstermektedir. Özellikle, WB97XD/6-31+G(d) seviyesinde ve çözücü ortamında yapılan modellemelerin deneysel sonuçlara daha yakın olduğu anlaşılmaktadır. Sülfonil radikali türevlerinin katılma tepkimelerinde ve polimerizasyonunun zincir transfer basamağında ana itici gücün kükürt merkezli radikal ara ürününün kararlılığı olduğu bulunmuştur.

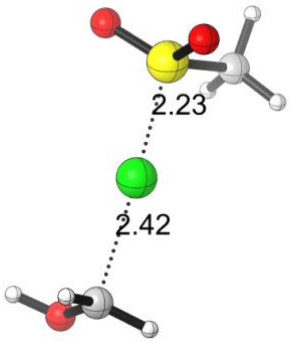

Figure 1. α-Hidroksil radikaline Cl atomu transferi tepkimesine ait geçiş konumu geometrisi.

Keyword: *Kuantum Kimya, DFT, Sülfonil radikalleri, Tosil radikali, Katılma tepkimeleri*

ID: 267

Utilization of Styrene as a HAT Sensitive Moiety in Poly(methyl methacrylate) for Photo Degradable Copolymers

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As increasing plastic waste accumulates rapidly in the environment, sustainable recycling methods are becoming increasingly important. Polymethylmethacrylate (PMMA) is a widely used polymer across various industries due to its high impact strength, optical clarity, and lightweight properties, but it presents significant challenges for degradation. Its degradation requires high temperatures and catalysts due to the absence of a common functional group to trigger the process. In our previous research we have utilized photochemical approaches to degrade PMMA copolymers containing halo-acrylates using halogen atom transfer [1,2] and polystyrene (PS) using hydrogen atom transfer (HAT) via phenacylbromide [3]. In this study, we have explored the incorporation of styrene monomer into PMMA to create a copolymer. This new material retains similar properties to PMMA while also being degradable, offering a sustainable alternative to conventional PMMA. Research includes an extensive study on the degradation mechanism and the effect of the both number and distribution of styrene units within the copolymer.

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*** The authors acknowledge the support of Istanbul Technical University Research Fund Project.

Keyword: *Methyl methacrylate, Photodegradation, P(MMA-co-styrene)*

ID: 264

Synthesis and Characterization of Epoxy-based Coatings: Investigating Mechanical Properties, Corrosion Resistance, and Enhanced Hydrophobicity

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In the study, two different epoxy-based coatings were obtained using the sol-gel method. (3-glycidoxypropyl) trimethoxysilane (GPTMS) and 3-aminopropyltriethoxysilane (APTES) were used as reactants in the coating solution to produce the first coating. In the preparation of the coating solution for the second coating, Dynasylan F 8261 was used as a source of fluoroalkyl silane (FAS) as a third reactant, in addition to GPTMS and APTES. Polymers featuring extended perfluorinated side chains have garnered significant interest because of their characteristics, including very low surface energy, liquid repellency, and robust chemical and thermal stability. Their hydrophobic nature, attributed to the low surface energy of $-CF_2-$ and $-CF_3$ groups, makes them useful in various applications.The solutions were prepared in a beaker using a magnetic stirrer at room temperature. Aqueous nitric acid solution was used as a pH adjuster in the system involving hydrolysis and condensation reactions. The coatings were coated on 430 grade stainless steel and glass substrates by spin coating and cured at room temperature. After obtaining homogeneous coatings, structural analysis was performed using fourier transform infrared (FTIR), and water repellency characteristics were analyzed using water contact angle measurements. While the first coating using GPTMS and APTES reactants showed hydrophilic character, the second coating using Dynasylan F 8261, a fluoroalkyl silane compound, showed hydrophobic character. By scanning electron microscopy (SEM) analysis of the surfaces and cross-sections of the coatings, it was determined that the coatings were spread uniformly and adhered well on the surface. It was determined that the thickness of the coatings was approximately two microns. Roughness measurement results from an optical profilometer and gloss measurement results supported each other. Mechanical tests including impact resistance, flexibility/conical bending, and deformation tests demonstrated that the coatings were durable. The coatings did not show scratch resistance. According to the salt spray test and humidity resistance test results, while the first coating did not show resistance to moisture and salt water, the second coating containing fluoroalkyl silane showed resistance. The coating containing fluoroalkyl silane has corrosion resistance.
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Keyword: *Epoxy coating, Sol-gel, Hydrophobicity*

ID: 262

Microfluidic vs Batch Synthesis of Fluorescent POSS Nanoparticles

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Fluorescent hybrid particles are essential in nanomedicine and biological applications, such as imaging, diagnostic tools, drug delivery, biosensing, multimodal imaging, and theragnostics[1]. Polyhedral oligomeric silsesquioxane (POSS) is an attractive candidate for these applications due to its unique hybrid structure, featuring an inorganic silica-cage core surrounded by functional organic substituents like vinyl end monomers[2]. This structure allows for the production of micro/nanoparticles via free-radical emulsion polymerization. Traditionally, batch synthesis techniques have well-defined parameters for obtaining emulsion mediums, such as the amount of emulsifier and the use of ultrasound sources. However, there is still a need for more research on producing stable emulsions with very small droplets using a microfluidic device. Recently, POSS hybrid nanoparticles have been generated via self-assembly emulsification in a microfluidic reactor, offering an alternative to traditional ultrasonic emulsification[3].

In this study, we present a method for generating self-assembly emulsions in a microfluidic reactor, enabling the continuous, one-step synthesis of fluorescent POSS nanoparticles via UV polymerization. By precisely controlling microfluidic reaction parameters, including flow rates, mixing ratios, and UV exposure time, we achieve efficient and reproducible synthesis of fluorescent hybrid nanoparticles. This streamlined synthesis approach represents a significant advancement in the field, offering a scalable and efficient method for producing fluorescent hybrid nanoparticles with customizable properties. The synthesized fluorescent POSS nanoparticles will be characterized by scanning electron microscopy (SEM), fluorescent microscopy, and Fourier-transform infrared spectroscopy (FTIR). The obtained particles could be promising for fluorescence imaging applications, specifically bio-detection in array systems.

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Keyword: *self-assembly emulsion, nanoparticle,, Microfluidics,UV-polymerization, fluorescent,*

ID: 260

Mobilya/Dekorasyon Sektörüne Yönelik Fenol Formaldehit Reçinesine İkame Biyobazlı Kağıt Emprenye Reçinesi Geliştirilmesi

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Fenol-formaldehit (PF) reçineleri, endüstriyel birçok alanda tercih edilen mükemmel yapışma özellikleri, suya dayanıklılık, ısı direnci ve kimyasal stabilite ile bilinir. Ancak, fenol yüksek toksisiteye sahip bir kimyasaldır ve özellikle sentez aşamasında serbest fenol, üreticiler ve çevre için ciddi riskler oluşturabilir. Bu nedenle, artan düzenlemeler, uygulama ve depolama süreçlerinde zorluklar doğurur. Bununla birlikte, petrol kaynakları sınırlıdır ve mevcut tüketim trendleriyle 40 yıl içinde tükenmesi beklenmektedir. Bu durum, petrokimyasal ürünlerin yüksek maliyetine ve fiyat dalgalanmalarına neden olur, bu da endüstriyel üreticileri ve araştırmacıları, doğal olarak bulunan, daha ekonomik, yenilenebilir ve petrokimyasal hammaddelerin alternatiflerini aramaya yönlendirir. Lignin, bitkilerde bulunan ve selülozla birlikte hücre duvarının bir parçası olan bir polimerdir. Lignin; üç fenil- propanol, yani p-kumaril alkol (p-hidroksil-fenil propanol), koniferil-alkol (guaiasil-propanol) ve sinapil- alkolden (şiringil-propanol) oluşur. [1] Lignin, ağırlıklı olarak ikincil bir yakıt olarak kullanılsa da, içindeki fenil propanol birimleri ve özgün aromatik özelliklerinden dolayı, kimya endüstrisi için potansiyel bir alternatif olabilir. Ancak, polifenil propan birimleri düşük reaktiviteye sahiptir, bu nedenle ligninin kullanımı için reaktivitesinin artırılması gereklidir. Ligninlerin reaktivitesini artırmak için metilleme, fenolleme ve demetilleme gibi temel modifikasyon yöntemleri kullanılabilir. Bu, PF reçinelerinde lignin yerine kullanılabilir veya fenol kullanımını azaltarak reçinedeki fenol miktarını düşürebilir. Reçine sentezinde de, ligninin fenol kaynağı olarak farklı oranlarda formülasyona dahil edilmesi ile elde edilen reçinenlerin performansı incelenmiştir. Sonuçlara bakıldığında, EDAX elementel analiz ve FTIR analizleri yapılmış ve lignin demetilasyonunun başarıyla gerçekleştiği bulgulanmıştır. Bununla birlikte, fenol kaynağı olarak modifiye ligninin ağırlıkça % 5 ila % 50 aralığında değişen oranlarda ilavesinin, % 100 fenol bazlı ürüne kıyasla rekabet edebilir performans gösterdiği bulunmuştur.

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Keyword: *Fenol-formaldehit reçineleri, modifiye lignin ve türevleri, lignin bazlı kağıt emprenye reçinesi*

ID: 257

İki Basamaklı Benzoxazine Sentezinde; Aşama Sürelerinin Termal ve Kimyasal Özelliklere Etkilerinin Tespit Edilmesi

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Benzoksazin türevleri, ileri kompozit malzeme üretiminde sunduğu mükemmel termal stabilite, düşük yanıcılık, boşluksuz kürleşebilme ve mekanik özellikler sayesinde son yıllarda sıklıkla tercih edilmektedir. Üretim süreçlerinde solventsiz ve %100 aktif bileşen sunmasına rağmen, düşük viskoziteye sahip olmaları kompozit üretiminde kolay işlenebilirlik sağlamaktadır. Mekanik özellikleri, dayanıklılığı artırır ve uzun ömürlü malzemeler üretmeye olanak tanır. Bu özellikler, havacılık, otomotiv ve elektronik gibi alanlarda hafif ve güçlü yapılar elde etmek için kullanılmalarını sağlar. Çukurova Kimya End. A.Ş. bünyesinde anilin, fenol ve formaldehit kullanılarak endüstriyel büyüklükte üretime uygun hale getirilerek iki ana basamakta sentezlenen benzoksazin prepolimerinde, elde edilen reçinenin özelliklerinin bu iki ana basamağın sürelerine bağlı olarak değiştiği tespit edilmiştir. İlk basamak olarak anilin ve formaldehitin tepkimesi sonucu oluşan triaza molekülleri, ikinci aşamada fenol ve benzoksazin oluşumunu tamamlatacak formaldehit eklenmesi ile devam etmiştir. 40°C'de 1000 – 2000 cP viskozite aralığına gelene kadar devam eden reaksiyonda, kırılma indeksi, serbest formaldehit, 200°C katı madde gibi özelliklerin yanı sıra kontrollü kürleştirilen ürüne ait DSC ölçümü ile camsı geçiş sıcaklığı (Tg) tespiti gerçekleştirilmiştir. Benzoksazin prepolimeri için en büyük beklentilerden olan yüksek Tg >115°C değeri, aşamalar optimize edilerek sağlanmıştır.

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Keyword: *Benzoksazinler, Endüstriyel ölçek, Polimer sentezi ve karakterizasyonu*

Perlit ve Genişletilmiş Perlit İlavesi ile Etilen Propilen Dien Monomer (EPDM) Kauçuğunun Fiziksel ve Yanmazlık Özelliklerinin İncelenmesi

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Bu çalışmada, Etilen Propilen Dien Monomer (EPDM) kauçuğuna ilave edilen perlit ve genleştirilmiş perlit katkılarının fiziksel ve yanmazlık özelliklerine etkisi araştırılmıştır. Bu amaçla, katkısız EPDM (EPDM), 50phr perlit katkılı EPDM (EPDM50P) ve 50phr genleştirilmiş perlit katkılı EPDM (EPDM50GP) kauçukları laboratuvar tipi mini banbury kullanılarak hamur haline getirilmiştir. Hamurlar preste 180 ºC ve 20 dk. boyunca vulkanize edilmiş ve test plakaları üretilmiştir. Fiziksel özelliklerin belirlenmesi için yoğunluk ve Shore A sertlik testleri, EPDM kauçuğunda mevcut olan katkıların dağılımı için ise dispersiyon analizi yapılmıştır. Yanmazlık özelliklerinin belirlenmesi için standartlara uygun olarak UL94-HB yanmazlık testleri yapılmıştır. Deneyler sonucunda, EPDM kauçuğunun sertliği 55 Shore A iken EPDM50P ve EPDM50GP kauçuklarının sertliği sırasıyla 62 ve 65 Shore A elde edilmiştir. Dispersiyon testleri sonucunda, EPDM50GP kauçuğuna göre, EPDM50P kauçuğunda yüksek dispersiyon oranı (88,64%) ve düşük tane boyutu (3.34µm) elde edilmiştir. UL94-HB yanmazlık testi değerlendirildiğinde ise EPDM kauçuğuna ilave edilen perlit ve genleştirilmiş perlit yanma hızını sırasıyla %19.5 ve %24.8 oranlarında azaltmıştır. Perlit ve genleştirilmiş perlitin alev geciktirici dolgu maddesi olarak EPDM kauçuğunda potansiyel olarak kullanılabileceğini göstermiştir.

Keyword: *EPDM, Perlit, Genleştirilmiş Perlit*

Effect of Polymeric Additives on the Efficiency and Stability of n-i-p Structured Perovskite Solar Cells

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Diketopyrrolopyrrole (DPP)-based polymers have gained significant attention in the field of perovskite solar cells (PSCs) due to their exceptional electronic properties, structural versatility, and ability to improve the performance and stability of PSCs.[1-3] Herein, DPP-based polymers with biselenophene (**poly-ADD1**) and thienothiophene (**poly-ADD2**) donor units are introduced into 3D CsFAMA-based PSCs via the anti-solvent addition method. Their bulky and well-ordered molecular structures contribute to improved film morphology and enhanced charge transport in PSCs. X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) studies were done to analyse the crystallization and morphology control of n-i-p type 3D CsFAMA-based PSCs. SEM images reveal that films treated with DPP-based polymers exhibit enhanced surface smoothness and larger crystal sizes than untreated films. XRD analysis confirms improved crystallinity, indicating that the additives help form a more ordered crystal structure. Perovskite films with polymeric additives show decreased photoluminescence (PL) intensity. This suggests better hole extraction and reduced charge recombination, which are critical for higher efficiency. The PSC incorporating **poly-ADD1** achieves a power conversion efficiency (PCE) of 20.97%, significantly higher than the pristine PSC's 18.99%, and the fill factor (FF) for the **poly-ADD1**-treated PSC is 81.23%, indicating superior charge collection and reduced losses. The **poly-ADD1**-containing PSC maintains 67% of its initial PCE after 1600 hours of storage in humid ambient air at 85 °C without encapsulation. In contrast, the pristine PSC shows a greater PCE loss, retaining only 29% under the same conditions. The findings provide a guideline for the development of DPP-modified polymeric additives. These additives are crucial for improving the efficiency and stability of PSCs, paving the way for their industrialization and commercial use.

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Keyword: *perovskite solar cells, diketopyrrolopyrrole-based polymeric materials, power conversion efficiency*

Radical Ring-Opening Polymerization of Cyclic Ketene Acetals: A Theoretical Study of Biodegradable Plastics

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Cyclic Ketene Acetals (CKAs) are molecules that can combine the benefits of radical and ring opening polymerization (rROP)[1]. This method can produce polyesters or polymers containing other functional groups with strong yields while maintaining the mild conditions of a radical process[2]. The ability to copolymerize CKAs with conventional vinyl monomers, which adds cleavable functionality to a vinyl-based polymer backbone (e.g. PVC) and enables (bio)degradation, has recently given rROP a new lease of life[3]. The discovery of effective CKA monomers is complicated by the competition between the reactions taking place with ring opening and ring retention[1]. In this study, the radical ring-opening polymerization of N,N-CKA5, N,N-CKA6, N,O-CKA5, and N,S-CKA5 cyclic ketene acetals was investigated in detail by calculations at the M062X/6-31+G(d) level (Figure 1). The modeling shows that the N,S-CKA5 structure can undergo radical ring opening and the thioamide bond can be inserted into the PVC polymer backbone.

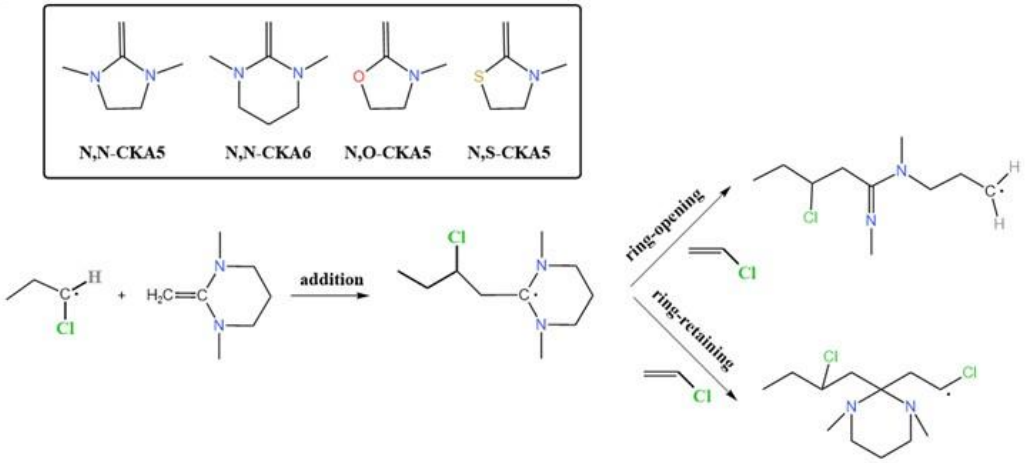

Figure 1. An example of the cyclic ketene acetals (CKA) studied and the mechanisms of radical ring opening and ring retention.

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Keyword: *DFT, Radical Ring Opening Polymerization, Cyclic Ketene Acetals*

Biyomedikal Uygulamalar İçin Agaroz Bazlı Antibakteriyel Kriyojellerin Sentezi ve Karakterizasyonu

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Kriyojeller, biyomedikal ve biyoteknolojik uygulamalarda önemli potansiyele sahip, kriyojenik işlem sonucu oluşan büyük gözenekli yapılar olarak tanımlanır. Monomerik veya polimerik öncüllerden oluşan bu yapılar, özellikle hemostaz, yara iyileşmesi gibi sağlık uygulamalarında kullanılmakta olup, düşük sıcaklıklarda basit ve ekonomik yöntemlerle elde edilebilen jel matrislerdir. Polisakkaritler ise biyolojik olarak aktif özelliklere sahip, doğal kaynaklardan bol miktarda bulunan ve kimyasal olarak değiştirilebilir yapılarıyla doku mühendisliği uygulamaları için önemli biyomateryallerdir. Özellikle polisakkarit bazlı kriyojeller, biyouyumlulukları, geniş ve düzensiz makro gözenekli yapıları, ısıya hassas olmaları, biyomoleküllerin yapısını korumaları ve hücre büyümesi ile doku entegrasyonu için uygun ortam sağlamaları gibi avantajlar sunarak doku mühendisliği ve biyomedikal uygulamalarda önemli rol oynarlar. Agaroz ise doku mühendisliği alanında öne çıkan mükemmel biyouyumluluğu, termo-geri dönüşümlü jelleşme davranışı, yüksek su emme kapasitesi ve hücre büyümesini destekleyen fizikokimyasal özellikleriyle bilinen bir biyomateryaldir. Bu özellikler, agarozun doku yenilenmesi ve rejenerasyonunda etkin bir rol oynamasını sağlar.
Kuaternizasyon işlemiyle elde edilen antibakteriyel kriyojeller, kuaterner amonyum gruplarına sahip polikatyonların yüksek antibakteriyel aktivitesi ile öne çıkarlar. Bu sayede, antibakteriyel ajan yüklemesi gerektirmeyen ve potansiyel toksisite sorunlarına alternatif çözümler sunar. Bu çalışma, agaroz kriyojelin farklı oranlarda kuaternize edilmesiyle elde edilen jelleşme özellikleri, gözeneklilik yapısı, şişme\sıvı emme kapasitesi ve antibakteriyel özelliklerinin incelenmesini hedeflemektedir. Bu çalışma sonucunda geliştirlilen agaroz bazlı kuaternize kriyojeller doku mühendisliği ve biyomedikal uygulamalarında, yara iyileşmesi gibi çeşitli sağlık sorunlarının tedavisinde yenilikçi ve etkili çözümler sunan önemli bir potansiyele sahiptir.

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Keyword: *Biyomateryaller, Kuaternizasyon, Kriyojel*

Development of Sustainable Bio Composites for Automotive, Aerospace, and Leisure Application

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The contemporary composite market is approaching saturation point with regard to petroleum-based composites comprising a matrix and fibers. Nevertheless, there is a notable focus on biobased composites as a means of enhancing the sustainability of commodity resins and reinforcers. The use of renewable raw materials, including glucose, glycerol, and lignin, as well as flax and hemp, as a matrix and reinforcer, respectively, is gaining interest as a means of producing sustainable bio-composites. For example, Epichlorohydrin, a key component in epoxy-based resin synthesis, is currently produced via a petroleum-based polypropylene (route A), which is unsustainable. However, the recent emergence of a biobased alternative, epichlorohydrin derived from glycerol (route B), has gained prominence as a sustainable properties. A comparative analysis of the carbon footprints of two routes reveals that the biobased route exhibits a lower percentage (61%) than the petroleum-based route.
Two primary categories of biobased resin matrices exist. If only biobased epichlorohydrin is utilized in the synthesis of epoxy resin, the final resin is designated as "partially biobased," whereas if both are biobased, the resulting resin is classified as "fully biobased epoxy resin."
As an alternatives to glass, carbon reinforcements; flax and hemp fibers can be employed due to their sustainability properties. There are numerous advantages to utilizing biobased reinforcements.
Renewable Resource: Flax and hemp are plants that can be grown annually, making them renewable resources.
Biodegradability: Natural fibers like flax and hemp are biodegradable, reducing the environmental impact at the end of the product's life cycle.
Lower Carbon Footprint: The production of natural fibers generally requires less energy compared to the energy-intensive processes needed for manufacturing glass and carbon fibers, resulting in a lower carbon footprint.
The production of biobased prepregs consists of 3 stages. The first stage is preparation of biobased resin. The resin system is prepared by mixing the biobased resin with curing agents, hardeners, and additives to achieve the desired properties. The second stage is preparation of biobased resin films. Biobased resin is coated on the siliconized paper to make film. The final stage is impregnation. The biobased fibers are impregnated with the resin using rollers.

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Keyword: *Biobased Epoxy, Natural Fibers, Biocomposites*

ID: 234

Development of Bisphenol-Free Innovative and Environmentally Friendly Chemicals for Textile Processes

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In the context of Green Deal/New chemical strategy the target is to develop means based on renewable raw-materials based, nontoxic color fixing agents for polyamide dyes for textiles worn close to the skin to substitute common Bisphenol (S)containing products. These bisphenol based products are intended to be banned within the framework of the European Union's "New Chemical Strategy"
In the polyamide dye fixative market, bisphenol-(S)/phenol-based products are widely used. The current bisphenol S-based polymer products used contain in between 3000 ppm to 26000 ppm of free Bisphenol S, which is a high burden for the environment and a toxic risk for the consumer.
In commonly used processing Bisphenol S residuals are released to the wastewater. If the wastewater is not cleaned the Bisphenol S will be released to the environment. A highly efficient and rapid development of alternative, renewable bisphenol-free dye fixing product for Polyamide fibers is intended to underpin and support the success of the corresponding REACH restriction, the ECO Design Regulation, the EU-Textile Strategy, etc. and has therefore a high environmental improvement potential in the global textile industry, one of the biggest industries on the globe.
The projects focus a non-fossil, renewable, wood based raw material which is a byproduct of the cellulose production for paper and manmade cellulosic fiber industry. New detected alternative Lignin qualities are such a promising target to achieve the projects goals because it contains aromatic groups which are necessary to fix polyamide dyes but less ionic groups.
Common Bisphenol-S-based fixative products are commonly used in the nylon textile industry. With their aromatic pi electron systems, they interact highly with fabric and dye to form bigger less water-soluble agglomerates and in addition as polymer they close the porous of the polyamide fiber. These two main modes of actions five good performance as a dye fixative.
Polymeric structures with aromatic pi electron systems are almost water insoluble but need to be applied in aqueous condition on the polyamide Fiber/fabric a selected a defined amount of polar ionic groups. These general rules are to be expected also for potential alternatives for such applications based on lignin.

Keyword: *nylon textile, biomaterials, fixing agent*

Investigating the Potential Usage of Bio-based Oil from Algae in the Production of Thermoplastic Elastomer

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Thermoplastic elastomers (TPEs) have gained importance due to their combined properties over conventional rubbers. The main advantage of TPE is its recyclability and low processing cost. Part producers for the automotive industry are evaluating new sources of materials that are derived from sustainable feedstocks. The use of biomaterials may offer several benefits including reduced dependence on limited petroleum sources, competitive pricing, improved environmental footprint, and enhanced performance. Oils derived from renewable and bio-sources have shown promising results in plastic applications such as adhesives and urethanes. The use of algae in plastic production constitutes a strong alternative to other microbial resources. The potential to incorporate algae-based oils in elastomers comes for many reasons;

a) Algae have the ability to capture and store carbon dioxide during photosynthesis. Incorporating algae into polymer production processes can contribute to carbon capture and help reduce greenhouse gas emissions [1,2].

b) The use of oils from algae in elastomers reduces dependence on petroleum-derived raw materials.

c) Algae is a renewable resource that can be grown relatively quickly, unlike oils distilled from petroleum-based which are finite and contribute to environmental problems.

In the literature, it is possible to find researches based on algae-derived polymers such as TPU, EPDM, PLA, PVA, and other intermediate products, nevertheless, there are not sufficient and detailed researches based on styrene-butadiene-styrene block copolymer (SEBS)/polypropylene (PP) blended TPE [1,3-5]. The study aims to investigate the potential of algae based oleic acid oil as a sustainable counterpart of paraffinic technical oils in elastomer compounding and to create an innovative biobased TPE. The usability of oils derived from algae in TPE will be investigated not only with their physical and mechanical performance but also their UV and heat resistivity in specified conditions compared to the paraffinic petroleum-based oil. This study will also discuss the technical challenges and potential future opportunities for using algae oils in elastomer compounds.

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Keyword: *sustainability, thermoplastic elastomer, algae*

ID: 232

PVA-Polysaccharide Hydrogels as Robust Wound Dressings for Oxytetracycline Release

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Hydrogels are three-dimensional, hydrophilic polymer networks that can absorb significant amounts of water or biological fluids. They are primarily used as wound dressing materials, where active ingredients can be loaded into their structure to support the healing process and provide a controlled drug release mechanism [1]. This study, employed the freeze-thaw method to synthesize hydrogels, eliminating the need for potentially harmful cross-linking agents, which is particularly beneficial for biomedical applications. The use of poly(vinyl alcohol) (PVA) in the freeze-thaw method promotes the formation of hydrogels with homogeneous structures, encouraging a balanced distribution of water and active ingredients, thus providing a cost-effective and easily applicable synthesis process. However, using this method, hydrogels made with PVA typically exhibit low mechanical strength. For applications demanding higher mechanical strength, PVA hydrogels should be reinforced with alternative polymers or cross-linked versions [2].

In this study, the physical properties of PVA hydrogels, including swelling ratios and mechanical strength, were improved through physical cross-linking with various polysaccharides. This optimization process included investigating different PVA/polysaccharide ratios, molecular weights, and freeze-thaw cycle numbers, as confirmed by gravimetric measurements of swelling capacity and mechanical tests. In the subsequent stages of the study, oxytetracycline was loaded into the optimized hydrogels. Oxytetracycline is an antibiotic that inhibits bacterial protein synthesis by binding to the bacterial ribosome. Dermal applications of oxytetracycline in hydrogels offer significant advantages for treating infected wounds, providing controlled release that enhances drug effectiveness while minimizing side effects and systemic toxicity. Direct application to the affected area promotes faster healing, supported by the moisturizing effect of hydrogels that prevents wound drying and improves healing conditions, reducing infection risks [3]. In the study, hydrogel structures with optimized properties were loaded with the antimicrobial agent oxytetracycline. The release dynamics of oxytetracycline from the hydrogel matrix were investigated over time under varying temperatures and pH levels, alongside the influence of polysaccharide addition to PVA hydrogels.

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Keyword: *Poly(vinyl alcohol) (PVA), Hydrogel, Oxytetracycline*

ID: 229

Yenilenebilir Manyetik Biyokompozit ile Safranin-O Adsorpsiyonu

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Yaşamın sürdürülebilirliği için bütün canlıların en temel ihtiyacı sudur. Artan nüfus ve beraberinde gelişen farklı sektörel faaliyetler su talebinin her geçen gün artmasına neden olmaktadır. Tarım, endüstri ve evsel faaliyetlerde 1900' lü yıllardan 2000 yılına kadar 0,67 trilyon m^3/yıl'dan 3,79 trilyon m^3/yıl'a yükselmiştir. Bu rakamın 2050 yılında %55 oranında artacağı tahmin edilmektedir. İklim değişiklikleri sonucu da kullanılabilir su miktarında azalmalar meydana gelmektedir[1]. Bütün bu nedenlerden dolayı mevcut kullanılabilir suyun talebi karşılayabilmesi için temiz formunun korunması elzemdir, ancak özellikle endüstriyel faaliyetler sonucunda oluşan atık sular temizlenmeden doğaya bırakıldığında doğa ve canlılar için ciddi tehdit oluşturmaktadır. Bu faaliyetlerin büyük oranını boya içerikli üretimler gerçekleştiren gıda, kağıt, tekstil, deri ve boya gibi farklı endüstrilerin faaliyetleri oluşturmaktadır. Boyaların su sistemine karışması, sucul yaşamı, insan sağlığını olumsuz etkilemektedir [2]. Bu bileşenlerin sulardan farklı yöntemlerle uzaklaştırılması, su ve doğa kirliliğini önleyerek, kullanılabilir suyun sürdürülebilirliğine önemli katkı sağlamaktadır. Literatürdeki farklı giderim yöntemleri arasında basit, kolay uygulanabilir adsorpsiyon yönteminde; biyouyumluluk, toksik olmama, sürdürülebilirlik gibi avantajları ile selüloz gibi doğal polimerlerin boyaların sulardan uzaklaştırılmasında adsorban olarak kullanılabilirliği son yıllarda araştırmacılar tarafından ilgi odağı olmuştur[3,4].
Bu çalışmada hazırlanan selüloz tabanlı multifonksiyonel manyetik biyokompozitin tekstil, gıda, farmasotik ve biyokimya endüstrilerinde kullanılan katyonik Safranin-O boyasının sulardan uzaklaştırılmasında adsorban olarak kullanılabilirliği araştırıldı. Bu amaçla adsorpsiyona adsorban miktarı, pH, süre, derişim etkisi ve geliştirilen adsorbanın tekrar kullanılabilirliği detaylıca araştırıldı. Yapılan çalışmalar ve özellikle ardışık tekrarlanan 20 adsorpsiyon/desorpsiyon sonuçları adsorbanın Safranin-O boyası için etkin bir adsorban olduğunu göstermiştir.
Bu çalışma Yozgat Bozok Üniversitesi Bilimsel Araştırma Projeleri birimi tarafından FDK-2024-1309 kodlu proje ile desteklenmiştir

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Keyword: *Manyetik Biyokompozit, Adsorpsiyon, Safranin-O*

Effect of Silane Additive Ratio on the Properties of Polyurethane Coatings

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Continuous advances in the formulation and processing techniques of polyurethane (PU) coatings include protection against environmental factors as well as aesthetic appearance. The strong bonding formed by silanes increases the durability of the coating as it is highly resistant to damaging conditions such as moisture and heat. Additionally, many studies show that the presence of silane groups in the polymer matrix increases the corrosion resistance of coatings on steel and aluminum surfaces. In this study, the formulation of PU coating containing polyethylene glycol 600 (PEG600), isophorone diisocyanate (IPDI) and trimethoxysilylpropylcarbamoyloxyhexane (TMSCH) silane-based additive was optimized to obtain a highly scratch-resistant coating. The change in the properties of the coatings was studied by changing the TMSCH content in the coating formula from 1.5 to 43.1 wt%. Adding 43.1 wt% TMSCH to the PU formulation resulted in a significant improvement in scratch resistance and wettability properties compared to pure PU film. Homogenously prepared micron-thick coatings were characterized using scanning electron microscopy (SEM) analysis and Fourier transform infrared spectroscopy (FTIR). The results confirm the presence of silane additives in the PU coating matrix. By increasing TMSCH in the PU formulation, mechanical properties improved due to the increase of cross-linking networks through the formation of urethane bonds. While PU coating without silane additive showed hydrophilic properties and fractured surface morphology, the surface properties of PU coatings improved with the increase of silane additive. The prepared PU coating showed combined properties such as transparency, hydrophobicity, scratch resistance and mechanical strength, making it a promising candidate for white goods applications.

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Keyword: *coating, polyurethane, silane*

ID: 219

Optimum Conditions of Plasticizers Used in Wood-Based Pencil Paints

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Wood-based pencils are produced by processing trees grown specifically for pencil production. These woods, which are processed and cut into pencil size, are called slats. Paint is applied to wood-based pencils to always obtain the same visual and high-quality slats, to make the pencils last longer and to look more attractive to users. Paint can be of a certain thickness and can be water or solvent based. Whether it is solvent or water based, the raw materials and additives to be used must be selected according to the solvent system. Paint additives, thickeners, UV agents, defoamers, deaerators, surface agents, plasticizers and many other raw materials that will make the paint better are used. Since the pen paint comes into direct contact with the human hand, it should provide an ergonomic feeling when holding it. Because of this reason filling materials are added to pencil paints. With the addition of filler materials, the body paint reaches a harder structure and cracking occurs in the pencil paints after moisture. To prevent this situation, it is necessary to make the paint more elastic and plasticizing agents are used at this stage. Plasticizers reduce the viscosity while increasing the softness and flexibility of the material to which it is added. Within the scope of this study, plasticizers are added to body paints at certain rates in order to prevent body paints from cracking after moisture and to develop a more flexible surface. A plasticizer concentration study was conducted to determine the optimum ratio and to see what effect it has on the paint when the amount of plasticizer changes. It has been determined how different proportions and suitable plasticizer materials affect viscosity, surface adhesion and cracking in the paint mixture.

Keyword: *Pencil, Coating, Plasticizer*

ID: 218

Synthesis of Biobased Monomers for the Waterborne Acrylic Binders to Provide Water Repellent Coating Without the Use of PFAS

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Per- and polyfluoroalkyl substances (PFAS) are both hydrophobic and oleophobic, effective surfactants or surface protectors. PFAS have attracted worldwide attention in the scientific and regulatory community and among the public due to their persistency and high mobility in air and water [1]. Therefore, chemicals having a chronic effect for human health and environment must be substituted, particularly, in consumer products to move towards a toxic-free environment. In this study, to achieve the main objective, new organic and hybrid free toxic coatings with water and oil repellence that are biobased, safe and environmentally-friendly is being developed as an alternative to the perfluorinated chemicals.

In this study, polydimethylsiloxane (PDMS) and polyhedral oligomeric silsesquioxane (POSS) functionalized biomonomers were synthesized by hydrosilylation reactions [2] between acrylated soybean oil to provide water and oil repellency. The kinetic of the hydrosilylation was monitored through FTIR, the functionalization degree was monitored by ^{1}H NMR.

The coating will be applied by different industrial processes depending on the industrial field and validating in industrially relevant environments to obtain a performance at least identical to PFAS coatings in terms of water and oil repellence and tested according to the main textile, packaging and kitchenware specifications. This project (TORNADO) is supported by EU under grand agreement 101091944.

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Keyword: *polyfluoroalkyl, polydimethylsiloxane, hydrophobicity*

ID: 216

Increase the Moisture Resistance of Polyamide 5,6 Compound by Chemical Additives

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Among the biobased polyamides, polyamide 56 (PA56) shows excellent solvent resistance, high tensile strength, high flame resistance. Therefore, PA 56 can be efficiently used in automotive plastics and membrane technologies. Despite of its superior material properties, PA 56 has limited thermal stability and high moisture absorption profiles. There have been various studies based on the improvements of the mechanical properties and the thermal resistance of PA56. [1-3] Anti-moisture absorption capability of PA 56 and its polymer composites containing macromolecular heat/moisture-resistant agents, p(N-(4-F-phenylmaleimide)-alt-styrene) (PFS) and p(N-(4-F-phenylmaleimide)- alt-triallyl isocyanurate) (PFT) have been reported by He et al. [4] According to report, moisture uptake was decreased by 14.6% and 15.5% respectively, when PFS and PFT were used by the additive ratio of 10 %. Here, we have reported that addition of the selecting chemicals in PA56 compound can decrease the its moisture absorption ratio. The selected chemicals are selected supramolecular moieties and high molecular weight saturated hydrocarbons. The main goal of using the supramolecular moieties is to prevent the deep penetration of the water molecules inside PA 56 by their noncovalent interaction capabilities. The experimental results show that PA 56 compounded with 0,5 % of selected supramolecular system has 11,8 % lower moisture uptake than the pure PA 56. The data confirm that a remarkable reduction in the moisture absorption was gained in PA 56 with a 20 times lower additive content compared to the literature. The moisture uptake ratio can be increased with an increased concentration of cyclodextrin in PA 56. The ongoing works aim to decrease water uptake by the optimization studies in the selected supramolecular and saturated hydrocarbons.

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Keyword: *polyamide 5,6, cyclodextrin, N,N' ethylene bis-stearamide*

Stiren ve Metil Akrilat İçin Silan-en Polimerizasyonunun DFT İncelenmesi

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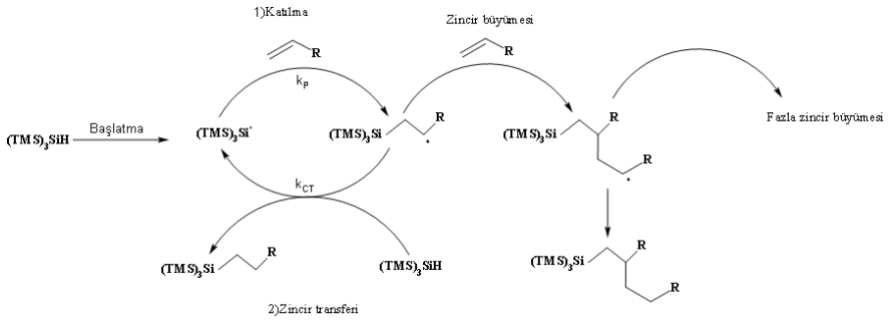
Bu çalışmada silan-en polimerizasyonunun ayrıntılı bir kuantum kimyasal incelemesi gerçekleştirilmiştir. Tris(trimetilsilil)silan radikali (TTMSS) ile stiren (STY) ve metil akrilat (MA) monomerleri arasındaki reaksiyonları modellemek için M06-2X/6-31+G(d,p) ve wB97XD/6-31+G(d,p) teori seviyeleri kullanılmıştır. Silan-en polimerizasyonu için en önemli adımlar olduğu öngörülen katılma ve zincir transferi tepkimeleri mekanizması Şema 1'de verilmektedir. Her monomer için katılma (k_p) ve zincir transfer hız sabitleri (k_{CT}) hesaplanarak, monomerlerin silan-en polimerizasyonu için uygunluğu hakkında bilgi veren kp/k_{CT} oranı tespit edildi. Mekanizmadaki radikal türlerin radikal kararlılık enerjileri (RSE) ve monomerlerin singlet-triplet enerji farkları (ΔE_{S-T}) hesaplanarak, bu monomerlerin reaktivite farkları ve reaksiyon hızları belirlendi. Hem STY hem de MA'nın TTMSS ile polimerizasyon için uygun monomerler olduğu sonucuna, STY'nin k_p/k_{CT} oranı yaklaşık 10^4 iken MA'nınki yaklaşık 45 ve zincir transfer hız sabitleri 10^3 L/mol·s'den büyük olduğu verilerine dayanarak tespit edildi. (Mekanizmanın en iyi performansı için k_p/k_{CT} oranının 1'den büyük olması gerekmektedir, kp/k_{CT} oranı ne kadar yüksek olursa, silan-en polimerizasyon verimi o kadar iyi olur.)



Şema 1. Silan-en polimerizasyonunun genel şeması.

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Keyword: *Silan-en polimerizasyon, Yoğunluk-Fonksiyonel Teorisi (DFT), Stiren*

Preparation and Characterization of Biogels for Soft Tissue Engineering

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Purpose/Objectives:
The superior properties of double-network (DN) hydrogels are attributed to i) the presence of a strong covalent network that can maintain the structural integrity of the hydrogels and ii) a reversible and ion-mediated network that can break upon mechanical loading to dissipate energy.[1] The aim of this study was to develop mechanically robust next-generation biogels derived from natural sources. These hydrogels were designed to form ionic reversible crosslinking and covalent networks with alginate methacryloyl (AlgMA) and dopamine methacryloyl (DopaMA), a catechol-containing compound. This combination can enable the repair of soft tissues and effectively distribute fracture energy under stress.

Methodology:
The alginate and dopamine were subjected to methacrylation to obtain methacryloyl alginate (AlgMA) and methacryloyl dopamine (DopaMA). AlgMA-DopaMA hydrogels were cured to a certain extent using a visible light photoinitiator with FDA-approved LED light. They were then immersed in $FeCl_3$ at different concentrations (0.1M, 0.5M ve 1M) for ionic crosslinking.

Results:
Increasing the $FeCl_3$ concentration led to reductions in degradation and swelling levels. At the highest $FeCl_3$ concentration, a more porous structure was obtained. Increasing the concentration of $FeCl_3$ also enhances the crosslinking points, thereby increasing the strength of the hydrogel. The compressive strength results indicated that hydrogels containing a higher concentration of $FeCl_3$ showed increased compressive strength compared to the control hydrogel. The chemical, physical, and mechanical properties were determined to understand their usability for soft tissue engineering.

Conclusion/significance:
In this study, biocompatible BioGel structures with mechanical properties similar to those of stretchable tissues were prepared and characterized. The findings of this study provide promising results for the development of biogels that can mimic the microenvironment of soft tissues, such as the natural lung.

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Sun, J.Y., et al., Highly stretchable and tough hydrogels. Nature, 2012. 489 (7414): p. 133-136.

Keyword: *Biogel, Algma, Dopama*

ID: 211

Synthesis of Halogene Substituted Novel Quinoxaline-based Conjugated Polymers for Organic Solar Cell Aplications

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Benzodithiophene (BDT)-based polymers offer significant advantages in solar cell technology due to the ability to efficiently absorb a wide range of solar photons, thereby enhancing light harvesting efficiency, and quinoxaline-based D-A copolymers, featuring an electron-deficient nitrogen-containing backbone, effectively adjust energy levels and reduce copolymer bandgaps. Moreover, it has been observed that halogen substituents have a dual impact which includes improving the open-circuit voltage (V_{OC}) by lowering the highest occupied molecular orbital (HOMO) levels of the polymers and also influencing V_{OC} in organic solar cells (OSCs) by reducing the binding energy of charge transfer excitons (CTEs). In this study, the benzodithiophene-based donor molecule and selenophene π-bridged quinoxaline-based novel acceptor molecule were polymerized by a Stille crosscoupling reaction to produce six donor conjugated polymers.(P1F ,P2F ,PCL ,P1FS ,P2FS ,PCLS) The polymers possessed the highest occupied molecular orbital (HOMO) levels ranged −5.13 to −5.47 eV , which covered broad absorption ranges with low optical bandgaps (1.67-1.72 eV). The GPC analyses of the synthesized polymers P1F, P2F, and PCL revealed the following molecular characteristics; P1F has a number-average molecular weight (Mn) of 7736 kDa and a weight-average molecular weight (Mw) of 10554 kDa, with a polydispersity index (PDI) of 1.36. For P2F, the Mn is 22676 kDa, Mw is 27812 kDa, and PDI is 1.23. PCL has an Mn of 13152 kDa, Mw of 28312 kDa, and a PDI of 2.15. Each synthesized polymer features a BDT core with alkyl-substituted thienothiophene side chains and a quinoxaline core. The side chain of BDT varies in sulfur (S) atom content, while the quinoxaline core is modified with different halogen atoms (Cl and F). The primary objective of the work is to investigate the characteristics of Ternary Organic Solar Cells (TOSCs) by adding Cl and F atoms to the main chain of the quinoxaline-based acceptor. The polymers were examined through optical and electrochemical analyses. TOSCs, which feature an active layer comprising a combination of conjugated donor-acceptor polymers and either fullerene-based or non-fullerene acceptor materials, are intended to be fabricated in a glovebox setup. The current-voltage characteristics of fabricated devices are planned to be evaluated with the aid of a solar simulator illuminated by AM 1.5G light.

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Keyword: *bdt, quinoxaline, halogens*

Synthesis of Thiophene Π-Bridge Modified Benzodithiophene and Quinoxaline Based Conjugated Polymers for Organic Bulk Heterojunction Solar Cell Applications

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The development of clean and renewable energy technology is heavily dependent on the conversion of solar energy into electrical energy. OSCs (Organic Solar Cells) are brought to the forefront compared to other solar cell technologies due to their cost-effectiveness, adaptability, and suitability for mass production. In this study, benzodithiophene and quinoxaline-based conjugated polymers were synthesized through Stille cross-coupling reactions, and the effects of mono-fluorinated, double-fluorinated, and chlorinated structures on quinoxaline were investigated. The introduction of fluorine atoms into the conjugated side chains of the polymers was found to improve V_{oc} by lowering the HOMO energy level, and both fluorination and chlorination have the potential to lower the LUMO and HOMO levels. The synthesized polymer P2FQ has a 1.98 eV optical bandgap, M_n value is 3622 kDa, M_w value is 4964, and PDI value of 1.37. According to the cyclic voltammetry results the polymer has a 2.13 eV electronical bandgap. In the scope of these analyses, it is possible to state that the mentioned polymers have the potential to construct highly efficient organic solar cells. The structural properties of the synthesized polymers are characterized by using Nuclear Magnetic Resonance (NMR), Gel Permeation Chromatography (GPC), and Infrared Spectroscopy (IR). Their optical and electrochemical properties are investigated by using UV-Vis Spectroscopy and Cyclic Voltammetry (CV). Organic solar cells, whose active layer is composed of a combination of conjugated polymers and acceptor materials, will be constructed in a glovebox system filled with nitrogen. The devices' current-voltage properties will be studied using a solar simulator that emits AM 1.5G light. The short circuit current density (J_{sc}), open circuit voltage (V_{oc}), fill factor (FF), and power conversion efficiency (PCE) characteristics will be determined using the collected current-voltage curve.

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Keyword: *Polymer, Solar Cell, Thiophene*

ID: 208

Suda Çözünebilen Polimerler İçin HPLC ile Sodyum Klorür Analizi

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Polimer Sentezlerinde ara ürün ve/veya safsızlık olarak ortaya çıkabilen Sodyum Klorür (NaCl) tayini önem kazanmaktadır. Sodyum Klorür tayini için birçok analitik metot bulunmaktadır. Bunların en yaygın gözlemleneni titrasyon metodudur.Bu çalışmada HPLC(Yüksek Performanslı Sıvı Kromatografisi) enstrumental cihazı kullanılmıştır. Polimer sentezinde sodyum klorür analizi için kromatografik metodun tercih edilmesinin amaçları; titrasyon metodunda insan kaynaklı oluşabilecek hataların önüne geçmek, titrasyon metodunda kullanılan kimyasalları kullanmayıp daha az zararlı kimyasallar kullanarak zararlı kimyasal kullanımını azaltmak ve kromatografi genellikle yüksek hassasiyet sağladığı için daha hassas sonuçlar elde etmektir. Farklı nokta konsantrasyonlarına göre Kalibrasyon Doğrusu oluşturulmuş olup metot geçerli kılınması için çalışmalar yapılmıştır. Çalışmada gözlemlenen avantajlar, bireysel hataların ve kullanılan kimyasal çeşitliliğin azaltılmasıdır.

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Keyword: *NaCl, Polimer, Kromatografi*

Dual-Responsive Nanoplexes for Synergistic Combination Therapy Against Melanoma

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Among all cancers, skin cancer is one of the most prevalent worldwide. Melanoma is the cause of 75% of skin cancer deaths even though it only makes up 3-4% of all occurrences of the disease. [1] Patients with melanoma can receive therapy if they are diagnosed early, but at more advanced stages, traditional treatment plans are ineffective. The treatment of melanoma requires the development of more potent agents and regimens. RNAs (RNAs) based treatments such as gene silecing via short non-coding RNAs such as micro-RNAs (miRNAs) have attracted more attention due to their inherent benefits and potential for treating malignant melanoma. [2] Certain miRNAs can create oncogenic effects and inhibition of miRNAs via miRNA inhibitors (miRNAi) increases chemosensitivity and reduces invasion and metastasis of cancer cells. Inhibition of miR-21 is a important target that has high potential for an effective treatment opportunity in metastatic melanoma. [3]

The effectiveness of their therapeutic action is heavily reliant on how well their delivery system with high cellular permeability and biocompatibility delivers them into the cytoplasm. Delivery-system can put together photodynamic therapy (PDT), photothermal therapy (PTT), and chemotherapy agents to improve efectiveness of treatment and prevent multiple drug resistance and poor cellular internalization. Nonetheless, the main challenge in maximizing the effectiveness of combinational treatments is the lack of suitable codelivery techniques that offer efficient endo/lysosomal escape and controlled drug release/gene unpacking.

Herein, biomimetically generated cationic glycopeptide nanocarrier systems were synthesized via condensation of sugar and peptide monomers. Protoporphyrin IX (PpIX) was coupled with glycopeptide polymers to create a photosensitizer (PS) for photodynamic therapy. Micellar formulations were created by encapsulating chemotherapeutic agents (Paclitaxel, PTX) and then integrating an oncogenic micro-RNA inhibitor (miR-21i) into the nanocarrier system. The pH microenvironment in tumor cells triggers the progressive degradation of the proposed delivery system, which results in its intracytoplasmic release features and optimal combination therapeutic efficacy for PTX/miR-21i. Additionally, the PS can mediate PDT in conjunction with the production of reactive oxygen species (ROS) in response to applied light irradiation.

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Keyword: *Photodynamic Theraphy, Combination Therapy, Melanoma*

ID: 202

Yalıtım Sektörüne Yönelik Melamin- Formaldehit Köpük İçin Reçine Formülasyonun Geliştirilmesi ve Köpük Kompozisyonun Hazırlanması

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MF köpüğü, ısıya dayanıklılık, ses emilimi, sağlık güvenliği, düşük duman, korozyon direnci, kolay işlenme vb. avantajlara sahiptir.[1] MF reçinesi, formaldehit ve melaminin uygun sıcaklıkla polikondenizasyonu ile elde edilen, farklı zincir uzunluklarında metilol sonlu prepolimer karışımıdır. Genellikle suda çözünebilir prepolimerler yüksek sıcaklıklarda metilen veya eter köprüleri üzerinden çapraz bağlanarak MF reçinesine dönüşür. Muadillerine göre kısa zincirli prepolimerlerden oluştuğundan köpüğün korunabilmesi için prepolimer zincir uzunluklarını ya da reçine karışımındaki prepolimer oranını (katı içerik) artıracak polimer sentezi gerçekleştirilmelidir. Özellikle metilollenen reçineler, polimerizasyon derecelerine göre suda çözünebilirliğini kaybedebileceğinden hem su-yağ dengesini sağlayabilecek hem de dispersiyon özelliği olan sürfaktanların seçilmesi önemlidir. Bu çalışmada Melamin formaldehit prekondensat sentezi için gerekli olan parametreler, kullanılacak sürfaktan ve ko-sürfaktan, köpük yapıcı ajan ve oranlar üzerinde çalışılmıştır. 5 Farklı sürfaktan konsantrasyonlarının reçinenin sentez verimine ve kürlenme sıcaklığına etkisi incelenmiştir. Literatür araştırmalarından anlaşıldığı üzere sürfaktan konsantrasyonu ve kullanılan köpük yapıcı ajan miktarının, hücresel dağılımın sağlanmasında önemli etkileri vardır. Bu kapsamda literatür verilerine göre uygun köpük dağılımı için minimum %2 sürfaktan konsantrasyonu baz alınmıştır.[2] Denemelerde; prekondensat sentezi iki aşamalı yapılmıştır. M:F oranı 1:3,25 en uygun reçete olarak belirlenmiştir. Başlangıç pH 10 ve reaksiyon süresi 3 saat olarak belirlenmiştir. SFA, %1' in altına indirilmiştir. Polimerizasyon derecelerine bakıldığında, metilollemenin başarıldığı gözlenmiştir. Nonil fenol etoksilat- 4 ilavesi ile sentezlenen reçinenin raf ömrünün diğerlerinden daha uzun olduğu belirlenmiştir. Köpük denemeleri 30*30*15 cm' lik kalıpta yapılmıştır. SDBS oranının ağırlıkça % 1-2'si, köpük yapıcı ajan oranının, reçine ağırlığının ağırlıkça % 12-16' sının, karıştırma hızının 1200 devir, süresinin 120 s, Ortam sıcaklığının 23-25 ^{0}C olduğunda kürlenme sıcaklığının 110-115 ^{0}C ve kürlenme süresinin 15-20 dk olarak belirlenmiştir. Ulaşılan köpük analiz sonuçları ise; Termal iletkenlik: Düşük, Ses Absorplama> %91, Yanmazlık testi: V- 0(UL 94), Gözenek Dağılımı>%95 Açık hücreli/Homojen şeklindedir. Köpük formülasyonundaki hedeflenen değerdeki farklılıklar, kullanılan sisteme göre son kullanıcı isteğine göre, köpük üreticisinin üretim sistemine göre ve ilave katkılara göre değişebilmektedir.

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Keyword: *Melamin-formaldehit prepolimer reçine, Yalıtım, Melamin-formaldehit köpük*

İç Organ Yaralarının İyileştirilmesi İçin Esnek Biyo-Yapışkan Olarak Fe+3 ile Çapraz Bağlanmış Foto-Çapraz Bağlanabilir Katekol Konjugat Hibrit Kompozit Hidrojellerin Geliştirilmesi

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Bu çalışmada, mekanik özellikleri ve biyouyumluluğu artırılmış yenilikçi bir biyoyapıştırıcı kompozit malzeme olan Fe+3 ile çapraz bağlanmış GelMA-I AlgMAC'in sentezi ve karakterizasyonu sunulmaktadır. Jelatin metakriloyl (GelMA) malzemesi izosiyanat ile kimyasal olarak modifiye edilerek GelMA-I elde edilmiştir. Bu modifikasyon, malzemenin çapraz bağlanma yeteneklerini ve mekanik dayanımını artırmaktadır. Aynı zamanda, aljinat metakrilat (AlgMA), dopamin aracılığıyla katekol grupları ile fonksiyonelleştirilerek AlgMAC oluşturulmuştur. GelMA-I ve AlgMAC'in hibritlenmesi ile üstün bir biyoyapıştırıcı malzeme geliştirilmiştir.
Hibrit hidrojellerin mekanik dayanımını ve yapışma mukavemetini artırmak amacıyla, geleneksel Ca+2 iyonları yerine dinamik ve tersinir çapraz bağlanma özelliğine sahip Fe+3 iyonları kullanılmıştır. Fe+3 iyonları, Ca+2 iyonlarına kıyasla daha güçlü çapraz bağlar oluşturur ve bu da malzemenin hem tokluk hem de yapışma özelliklerini önemli ölçüde iyileştirir (1,2). Fe+3 iyonlarının etkinliğini değerlendirmek için NaIO4 püskürtme yöntemi de denenmiş, ancak Fe+3 iyonlarının, NaIO4'e kıyasla daha üstün yapışma mukavemeti ve mekanik dayanım sağladığı gözlemlenmiştir.GelMA-I AlgMAC kompoziti, mekanik testlere tabi tutulmuştur. Özellikle patlama basıncı testleri, bu kompozitin modifiye edilmemiş GelMA'ya kıyasla üstün performans sergilediğini göstermiştir. Fe+3 iyonları ile çapraz bağlanmış hibrit hidrojeller, büyük gerilim altında bile yüksek yapışma mukavemeti ve dayanıklılık sergilemiştir. Bu sonuçlar, GelMA-I AlgMAC'in biyoyapıştırıcı olarak kullanılabileceği çeşitli biyomedikal uygulamalarda, özellikle cerrahi müdahalelerde güçlü ve güvenilir doku yapışması sağlama potansiyelini ortaya koymaktadır (2).AlgMA'nın katekol grupları ile fonksiyonelleştirilmesi, kompozitin yapışkan özelliklerini artırmıştır (3). Katekol grupları, biyolojik ve sentetik yüzeylerle güçlü yapışma etkileşimleri sağlar ve bu da biyoyapıştırıcının genel performansına önemli katkıda bulunur (3, 4). Fe+3 iyonlarının kullanımı, malzemenin daha stabil ve mekanik olarak dayanıklı bir ağ oluşturmasını sağlamış ve bu sayede hem yapışma hem de tokluk özellikleri iyileştirilmiştir (4). GelMA-I AlgMAC'in biyouyumluluğu in vitro hücre kültürü çalışmaları ile değerlendirilmiştir. İlk sonuçlar, bu kompozitin hücre yapışması ve çoğalmasını desteklediğini göstermektedir. Mekanik dayanım, yapışma ve biyouyumluluk gibi özellikler, GelMA-I AlgMAC'i biyoyapıştırıcı uygulamaları için umut verici bir aday haline getirmektedir.
Sonuç olarak, Fe+3 iyonları ile çapraz bağlanmış GelMA-I AlgMAC'in geliştirilmesi, biyoyapıştırıcılar alanında önemli bir ilerlemeyi temsil etmektedir. İzoyanat ile modifiye edilmiş GelMA'nın katekol fonksiyonlu AlgMA ve Fe+3 iyonları ile birleştirilmesi, üstün mekanik özellikler ve biyouyumluluk gösteren bir kompozit malzeme ortaya çıkarmıştır. Klinik ortamlarda tam potansiyelini keşfetmek için daha fazla çalışmaya ihtiyaç duyulmaktadır.

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Keyword: *GelMA, izosiyanat, AlgMA, katekol, Fe+3, NaIO4, biyoyapıştırıcı, mekanik özellikler, biyouyumluluk, kompozit malzeme.*

ID: 77

Preparation of Macrophage-Targeted PLGA Nanoparticles for the Delivery of Vitamin E Derivatives to Treat Atherosclerosis

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Inflammation is a defence mechanism of the body against pathogens, infections, and tissue injury. There are several reasons that induce inflammation, and it has to be resolved properly since the persistence of inflammation leads to chronic inflammatory diseases such as atherosclerosis (1,2). Macrophages, as immune cells, play a crucial role in controlling the initiation and progression of inflammation and immunological processes (3). In this study, macrophage-targeted anti-inflammatory vitamin E metabolites containing poly(lactic-co-glycolic acid) (PLGA) nanoparticles (NPs) were developed against atherosclerosis. Two different anti-inflammatory drug molecules, garcinoic acid (GA) and α-13'-COOH, were separately used. The S2P peptide, which specifically binds to the stabilin-2 receptors overexpressed on macrophages, was synthesized as a targeting agent (4,5). The peptide was then linked to the PEGylated lipid (DSPE-PEG), and the resulting DSPE-PEG-S2P was utilized as a targeting conjugate. NPs were synthesized by the nanoprecipitation method via self-assembly, resulting in monodisperse and stable NPs within the desired diameter range. The addition of the positively charged S2P peptide caused shifts in the zeta potential values towards the positive side, demonstrating the successful conjugation of targeting agents onto the surface of the NPs. Additionally, the drug encapsulation efficiency ranged from 72.03% to 80.40% when the drug was α-13'-COOH, while it ranged from 18.82% to 20.52% when the drug was GA. The presence of the targeting agent was validated by analysing the net protein concentration using a Nanodrop device. The smooth and spherical morphology of the NPs was confirmed using SEM, while the presence of coating layer around the NPs was observed with TEM. Furthermore, drug release studies demonstrated that drug release was higher at pH 5.5 than at pH 7.4, with prolonged and sustained release achieved in the acidic inflammatory environment. Additionally, dual-labelled NPs were also synthesized using both PLGA-RhB and DSPE-PEG-FITC for imaging purposes. Consequently, optimized macrophage-targeted PLGA NPs loaded with various vitamin E metabolites were successfully synthesized for treating atherosclerosis-induced inflammations.

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Keyword: *Inflammation, Macrophage, PLGA nanoparticles*

Design and Synthesis of a New Thiazolothiazole and Thienothiophene Containing Donor-Acceptor Type Conjugated Polymer for Organic Solar Cell Applications

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The primary concern of civilizations is the energy demand. Since non-renewable energy sources account for most of this urge, the resources are limited. Thus, expanding the array of renewable energy sources is crucial to guarantee the sustainability of energy-consuming operations that maintain nearly everything. Among all those renewable energy sources, photovoltaic solar cells (OSCs) are one of the most appealing, considering their low manufacturing costs and readily commercializable features, including flexibility and easy processing. Polymeric donor units, blended with electron acceptor units to form the photoactive layer of OSCs, are one of the most crucial components. Owing to their low production costs, oligothiophenes are a highly investigated class of polymers, yet their low power conversion efficiency (PCE) led to their disfavor in commercialization. An article has reported a breakthrough: when blended with non-fullerene acceptors, thiazolothiazole (Benin et al., 2009) containing oligothiophene based polymers has reached up to 16 % PCE (Yin et al., 2022), indicating their acceptability to the market again. The study additionally demonstrates that blend morphology improves with increasing polymer planarity and crystallinity, leading to greater PCE values. Thus, by taking benefit of the structural similarities among the donor and acceptor moieties, a new thiazolothiazole and a thienothiophene containing D-A type conjugated polymer have been synthesized in this research to improve the crystallinity and planarity of the polymer chain in blend film, thanks to its state of the art molecular design. When combined with non-fullerene acceptors, the polymer is expected to function with a higher PCE value and be even more eye-catching while remaining economically viable for commercialization.

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Keyword: *Organic solar cell, Thiazolothiazole, conjugated polymer*

ID: 408

Investigation of Electrokinetic and Antimicrobial Properties of Zn-Ferrite/Chitosan Composites

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In this study, magnetic zinc ferrite ($ZnFe_2O_4$) particles were synthesized by co-precipitation method. By preparing composites of zinc ferrite particles in the presence of chitosan and boric acid, environmentally friendly composites ($ZnFe_2O_4$/CS-H_3BO_3) were obtained with advanced properties. Characterizations of the synthesized materials were carried out by ATR-FTIR, XRD, TGA, SEM-EDS and TEM analyses. Magnetic properties of the composites were determined by VSM analysis. Electrokinetic properties of the materials were realized through zeta (ζ)-potential measurements in aqueous medium using different parameters (i.e., various pH, salts, surfactants and temperatures). Additionally, antimicrobial activities of $ZnFe_2O_4$ and $ZnFe_2O_4$/CS-H_3BO_3 composite particles were determined by the inhibition zone method using some Gr+ and Gr- pathogenic bacteria and fungi.
According to the ATR-FTIR spectra, characteristic peaks belonging to the both $ZnFe_2O_4$ and $ZnFe_2O_4$/CS-H_3BO_3 structures were determined. XRD results revealed that $ZnFe_2O_4$ has a more crystalline structure than $ZnFe_2O_4$/CS-H_3BO_3 composite due to the presence of amorphous chitosan structure. TGA results demonstrated that thermal stability of the composite was higher than bare chitosan and showed approximately 65% thermal stability at the end of 800ºC. SEM results exhibited that ferrite surface is covered by chitosan particles by converting the surface to a smoother structure with smaller grains. EDS spectrum pointed out the presence of C, N, Zn and B atoms in the composite structure as aimed. TEM results depicted that $ZnFe_2O_4$ particles are covered with chitosan and their dimensions are approximately 20-30 nm. Magnetic VSM results suggested that $ZnFe_2O_4$ particles have shown decreasing magnetization after the formation of $ZnFe_2O_4$/CS-H_3BO_3 composite due to the interactions with CS and H_3BO_3 units.
According to the electrokinetic studies, zeta (ζ)-potential of $ZnFe_2O_4$ changed in the range of +20 mV>ζ>-36 mV at pH=3-13 (IEP pH=6.2). However, (ζ)-potential of $ZnFe_2O_4$/CS-H_3BO_3 was constant as +57 mV at pH=3-13 which is attributed to the presence of polycationic chitosan. The highest (ζ)-potential value was obtained with the presence of three valence $AlCl_3$ ($\zeta_{pH=3}$=+43 mV for $ZnFe_2O_4$, and $\zeta_{pH=3}$=+56 mV for $ZnFe_2O_4$/CS-H_3BO_3). Finally, antibacterial experiments revealed that both $ZnFe_2O_4$ and $ZnFe_2O_4$/CS-H_3BO_3 particles showed higher antibacterial activity than readily available and commercially used Ampicillin/Sulbactam and Amikacin against B. Subtilis bacteria. Also, $ZnFe_2O_4$/CS-H_3BO_3 showed high antibacterial activity against S. Aureus. In terms of antifungal effect, $ZnFe_2O_4$/CS-H_3BO_3 and commercially available fluconazole were equally effective against Y. lipolytica fungi.

Keyword: *Zinc Ferrite/Polycationic Chitosan Magnetic Composite, Zeta Potential, Antimicrobial Effect*

ID: 411

Synthesis of Novel Oxadiazole-Containing Polymers for Organic Solar Cell Applications

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Production of energy directly from sunlight using photovoltaic technology is considered one of the most important ways to meet growing global energy needs using a renewable resource. Organic solar cell research has evolved over the past 30 years, also has attracted scientific and economic attention, especially in the last decade, triggered by the rapid increase in power conversion efficiency. Additionally, the properties such as their potential benefits of being produced in large areas, flexibility, easy integration, and cheap cost of solution processing are among the advantages of organic solar cells (OSCs). Organic solar cell devices are mainly composed of five layers involving cathode, electron transporting layer, hole conducting layer, photoactive layer, and indium tin oxide (ITO) coated on glass as anode. The strategy of this research was based on building up donor-acceptor type conjugated polymerization with Stille cross-coupling reactions. This research mainly focused on polymeric donor and acceptor units containing photoactive blend which includes the energy conversion process by selenophene π-bridged oxadiazole-based conjugated polymers. In this study, oxadiazole group is selected as main core because of three main reasons: its butadiene character, the presence of two electron-withdrawing C=N double bonds, and the existence of strong electron-withdrawing oxygen atom. According to research in the literature, solar cells with conjugated polymers containing oxadiazole are more efficient than those with other types of polymers. Furthermore, it has been demonstrated in the literature that they have stronger absorption in the visible light range because they have lower HOMO levels than their competitors. Moreover, the effects of the Si atom of the other candidate polymer will also be investigated and documented in the literature. The open circuit voltage (V_{OC}), short circuit current density (J_{SC}), power conversion energy (PCE), and fill factor (FF) of organic solar cell device are expected to enhance as a result of this research.

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Keyword: *Organic Solar Cell, Conjugated Polymers, Oxadiazole*

ID: 388

Pil Uygulamaları için Karboksimetil Selüloz Geliştirilmesi

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Günümüzde, enerji depolama sistemlerine olan ihtiyaç giderek artmakta ve bu bağlamda Li-iyon bataryalar önemli bir rol oynamaktadır. Li-iyon bataryaların performansını ve ömrünü artırmak amacıyla, çeşitli bağlayıcı malzemeler üzerinde çalışmalar yoğunlaşmıştır. Karboksimetil selüloz (CMC), su bazlı ve çevre dostu özellikleri nedeniyle yaygın olarak kullanılan bir bağlayıcıdır. Ancak, ticari CMC'nin saflığı, kimyasal ve fiziksel özellikleri, batarya performansını sınırlayabilmektedir [1]. Bu çalışmada, CMC'nin sübstütisyon derecesi (DS), molekül ağırlığı ve viskozitesinin Li-iyon batarya üzerindeki etkileri incelenmiştir.

CMC, selüloz polimerinin karboksimetil grupları ile modifikasyonu ile elde edilir. CMC, suda çözünen bir polimer olmakla birlikte formülasyonuna girdiği ürünlerin reoloji özelliklerini değiştirir, viskoziteyi arttırır veya bağlayıcı olarak kullanılabilir. CMC üretimi iki aşamada gerçekleşir. İlk aşamada, selüloz, sodium hidroksit ile alkalize edilir. Daha sonra alkalize edilip aktif hale getirilmiş selüloz ile monokloroasetik asit veya monokloroasetik asidinin sodyum tuzu reaksiyona sokularak eter elde edilir. Bu reaksiyon sırasında yan reaksiyonlar sonucunda sodium klorür ve sodium glikolat oluşur ve bu yan ürünlerin varlığı CMC'nin saflık derecesini etkiler. Reaksiyonda kullanılan hammaddelerin stiokiyometrisine, proses şartlarına bağlı olarak farklı DS, molekül ağırlığı ve viskoziteye sahip CMC üretmek mümkündür.

Bu çalışma kapsamında, farklı DS, molekül ağırlığı ve viskozite değerlerine sahip CMC üretilmiştir. Elde edilen CMC numunelerinin karakterizasyonu için FTIR, DS, aktiflik, partikül boyutu dağılımı ve viskozite analizleri gerçekleştirilmiştir. Li-iyon pillerinde bağlayıcı olarak kullanılması planan bu CMC için ön performans testi olarak elektrot çamuru hazırlanıp folyo üzerinde kaplama testine bakılmıştır. Ön çalışmalarda, CMC'nin değişen özelliklerinin folyo kaplama performasını direkt etkilediği görülmüştür.

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Keyword: *Karboksimetil selüloz, lityum-iyon pil, bağlayıcı*

ID: 414

Pyrolytic recycling of waste elastomers

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Elastomeric materials are among the most difficult to recycle due to their chemical structure. The rapid adoption of circular economy and sustainability concepts worldwide compels the rubber industry to address its waste and find innovative solutions.
In pyrolysis processes, irreversible chemical decomposition occurs only by increasing the temperature in an inert or oxygen-free environment [1]. The recycling of rubbers through pyrolysis involves converting them into Recovered Carbon Black and Pyrolytic Oil, which are used as raw materials in various industries. State-of-the-art pyrolysis technologies prevent greenhouse gas emissions compared to traditional production processes and enhance resource efficiency, thereby closing the loop in the transition to a circular economy.
Today, all leading pyrolysis companies are repeatedly tested and certified by sustainability schemes (ISCC, ECOLOOP, EPEA Cradle-to-Cradle, TÜV, etc.). It can be concluded that the activities of state-of-the-art thermochemical recycling (pyrolysis) facilities produce sustainable chemical raw materials, thus supporting the general and specific targets of the EU Green New Deal and the UN Sustainable Development Goals, and significantly contributing to the reduction of greenhouse gases in the production of carbon black and basic chemicals [2].
Studies on thermochemical technology, which is a part of recycling, are increasing rapidly with the growing emphasis on sustainability. Pyrolysis, particularly noted as an accepted method for waste disposal in the rubber and tire industry, is a field suitable for technical and scientific advancement. Research conducted by global players in the tire industry contributes significantly to the development of this field. This poster presents the latest scientific, technological, and industrial advancements in the pyrolytic recycling of waste elastomeric materials.

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Keyword: *pyrolysis, Recovered Carbon Black, Elastomeric materials*

Preparation of structurally stable PEG 2000 phase change materials based on gluten biomaterial

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In the study, the use of PEG 2000 polymer is evaluated as a phase change material, as a stable composite material to be made in gluten, a bio-sourced polymer. In this study, PEG was provided to create its own stable environments within the gluten structure by using expanded graphics. In addition, gelatin was added to the structure to provide this stable contribution. As a result of the study, it was emphasized that gluten composites containing 50% phase change material were stabilized by changing the surfactant and expanded graphics amounts. As a result, stable composites that retain the phase change material were produced in the study. Since the stable composites to be produced showed an enthalpy very close to the mixing ratio and the energy storage and dissipation properties at the phase transition temperatures of the polyethylene glycol polymer used, it was concluded that they could be evaluated as potential materials in various applications where thermal energy storage materials are used.

Keyword: *polymer composite, shape stable phase change material, thermal energy storage*

ID: 423

Synthesis and Characterization of Chitosan Full-IPN Cryogels

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In cases of injury with high tissue loss, the wound should be covered immediately with an antibacterial dressing to prevent infection and accelerate tissue regeneration. For thispurpose, antimicrobial and antioxidant systems such as hydrogels, films, membranes, nanofibers and cryogels with different morphologies have been prepared [1-2]. Cryogels have interconnected macroporous structure allowing a fast liquid absorption and transport via the continuous macropores [3-4]. These sponges can expand by rapidly absorbing blood and this phenomenon contributes to blood clotting and increased adhesion and activation of blood cells/platelets [5]. In present study, chitosan cryogels ($[Ch\text{-}1]_{cry}$,$[Ch\text{-}2]_{cry}$, $[Ch\text{-}3]_{cry}$) and their full-IPN forms ($[Ch\text{-}1@Ch]_{cry}$, $[Ch\text{-}2@Ch]_{cry}$, $[Ch\text{-}3@Ch]_{cry}$) were prepared for this purpose. SEM analysis, equilibrium swelling studies, and the mechanical tests were selected for characterization techniques. It has been understood that $[Ch\text{-}1@Ch]_{cry}$, $[Ch\text{-}2@Ch]_{cry}$, $[Ch\text{-}3@Ch]_{cry}$ have more compact structures and can be handled more easily compared to $[Ch\text{-}1]_{cry}$, $[Ch\text{-}2]_{cry}$, $[Ch\text{-}3]_{cry}$. $[Ch\text{-}3@Ch]_{cry}$ had the largestP (0.895±0.012 cm^3 pore/cm^3 dry cry)and P_s (0.890±0.014 cm^3 pore/cm^3 wet cry) values,while $[Ch\text{-}1]_{cry}$ cryogel had the smallest P (0.729±0.050 cm^3 pore/cm^3 dry cry) values and P_s (0.785±0.005 pore/cm^3 wet cry) value. Since the q_w% values for all six cryogel samples are greater than 2800, they can be defined as interconnected macroporous spongy structures. It can be said that the walls of the first cryogel structure are rearranged during the formation of full-IPN cryogel. Preparation of $[Ch\text{-}1]_{cry}$, $[Ch\text{-}2]_{cry}$, and$[Ch\text{-}3]_{cry}$ cryogels in full-IPN structure had an increasing and healing effect on themechanical strength of cryogels. Furthermore, the cryogel with the highest mechanical strength is $[Ch\text{-}2@Ch]_{cry}$, followed by $[Ch\text{-}3]_{cry}$ cryogel. Cryogels are loaded with cinnamicacid, which has a wide spectrum of biological activity and the properties of antioxidant, antimicrobial, and radical scavenging. From the cumulative release profiles, it was concluded that the cryogel that releases the least adsorbed cinnamic acid molecules is the $[Ch\text{-}2@Ch]_{cry}$ cryogel.

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Keyword: *cryogels, Chitosan, hydrogels*

ID: 170

Electrochemical Contribution of NiAl-LDHs to Gelatin Hydrogel Modified Electrode

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Hydrogel-based sensors show great potential in health monitoring, human-machine interfaces, and soft robotics. Due to its porous structure and good flexibility, hydrogel structures show excellent application studies in flexible, wearable electronics, batteries, and biosensors [1, 2]. Gelatin, a natural polymer, is used as the flexible supporting matrix to ensure good dispersion of additives within the hydrogel [3]. Layered double hydroxides (LDHs), known as anionic clays, are a family of 2D materials that have recently attracted significant attention. Synthetic inorganic materials with well-ordered cavities and surfaces exhibit advantageous properties for the design of innovative composites [4].

In this study, Gelatin@NiAl-LDH composite hydrogel platforms as a flexible and conductive substrate were prepared on a screen-printed electrode surface. To improve both the electrochemical properties of the hydrogel platform and to enable the immobilization of appropriate biorecognition elements through surface modification, NiAl-LDH structures were included in the hydrogel system. NiAl-LDH structures were synthesized by the co-precipitation method and characterized in detail by FTIR, XRD, XPS, SEM, EDX, and TEM methods. According to the information obtained as a result of the measurements of the conductive hydrogel system containing the optimum NiAl-LDH structure using various electrochemical methods such as CV, DPV, and EIS. It has been stated that the determined optimum amount of the NiAl-LDH structure exhibits effective signal-enhancing properties that support fast electron transfer. It is thought that the proposed system can be an alternative platform for biosensor studies after the immobilization of a preferred electrochemical biorecognition unit and can subsequently create an infrastructure for designing a possible wearable sensor that can enable the detection of different diseases.

Acknowledgments:
Vildan Sanko received financial support from The Scientific and Technological Research Council of Türkiye (TÜBİTAK) in the form of Research Fellowships (2218-TÜBİTAK project number: 122C069) through the 2218-National Postdoctoral Research Fellowship Program. F. Kuralay acknowledges the Turkish Academy of Sciences (TÜBA) as an associate member.

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Laipan, M., et al., Functionalized layered double hydroxides for innovative applications. Materials Horizons, 2020. 7(3): p. 715-745.

Keyword: *Hydrogel, Biopolymer, Layered double hydroxides, Electrochemical Analysis.*

ID: 428

Recycling of Waste PMMA as an Optically Transparent Matrix

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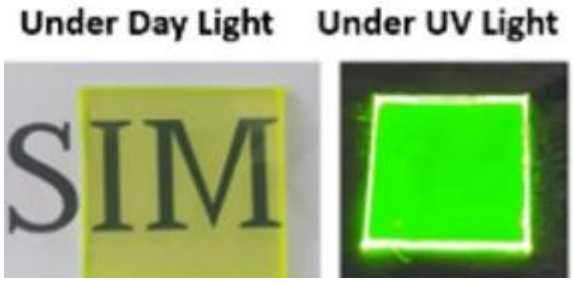
In this poster presentation, our study published in the journal "JOTCSA. 2024;11(3):1141-50" will be summarized [1]. In this study, thin films with homogeneous emission properties were produced by dissolving wPMMA in toluene and adding a fluorescent perylene dye (perylene-3,4,9,10-tetracarboxylic hexyl ester, PTHE) by spin coating method. The obtained films have 84% photoluminescence quantum yield (PLQY), are green emission and optically transparent. The optical properties of these films such as absorption, photoluminescence, emission lifetime and dye photostability were analyzed by various spectroscopic methods. Compared to the solution phase, the films showed excimer-induced photoluminescence (PL) at longer wavelengths and extended the emission lifetime by approximately three times. In addition, the CIE color coordinates (x, y) of the blue-green PL in the solution phase were 0.21, 0.56, while the PL spectrum of wPMMA films was measured as (x, y) 0.30, 0.60. Recycling of such waste polymers and converting them into value-added products has the potential to contribute to sustainable development goals in terms of clean energy, energy efficiency and waste management.



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Aksoy E. Recycling of Waste Polymethyl-Methacrylate as an Optical Transparent Host. J Turkish Chem Soc Sect A Chem 2024;11:1141–50. https://doi.org/10.18596/jotcsa.1412323.

Keyword: *Recycling*

ID: 101

Synthesis and Characterization of Cationic Surface Sizing Agent for Paper Recycling

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Surface sizing agents play an important role for the pulp and papermaking industry [1]. Surface sizing agents are often used as water repellent and prevent the ink from clouding due to contact with water [2]. Surface sizing agents are amphiphilic copolymers with both hydrophilic and hydrophobic moieties, more often hydrophobic moieties. They form a thin film on the paper surface, with the hydrophilic tail facing outward while interacting with the cellulose fibers. There are different chemicals used as surface sizing agents such as modified starches, Styrene Maleic Anhydride (SMA), Styrene Acrylic Emulsion (SAE), Styrene Acrylic Acid (SAA), Ethylene Acrylic Acid (EAA) and Polyurethane (PUR). Generally, surface sizing agents are applied to the paper surface in the sizer unit located between the front and rear drying in recycling paper mills.

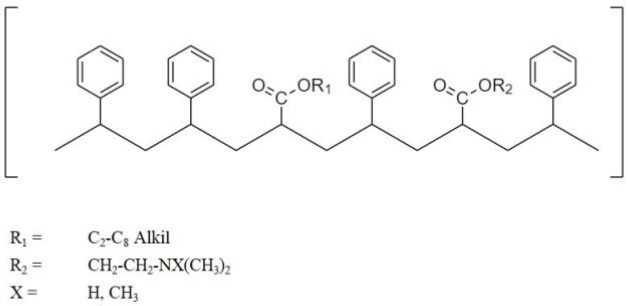

Figure 1. Styren Acrylic Emulsion (SAE)

In this study, we have synthesized a new cationic styrene acrylic emulsion (SAE), which provides high water repellency and at the same time an increase in print quality, for use in the recycling (waste) paper industry. The synthesized water-based copolymer was characterized by infrared spectroscopy (FTIR), particle size distribution (PSD) and differential scanning calorimetry (DSC). The targeted cobb values in the recycling paper were obtained using a lower amount of styrene acrylic emulsion.

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Keyword: *Styrene acrylic emulsion, Surface sizing agent, Paper Recycling*

ID: 236

Synthesis and Characterization of N-[2-(diethylamino)ethyl]acrylamide Based Stat- and Block Copolymers

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In recent years, new developments in the field of polymer science have led to extensive research on smart hydrogels (temperature and pH-sensitive polymers). The most studied smart hydrogel is poly (N-isopropylacrylamide) (PNIPAAm). PNIPAAm is a thermoresponsive polymer and it has lower critical solution temperature (LCST) of 32 °C. Poly N-[2-(diethylamino)ethyl]acrylamide (PDEAEAM) is both thermoresponsive and pH/CO2-responsive due to the moieties of the diethylamino and acrylamide groups and has LCST of 36 °C which is very close to human body temperature, PDEAEAM has attracted significant interest in recent years. [1] [2] [3] In this study, N-[2-(diethylamino)ethyl]acrylamide-based homopolymers, stat-copolymers (with different ratios (3 mol%, 5 mol%, 7 mol%, 10 mol%) of acrylic acid and methacrylic acid) and block copolymers were synthesized using the Reversible Addition−Fragmentation Chain-Transfer (RAFT) polymerization method. Prior to syntheses, the N-[2-(diethylamino)ethyl]acrylamide monomer (DEAEAM) were synthesized using acryloyl chloride and N,N-diethylenetriamine and RAFT reagent (S,S'-bis(α,α'-dimethyl-α''-acetic acid)-trithiocarbonate) were synthesized according to the literature. [4] The chemical structures of monomer, RAFT reagent and polymers were characterized by FT-IR, ^{1}H NMR, and ^{13}C NMR. Attempts were made to characterize the molecular weight and molecular weight distribution of the polymers using GPC, but no useful results were obtained from GPC. Subsequently, the temperature responses and lower critical solution temperatures (LCST) of these polymers and their response to pH were determined using UV-Vis spectroscopy. Although an LCST of 36°C was identified for the homopolymer, the LCSTs of the stat-copolymers containing acrylic acid and methacrylic acid could not be determined. Subsequently, block copolymers will be synthesized using different ratios of acrylic acid and methacrylic acid, and the responses of these block copolymers to both temperature and pH changes will be determined.

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Keyword: *N-[2-(diethylamino)ethyl]acrylamide, PolyN-[2-(diethylamino)ethyl]acrylamide, Temperature Sensitive Polymer*

ID: 235

Formaldehit Absorbsiyon Özelliğine Sahip Core-Shell Polimerlerin Geliştirilmesi ve Boya Performanslarının İncelenmesi

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Akrilik asit ester stiren ve çapraz bağlama özelliğine sahip multi fonsiyonel monomer karışımları ile yapılan bu çalışmada formaldehit absorbsiyon özelliklerinin arttırılması hedeflenmiştir. Emülsiyon polimerizasyon sistemlerinde olan pre-emülsiyon ya da monomer karışımları ile sistem tek seferde beslenirken, bu çalışmada ikili besleme yöntemi kullanılmıştır [1]. Sistemin avantajları yüzey alanının genişletilmesi ile malzeme üzerinde formaldehit absorbsiyon miktarının arttırılması ayrıca su dayanımı, ovalama dayanımı gibi özellikleri geliştirilmiştir. Core-shell sistemi ile üründe kullanılan monomer oranlarında değişimler yapılarak kullanım alanına yönelik olarak birden fazla özelliği biraraya toplamak mümkündür [2]. Bu yöntemde öncelikle monomerler ve yüzey aktif maddeler kullanılarak core bileşen olarak hazırlanmıştır. Monomerler ve diğer sürfaktanlardan oluşan shell bileşeni, bileşik lateksi üretmek için reaksiyon sistemine ilave edilmiştir [3]. Yapılan çalışmalarda farklı core-shell oranlarına sahip polimerler sentezlenmiştir. Polimerlerin FTIR, DSC, GC-MS karakterizasyonları gerçekleştirilmiş ve parçacık boyutları belirlenmiştir. Sentezlenen polimerler ile boya formülasyonları oluşturularak performansları incelenmiştir. Boya formülasyonlarının uygulamaları neticesinde formaldehit absorplama miktarları ppm cinsinden zamana göre ölçülmüştür. Core-shell yöntemi ile hazırlanan polimerler, klasik emülsiyon yöntemleri ile elde edilen polimerler kıyaslanmıştır. Core-shell yapısındaki polimerlerin absorblama kapasitesinin klasik yöntemle elde edilen polimerlere göre %10 daha fazla formaldehit absorbladığı tespit edilmiştir.

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Core–shell polymers: a review; Ros Azlinawati Ramli, Waham Ashaier Laftah* and Shahrir Hashim

Keyword: *polimer, dekoratif boyalar, emülsiyon polimerizasyonu*

ID: 231

Aşındırıcı Disklerde Kullanılmak Üzere İşleme Performansını Geliştiren Fenol Formaldehit Reçinesinin Sentezi

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Çukurova Kimya Endüstrisi A.Ş. Ar-Ge Merkezi, Türkiye

Aşındırıcı diskler, bileşiminde aşındırıcı toz malzemeler ve çeşitli elyaflar içeren; bağlayıcı olarak organik veya inorganik maddelerin kullanıldığı malzemelerdir. Aşındırıcı diskler, taşlama veya kesme makinelerine takılır ve yüksek hızlarda döndürülerek çeşitli malzemelerin şekillendirilmesinde kullanılır. Aşındırıcı disk bileşiminde kullanılan bağlayıcılardan biri de fenolik reçinelerdir.
Aşındırıcı disklerde kullanılan fenolik reçineler, fenol ve aldehitin polikondenzasyon reaksiyonu ile sentezlenen bir reçine türüdür. Reçine sentezi için önemli bir parametre, kullanılan katalizörün seçimidir.
Aşındırıcı disklerin yüksek hızı ve basıncı ile disklerin iyi dönme mukavemetine ve iyi aşınma direncine sahip olması gerekir. Reçinenin kürleşme hızının yüksek olması, sıcak presleme işlemi sırasında çok sayıda gaz çıkışı sebebiyle çatlama gibi yapıda bozukluklara sebebiyet verir. Bu da aşındırıcı diskin bağlanma performansını ve dönme mukavemetini etkiler.
Aşındırıcı disklerde kullanılan bağlayıcı reçinelere kıyasla, mevcut çalışmada sentezlenen fenol formaldehit reçine ile karışım tozunun karakteristik ve işlenebilirlik özelliklerinin geliştirilmesi sağlanmıştır. Aşındırıcı malzeme, bağlayıcı madde içinde eşit şekilde dağılabilir, topaklanma, kümelenme olgusu yaşanmamaktadır. Disklerin kullanım döngüsünde artış meydana gelmiştir. Kullanıcı konforunda artış sağlanmıştır.

Keyword: *Fenol Formaldehit Reçine, Katalizör, Aşındırıcı Disk*

ID: 228

Aşırı Dallanmış Polimerlerin Boya ve Kaplama Sektöründe Kullanımı

Aylin Aydemir *

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Boyalar ve kaplamalar, su veya solvent içeren boya ve kaplamalar olmak üzere iki ana gruba ayrılır. Bu boyaların renklendirilmesinde genellikle pigment pastalar kullanılır. Pigment pasta, boya ve kaplama endüstrisinde kullanılan, yüksek pigment konsantrasyonuna sahip viskoz sıvı veya macun kıvamındaki karışımlardır. Bu pastalar, renk vermek amacıyla boya veya kaplama sistemlerine eklenir. Pigment pastaların bileşenleri pigmentler, dispersiyon ajanları, çözücüler (su veya solvent), bağlayıcılardır. Pigment pastaların üretimindeki en kritik unsur dispersiyondur. Pigment konsantrasyonu yüksek olan pigment pastaların iyi bir dispersiyonunu sağlamak ve stabil kalmasını temin etmek amacıyla özel tasarlanmış dispersiyon ajanları kullanılmaktadır.

Pigment pasta üretiminde kullanılan pigmentin fiziksel ve kimyasal özellikleri çok önemlidir. Pigmentin yağ emilimi, yüzey alanı, tanecik boyutu ve yüzey morfolojisi gibi özellikleri boya formülasyonu hazırlanırken ve dispersiyon ajanı seçilirken dikkate alınmalıdır. Bir polimerin dispersiyon ajanı olarak kullanılabilmesi için temel kural, pigment yüzeyi ile temas ederek pigmentlerin birbirine yaklaşmasını engellemesidir. Dispersiyon ajanının yapısında bulunan pigment afinite grupları pigment yüzeyi ile etkileşirken ajanın diğer kısmını oluşturan hacimli gruplar ise pigmentlerin birbirine yaklaşmasını engeller.

Ftalosiyanin mavisi, yapısı ve morfolojisi gereği dispers edilmesi oldukça zor bir pigmenttir. Bu çalışmada, iki farklı tipte dispersiyon ajanı kullanılarak üniversal ftalosiyanin mavisi pigment pastalar hazırlanmıştır. Kullanılan dispersiyon ajanlarından bir tanesi lineer blok kopolimer yapısındayken diğeri aşırı dallanmış bir polimerdir. Farklı yapıdaki dispersiyon ajanları kullanılarak elde edilen pigment pastaların dispersiyon süresi, pigment şoklanması, renk değerleri, viskozite gibi özelliklerinin dispersiyon ajanının yapısına bağlı olarak nasıl değiştiği ortaya konmuştur. Aşırı dallanmış polimerik yapıdaki dispersiyon ajanının pigmentleri daha kısa sürede (1 saat) dispers ettiği tespit edilirken renk değeri, pigment şoklanması gibi özelliklerde de blok kopolimer yapıdaki dispersiyon ajanına göre daha iyi performans verdiği gözlemlenmiştir. Aşırı dallanmış polimerik yapıdaki dispersiyon ajanının pigment pastanın stabilitesini artırdığı ve viskoziteyi daha uygulanabilir bir seviyede tuttuğu ortaya konmuştur.

Bu çalışma, aşırı dallanmış polimerlerin boya ve kaplama sektöründe dispersiyon ajanı olarak kullanımının diğer polimerik yapıdaki dispersiyon ajanlarına göre avantajlarını ve etkinliğini göstermektedir.

Keyword: *Boya ve kaplamada kullanılan polimerler*

ID: 223

Yüksek Isıya Dayanıklı İnorganik Silikat Reçine Bazlı Kaplama

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Yüksek sıcaklıkta bariyer özellikli inorganik silikat reçine bazlı kaplama tasarımı çalışmasında hedeflenen; yangın esnasında çelik konstrüksüyonun ısısını 540 °C'nin altında tutması ve çelik yapıların yüksek ısıya maruz kaldığı durumda, mümkün olan en uzun süre boyunca yapısını korumaya yardımcı olmak üzere pasif yangın koruyucu kaplama geliştirmektir. Hedeflenen ürün için su bazlı silikat reçine solüsyonlarını kullanarak çıplak alev karşısında ısı kalkanı özelliği sağlayan antikorozif bir ürün tasarlanmıştır. Bu çalışmada sürekli yüksek ısıya maruz kalan çelik yüzeylerin ısı iletkenliğini minimum seviyeye düşürmek amaçlanmıştır. İnorganik silikat boya kaplamaları çelik yüzeye nüfuz etmektedir ve çeliklerle kimyasal olarak (silisleşme) bağ yapmaktadır. Ürünün su bazlı olması planlanmıştır. Formül yapısının özelliklerini (stabilite,viskozite,akışkanlık,uygulanabilirlik v.b) desteklemek amacı ile minimum miktarlarda çeşitli organik bağlayıcılardan destek sağlanmıştır. Ayrıca ürünün ısıya dayanımını desteklemek için ısı iletim değerleri düşük olan inorganik dolgular da kullanılmıştır.
Çelik yüzeye uygulanacak olan 1,0 - 1,5 mm kuru film kalınlığındaki kaplamanın;
a) 1100 °C ve altındaki sıcaklıklarda çıplak alevden etkilenmemesi, çatlamaması , dökülmemesi , kırılmaması
b) En az %65 oranında ısı geçirgenliğini azaltması,
c) Zorlu iklim koşullarına (aşırı sıcak , aşırı soğuk, aşırı nemli , korozif ortam koşulları) , dayanıklılık göstermesi hedeflenmiştir.

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Keyword: *silikat, ısıya dayanıklı, kaplama*

ID: 217

Doymamış Polyester Sistemlerde Renkli Jelkot Tasarımı

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Kompozit malzeme ortam koşullarına dayanıklı, esnek ve bağlayıcı özelliğe sahip polimer esaslı matris reçine ile yüksek mekanik dayanımlı takviye edici cam, karbon ve/veya aramid gibi elyafların bir araya getirilmesi ile elde edilen üstün nitelikli bir malzemedir. Kompozit malzemeler günlük yaşamın her alanında kullanılmakla beraber, Türkiye'de büyük bir üretim kapasitesine (250000 ton/yıl) sahiptir.
Bu çalışmada; Otomotiv, Savunma Sanayi ve Havacılık Sektörü, Marin, İnşaat, Mobilya, Aksesuar, Spor Malzemeleri v.b sektörlerde kullanılan poliester kompozit malzemelerin renklendirilmesi için kullanılacak renklendirici pastaların tasarımı hedeflenmiştir.
Yapılan çalışmalar sonrası; piyasada kullanılan rakip ürünlere göre kullanım kolaylığı sağlayan, uygulama hatlarının durmasına neden olacak sorunlar yaşatmayan, tüm reçine sistemleri ile uyumlu universal kullanım imkanı sağlayan ve müşterinin tüm renk ihtiyaçlarını karşılayan renklendirici pasta sistemi tasarlanmıştır.
Böylece kompozit sektörüne sunduğumuz ürün gamının bütünleştirilmesiyle, müşteri ihtiyaçları tümüyle DYO'dan karşılanabilir hale gelmiştir. Renklendirici Pasta satışları ile beraber pazardaki payımız artmıştır

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• Pigment & Resin Technology, Issue(s) available: 441 – From Volume: 1 Issue: 1, to Volume: 53 Issue: 4

Keyword: *Kompozit malzeme, Jelkot, Pigment pasta*

ID: 206

Development of Plastic Biocomposite Stationery Product from Waste Biomass

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At Adel Kalemcilik, waste sawdust from the production of wood-cased pencils is burned in order to be used as heating energy. In line with the sustainability studies of Adel R&D Center, it is aimed to turn these waste wood used by burning into value-added products. For this purpose, within the framework of the cooperation to be made with the compound supplier, these waste wood will be used in newly developed compounds that will be an alternative to HIPS and PP plastics used in the production of watercolor plastic bodies and felt-tip pen plastic bodies. Thus, Adel Kalemcilik will contribute to sustainability by reducing the use of petrochemical-derived plastics in biocomposite products containing waste wood, and will also carry out cost improvement studies by using its own waste product.

Keyword: *sustainability, waste wood, plastic compound*

ID: 192

Dual Curing (UV and Heat) of Bio-Based Polyols Containing Benzoxazine Monomers

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Benzoxazines are a class of thermosetting resins characterized by a tricyclic structure containing a benzene ring, an oxygen atom and an amine group. These resins have unique properties such as high thermal stability, flame resistance, low water absorption, dimensional stability and good mechanical properties. The incorporation of benzoxazine groups into polyols enables the production of materials with improved thermal and mechanical properties. These benzoxazine-containing polyols can be used as components in the synthesis of polyurethane foams, coatings, adhesives and composites. They offer advantages such as improved heat resistance, dimensional stability and flame retardancy compared to conventional polyols. In this study, benzoxazine monomers will be synthesized using bio-based polyols and phenolic acids, and the effect of these compounds on coating applications and curing were studied. Dual curing (UV and oven, respectively) curing studies of bio-based polyols and benzoxazine monomer were carried out and the physical (adhesion, gloss, cure, hardness, etc.) and chemical properties of these coatings were examined. According to the findings, using benzoxazine moieties in the the coatings, enhanced mechanical properties can be obtained.

Keyword: *Biobased benzoxazine, thermoset resin, UV-curing*

ID: 189

Benzoxazine Containing Bio-Based Coatings

Not Presented

ID: 155

Fototerapötik Nanotaşıyıcı Sistemlerin Geliştirilmesi ve Kanser Tedavisinde Kullanımları

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Meme kanseri dünya çapında kadınlarda en sık görülen ve ölüm oranı en yüksek olan ikinci kanser türüdür. Bunun yanında erken teşhis ile yüzde 90'lara varan oranlarda iyileşme sağlanabilmektedir. Son yıllarda kanser tedavisinde fototermal terapi (PTT) ve kemoterapi kombinasyonunun kullanılmasının, tümör büyümesinin geciktirilmesi, metastaz ve anti-tümör bağışıklığının önlenmesinde etkin rol oynadığı kanıtlanmıştır. Polidopamin nanoparçacıkları (PDA NP), dopaminin alkali koşullar altında oda sıcaklığında basit oksidasyonu ile kendi kendine polimerizasyonu yoluyla elde edilen iyi biyouyumluluk ve biyobozunma gösteren PTT ajanlarından biridir [1]. Bunun yanında Süperparamanyetik Demir Oksit nanoparçacıklar (SPION), harici manyetik alana hızlı tepki ve in-vivo biyouyumluluk gibi özellikleri nedeniyle kanser teşhisinde yaygın olarak kullanılan T2 kontrast bir maddedir [2]. Yapılan çalışmalar SPION'ların PDA yapıları ile birleşiminin üstün özelliklerini ortaya koymaktadır [3]. Bu amaçla çalışma kapsamında meme kanserinin teşhis ve tedavisi için geleneksel kemoterapiye ek olarak PTT etkinliği gösteren hedeflendirilmiş aynı zamanda görüntüleme de yapabilen polimerik esaslı fototerapötik bir nanotaşıyıcı sistem hazırlanmıştır. P(OEGMA-b-((GMA-DOX/TPP)-b-DMAEMA)) polimerik zincirinin tasarlanmasında RAFT (Reversible addition−fragmentation chain-transfer) polimerizasyonu tekniği kullanılarak yapı ^{1}HNMR, UV-vis spektroskopisi, Fourier Dönüşümlü Kızılötesi Spektroskopisi (FT-IR) ve jel geçirgenlik kromatografisi (GPC) ile karakterize edilmiştir. Asidik pH duyarlı hidrazin bağı ile konjuge edilmiş Doksorubisin anti-kanser ilacı ve mitokondri hedeflendirici molekül içeren çok fonksiyonlu polimer zincirinin SPION@PDA NP sistemi ile birleşimi için karbodiimid birleştirme kimyası kullanılmaktadır. Hibrit nanoparçacık sistemi Dinamik ışık saçılımı (DLS) analizi, Geçirimli Elektron Mikroskobu (TEM), FT-IR spektroskopisi, termogravimetrik analiz (TGA) ve histerezis analizi ile karakterize edilmiştir.

Teşekkür: Bu çalışma Gazi Üniversitesi Araştırma Üniversiteleri Destek Programı (ADEP) tarafından proje No: FGA-2024-9122 ile desteklenmiştir.

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Keyword: *polymeric nanoparticle, Reversible addition−fragmentation chain-transfer polymerization, Chemo-photothermal therapy*

ID: 153

Nanohybrid Gel Polymer Electrolyte by In Situ Polymerization of Surface-Functionalized Boron Nitride Nanosheets and PEGDA for Lithium Metal Batteries

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Advanced gel polymer electrolytes (GPEs) are viewed as potential candidates for suppressing dendrite growth in lithium-metal batteries (LMBs)[1]. To improve the mechanical and electrochemical properties of GPEs, studies in which functionalized nanomaterials are integrated with chemical bonding to the polymer matrix in the electrolyte have been effective, because chemical bonding increases the interface compatibility between inorganic and organic materials and facilitates the homogenization of lithium-ion mobility during charge-discharge cycles[2]. GPEs employing two-dimensional (2D) hexagonal boron nitride nanosheets (BNNs) have shown great potential for improved thermal stability, ionic conductivity, Li^+ transference number, mechanical strength, and dendrite-suppressing properties for LMBs [3,4]. In this study, we designed and synthesized a novel nanohybrid gel polymer electrolyte (NGPE) composed of surface-functionalized h-BNN and poly(ethylene glycol) diacrylate (PEGDA). Owing to the presence of highly dispersed h-BNN as 2D nanomaterial within the polymer matrix, we aimed that NPGE structures having crosslinked h-BNN would show low interfacial resistance, high Li-ion transference number and wide electrochemical stability window. For this purpose, we first produced hexagonal boron nitride nanosheets by liquid phase exfoliation method employing probe sonication[5,6]. Upon surface functionalization of hBNN-OH with 3-aminopropyltriethoxysilane (APTES), we obtained h-BNN-APTES, and then treated it with 3-(acryloyloxy)-2 hydroxypropylmethacrylate to obtain the h-BNN monomer with methacrylate functionality (h-BNNACOM). The thickness, crystal structure and morphology of hBNN-OH and functionalized hBNN monomers were characterized by AFM, TEM/SEM, XRD and FTIR techniques. We fabricated NPGE-BNN structures by thermal in situ polymerization of fixed amount of PEGDA with varying percentages of h-BNNACOM (%1, %2 and %3) in the presence of liquid electrolyte and catalytic amount of a thermal initiator. The synthesized NPGE-BNNACOM structures were characterized by FTIR, SEM, TEM and DSC. Their electrochemical properties were investigated by electrochemical impedance spectroscopy (EIS), lineer sweep voltammetry (LSV), cyclic voltammetry (CV) and chronoamperometry.

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Keyword: *functionalized hexagonal boron nitride nanosheets, nanohybrid gel polymer electrolyte, lithium metal battery*

ID: 143

Cell-Loaded Polymeric Microsphere Design for Treatment of Cardiac Regeneration After Myocardial Ischemia and In Vitro Evaluation

Not Presented

ID: 133

Processing of PMMA Based Nanofibers by Electrospinning Method and Their Characterization

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The main aim of this study is to produce poly(methyl methacrylate) (PMMA)-based nanofibers by electrospinning method. The effect of solution properties (solution concentration and solvent type) and process parameters (applied voltage, feed rate, distance between tip-to-collector) were investigated on fiber formation and morphology. A laboratory-scale electrospinning device with drum collector was used to obtain the electrospun fibers. To investigate the effect of solvent type; electrospun fibers containing 15 wt.% PMMA were produced using acetone (AC), dimethylformamide (DMF) and binary solvent systems with different AC/DMF ratio of 1:1, 1:3, 1:4. Then, a series of electrospun fibers with various concentrations (15, 16, 17, 18, 20 wt.%) of PMMA in the solvent mixture of AC and DMF (1:3) were produced and characterized regarding their morphologies.

The AC/DMF with ratio of 1:3 was found to be the optimum binary system according to fiber formation, homogeneity and average fiber diameter. It was observed that increasing the polymer solution concentration resulted in an increase in the average fiber diameter in the range of 930 nm-1380 nm. The optimum polymer concentration for bead-free, continuous and smooth fiber formation was found as 17 wt.% PMMA. The average diameter of the electrospun fibers containing 17 wt.% PMMA was measured as 930 ± 190 nm. Process parameters such as applied voltage, feed rate and tip-to-collector distance were also assessed in terms of their effects on the fiber morphology. It was observed that the solution concentration had a more significant influence on the fiber diameter than the other process parameters. Moreover, it was found that when the distance between tip-to-collector was increased, the average fiber diameter decreased. Also, increasing the voltage lowered the average fiber diameter. However, the influence of the feed rate on the fiber diameter was not remarkable. According to experimental observations and average fiber diameter results, the optimum process parameters were found as 25 kV of applied voltage, 0.4 ml/h of feed rate, and 15 cm of tip-to-collector distance.

Keyword: *Electrospinning, PMMA, solvent type, process parameters, average fiber diameter*

ID: 132

The Role and Applications of Resins in Industrial Coatings

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DYO Boya Fabrikaları

Sanayi boyalarında reçineler, boyanın görünüm, yapışma, dayanıklılık, kimyasal direncini belirleyen temel bileşenlerdir. Her bir reçine türü, farklı endüstriyel ihtiyaçlara yanıt verecek şekilde formüle edilir ve bu da boyaların geniş bir uygulama yelpazesinde kullanılmasını sağlar.
Epoksi reçineler, mükemmel yapışma, kimyasal ve mekanik direnç özellikleriyle bilinir. Metal yüzeylerin korunmasında, zemin kaplamalarında ve ağır sanayi uygulamalarında yaygın kullanılır. Özellikle zorlu ortam koşullarında yüksek dayanıklılık sağlar, korozyon direncini artırır.
Poliester reçineler, yüksek dayanıklılıkları ve mükemmel elastikiyet özellikleri sayesinde otomotiv, denizcilik ve inşaat sektörlerinde tercih edilir. Bu reçineler, iyi yüzey sertliği ve kimyasal direnç sunar, bu nedenle ağır yüklere maruz kalan yüzeyler için idealdir.
Alkid reçineler, yüksek parlaklıkları ve esneklikleri bilinir. Koruyucu kaplamalarda, özellikle dış mekan uygulamalarında kullanılır, uzun kuruma sürelerine rağmen, mükemmel film oluşumu ve hava koşullarına dayanıklılık sağlar.
Akrilik reçineler, UV direnci, renk dayanıklılığı ve çevre dostu olmaları ile bilinir. Dış cephe boyaları, oto boyaları, mimari kaplamalar gibi uygulamalarda yaygın olarak kullanılır. Düşük VOC içeriği nedeniyle çevreye daha az zararlıdır, modern boyalarda popüler bir seçimdir.
Bu reçineler, sanayi boyalarında farklı ihtiyaçları karşılayarak, çeşitli yüzeylerin korunması ve estetik görünümünün sağlanmasında kritik bir rol oynar. Reçine türlerinin sunduğu bu çeşitlilik, boyaların farklı beklentideki sektörlere olan uyumunu ve performansını artırır, bu sayede geniş kullanım olanağı sağlar.

Keyword: *Reçineler, kaplama, sanayi boyaları*

ID: 123

Grafen Oksit/Fuller Earth/Jelatin Bazlı Nanokompozit Hidrojeller ile Ağır Metal Adsorpsiyonu

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Ağır metaller doğal ortamda parçalanamayan, ekolojik sisteme ve insana zarar vererek çevre kirliliği sorununun artmasına neden olan maddelerdir. Ağır metallerin atık sulardan uzaklaştırılması gerekmektedir. Ağır metal gideriminde bugüne kadar kimyasal çökeltme, kimyasal indirgeme, elektrokimyasal, membran ayırma, iyon değiştirme, biyolojik ve adsorpsiyon yöntemleri gibi çeşitli yöntemler kullanılmıştır. Bunlar arasında, grafen bazlı malzemelerle adsorpsiyon, son yıllarda geniş spesifik yüzey alanı, yüksek adsorpsiyon kapasitesi, yüksek giderim verimliliği ve iyi geri dönüştürülebilirlik nedeniyle ağır metallerin atık su sistemlerinden uzaklaştırılmasında çok daha fazla ilgi görmüştür.

Bu çalışmada, basit karıştırma ve liyofilizasyon yöntemi ile hazırlanan Grafen Oksit/Fuller Earth/Jelatin malzemesinin, endüstriyel atıksularda yaygın olarak incelenen Pb ağır metalini adsorplama kapasitesi incelenmiş ayrıca desorpsiyon kinetiği de çalışılmıştır. Hazırlanan kompozit malzemenin karakterizasyonu (FTIR, XRD ve SEM) kil tabakalarının aralandığını, malzemeler arasında etkileşimin olduğunu göstermektedir. Adsorpsiyon kapasitesi çalışmaları ortam koşullarında, pH 4'te 200 rpm karıştırma hızında gerçekleştirilmiştir. Adsorpsiyon kapasitesi 43,6 mg/g olarak hesaplanmıştır.

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Keyword: *grafen oksit, fuller earth, adsorpsiyon*

ID: 115

Development of Binding System for Increasing Plywood Production Capacity

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The plywood manufacturing industry has long relied on phenol-formaldehyde (PF) resins, particularly for marine-grade plywood production, due to their superior adhesive properties under harsh environmental conditions. However, the high cost of PF resins significantly impacts overall production expenses. This research project successfully addressed the need to optimize plywood manufacturing processes by developing an innovative binder system utilizing phenol formaldehyde resin and various filler materials. The primary goals achieved include reducing resin consumption, maintaining consistent viscosity across different climatic conditions, enhancing adhesive spread on veneers, and lowering the curing temperature to decrease energy costs.

Our approach created a binder system that operates effectively in all seasons, preventing the viscosity fluctuations typically observed with standard resin formulations. The developed binder system incorporated fillers such as starch, cellulose, and various minerals, which not only reduced resin usage but also stabilized the viscosity and improved cold tack capability before hot pressing.

The project involved detailed experimental procedures including Differential Scanning Calorimetry (DSC) to assess the curing behavior of the binder system at lower temperatures compared to conventional systems. Performance and stability tests confirmed that the binder system met industrial standards without phase separation or clumping. Field trials were conducted both domestically and internationally, demonstrating the system's robustness and reliability.

The outcomes included a significant reduction in glue costs for plywood manufacturers, enhanced production capacities due to shorter pressing times, and overall energy savings. By stabilizing the input viscosity of the resin across various temperatures, the binder system also improved the consistency and quality of the final plywood product. This project has consolidated the position of Polisan Kimya as a leader in the adhesive market by offering a novel, cost-effective solution that enhances the competitiveness of plywood producers in both domestic and export markets.

This research not only provided an innovative solution to a longstanding industry challenge but also exemplified the practical application of polymer chemistry and material science to enhance industrial manufacturing processes. The successful implementation of this binder system offers significant economic and operational benefits for plywood production.

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Keyword: *Plywood, Phenol-Formaldehyde Resin, Binder System*

ID: 96

Sikloalifatik Yapıda UV Dayanımı Yüksek Polimer Sentezi

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Çalışma kapsamında, ithal polimer yerine 2000 saat UV dayanımlı yerli polimer olarak siklo alifatik yapıda yüksek katılı polimer sentezlenmiştir. Sentez aşamasında, sikloalifatik asitler ve dioller kullanılarak esterifikasyon yöntemi ile sentezler gerçekleştirilmiştir. 1,4- cyclohexanedicarboxylic acid (1,4-CHDA); Hexahydrophthalic anhydride (HHPA); 1,4-cyclohexanedimethanol (CHDM), neopentyl glycol (NPG), hydroxypivalyl hydroxypivalate (HPHP), 2-butyl-2-ethyl-1, 3-propanediol (BEPD), 1,6-hexanediol (HD) gibi asit ve baz hammaddeler kullanılmıştır. Reaksiyon esterifikasyon reaksiyonu olup, yapı belirli bir moleküler ağırlık ve asit sayısına gelince sonlandırılır [1,2,3]. Yapılan çalışmalarda özellikle HHPA ve 1,4-CHDA asit türevleri kullanılarak farklı MW yapısına sahip yüksek dayanımlı polyester polimerlerinin kullanılmasıyla UV test performansı, sertlik ve yapışma ile ilgili boya performans özelliklerinin standart polyesterlere göre arttığı görülmüştür.

Çalışmanın çıktıları aşağıdaki gibidir,
Ithalat için beklenilen süreye ihtiyaç duymadan kendi tesisinde ithal ettiğimiz polimer yerine yerli polimer tasarımı yapılmıştır.. İthalat sırasında ilgili polimerin getirilmesi aşamasındaki maliyetten kurtulacaktır. İthal edilen polimerin kendi tesisimizde üretilmesi ile dışa bağımlılık azaltılacaktır.
Yerli polimerin üretilmesi ile maliyet avantajı sağlanarak, özellikle dış dayanımın performans beklentisinin yüksek olduğu yurt içi ve yurt dışı boya sektörlerine yönelik pazarlarda rekabet gücünün artması ile pazar payında önemli bir artış olacaktır.

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Keyword: *Polyester reçine, Uv Dayanımı, Sikloalifatik asitler*

Kanser Tedavisinde Kullanılmak Üzere Aşı Kopolimerle Kaplı Manyetik Hipertermi Nanoparçacıkların Geliştirilmesi

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Kanser tedavisinde kemoterapi, radyasyon tedavisi, cerrahi, gen tedavisi ve immünoterapi gibi mevcut tedavilerin yanında manyetik hipertemi (MHT) adı verilen tamamlayıcı bir tedavi yaklaşımı geliştirilmektedir [1]. MHT, manyetik nanoparçacıkların dış manyetik alanlarla etkileşimi sonucu açığa çıkan indüktif ısı enerjisinin tümörlü hücrelere transferiyle tümör hücrelerinin zayıflatıldığı ya da tamamen yok edildiği yeni nesil bir kanser tedavisi yaklaşımıdır [2]. Aynı zamanda, manyetik nanoparçacıkların en önemli avantajı, harici bir manyetik alanda manyetik olarak yönlendirilebilme yetenekleridir. Bu çalışmanın amacı, sağlıklı hücrelerin zarar görmesini engelleyerek, dışarıdan uygulanacak manyetik alan ile hipertermi özelliği gösterebilen ve bu bölgede kontrollü ilaç salımı yapabilen nano boyutlu sistemlerin geliştirilmesidir. Çalışmada çinko ferrit ($ZnFe_2O_4$) manyetik nanoparçacık, pH duyarlı kitosan-aşı-pektin kopolimeri (CS-g- Pec) ile kaplanarak anti kanser ilaç yüklenecektir.

Çalışma kapsamında aşı kopolimerle kaplanmamış saf $ZnFe_2O_4$ manyetik nanoparçacıklar birlikte çöktürme yöntemiyle sentezlenmiştir. $ZnFe_2O_4$ manyetik nanoparçacıkların kitosan ile kaplanmasında in-situ yöntem kullanılmıştır ($CS@ZnFe_2O_4$). Kitosan kaplı $ZnFe_2O_4$ manyetik nanoparçacıkların yüzeyleri, N-(3-Dimetilaminopropil)-N'-etilkarbodiimid, (EDC) , N-Hidroksisülfosüksinimit sodyum tuzu, (NHS) aktivasyonuyla pektin aşılanacaktır ($Pec/CS@ZnFe_2O_4$). Saf $ZnFe_2O_4$ manyetik nanoparçacıklar ve kitosan ile kaplanmış nanoparçacıkların yapısal karakterizasyonları X-Işını Kırınım (XRD) analizi ve Fourier Dönüşüm Kızılötesi Spektroskopisi (FTIR) ile yapılmıştır. Elde edilen FTIR sonuçlarına göre, $ZnFe_2O_4$ manyetik nanoparçacıklarda, 671 cm^{-1} de karakteristik Fe-O gerilme titreşimleri görülmüştür. Kitosan ile kaplandıktan sonra nanoparçacıkların FTIR spektrumunda, kitosana ait amino gruplarının tipik N-H bükülmesi ve C-N gerilmesi sırasıyla 1641 cm^{-1} ve 1489 cm^{-1} de tespit edilmiştir. Bu sonuç, önemli miktarda kitosanın, nanoparçacıkların yüzeyine başarılı bir şekilde kaplandığını göstermektedir. Kitosan kaplı nanoparçacıklara ($CS@ ZnFe_2O_4$), pektin aşılaması ve anti- kanser ilaç yükleme çalışmaları devam etmektedir.

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Keyword: *Aşı kopolimeri, Hipertermi, Nanoparçacık*

Environmentally Friendly Edgeband Coloring Innovation: Development of Innovative and Sustainable Liquid Color Masterbatches for Edgebanding

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EGGER DEKOR A.Ş.

In the plastic industry, the coloring processes, which play a critical role in highlighting the aesthetic and functional properties of products, are traditionally carried out using granular color masterbatches consisting of a mixture of polymer carriers and pigments. The use of liquid masterbatches instead of traditional granular color masterbatches for coloring products presents a sustainable alternative in line with sustainability goals.
Within the scope of the project, liquid masterbatch production was carried out using epoxidized fatty acids and dispersion devices. The liquid masterbatches ensured fast and efficient color integration with homogeneous distribution during the coloring process and lower usage rates of colorants.
The produced liquid masterbatches were characterized through mechanical tests, light tests, SEM, and DLS analyses, revealing higher durability, light stability, homogeneous surface morphology, and particle dispersion compared to alternatives. Epoxidized fatty acids enhanced wetting performance of pigment particles, improving mold injection cycle and extrusion processes, leading to increased production efficiency. This improved color technology, integrating epoxidized fatty acids, enhances pigment particle wetting, improving production efficiency and color stability. Integrated into thermoplastic production processes, it aims to adapt to industry innovations, making coloring processes environmentally friendly, energy efficient, and sustainable with a low carbon footprint. This technology has been integrated into thermoplastic production processes such as ABS and PVC, aiming to adapt to innovations in the industry and make coloring processes environmentally friendly, energy efficient and sustainable with a low carbon footprint.
As a result of our project, it has been observed that the use of epoxidized fatty acids and dispersion devices in the production process enables the attainment of a product quality beyond industry standards. Additionally, based on the data obtained from the project, it is aimed to achieve a total energy saving of 2.732 MW annually, including 1.872 MW in edge band production, 311,400 kW in masterbatch production, and 548,640 kW in recycling processes by replacing granular color masterbatches with liquid masterbatches. This saving implies a reduction of approximately 1,338 tons of carbon dioxide emissions annually, demonstrating significant contributions of our project in terms of both economic and environmental sustainability.

Keyword: *liquid masterbatch, energy efficiency & carbon emission, plastics*

ID: 84

The Effect of Using Different Amounts and Varieties of Raw Materials in Alkyd Resins on the Pot-Life of Paint

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İba Valresa Boya ve Kimya A.Ş.

Alkyd resins are widely used in industrial and decorative applications as one of the essential components of paints and coatings. These resins are produced through the polycondensation of fatty acids, polyols (mostly glycerol), and dibasic acids or anhydrides (e.g., phthalic anhydride). During the reaction, by-products such as water or alcohol are removed to obtain a resin with the desired molecular weight and viscosity. Changes in the amounts of raw materials, as well as parameters such as temperature, mixing speed, and reaction time, can significantly affect the performance and properties of the final product. Particularly, due to the supply issues currently affecting the industry, many changes in raw materials are being made. Investigations have been conducted to provide flexibility in this area and minimize the effects of changes made in the process on the paint. Pot-life, the duration in which the paint remains usable after being mixed with its hardener (isocyanate), is a critical property affected by these changes. This study aims to investigate the effect of using different amounts and varieties of phthalic anhydride and polyols in alkyd resin production on the pot-life of the paint. While analyzing, many properties of the paint were examined, but the effect on pot-life was comprehensively addressed according to the EN ISO 9514:2019 standard. Within the scope of the study, the acid-viscosity balance, temperature changes of the reaction, and water outputs of the produced alkyd resins has been followed, and molecular weights were determined by GPC (Gel Permeation Chromatography). Primary tests of the resin, such as solid content (%), viscosity, acid number, and OH number, have been done in accordance with standards. In addition, the properties of the paint after crosslinking (pot-life, hardness, gloss, scratch resistance, chemical resistance, etc.) were tested. The obtained results were interpreted with the help of the Minitab program.

Keyword: *polymer, alkyd, paint*

ID: 78

Preparation and in vitro Evaluation of Mitochondria-Targeted Quercetin-Loaded PLGA NPs for the Treatment of Oxidative Stress-Induced Inflammation

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Mitochondria perform various essential functions within the body and serve as the primary source of reactive oxygen species (ROS) (1). Excessive production of oxidants such as free radicals and ROS in the body results in the formation of oxidative stress, a major contributor to chronic inflammatory diseases (2,3). In this study, mitochondria-targeted anti-inflammatory drug-loaded poly(lactic-co-glycolic acid) (PLGA) nanoparticles (NPs) were developed against oxidative stress-induced inflammation. Quercetin (QCT) was used as a drug molecule for its anti-inflammatory properties, while positively charged lipophilic triphenylphosphate (TPP) served as a targeting agent (4,5). Considering these, non-targeted empty and QCT-loaded PLGA NPs were synthesized as control groups by nanoprecipitation method via self-assembly. Two different targeting conjugates, TPP-Tween80 (TT80) and PLGA-PEG-TPP (PPT), were synthesized, and targeted NPs were obtained by conjugating them in various weight ratios onto the NP surface. This allowed for the examination of the effects of using different targeting agents and their varying concentrations. After the successful synthesis of NPs, they were characterized in terms of their hydrodynamic diameter, surface charge, drug encapsulation efficiency (EE), stability, and morphology. The diameters ranged from 138.5 nm to 213.5 nm, demonstrating monodispersity. The surface charge of non-targeted NPs was negative, ranging from -13.10 ± 2.12 mV to -15.10 ± 1.79 mV. However, after the conjugation of positively charged targeting agents, the zeta potential values ranged from -11.80 ± 2.48 mV to 6.92 ± 0.62 mV. Additionally, drug EE ranged from 47.96% to 60.20%. The NPs exhibited high stability for up to 9 days and facilitated prolonged release of QCT in acidic inflammatory environments. Furthermore, in vitro characterization assays were conducted. The synthesized NPs exhibited high cellular viability even at elevated drug concentrations, and all targeted NPs effectively reduced ROS production under inflammatory conditions. JC-1 assay results revealed that targeted NPs promoted the formation of J-aggregates, indicating their ability to prevent mitochondrial apoptosis in the presence of inflammation compared to QCT and non-targeted NPs. This demonstrated the efficacy of developed NPs in targeting mitochondria. Consequently, optimized mitochondria-targeted NPs loaded with QCT were successfully synthesized, showing great potential for treating oxidative stress-induced inflammations.

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Keyword: *Mitochondria, Oxidative stress, PLGA nanoparticles*

ID: 76

Development of Active Microglia Targeted Nanoparticles for the Treatment of Neuro-Inflammation Related Diseases

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The blood-brain barrier (BBB) is a complex dynamic interface that functions as a gatekeeper to the central nervous system (CNS), reflecting its unique requirements. This complexity makes the BBB the most selective physical barrier, while at the same time, the cells that make up the structure of the BBB communicate with other cells of the CNS, respond to pathological conditions, and in some cases, participate in the initiation, maintenance, or progression of the disease (1,2). Especially in cases such as accidents and strokes, inflammation can lead to the activation of protective microglia and astrocytes in brain tissue, which protect neurons and ensure their myelination. It is followed by nerve cell death, which is widespread and rapid. Prompt delivery of anti-inflammatory/anti-oxidant drugs to the brain tissue is crucial to mitigate severity and prevent lasting damage (3). Due to the selective nature of the BBB, the accumulation of small drug molecules in damaged tissue is very low. This project focuses on preparing a targeted nano-drug delivery system to eliminate disorders caused by nerve tissue damage due to neuroinflammation after traumatic brain injury. All nanoparticles (NPs) were made of Chitosan polymer. To reduce inflammation caused by oxidative stress, α-lipoic acid molecules were attached to the side -NH_2 branches of chitosan via pH-sensitive hydrolyzable ester bonds (4). Subsequently, Anti-CD11b-antibody, which can bind selectively and with high affinity to the CD11b receptor synthesized specifically on the outer walls of active microglia cells, was selected as the microglia targeting group and bound to the NP's surface and directed to activated microglia. Cy3 fluorescent dye molecules, used as imaging agents, were attached to the nanoparticle surface using amine functional groups of Chitosan NPs. Morphological and functional group analyses were performed with FTIR, NMR, HPLC, UV-VIS, SEM, and TEM instruments. NanoDrop, Varioskan, and SEM-EDS detectors were used to quantify the Cy3, and BCA assay was used to quantify the antibody. LC-MS/MS demonstrated the conjugated drug release efficiency and cytotoxicity performed with mouse fibroblast cells (L929, ATCC CCL-1). Overall, a microglia-targeted nano-drug delivery system was achieved to reduce oxidative stress and neuroinflammation and, thus, to recover nerve cell damage.

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Keyword: *Neuroinflammation, Targeted Nanoparticles, Microglia*

ID: 70

Development of Porous Polymeric Sorbents for Organic Solvent and Oil Spill Cleanup

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Inspection of the porous structures that are currently present in nature has shown that their construction incorporates better qualities. With this inspiration, in comparison to their non-porous counterparts, the characteristics of porous polymers stand out for absorbent applications. The quality development provides polymers with new progressive features, mainly through to their increasing surface area, pore shape, and surface functionality [1].

Porogens aid in offering porous polymers that are manufactured for various applications. By utilizing the size, chemical composition, and physical structure of the chosen porogen, the most efficient polymers can be developed. Researches utilize porous materials for a wide range of applications, such as; gas storage, separation materials, catalysts/as supports for catalysts, encapsulation, and absorbents [1,2].

Porous polymer sorbents have proven to be beneficial materials for absorbing a variety of hazardous pollutants for the environment, such as oil spills, hazardous paint chemicals, heavy metals. These types of industrial waste products pollute the seas and seawaters as a result of transportation and accidents due to the growth of oil and chemical businesses. In order to eliminate water pollution, physical (booms, skimmers, absorbents), chemical (dispersants, solidifiers), and biological (bioremediation) solutions are now being developed or utilized in the industry. The utilization of absorbents stands out among these approaches because of their high absorption capacity, durability, reusability, and accumulation [3,4].

The fabrication of porous polymeric sorbents was conducted via bulk polymerization with porogens, but in the absence of solvents, initiators, or dispersants. The fabricated porous polymeric sorbents point out that the used macromonomer type has a high capacity to absorb organic pollutants like BTEX solvents. Sorbents show remarkable selectivity in simulated binary environments and absorb organic solvents or petrol-derived substances instead of water. Hence, they are successful for the clean-up of oil spills, which are frequently caused by human activity and have a significant impact on biodiversity, marine ecosystems, and the delicate balance of our world.

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Keyword: *Sorbent, porogen, oil-spill*

ID: 69

Development of UV/LED Curable Overprint Varnish (OPV) for Metal Packaging

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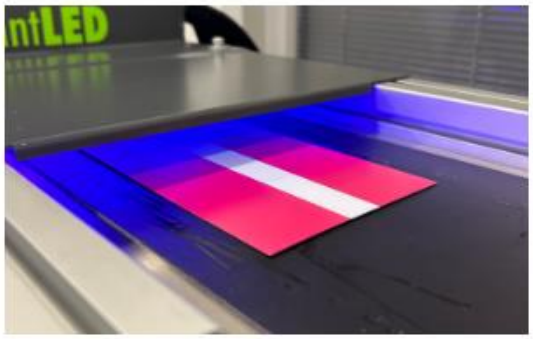
In the can coating process, the internal and external surfaces of the package are coated to protect the metal from rust and to prevent contact between the metal and the food. After the external surfaces of the metal cans have been coated with a printable basecoat, the ink is applied by offset printing to create the visual effect. As the ink doesn't have any physical resistance properties, an overprint varnish (OPV) is applied. This varnish is a transparent polymer film and provides gloss on the printed surface and resistance to external environmental conditions (weather, water, abrasion, scratch, impact resistance...)OPV applied to metal packaging can be divided into two types: Conventional solvent curing varnishes and radiation curing varnishes[1]. Conventional curing varnishes, which are the most widely used in the industry, have disadvantages such as high heat requirements, long curing times, volatile compounds released and high energy costs. Radiation curing systems are cheaper and more practical than conventional curing systems. High voltage mercury lamp light sources are commonly used for UV curing. However, it causes high energy consumption and high thermal and ozone emissions. However, the absorption range of UV-LED radiation, which is in the range of ~380-500 nm in the electromagnetic spectrum, is much longer than UV (~250-380 nm), and therefore LED curing systems require less energy than UV systems. This study describes a sustainable UV-LED OPV that has superior technical properties, consumes less energy and contributes to reducing the carbon footprint of packaging. In the developed study, an LED-curable OPV was prepared by formulating suitable acrylate resins, photoinitiators and monomers. The curing reactions of the developed coating were studied by FTIR method.It was observed that the reaction initiated by LED irradiation could be radical or cationic.The impact of the OPV on the technical attributes of the packaging was examined. Comparative physical and chemical assessments of the product were conducted in a metal packaging printing facility. Upon comprehensive evaluation of the test outcomes, it was determined that the engineered UV-LED curable OPV is compatible with all coating layers and can be employed in metal packaging coating applications.





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Keyword: *Metal Packaging, OPV, LED Curing*

ID: 54

Spectroscopic and Thermal Characterization of Polystyrene and Its Composites with Silica and Halloysite Additives

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This study presents a comprehensive analysis of structural and thermal enhancements in polystyrene (PS) composites, which incorporate microspherical silica (0.5 micrometers) and nano-sized halloysite nanotubes (hundreds of nanometers). Utilizing Fourier Transform Infrared (FTIR) spectroscopy and Thermogravimetric Analysis (TGA), the research delineates the chemical structure modifications and stability improvements imparted by these additives.

FTIR analysis effectively differentiates between pure PS and its composites. While pure PS exhibits characteristic absorption bands associated with its inherent molecular structure, the composites display additional peaks indicative of their respective additives.[1] The silica-enhanced spectra showcase Si-OH and Si-O-Si vibrations at 1150 cm^{-1}, 1100 cm^{-1}, and 970 cm^{-1}, whereas the halloysite composites resonate with Al-OH and Si-O-Si stretches at 3693 cm^{-1}, 3621 cm^{-1}, and 1030 cm^{-1}.[2] This spectral evidence highlights the successful integration of these materials into the PS matrix.

Thermogravimetric analysis (TGA) reveals that the composites possess significantly enhanced thermal stability compared to pure PS. The onset of degradation for pure PS occurs at 350 °C, while the PS-Silica and PS-HNT composites begin decomposing at higher temperatures of 362 °C and 287 °C, respectively, with peak decomposition temperatures reaching 443 °C for silica and 450 °C for HNT. Furthermore, both composites retain a greater mass after exposure to high temperatures, underscoring their enhanced thermal shielding capabilities.[3]

Morphological assessments conducted using Atomic Force Microscopy (AFM) demonstrate distinct surface characteristics. The silica composites exhibit smoother surfaces due to the even distribution of micron-scale particles, whereas the halloysite composites show increased roughness with an average roughness (Sa) reaching 219.95 nm, compared to 32.7 nm for silica and 10.9 nm for pure PS. These results confirm that the nanoparticle additives significantly alter the surface topology of the composites, enhancing their potential for varied industrial applications.

In conclusion, the integration of silica and halloysite into PS composites not only modifies their chemical and physical properties but also significantly improves their structural integrity and thermal resistance, making them more suitable for advanced material applications.

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Keyword: *composites, polystyrene, characterization*

Photochromic Polymer Membrane Production with Viologen based Porous Ionic Polymer using In-Situ Method

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Photochromic materials have garnered significant attention due to their dynamic responsiveness to light stimuli, enabling applications in various fields including sensing, imaging, and smart devices [1]. A range of phototropic materials, including silver halides, spiropyrans, and naphthopyrans, have been extensively studied for their photochemical and thermal properties [2]. In addition, viologens, which are small organic molecules with charged structures, stand out for their electrochromic as well as phototropic properties [3].

In this study, we present a novel approach for the production of photochromic polymer membranes utilizing Viologen based Porous Ionic Polymers (V-PIPs) through an in situ method. V-PIPs exhibit exceptional properties such as high surface area, tunable porosity, and inherent photochromic behavior, making them promising candidates for advanced membrane applications. The synthesis process involves the integration of viologen-based organic moieties within the polymer matrix through a facile in situ polymerization technique. The resulting photochromic polymer membranes demonstrate remarkable photoresponsive characteristics, undergoing reversible color changes upon exposure to light stimuli. The incorporation of viologen groups imparts photochromic functionality to the membranes, enabling precise control over their optical properties. We also systematically investigate the influence of polymer composition, viologen concentration, and processing parameters on the photochromic and membrane performance properties. This study not only provides insights into the design and fabrication of photochromic polymer membranes but also offers a deeper understanding of the structure-property relationships governing their functionality. The development of such advanced materials holds significant promise for diverse applications in the fields of sustainability and energy conservation, paving the way for innovative solutions in responsive membrane technologies.

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Keyword: *photochromic polymer, viologens, porous ionic polymer*

ID: 35

Developing Novel β-Cyclodextrin-Based Nanosponge as Nanocarrier of Hydroxyurea Anticancer Agent

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For contemporary researchers, achieving targeted delivery of anticancer drugs to specific sites remains one of the paramount and intricate challenges in the field.[1] Hence, the facilitation of targeted anticancer drug transportation through β-cyclodextrin-based nanosponges (CD-NS) assumes a pivotal and consequential role within scientific inquiry. Nanosponges offer a versatile platform for establishing diverse drug conjugations tailored for targeted drug delivery systems.[2] In this investigation, a variety of β-cyclodextrin-based nanosponges were synthesized to facilitate the transport of hydroxyurea (HU), a notable anticancer agent. Employing three distinct cross-linkers (namely maleic anhydride, epichlorohydrin and a combination thereof), nanosponges were modified with halloysite clay (HNT)—an inorganic agent recognized for its non-toxic nature and recurrent mention within the realm of green chemistry.[3] This modification aimed to augment the surface area of the nanosponges, thereby fostering enhanced drug binding capabilities. Characteristic properties of the synthesized structures were elucidated through thermal analysis (TGA), dynamic mechanical analysis (DMA), and X-ray photoelectron spectroscopy (XPS) for elemental analysis across unmodified nanosponges, HNT modified nanosponges, and drug-conjugated structures.

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Keyword: *nanomaterial, nanosponge, cancer*

ID: 34

Preparation and Analysis of Dynamic Mechanical Properties of Dextran-Halloysite Nanocomposites

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Recently, the design and fabrication of nanostructured materials consisting of various organic/inorganic structures has gained importance. Nanocomposites prepared using polymer containing functional groups and clays are very popular due to their unique structures. These nanomaterials attract attention in biotechnological applications, especially as polymer-based biomaterials. In the preparation of these structures, it is preferred to use natural polymers due to their abundance in nature and their renewable and biodegradable properties.[1]

In this work, a series of potential biocompatible nanocomposite materials were prepared. Nanocomposites based on different molecular weight of dextran, a water-soluble and naturally occurring polysaccharide with biocompatible and biodegradable properties, were prepared via solution casting/solvent evaporation method with halloysite nanotube (HNT). The formation of nanocomposite structures and the interfacial interactions between dextran and HNT were analyzed by ATR-FTIR Spectroscopy. The obtained results confirmed the halloysite-polymer compatibility and the successful preparation of nanocomposites. Dynamic mechanical properties of the pristine materials and nanocomposites were investigated by Dynamic Mechanical Analysis (DMA). It was observed that HNT nano additive improved the dynamic mechanical properties of dextran polymers.

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Keyword: *Dextran, halloysite nanotube, nanocomposite*

ID: 33

Solvent Bazlı Boyalarda Akma Direnci ve Stabilitenin Reolojik Ölçümlerle İncelenmesi

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Reolojik ölçümler, boya ve yüzey örtü maddeleri gibi çok bileşenli, reaktif ve viskoelastik davranış gösteren akışkanların depolama ve uygulama sırasındaki akma davranışlarının belirlenmesi ve değişen koşullara bağlı olarak ön görülmesi için kantitatif veriler sağlamaktadır. Reometrede, kayma hızı, kayma gerilimi, frekans, uzama gibi deformasyon parametrelerine ya da zaman ve sıcaklığa bağlı olarak gerçekleştirilen ölçümlerle boyaların viskoelastik özellikleri detaylı olarak incelenebilmektedir.

Boyaların farklı kayma hızları ve gerilimleri altında üretim, depolama, uygulama sırasında ve uygulama sonrasında farklı reolojik davranışlar sergiledikleri [1], reolojik davranışlarının standart test prosedürleri ile ölçüm ve yorumlanmasının oldukça zor olduğu ve bu zorluğun da başlıca, boyaların çok bileşenli olmaları, uygulama gerekliliklerine göre formülize edilmeleri ve reaktif bileşenler içermelerinden kaynaklandığı bilinmektedir. Boyanın kutu içinde depolanması sırasında pigment taneciklerinin uzun süre süspanse halde kalması için bağlayıcı fazın viskozitesini ya da taneciklerin yüzey özelliklerini manipüle eden katkı maddeleri kullanılmaktadır. Bu tür reoloji düzenleyici katkılar ile boyanın uygulandıktan sonraki akma ve damlama eğilimleri de giderilebilmektedir.

Boyaların depolama stabilitesi ölçümleri, hızlandırılmış çökelme koşullarının sağlanmaya çalışıldığı ve kalitatif gözlemlere dayanan test prosedürleri ile yapılmaktadır. Bu çalışmada ise, yeni ve özgün bir yaklaşım olarak; farklı oranlarda reolojik katkı maddesi içeren, solvent bazlı bir poliüretan (PU) boyanın reolojik özellikleri, karakteristik akış eğrisi ve reolojik parametrelerin frekans ve genliğe bağlı değişimlerinin ölçümü ile değerlendirilmiştir. Gerçekleştirilen reolojik ölçümlerle, kullanılan reoloji katkı maddesinin oranı arttıkça örneklerin akma gerilimi, sıfır kayma hızı viskozitesi ve depolama stabilitelerinin iyileştiği, fakat boyanın uygulandığı yüzeydeki yayılma özelliğinin negatif etkilendiği görülmüştür.

Keyword: *Solvent Bazlı Boya, Akma Direnci, Depolama Stabilitesi*

Polydimethylsiloxane and Cellulose, Beetroot, and Sea Buckthorn Extract Composites: Phytochemical Properties and Antioxidant Activity

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Silicone rubber is a polymer material with excellent physical and chemical properties, resistance to extreme temperatures, and good biocompatibility. Silicone rubber mainly consists of polydimethylsiloxanes (PDMS) with repeat unit [$Si(CH_3)_2$–O–]. Due to this chemical structure, PDMS is a relatively weak elastomer in need of reinforcement. To increase the mechanical properties of PDMS, use filler-like layered particles such as clays, mica, graphite, carbon black, and silica. Microcrystalline cellulose (MKC) is being used as a potential reinforcing material for many advantages, such as being abundantly available, biodegradable, cheaper, renewable, and having relatively high strength. The beetroot is a tubercle belonging to the Chenopodiaceae family, native to Europe and North Africa. It has attributed preventive properties against several human diseases originating from free radicals proliferation, mainly for its high content of bioactive compounds content and polyphenols. Besides this, for the broader use of PDMS in the medical industry, silicone must be mechanically strong and exhibit antimicrobial effects. Beetroot (b) and sea buckthorn (s) leaf raw material are characterized as having one of the strongest coloring properties. Scientific literature states that beetroot and sea buckthorn extracts have strong antioxidant activity. This effect is due to phenolic compounds and biologically active compounds.
The aim of this study is to modified a PDMS with MKC beetroot and sea buckthorn extract composites to attain a mechanical strong, antioxidant activity and colouring properties PDMS/CMF/b and PDMS/CMF/s composites.
This work characterized PDMS/CMF/b and PDMS/CMF/s in terms of their structure, mechanical properties, morphology, and antibacterial effect. Composite morphology was characterized by SEM-EDS, and a uniaxial tensile test evaluated mechanical behavior. Color Measurement of PDMS/CMF/b and PDMS/CMF/s indices in the CIEL*a*b* space was measured with a MiniScan XE Plus spectrophotometer.
From the microscope studies (SEM) analysis of PDMS/CMF/b and PDMS/CMF/s showed rough surface. The antioxidant activity values were of varied PDMS/CMF/b 47,13±6,95 μmolTE/100 ml and of PDMS/CMF/s 31,84±1,02 μmolTE/100 ml. The colors of the investigated composites were bright red and PDMS/MKC/b and yellowish-orange PDMS/CMF/s.

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Keyword: *polydimethylsiloxane, composite, pigments*

ID: 16

Synthesıs of Polyester Co-Binder Resin with Hih Flexibility Breaking and Impact Resistance for Paint Systems Applied to Plastic Surfaces

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Resin is the most important raw material in the paint industry and provides the properties that the paint should give to the surface. Generally paint systems are called according to the resin type which use in paint.
Polyester resins are one of the most important resin types used in paint. Polyester resins occupy a large place in the synthetic resin family. In addition to its use as a paint raw material, it is also used in the adhesive industry [1]. In this study, a low viscosity polyester resin with high flexibility and excellent adhesion to the surface was designed to be used in paints developed to provide flexibility and adhesion to the applied surface. In addition to its flexibility, it aims to prevent long-term brittleness on painted surfaces and improves adhesion to the surface.[2] Since it is a polyester resin that provides flexibility, it is widely used in paints where impact resistance is required on the application surface, and in this case, it shows that its adhesion is strong. It is used as an co-binder due to its low content in the paint design formula.[3] It is advantageous in terms of cost as it provides the desired properties to the paint even when used in low amounts.
In ongoing studies, flexibility, adhesion and impact resistance properties will be determined by international standards. Comparisons will be made with its equivalents on the market based on the same tests, and resin will continue to be developed as a result of these tests.

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Keyword: *synthetic resin, co-binder, polyester resin*

Electroactive Viscoelastic Properties of Industrial Hemp/Polyanthracene Composites

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Due to its high strength, durability and environmentally friendly properties, industrial hemp became one of the favored filler for the preparation of natural composite materials. Industrial hemp is mainly composed of cellulose besides hemi-cellulose, lignin and pectin. In this study, to obtain an enhanced electroactive as well as having high mechanical and thermally stable composite, a new materials composed of insulating industrial hemp and conducting polyanthracene (PAT) was prepared via primary and secondary forces. It was assumed that industrial hemp/PAT dispersions prepared in insulating silicone oil (SO) may show electric field induced polarizability under externally applied electric field strengths and form strong fibril structures. Additionally, it was expected that primary and secondary bodings between hemp and PAT differentiates the electroactive effect in dispersion systems. That is why first of all it will be scientifically interesting to investigate the dielectric properties of this industrial hemp/PAT/SO dispersion systems by determining dielectric constants, polarizability and relaxation times. Secondly, it was another curiosity to reveal the behaviors of industrial hemp/PAT/SO dispersion systems under externally applied electric field strengths, shear rates, shear stresses and viscosity conditions which undergoes to electrorheological effect. Also viscoelastic properties such as elastic modulus, viscous modulus and damping factor of industrial hemp/PAT/SO dispersion systems were enlightened. Further creep-recovery test was also applied to the dispersion system at the linear viscoelastic region. It was concluded that industrial hemp/PAT/SO dispersion systems showed a smart behavior under applied electric field by forming strong fibrillar structures with potential vibration damping capability for potential industrial applications.
Acknowledgement: This study is supported by TÜBİTAK 2209-A [Grant No: 1919B012304551] program.

Keyword: *Industrial hemp, Polyanthracene, Electrorheology*

Preparation of a Smart Vibration Damping Suspension System from Industrial Hemp/Polyaniline Hybrid Composite

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The aim of this study is to prepare a brand new smart hybrid composite composed of naturally available industrial hemp and conducting polyaniline (PAni). Industrial hemp/(PAni) composite was dispersed in insulating silicone oil (SO) to prepare suspensions at various mass fractions. Firstly, dielectric properties of industrial hemp/(PAni)/SO system were investigated and various dielectric parameters such as dielectric constant, polarizability and relaxation time were determined. Secondly, electrophoretic mobilities of industrial hemp/(PAni) particles were examined in aqueous and SO media. Thirdly, flow behaviors of industrial hemp/(PAni)/SO system were revealed under various externally applied field strengths to enlighten the electrorheological properties which is not hitherto been reported in the literature. Further, viscoelastic and creep-recovery properties of industrial hemp/(PAni)/SO system were evaluated. It was concluded that 70%industrial hemp/30%PAni/SO suspension system is the optimum composition with strong polarizability and electric field induced fibril like structure with electro active vibration damping capability.

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Keyword: *Industrial hemp, Polyaniline, Electroactive vibration damping*

ID: 44

Elektrokromik Süperkapasitör Uygulamaları İçin Çapraz Bağlı Viyolojen İnce Filmlerin Hazırlanması

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Elektrokromik malzeme teknolojisinde ilk çalışmalar diğer tüm yarı iletken teknolojilerinde olduğu gibi inorganik yarı iletkenler kullanılarak gerçekleştirilmiştir [1]. Özellikle 1980'li yıllarda küçük organik moleküller olan viyolojenler üzerine araştırmalar başlamış ve günümüze kadar bu materyaller üzerinde araştırmalar sürdürülmüştür. Viyolojenler, organik monomerik elektrokromik olarak bilinen ve radikal katyon durumunun yüksek renk yoğunluğundan dolayı elektrokromik teknolojide sıklıkla kullanılan bipiridinyum tuzlarıdır. Viyolojenlerin, dikatyon (V^{2+}), monokatyon (V^{+}) ve nötral (V^{0}) olmak üzere üç redoks durumu vardır ve en kararlı hali dikatyon formudur. Katodik bölgede aktif olan viyolojen türevleri, elektrokimyasal olarak geri dönüşümlü bir şekilde dikatyon formundan radikal forma ve nötr forma geçebilirler. Her basamakta farklı renklere sahip olmaları, elektrokromik uygulamalarda büyük bir avantaj sağlamaktadır [2].

Bu çalışmada, öncelikle yan grubunda çapraz bağlanabilir allil grupları içeren ALV-X malzemelerinin sentezi ve kimyasal karakterizasyonu ile birlikte teorik DFT hesaplamaları gerçekleştirildi. Daha sonra, sentezlenen ALV-X malzemelerin cam yüzeyine çapraz bağlanma reaksiyonları farklı oranlarda tetratiyol bazlı çapraz bağlayıcıların varlığında gerçekleştirildi ve elde edilen filmlerin morfolojileri AFM ve mikroskop görüntüleriyle incelendi. Belirlenen koşullarda ITO/Cam yüzeyine hazırlanan elektrotların karakterizasyonu, döngüsel voltametri, kronopotansiyometri, kronoamperometri ve elektrokimyasal impedans spektroskopisi gibi teknikler kullanılarak detaylı bir şekilde gerçekleştirildi. Elde edilen sonuçlar özellikle elektrokromik cihazlarda viyolojen tabanlı çapraz bağlı elektrotların katodik tabakada kullanılabileceklerini ve yüksek yük depolama yeteneğine sahip olduklarını göstermiştir.

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Keyword: *elektrokromik, süperkapasitör, çapraz bağlı viyolojen*

ID: 196

Synthesis of Biopolymer-Modified Cancer Cell Membrane Coated Magnetic Nanoparticles and Investigation of Therapeutic Efficacy in Glioblastoma

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The most prevalent and deadly primary brain cancer in adults is called glioblastoma (GBM). The most popular course of treatment for GBM patients is chemotherapy, which comes after surgical resection. But the clinical efficacy of medication therapy for GBM is far from ideal. Poor physicochemical qualities, low therapeutic molecule targeting capacity, and the existence of the blood-brain barrier (BBB) and blood-brain tumor barrier (BBTB) are the main obstacles to effective medication delivery for GBM. Therefore, there is an urgent need to develop a new therapeutic platform that overcome physiological and pathological barriers in treating GBM. [1] Scientists are focused on developing new therapeutic approaches such as cell membrane (CM) camouflage to increase the biocompatibility and active targeting ability of nanocarrier systems. Obtaining natural biomimetic nanostructures by combining cell membranes with nanoparticle structures is a developing field of research. By designing these nanocarriers with surfaces that directly replicate complex biological activities, long-term circulation, and active targeting in the body can be achieved by providing the formation of structures derived mainly from the cell membrane and mimicking the properties of the parent cell. [2]

This study aimed to investigate the effect of the synthesized biomimetic nanoplatform in the treatment of GBM. First, magnetic iron oxide particles were synthesized by the co-precipitation method. Size distribution and zeta potential of magnetic iron oxide particles were analyzed via DLS. U87-MG cell membrane fragments were isolated and determination of membrane proteins were performed by western-blot. Afterward, the coextrusion method assembled the biomimetic nano platform (Fe_3O_4@CM).The triblock polymers containing tertiary butoxide protected lysine methacrylate ($tBoc_2$LysMA) temozolomide methacrylate (TmzMA) and 2-hydroxy-ethyl methacrylate (HEMA) units were synthesized via RAFT polymerization. Then, tBoc protecting groups were removed via an acidic hydrolysis reaction. Polymers were characterized by ^{1}H NMR and GPC analyses. Polymers revealed monomodal distributions in GPC analysis. The obtained Fe_3O_4@CM@P biomimetic nanoplatoforms were assembled by electrostatic interactions. The size and morphology of the biomimetic nanoplarforms were characterized using TEM analysis. The therapeutic effect of the obtained nanoplatforms against the U87-MG glioblastoma cancer cell line was evaluated in terms of cytotoxicity by MTT tests. [3]

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Keyword: *Glioblastoma Multiforme, Cell-membrane coated nanotechnology*

ID: 195

Development and Characterization of Hydrogel-Based Tissue Matrices for Use in Joint Cartilage Regeneration

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Purpose/Objectives:
Joint cartilage is a highly differentiated tissue with limited healing capacity since it is nourished by synovial fluid. Therefore, repair or regeneration occurs within the tissue as blood-derived growth factors do not reach it (1). Studies focusing on cartilage repair in clinical settings often involve (i) cells, (ii) scaffolds, or (iii) signaling molecules used alone or in combination, also known as tissue engineering (2). This study aims to produce and characterize cell-free tissue matrices.

Methodology:
PEGDA was obtained by diacrylation of PEG, and ALGMA was obtained by methacrylation of alginate. Subsequently, hydrogels were prepared using combinations of these materials in different ratios with a visible light photoinitiator system. Swelling, degradation, porosity, surface analysis and mechanical characterization properties were examined.

Results:
As the proportion of AlgMA in the matrix structure increased, the morphological characteristics led to the formation of porosity. The higher the AlgMA content, the more pronounced the pores became. Since the PEGDA structure is photoactivated, the degree of cross-linking directly affects the swelling properties. The control PEGDA hydrogel, which did not contain AlgMA, showed less swelling compared to the hydrogels containing 6% w/v AlgMA. Cross-linking points enhanced the strength of the PEGDA hydrogel. Notably, hydrogels containing 6% w/v AlgMA exhibited significant degradation resistance compared to other hybrid structures. Compression strength results indicated that hydrogels containing AlgMA showed increased compression strength compared to the control PEGDA.

Conclusion/Significance:
Biocompatible and injectable hydrogel tissue matrices with adapted features for different types of cartilage regeneration have been developed and characterized. Physical, chemical and mechanical properties were showed. The findings of the study have provided promising outcomes for mimicking tissue in cartilage repair.

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Keyword: *Cartilage, Pegda, Algma*

ID: 194

Tartaric Acid as Helicity Provider to Imine Based Polymers

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Helicity is one of the most abundant motifs in nature, from the double helix of DNA to secondary structures of proteins. Helical polymers inspired by nature found applications in enantioselective crystallization, enantioselective separation, and asymmetric catalysis thanks to their inherited helical chirality. Here, we hypothesize that chiral tartaric acid moieties may provide helicity to the synthesized polymers in a cheap and easy way. Moreover, controlling the configuration of tartaric acid moiety may result in selectivity in the helicity of the polymers in one preferred direction. To demonstrate the validity of these hypothesis, four different polymers with a tartaric acid backbone and their corresponding monomer structures have been synthesized and characterized by conventional methods. Semi-empirical PM3 calculations also support our hypothesis.

Keyword: *helical, polymer, tartaric acid*

ID: 191

Phenanthroimidazole Based Materials for OLED Application

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In this study, phenanthroimidazole based materials were synthesized and their organic light emitting diode (OLED) device performances were investigated to make a contribution to the development of blue-light emitters, which is a challenging process.[1] Phenanthroimidazole core is a typical building block for blue-light emitting molecules[2], and this study was conducted to investigate the effect of electron-withdrawing substituents and triphenylamine moiety on device performance by using various emitters based on phenanthroimidazole core. Optical characterizations of these emitters were carried out by using UV-Visible spectroscopy and photoluminescence spectroscopy methods. Electrochemical characterizations of these materials were conducted by using cyclic voltammetry technique. OLED device performances of blue-light emitting materials were investigated. Important device parameters such as turn-on voltage, luminance, current efficiency, external quantum efficiency and Commission Internationale de l'Eclairage (CIE) color coordinates were determined for phenanthroimidazole derivatives used in this study. Among these phenanthroimidazole-based small molecules, 4,4'-(1-(4-fluorophenyl)-2-phenyl-1H-phenanthro[9,10-d]imidazole-5,10diyl)bis(N,N-diphenylaniline) gave the superior device performance with external quantum efficiency of 6.00%, turn-on voltage of 2.96 V, with luminance and current efficiency of 17310 cd/m^2 and 37.01 cd/A, respectively.

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Keyword: *OLED, phenanthroimidazole, blue-light emitter*

ID: 188

pH-Sensitive Biocompatible Polymers for Cell Membrane Modification

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The physical characteristics of biological cell membranes, which are responsible for processes like fusion or cell membrane sealing and repair, can only be greatly altered by a small number of chemical agents and cholesterol, which has an important function in cell membrane integrity, is one of the molecules used in cell membrane surface modification [1]. Membrane surface modification gives cells different functions and makes it possible to use cells in diagnosis and increase treatment effectiveness. The development of non-genetic cell membrane modification methods has accelerated studies in the field of delivering therapeutic molecules, targeting them to the anticancer site, and providing in vitro imaging.

The synthesis of various cholesterol derivatives and their incorporation into polymeric structures have been studied by different researchers. Polymeric structures are preferred in membrane engineering studies using non-genetic methods due to their various advantages. Polymeric structures are used as biocompatible and controlled drug release systems for the targeted delivery of different anticancer agents to the tumor site. Polymerization of different monomers enables the synthesis of polymeric structures with various chemical and physiological properties, and this provides polymers used for therapeutic purposes with capabilities such as targeting, reducing toxicity, and responding to environmental stimuli including pH, temperature, light, electrical or magnetic fields, and ionic strength. For instance hydrazine bond is used to conjugate drug molecules to polymeric systems and can provide pH-sensitive drug release [2].

2-methacryloyloxyethyl phosphorylcholine (MPC) is a zwitterionic monomer containing a phosphorylcholine group. MPC polymers which are non-toxic, non-immunogenic, and non-antigenic polymer, are commonly used to produce biocompatible materials as mimicking phospholipid bilayer [3]. Due to the amphiphilic nature of MPC polymers, they attract the attention of researchers for use in cell membrane modification. In this study, biocompatible, pH-sensitive polymers were synthesized and characterized for use in non-genetic cell membrane modification. The study is important for the development of polymeric systems that can respond to various stimuli and have the potential to be used for modification on different cell membrane surfaces.

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Keyword: *Cell Membrane Modification, pH-Sensitive, Biocompatible Polymers*

ID: 186

Ambalaj Uygulamaları İçin Bitkisel Kaynaklı Filmlerin Hazırlanması ve Karakterizasyonu

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Günlük hayatımızda kullandığımız pek çok tek kullanımlık plastik ürünün ham maddesi petrol türevli bileşenlerdir. En çok kullanılan petrol türevli polimerler polietilen tereftalat (PET), düşük ve yüksek yoğunluklu polietilen (PE), polipropilen (PP), polivinil klorür (PVC) ve polistirendir (PS). Biyo esaslı malzemeler petrol türevli (polistiren, polipropilen vb.) malzemelere alternatif olarak yenilenebilir kaynaklı, karbon ayak izini azaltan çevre dostu malzemelerdir. Bu çalışmanın amacı sıcak gıda uygulamalarında kullanılabilecek yüksek ısı dayanımına sahip, gıda sıcaklığını belli bir düzeyde tutan, biyo-esaslı, çevreci ve daha sürdürülebilir ürünler elde etmektir. Bu çalışmada öncelikle mısır yağının hidrolizlenmesi ile yağ asidi amid türevlerinin elde edilmesi ve sonrasında epoksi gruplarıyla modifiye elde edilmesiyle faz değiştiren malzemelerin (FDM) hazırlanması amaçlanmıştır. Elde edilen bu FDM'lerin sıcak gıda uygulamalarında ambalaj olarak kullanılmasını test etmek amacıyla biyopolimer ile belirli oranlarda karıştırılarak sıcak press ve solvent casting yöntemiyle homojen filmler hazırlanmıştır. Filmlerin ısıtma ve soğutma periyotları boyunca gösterecekleri faz geçiş sıcaklıkları ve bu esnadaki ısı depolama kapasitelerinin belirlenmesi için diferansiyel taramalı kalorimetri (DSC) ile ölçümleri yapılmıştır. Aynı zamanda filmlerin su iticilik özelliklerini belirlemek amacıyla temas açısı ölçümleri yapılmıştır. Hazırlanan filmlerin yüzey özellikleri Atomik Kuvvet Mikroskobu (AFM), yüzey analizleri ise X-ışını Fotoelektron Spektroskopisi (XPS) ile belirlenmiştir. Elde edilen sonuçlar petrokimyasal ambalaj ürünlerine alternatif olarak biyo-esaslı sürdürülebilir ambalajların geliştirilmesine katkı sağlayacağını göstermektedir.

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Keyword: *Akıllı ambalaj, PLA, mısır, Sürdürülebilirlik*

ID: 182

Nanohibrit Katkılı Nanokompozit Hidrojellerin Sentezi ve Yara Örtüsü Uygulanmalarında İlaç Salım Özelliklerinin İncelenmesi

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Mevcut yara örtüleri ile karşılaştırıldığında, hidrojel bazlı yara örtüleri, yaradan yüksek miktarda eksüda emilimi sağlayarak yaranın daha güvenli ve nemli bir ortamda iyileşmesine olanak tanımasıyla dikkat çekmiştir. Hidrojeller, biyoaktif etken moleküllerin hedeflenen bölgelere kontrollü terapötik dozla sürdürülebilir şekilde lokal olarak taşıyan bir araç olarak yaygın şekilde kullanılmaktadır [1]. Hidrojeller, biyoaktif moleküllerin sürdürülebilir yerel rezervuarları olarak hizmet etmenin yanı sıra, doku onarımını ve yenilenmesini kolaylaştırmak için yapısal destek de sağlarlar [2]. Polimer matrise takviye olarak nanotaneciklerin katkılandırılması nanokompozit hidrojelin termal ve mekanik kararlılığını artırmakta ve hidrofilik özelliğini geliştirmektedir [3].

Bu çalışmada üretilen nanohibrit katkılı nanokompozit hidrojel; sentezinde kullanılan malzemelerden gelen üstün özellikler ve nanohibrit tanecikler katkılandırılarak sağlanan gelişmiş kontrollü ilaç salım özelliği ile modern bir yara örtüsü olarak tasarlanmıştır. Bu amaçla; N-izopropilakrilamid (NIPAM) ve 2- (dimetilamino)etil metakrilat (DMAEMA) monomerleri kitosan ve poli(vinil alkol) (PVA) varlığında serbest radikalik polimerizasyon ile çapraz bağlanarak yarı iç içe geçmiş ağ yapıda hidrojel (Semi-interpenetrating network/ semi-IPN) sentezlenmiştir. Ayrıca elde edilen semi-IPN hidrojeller; mekanik dayanımı ve adsorpsiyon kapasitesini arttırmak amacı ile Hummers' metodu ile sentezlenen grafen oksit (GO) nano tabakaları ve kontrollü ilaç salım sistemine destek sağlayacak mezogözenekli silika (MSN) nanopartikülleri ile oluşturulmuş nanohibritler ile katkılandırılarak nanokompozit hidrojel yapı oluşturulmuştur. Farklı oranda MSN-GO nanohibrit katkılandırılmış hidrojellerin zamana, sıcaklığa ve pH'a bağlı şişme davranışı incelenmiştir. Hidrojellerin ilaç salım özellikleri antioksidan özellikte bir molekül olan protokateşik asit etil ester kullanılarak incelenmiştir.

Zamana bağlı şişme deneyi çalışmalarında MSN-GO nanohibrit katkısının semi-IPN hidrojellerin şişme özelliğini büyük oranda arttırdığı belirlenmiştir. Hidrojellerideki nanohibrit içeriği arttıkça şişme değerleri de artmıştır. Hidrojellerin tamamının pH'a bağlı olarak şişme büzülme davranışına sahip olduğu belirlenmiştir. İlaç yükleme çalışmaları sonucunda semi-IPN nanokompozit hidrojellerin yüzde ilaç yükleme kapasitesi ve yüzde ilaç yükleme etkinliklerinin artan MSN-GO nanohibrit miktarıyla birlikte arttığı görülmüştür.

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Keyword: *Nanokompozit hidrojel, Hidrojel yara örtüsü, Kontrollü ilaç salım sistemleri*

Fabrication of Fluorescent Branched Glycopolymer as a Potential Photosensitizer for Photodynamic Therapy and Imaging

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Cancer is the cause of one in every six deaths in the world[1], and many studies are being carried out to develop polymer-based systems for the diagnosis/treatment of cancer. Classical cancer treatment include surgery, chemotherapy and radiation. Many new approaches have been developed to address the disadvantages of conventional cancer treatments, such as low tumor selectivity, systemic toxicity, off-target toxicity, and multidrug resistance. Photodynamic therapy (PDT) and photothermal therapy (PTT) are non-invasive, light-triggered and recently developed approaches, and they have been employed in clinical studies for cancer treatment and some other diseases. Moreover, targeted delivery of therapeutics is another way to minimize disadvantages of traditional methods. Today, fluorescent dyes offer significant advantages in applications such as in vivo imaging, PDT and drug release monitoring. Compared with traditional fluorescent dyes, azadipyromethene boron complexes (aza-BODIPY) have strong absorption in the visible region, narrow emission band with high quantum yield, and good physiological and photochemical stability[2-3]. Fluorescent polymers containing both cancer cell-targeting ligand and aza-BODIPY in their structure are good candidates for imaging and photodynamic therapy. Glycopolymers are synthetic macromolecules with pendant sugar groups in their side chains and are widely used to target cancer cells via GLUT receptor. For this purpose, a branched glycopolymer containing aza-BODIPY molecules was synthesized by Reversible Addition-Fragmentation Chain Transfer (RAFT) polymerization. The water-soluble polymer was chemically and photochemically characterized by various spectroscopic methods such as NMR, FT-IR, UV-Vis and fluorescence, and showed potential properties required for PDT and imaging.

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Keyword: *Fluorescence glycopolymers, aza-BODIPY, photodynamic therapy*

ID: 180

Synthesis and Characterization of Fluorescent Glycopolymer as a Candidate for Photosensitizer in Photodynamic Therapy

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Cancer is one of the leading causes of mortality in worldwide and represents a significant obstacle to increasing life expectancy [1]. Developing new diagnostic and therapeutic methods on how to fight with cancer is at the center of global-scale scientific research efforts. Surgery stands as the primary approach in cancer treatment, with chemotherapy and radiation serving as predominant methods when surgical options are constrained or utilized adjunctively. Conventional chemotherapy uses cytotoxic agents to eliminate cancer cells but faces challenges such as side effects due to nonspecific distribution, limited bioavailability and drug resistance etc. [2]. Various new methods such as personalized treatment, hyperthermia, targeted chemotherapy, and photodynamic therapy (PDT) have been developed and applied to overcome these aforementioned side effects. PDT is considered as a minimally invasive treatment that utilizes photosensitizers, light, and molecular oxygen to selectively induce tumor cell death, demonstrating promising potential in cancer treatment [3]. Fluorescent dyes commonly used in PDT have certain disadvantages, such as weak absorbance in the NIR region and dark-toxicity. In contrast, aza-BODIPY derivatives stand out due to their strong NIR absorption and high photochemical stability [4]. However, these dyes have low water solubility. Herein, fluorescent glycopolymer with potential as a photosentisizer was designed and synthesized using aza-BODIPY based initiators via ATRP (Atom Transfer Radical Polymerization). This system containing aza-BODIPY core for fluorescence properties and glycopolymer as hydrophilic segment for cancer cell targeting. Chemical and photochemical characterizations of the small molecules and fluorescence glycopolymers were performed with NMR, FT-IR, UV-Vis and fluorescence spectroscopies. The aza-BODIPY initiator and polymeric structures have great potential to be used in PDT and will contribute to develop systems applicable to cancer diagnosis and/or treatment.

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Keyword: *Fluorescence glycopolymers, aza-BODIPY, Photodynamic Therapy*

ID: 176

PMAIpGP-b-PDMAEMA Katyonik Kopolimerinin Sentezi ve DNA ile Etkileşiminin İncelenmesi

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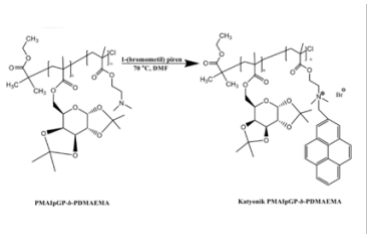
Karbonhidrat taşıyan polimerler olan glikopolimerler, özellikle asılı gruplar olarak şeker parçaları içeren sentetik polimerlerdir. Bu polimerler, hidrofobik bir ana zincire ve hidrofilik yan zincir olarak şeker kalıntılarına sahiptir. Glikopolimerler, biyolojik olarak uyumlu ve biyolojik olarak parçalanabilir özelliklerine dayanarak doku mühendisliğinde ve kontrollü ilaç salım sistemlerinde kullanılmaktadır. **[1]** Bu çalışmada, glikopolimerlere ve üçüncül amin metakrilatlara dayalı sıcaklık duyarlı amfifilik AB tipi doğrusal diblok kopolimerler sentezlendi. Bu kopolimerler, 2-(N,N-dimetilamino)etil metakrilat (DMAEMA) ve 6-O-metakriloil-1,2:3,4-di-O-izopropiliden-D-galaktopiranoz (MAIpGP) monomerlerinin, başlatıcı olarak etil 2-bromoizobutirat (EBiB) kullanılarak atom transfer radikal polimerizasyonu (ATRP) vasıtasıyla sentezlendi. PMAIpGP-b-PDMAEMA diblok kopolimerlerindeki PDMAEMA birimlerinin kuartinizasyonu, blok kopolimerlerdeki PDMAEMA birimlerinin 1-(bromometil) piren ile reaksiyona sokulmasıyla gerçekleştirilmiş ve böylece katyonik polimerler elde edilmiştir. Elde edilen katyonik PMAIpGP-b-PDMAEMA kopolimeri Nükleer Manyetik Rezonans (NMR), Ultraviyole-Görünür Spektroskopisi (UV-Vis), Fourier Dönüşümlü Kızılötesi Spektroskopisi (FTIR) analizleri vasıtasıyla karakterize edildi ve UV-Vis spektroskopisi, Etidyum bromür (EB) ile yarışmalı floresans spektroskopisi ve agaroz jel elektroforez yöntemleriyle DNA etkileşimi araştırıldı. Gen taşıma sistemlerinde kullanılan katyonik polimerler, genetik materyalin korunmasını ve hücre içine etkin bir şekilde taşınmasını sağlamaktadır. **[2]** PMAIpGP-b-PDMAEMA kopolimeri, bir hidrofilik blok (PMAIpGP) ve bir katyonik blok (PDMAEMA) içerir. Bu yapı, DNA ile elektrostatik etkileşimler kurarak, stabil ve verimli gen taşıma kompleksleri oluşturabilir. Elde edilen sonuçlar, katyonik PMAIpGP-b-PDMAEMA kopolimerinin DNA ile ancak yüksek derişimlerde kompleksleşebildiğini ortaya koymuştur. Elektroforez çalışmalarında, kopolimerlerin pozitif yüzey yüküne sahip olduğunu ve DNA'yı yüksek derişimlerde başarılı bir şekilde stabilize edebildiğini göstermiştir. UV titrasyon çalışmaları kopolimerin DNA ile elektrostatik olarak etkileştiğini ve EB ile yapılan yarışmalı floresans çalışmaları polimerin EB moleküllerini DNA baz çiftleri arasından çıkmaya zorladığını göstermiştir. Katyonik PMAIpGP-b-PDMAEMA diblok kopolimeri, gen taşıma sistemlerinde potansiyel bir aday olarak değerlendirilebilir. Gelecek çalışmalar, bu kopolimerlerin in vivo performansını ve gen ekspresyonu üzerindeki etkilerini inceleyerek biyomedikal uygulamalardaki potansiyellerini daha da derinlemesine araştırmayı hedeflemektedir.



Şekil: Katyonik PMAIpGP-b-PDMAEMA Blok Kopolimer Sentezi

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Keyword: *Poli (6-O-metakriloil-1,2:3,4-di-O-izopropiliden-D-galaktopiranoz) (PMAIpGP), Poli(2-(N,N-dimetilamino) etil metakrilat) PDMAEMA, Katyonik polimerler, DNA etkileşimi, Gen taşıma*

Poli(N-Bütil Metakrilat) ve Poli(N,N-Dimetilaminoetil Metakrilat) İçeren Katyonik Kopolimerlerin Sentezi ve DNA ile Etkileşiminin İncelenmesi

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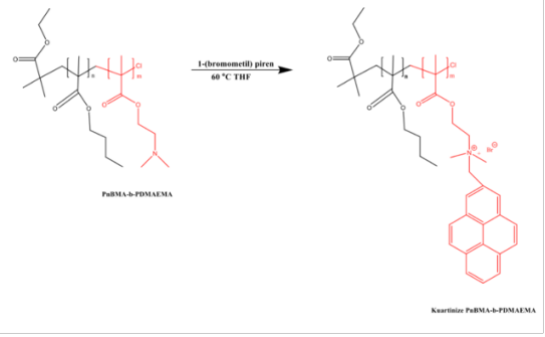
Katyonik polimerler, omurgasında veya yan zincirlerinde pozitif yükler taşıyan makromoleküller olarak tanımlanır. Pozitif yüklerin farklı konumları ve farklı polimerik yapılar, birçok farklı türde katyonik polimerler oluşturur. Katyonik polimerlerin ortak karakterleri, protonlanabilen fonksiyonel amin gruplarıdır. Katyonik polimerler, çeşitli endüstriyel ve tıbbi uygulamalarda önemli rol oynamaktadır. Bu çalışmada ilk olarak PBMA-co-PDMAEMA rasgele kopolimerleri azobisizobütironitril (AIBN) azo başlatıcısı kullanılarak geleneksel radikalik yöntemle, PBMA-b-PDMAEMA diblok kopolimeri ise Atom Transfer Radikalik Polimerleşme (ATRP) yöntemiyle sentezlendi. Elde edilen kopolimerler; Jel Geçirgenlik Kromatografisi (GPC), Fourier Dönüşümlü Kızılötesi Spektroskopisi (FTIR) ve Nükleer Manyetik Rezonans (NMR) Spektroskopisi gibi teknikler kullanılarak karakterize edildi. İkinci aşamada kopolimerlerdeki PDMAEMA kısımları 1-(bromometil) piren ile reaksiyona sokularak kuartinize edilmiş ve kopolimerler katyonik hale dönüştürülmüştür. Ardından ^{1}H-NMR, Ultraviyole-Görünür Spektroskopisi (UV-Vis) ve FTIR analizleri vasıtasıyla 1-(bromometil) piren'nin yapıya bağlandığı belirlenmiştir. Elde edilen katyonik kopolimerlerin DNA ile etkileşimleri UV Titrasyon Yöntemi, Etidyum bromür (EB) ile Yarışmalı Floresans Spektroskopisi ve Agaroz jel elektroforez yöntemleri ile incelenmiştir. UV titrasyon sonuçları polimerin DNA ile elektrostatik olarak etkileştiğine işaret etmektedir. (EB) ile yapılan yarışmalı floresans sonuçları polimerin EB moleküllerini DNA baz çiftleri arasından çıkmaya zorladığını göstermiştir. Elektroforez sonuçlarında, kopolimerlerin sahip olduğu pozitif yüzey yükü sayesinde DNA ile etkileştiği özellikle hidrofobik blok uzunluğunun artmasıyla düşük konsantrasyonlarda bile DNA ile etkileşerek DNA'yı nötralize ettiği anlaşılmıştır. Bu bulgular, kopolimerlerin DNA ile etkili bir şekilde kompleksleştiğini ve PnBMA ve PDMAEMA içeren katyonik kopolimerlerin, ilaç salınım sistemleri, biyomedikal alanlar ve gen terapisi gibi alanlarda potansiyel bir aday olarak değerlendirilebileceğini göstermektedir. Gelecek çalışmalar, bu kopolimerlerin hücre içi dağılımı ve gen ekspresyonu üzerindeki etkilerini inceleyerek biyomedikal uygulamalardaki potansiyellerini daha da derinlemesine araştırmayı hedeflemektedir.



Şekil: PBMA-b-PDMAEMA Blok Kopolimerinin Kuartinizasyonu

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Keyword: *Poli(n-bütil metakrilat) (PnBMA), Poli(N,N-dimetilaminoetil metakrilat) (PDMAEMA), ATRP, DNA etkileşimi, gen taşıma.*

Fabrication of Ibuprofen Loaded Chitosan-PLA Nanofibers by Centrifugal Spinning for Drug Release

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The design and development of drug delivery or controlled-release technologies are among the deliverables of materials and polymer sciences that collaborate with the pharmaceutical industry. Biodegradable polymers are promising to create novel materials for biomedical applications [1].
Chitosan (CS), is one of the most abundant natural polysaccharides, displaying excellent biocompatible, biodegradable, and antibacterial properties. Due to its limited solubility in weakly acidic media, easy agglomeration, and formation of large repulsive forces between the positively charged groups, it is challenging to spin CS into fibrous materials. In addition, the inherent features of CS complicate the process of continuous fiber formation. To overcome the difficulty of the spinnability of CS, it is generally combined with an easily spinnable polymer [2]. Polylactic acid (PLA) is one of the most promising biodegradable natural polymers due to its mechanical properties, biocompatibility, biodegradability and processability. In our present work, PLA and CS polymers were selected to produce environmentally friendly composite nanofibrous drug release membranes [1]. Centrifugal spinning is a promising technique with high production rate and ease of fabrication of aligned nanofiber structures. For the optimization study, rotational speed and different blend ratios of two polymer solutions were chosen.
In this study, CS and PLA were centrifugally spun to obtain a composite nanofibrous membrane for the controlled release of ibuprofen. For this purpose, 2.5% CS/acetic acid and 5% PLA/chloroform solutions were prepared individually. These solutions were mixed in the CS: PLA volume ratio of 10:90, 20:80, and 30:70 to obtain the spinning blend solution. Afterwards, ibuprofen was added to the solutions in different amounts (2.5–12.5 mg). The fiber formation was observed by SEM and average fiber diameter (AFD) of samples was measured from captured SEM images by using ImageJ open-source software. AFDs of samples were reduced with the increasing CS content. FTIR spectroscopy was utilized to identify the interaction between CS and PLA. Tensile testing, water contact angle, and porosity measurements were used to analyze the final properties of the membranes. Drug delivery capabilities were also elucidated via UV-VIS spectrophotometer. The findings of this study are significant for manufacturing novel CS-PLA composite-based materials for biomedical applications.

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Keyword: *Chitosan, Polylactic acid, centrifugal spinning*

ID: 166

Metal Ferrit Destekli Kompozit Hidrojel Sentezi; Karakterizasyonu ve Boya Adsorpsiyonu

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Endüstriyel faaliyetler ve bu faaliyetlerin yol açabileceği olumsuz sonuçlardan kaynaklanan su kirliliği günümüzde küresel bir endişe konusu haline gelmiştir. Suya karışan toksik maddeler suyun her alanda kullanımını kısıtladığı gibi canlılar için hayati öneme sahip olan temiz su miktarını da azaltmaktadır. Birçok kimyasal kirletici grubundan biri olan ağır metaller, ekosistem için oldukça zararlı maddeler olarak bildirilmelerine rağmen, günümüzde üretilen boyalar hem ağır metal içerdiklerinden hem de diğer kimyasal içeriklerinden dolayı çevre kirleticileri arasında büyük paya sahiptir. Doğal ve sentetik boyalar gıda, ilaç, kozmetik, kağıt, deri, plastik ve tekstil ürünlerinin üretildiği pek çok endüstri alanında yaygın olarak kullanılmaktadır. Sentetik boyalar, gıda endüstrisinde sıkça kullanılan doğal boyalara kıyasla özellikle kumaş ve tekstil endüstrisinde daha yaygın kullanılmaktadır [1]. Çeşitli endüstriyel uygulamalarda, özellikle üretilen ürünlerin boyanmasında 10.000'den fazla boya türünün kullanıldığı tahmin edilmektedir. Literatüre göre, dünya çapında yılda 8x 105 tondan fazla sentetik boya üretildiği, bu boyaların da yaklaşık % 10-15'inin doğal su ortamına atık olarak salındığı bildirilmektedir [2]. Sentetik boyalar genellikle biyolojik bozunmaya karşı direnç gösterirler ve çevrede uzun süre kalıcı olmaları özelliklerinden dolayı dünya çapında ciddi bir sorun haline gelen çevre kirliliğine önemli ölçüde katkı sağlarlar. Sentetik boyaların çoğu toksik, kanserojen ve mutajeniktir [3]. Bu nedenle atık sudaki boyalar az miktarda da olsa istenmeyen bir durumdur ve çevreye boşaltılmadan önce uygun şekilde uzaklaştırılmalıdır.

Bu çalışmada metal ferrit (MFe2O4) katkılı hibrit polimerik hidrojel sentezlendi. Bu amaçla çalışmanın birinci basamağında AMPS, İA monomerleri, MBAA'nın çapraz bağlayıcı ve KPS başlatıcısı kullanılarak radikalik polimerizasyonla hidrojel sentezlendi. İkinci basamakta ise sentezlenen hidrojelin MClx.yH2O/FeCl3.4H2O sulu çözeltisinde modifikasyonu ve ardından birlikte çöktürme yöntemi ile MFe2O4 katkılı hidrojeller hazırlandı. Üçüncü basamakta sentezlenen hibrit polimerik hidrojellerin karakterizasyonu FESEM-EDX, STEM, FTIR, XRD, TG/DTG, DLS, BET, VSM-DG magnetizasyon, Zeta potansiyel teknikleri ile detaylı karakterizasyonu gerçekleştirildi. Karakterizasyon çalışmaları sonucunda hazırlanan hidrojellerin manyetik özelliğe ve termal kararlılığa sahip olduğu, yüzey özelliklerinin de adsorpsiyon için uygun olduğu görülmüştür.

Son basamakta ise sulu çözeltiden boya adsorpsiyon çalışmaları yapıldı. Bu amaçla model boya olarak farklı endüstrilerde geniş kullanımı olan MB kullanılarak adsorpsiyon koşulları optimize edilerek hidrojellerin bu amaçla kullanılabilirliği araştırıldı.

Bu çalışma Yozgat Bozok Üniversitesi Bilimsel Araştırma Projeleri birimi tarafından FYL-2024-1313 kodlu proje ile desteklenmiştir.

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Keyword: *Metal Ferrit, Kompozit Hidrojel*

Characteristic Properties of Hydrogels Synthesis with Photoinitiators

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One of the methods used in the preparation of hydrogels, which we encounter in many areas of life, is photopolymerization performed with light stimuli of different wavelengths. Light stimulation attracts a lot of attention from researchers due to its affordability, user and environmental friendliness. Hydrogels formed by photopolymerization have a wide range of applications, from healthcare to drug delivery systems and 3D bioprinting. In this method, a photoinitiator or photoinitiator system (with relatively high absorption coefficients) is required to convert photolytic energy into reactive species that can drive chain growth through radical or cationic mechanism [1]. Initiators used for photopolymerization that absorb UV or visible light are classified as Type I and Type II.

In this study, hydrogels were prepared with a single formulation using 5 different photoinitiators that show activity at different wavelengths. The photoinitiators, which are widely used in the literature and are chosen based on their different types (Type I and II), are lithium phenyl-2,4,6-trimethylbenzoylphosphinate (LAP), (2,4,6 trimethyl benzoyl) diphenyl phosphine oxide (TPO), Eosin-Y is (1-[4-(2 hydroxyethoxy)-phenyl]-2-hydroxy-2-methyl-1-propan-1-one) (Irgacure2959) and 1-Hydroxycyclohexyl Phenyl Ketone (Irgacure 184). Depending on the formation of the same network structure with different initiators, the effect of the hydrogels on both the reaction kinetics and the properties of the resulting product such as rheological behavior, swelling kinetics, mechanical strength and morphological structure were evaluated. Additionally, cell viability percentages were analyzed by direct contact test in vitro. It has made a unique contribution to the literature in the field of hydrogel by bringing together and comparing the data obtained and photoinitiators, which are frequently preferred in polymer research.

Keyword: *Hydrogels, Photoinitiators, Cytotoxicity*

ID: 156

Yeni Nesil Enjekte Edilebilir ve Elektroaktif Hibrit Hidrojellerin Geliştirilmesi ve Kontrollü İlaç Salımındaki Kullanımı

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Enjekte edilebilir hidrojeller bilindiği gibi viskoelatik malzemelerdir. Viskoelastik malzemeler bulundukları sıvı formdan fiziksel (van der Waals etkileşimleri, hidrojen bağları, iyonik etkileşimler) ve kimyasal bağlarla (kovalent bağlar) jel formuna kolaylıkla dönebilen malzemelerdir. Bu özellikleri ile enjekte edilebilir bu hidrojel temelli sistemler enjeksiyon öncesi sıvı formda iken uygulamaya özel olarak gerekli hücrelerle ve/veya tedavi amaçlı terapötik ajanlarla karıştırılarak bölgeye enjekte edilmekte ve lokal olarak yerinde (in-situ) jelleşebilmektedir. Bu biyomalzemeler enjekte edildiği bölgede jelleşerek çalışıldığı bölgeyi doldurabilmekte ve akıllı bir implant görevi görebilmektedir. Böylelikle ön bir hazırlama işlemi olmadan kişiye ve/veya amaca özel tasarlanmış biyomalzemeler oluşturulabilmektedir. Ayrıca, enjekte edilebilir jeller, dokulara benzer yüksek su içeriği, ekstraselüler matriksi (ECM) taklit etme yeteneği, hücreleri homojen enkapsülasyon yeteneği, etkili madde transferi sağlaması, kimyasal ve fiziksel modifikasyonun kolay yapılabilmesi ve minimal invasiv salım yeteneği ile umut vaad eden bir sistemdir[1]. Bu çalışmada, biyouyumlu, iletken, ilaç taşıyan yeni bir enjekte edilebilir hibrit hidrojel hazırlanmış ve kontrollü ilaç salımı etkinliği incelenmiştir. Bu amaçla, jel öncül polimerlerinden olan Jelatin (Gel), iletken tetraanilin oligomeri (TA) ile konjuge edilerek Gel-TA elektroaktif polimeri sentezlenerek elde edilir. Enjekte edilebilir biyobozunur ve iletken jellerin ana iskelet yapısını Aldehit fonksiyon gruplu aljinat (Ald-Alg) ve N- süksinil kitosan (NS-KT) polimerinin arasında Schiff Bazı oluşumu ile sağlanan çapraz bağlanmadır. Enjekte edilebilir jeller içine anti-inflamatuar TS-IIA ilacı yüklenmiştir. İlaç yüklü enjekte edilebilir jellerin kontrollü ilaç salım etkinlikleri ve jellerin degredasyon süreleri incelenmiştir. Bu şekilde jellerin kontrollü ilaç salımı uygulamaları için kullanılabilirlikleri aydınlatılmıştır.

*Bu çalışma 121Z581 nolu proje kapsamında TÜBİTAK tarafından desteklenmiştir.

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Keyword: *enjekte edilebilir jel, iletken oligomer, biyopolimer, ilaç salımı,*

ID: 154

Çok Fonksiyonlu Esnek ve İletken Nanokompozit Hidrojellerin Geliştirilmesi

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Günümüzde sürekli gelişen teknoloji ile birlikte insan sağlığının anlık olarak takibi çok önemli bir çalışma konusu hale gelmiştir. Kişiye özel e-sağlık hizmetleri, elektronik giyilebilir cihazlar, yumuşak robotik sistemler ve insan bilgisayar etkileşimi için esnek ve iletken malzemelerin geliştirilmesi çok önemli bir husustur. İletken hidrojeller, biyouyumlu olmaları, sahip oldukları uygun seviyedeki Young modül değerleri ve iletkenlik özelliklerinin kombinasyonu sayesinde esnek elektronik ve giyilebilir sensör alanlarında büyük bir ilgi görmektedir. Ancak, hidrojellerin yapısı gereği yüksek su içeriği düşük ve yüksek sıcaklıklarda mekanik özelliklerini ve buna bağlı olarak uygulama alanlarında kullanımlarını sınırlamaktadır[1]. Günümüzde bu dezavantajların üstesinden gelebilmek adına Derin Ötektik Solvent (DES) temelli iyonojeller giyilebilir sensörler alanında kullanılmaya başlanmıştır. DES'ler toksik olmayan, ucuz ve hazırlanışı pratik olan, düşük donma sıcaklıklarına ve yüksek kaynama sıcaklıklarına sahip ve aynı zamanda iyonik iletkenlikleri yüksek olan "yeşil çözücüler" olarak bilinmektedirler. Bu çalışma kapsamında çözücü ortamı DES'ler olan, iletken polimer/kil nanokompozit katkılı iyonojeller geliştirilmiştir. Jellerin yapışabilirlikleri, mekanik ve iletkenlik özellikleri karakterize edilerek giyilebilir sensör uygulamaları için kullanılabilirlikleri araştırılmıştır.

Bu çalışma 223Z170 nolu proje kapsamında TÜBİTAK tarafından desteklenmiştir.

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Keyword: *İletken Polimer, Gerilebilir ve Giyilebilir Sensör*

ID: 150

Synthesis, Characterisation, and Application of Polychalcogenourea Based Polymers

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Multicomponent polymerizations (MCPs) have emerged as a promising strategy for synthesizing novel polymers. The MCP method enables the synthesis of polymers with various functional groups in a simple, efficient and catalyst-free manner, producing high-performance and versatile materials while reducing environmental impacts. In this study, it have been researched synthesis of sulfur-containing and selenium-containing polychalcanoureas by using MCPs method with potential applications in removing heavy and precious metal ions. This work investigates the use of MCPs to form polychalcanoureas from an elemental chalcogen (selenium or sulfur), 1,4 bis(isocyanomethyl)methane, and 1,6-diaminohexane eliminating the need for catalysts. Nuclear Magnetic Resonance (NMR), Fourier Transform Infrared Spectroscopy (FTIR) have been used to characterize the chemical structure of the synthesized polymers. Then, thermogravimetric analysis (TGA) has been used to characterize the polymers by providing detailed information about their thermal properties and behavior. This combined approach holds promise for developing new functional polymers with precious metal capture capabilities. Additionally, hydrogen is produced from aminoborane by catalyzing polymer supported silver nanoparticles.

Keyword: *Polychalcogenourea, Multicomponent Polymerization, Silver Nanoparticles*

ID: 148

Effect of Polymer Structure on the Synthesis of Silver Nanoparticles

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Polythioureas, belonging to the family of sulfur-containing polymers, are recognized for their diverse properties, including self-healing capabilities, high refractive indices, good electrical insulating properties, and ability to bind with heavy metal ions. However, their versatility is often hindered by the limited availability of synthesis methods. In this study, a facile and accessible approach for the synthesis of polythioureas is presented, by combining 4,4'-diphenylaminomethane and 1,6-diaminohexane with carbon disulfide (CS_2) in dimethylformamide (DMF) under a protective nitrogen gas atmosphere. The primary focus of this investigation is elucidating the differences between the alternating copolymer, which was synthesized previously via multicomponent polymerization, and random copolymer which is synthesized in this study. Utilizing 4,4'-diphenylaminomethane and 1,6-diaminohexane in presence of DMF and CS_2, a random polythiourea copolymer was successfully synthesized. The presence of a nitrogen gas atmosphere proves instrumental in facilitating the copolymerization process. The corresponding polythiourea exhibits diverse structural characteristics, with distinct properties attributed to the specific monomer combinations employed.
Furthermore, the copolymerization behavior of both aromatic and aliphatic monomers with CS_2 is investigated, leading to the synthesis of polythioureas with varying compositions and properties. As an innovative aspect of this study, the influence of copolymer structure on the synthesis of silver nanoparticles is observed. Understanding the relationship between polymer structure and nanoparticle morphology is crucial for tailoring the properties of these nanoparticles for specific applications.Characterization of the synthesized polythiourea and silver nanoparticles will involve a comprehensive suite of analytical techniques, including proton nuclear magnetic resonance spectroscopy (H-NMR) and Fourier-transform infrared spectroscopy (FTIR) for elucidating chemical structures, and transmission electron microscopy (TEM) for analyzing morphology and size distribution. This comprehensive characterization approach was used to gain valuable insights into the structure-property relationships of the synthesized materials, facilitating their potential applications across various fields.

Keyword: *Polymer types, supporting material, polythioureas*

ID: 142

Yeni Schiff Bazı Türevlerinin Sentezi, Karakterizasyonu ve Biyolojik Özelliklerinin İncelenmesi

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Schiff bazları, primer aminlerin karbonil gruplarıyla verdikleri reaksiyon sonucu oluşan, yapılarında imin bağı bulunduran organik moleküllerdir. Schiff bazları, çeşitli reaksiyonlarda ara ürün ve katalizör olarak kullanılan yapılar olmakla beraber, aynı zamanda bu moleküller metal iyonlarıyla kararlı kompleks yapılar oluştururlar [1].
Literatürde, Schiff bazları ve Schiff baz metal komplekslerinin antibakteriyel [2], antimikrobiyel, antifungal, antioksidan [3] ve antikanser [4] gibi çeşitli biyolojik aktiviteler sergilediği rapor edilmiştir. Söz konusu biyolojik aktiviteler, bu moleküllerin potansiyel terapötik uygulamalar için değerlendirilmesini gündeme getirmiştir. Schiff bazlarının sentez, karakterizasyon ve biyolojik aktivite çalışmaları, organik ve koordinasyon kimyası alanlarında yoğun ilgi görmektedir. Bu bileşiklerin çeşitli özellikleri ve uygulama alanları hakkındaki araştırmalar, kimya ve ilgili disiplinlerde halen devam etmektedir.
Bu çalışmada, primer aminlerin aldehit varlığında, uygun koşullarda gerçekleştirilen reaksiyonu sonucu iki farklı Schiff bazı türevinin sentezi gerçekleştirilmiştir. Elde edilen Schiff bazlarının karakterizasyon çalışmaları yürütülmüştür. Bu kapsamda, Fourier dönüşümlü kızılötesi spektroskopisi (FT-IR), nükleer manyetik rezonans spektroskopisi (NMR), yüksek performanslı sıvı kromatografisi (HPLC), kütle spektroskopisi (MS), UV-Vis absorpsiyon spektrofotometresi, floresans spektrofotometresi gibi çeşitli spektroskopik cihazlar kullanılmıştır. Sentezlenen Schiff bazı türevlerinin fotobaşlatma özellikleri UV ile kürlenebilir formülasyonlarda incelenmiştir [5]. Antibakteriyel özelliklerinin incelenmesine yönelik çalışmalarımız devam etmektedir.

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Keyword: *Schiff bazı, Fotopolimerizasyon, Antibakteriyel*

ID: 141

L-Proline Takılı PVA Polimer Sentezi ve Karakterizasyonu

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Günümüzde biyobazlı polimerler üzerine yapılan çalışmalarda, biyolojik olarak parçalanabilirlik konusu önemli bir odak noktası haline gelmiştir [1]. Biyobozunur sistemler, belirlenen koşullar altında doğal olarak parçalanıp zararsız hale gelen ve vücuttan atılan biyouyumlu malzemelerdir. Polivinil alkol (PVA), biyolojik olarak parçalanabilen en önemli polimerlerden biridir. Kimyasal ve termal açıdan stabil olmasıyla birlikte hidrofilik bir yapıya sahiptir. Yüksek biyolojik uyumluluğa ve toksisite içermemesine ek olarak, işlenmesi kolaydır ve farklı çapraz bağlayıcı maddelerle reaksiyona girerek jel oluşturabilir. Bu özellikler, PVA'nın tıp, kozmetik, gıda, ilaç ve ambalaj endüstrilerinde geniş bir kullanım alanına sahip olmasını sağlamıştır. PVA'nın viskozitesi, PVA kaplama maddelerinin tabletler, kapsüller ve diğer formlara tipik olarak uygulanmasını mümkün kılar. Ayrıca, PVA, aktif bileşenleri nemden, oksijenden ve diğer çevresel etmenlerden korurken aynı zamanda tat ve koku gizlemesine yardımcı olur [1,2].
Kolajen bazlı polimerlere yönelik çalışmalarda ise, kolajen önemli bir biyomalzeme olarak kabul edilmektedir [3]. Bağ dokusunun kritik bir bileşeni olan kolajen, vücudu bir arada tutmada önemli bir rol oynar. Bir aminoasit olan L-prolin, kolajen proteininin üretiminde ve insan vücudundaki biyokimyasal süreçlerde önemli bir rol oynar [4]. L-prolin, cilt ve bağ dokularının geliştirilmesi ve korunmasında önemli işlevlere sahiptir. Ayrıca, yaraların iyileşmesi, hasarlı dokuların onarılması ve kasların yenilenmesi süreçlerinde de rol oynar. L-prolin, sağlıklı bireyler tarafından vücutta sentezlenebilen esansiyel olmayan bir amino asittir [5].
Bu çalışmanın amacı, bir amino asit türevi olan L-prolin ile Polivinil alkol (PVA)'nın esterifikasyon reaksiyonu sonucu PVA bazlı bir poimerik film eldesidir. Sentezlenen PVA-L-prolin polimerik filminin karakterizasyonu NMR ve FTIR ile termal karakterizasyonu Diferansiyel Taramalı Kalorimetri (DSC) ile gerçekleştirildi. Fotofiziksel özellikleri UV-Vis Absorpsiyon Spektroskopisi, Floresans Spektrofotometresi, gibi çeşitli analiz yöntemleri kullanılarak değerlendirilmiştir. PVA-L-prolin polimerik filmin hedeflenen gelecek çalışmaları arasında iletkenlik ve doku iyileşmesi uygulamalarındaki potansiyeli de incelenecektir.

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Keyword: *Polimerik Film, Biyobazlı Polimerler, L-prolin*

ID: 140

Kenevir Yağının Akrillenmesi ve UV ile Kürlenebilir Formülasyonlarda Kullanımı

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Günümüzde artan çevre kirliliği ve tükenmekte olan yenilenemeyen kaynaklar, endüstriyi ve akademiyi çevre dostu yenilenebilir kaynaklardan üretilen malzemelerin geliştirilmesi konusunda araştırmalara yöneltmiştir. Biyo bazlı reçinelerin çoğunun düşük çevresel etkilerinin yanı sıra doğal ve yenilenebilir kaynaklardan üretilmesi petrol bazlı reçinelere cazip bir alternatif sunmaktadır[1]. Çevreci polimerizasyon proseslerinin geliştirilmesi, günümüzde kritik bir öncelik haline gelmiştir. Artan çevre bilinci ve yasal düzenlemeler nedeniyle kaplama ve baskı endüstrilerinde ekolojik ürünlerin oluşturulması, sektörün en önemli motivasyon kaynaklarından birini teşkil etmektedir[2].

Yaygın kullanılan polimerler ve polimer kompozitleri genellikle petrol kaynaklarından elde edilmektedir. Bu da bu malzemeler için hala alternatif ve sürdürülebilir bir kaynağa ihtiyaç olduğunu göstermektedir. Petrol fiyatlarının artması ve çevre sorunları da göz önüne alındığında, son on yılda bitkisel yağlardan sürdürülebilir polimer malzemeler geliştirmek adına yoğun araştırmalar yapılmıştır. Bitkisel yağlardan polimer elde etme yöntemleri, biyo-bozunabilirlik, çevre dostu üretim, enerji verimliliği ve yenilenebilir hammadde kullanımı gibi "yeşil kimya" prensiplerini de karşılamaktadır[3].

Kaplama endüstrilerinde, ısıl kürlenme yönteminin yerine UV kürlenme tekniğinin kullanılmasının nedeni, UV kürlenmenin düşük enerji tüketimi, oda sıcaklığında bile yüksek kürlenme hızı ve VOC emisyonu olmaması gibi özellikler sunmasıdır[4]. Fosil kaynaklarının öngörülebilir tükenmesi ve artan çevre endişeleri nedeniyle, UV kürlenebilir kaplamalarda biyo bazlı kaynakların kullanılması, günümüz kaplama endüstrisi için "yeşil + yeşil" bir çözüm sunmaktadır[5].

Bu çalışmada, sürdürülebilir bir kaynak olan kenevir tohumu yağından türetilen, çevre dostu ve UV kürlenebilir bir formülasyon geliştirilmiştir ve kenevir yağından sentezlenen akrilatın UV kürlenebilirlik özelliği başarıyla kanıtlanmıştır.

Bitkisel yağların akrilatlanması için literatürde yaygın olarak uygulanan yöntemi takip ederek, kenevir yağındaki çift bağlar, hidrojen peroksit varlığında epoksitlenmiş ve epokside kenevir yağı (EHO) elde edilmiştir. Ardından, epoksi halkasının açılması sonucu akrilatlanmış epokside kenevir yağı (AEHO) başarılı bir şekilde sentezlenmiştir. Sentezlenen AEHO oligomerinin yapısal karakterizasyonu, Fourier Dönüşümlü Kızılötesi (FTIR) Spektroskopisi, Jel Geçirgenlik Kromatografisi (GPC) ve Nükleer Manyetik Rezonans (NMR) Spektroskopisi kullanılarak gerçekleştirilmiştir.

Sentezlenen akrilatlanmış epokside kenevir yağı (AEHO) oligomeri, tris(3-merkaptopriyonat) (TMPTA) ile farklı oranlarda karıştırılarak UV kürlenebilir formülasyonlar hazırlanmıştır. Elde edilen formülasyonların fotofiziksel ve fotokimyasal özellikleri ayrıntılı bir şekilde incelenmiş, kürleme kinetiği ise foto diferansiyel taramalı kalorimetre (foto-DSC) tekniği kullanılarak karakterize edilmiştir. Ayrıca farklı aydınlatma sürelerinde gerçek zamanlı Fourier Dönüşümlü Kızılötesi Spektroskopisi (RT-FTIR) analizleri gerçekleştirilmiş olup formülasyonların fotokürlenme davranışları izlenmiştir.

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Keyword: *Kenevir Yağı, Fotopolimerizasyon, Biyo-Bazlı Kaplamalar*

ID: 139

Alginate-based Porous PolyHIPE for Removal of Single and Multi-Dye Mixtures

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PolyHIPEs are promising adsorbent materials [1-3] because they can combine low bulk density, an open cellular structure with interconnected pores, substantial specific surface area, high permeability with mechanical integrity, and other unique features.
In this study, A novel hydrophilic porous alginate-based polyHIPE (AGA) was synthesized via an oil-in-water emulsion templating approach. AGA was used as an adsorbent for removing methylene blue (MB) dye in single- and multi-dye systems. BET, SEM, FTIR, XRD, and TEM were used to characterize AGA to elucidate its morphology, composition and physicochemical properties. According to the results, 1.25 g/L AGA adsorbed 99 % of 10 mg/L MB in 3 h in a single-dye system. The removal efficiency decreased to 97.2 % in the presence of 10 mg/L Cu^{2+} ions and 40.2 % when the solution salinity increased to 70 %. In a single-dye system, the experimental data do not match well with the Freundlich isotherm, pseudo-first order, and the Elovich kinetic model, however, in a multi-dye system, it fits well with both extended Langmuir and the Sheindorf-Rebhun-Sheintuch. Notably, AGA removed 66.87 mg/g in a dye solution containing only MB, whereas 50.14–60.01 mg/g adsorption of MB was accomplished in a multiple-dye system. According to the molecular docking analysis, the dye removal process involved chemical bonds between the functional groups of AGA and the dye molecules, hydrogen bonds, hydrophobic and electrostatic interactions. The overall binding score of MB decreased from − 26.9 kcal/mol in a single-dye system to − 18.3 kcal/mol in a ternary system.
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Keyword: *PolyHIPEs, Alginate, Adsorption*

Synthesis and Characterization of Thyme Oil and Snail Mucus loaded Chitosan-based Hydrogels for Wound Healing Applications

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Wounds, especially those affecting the skin, represent a major challenge for humanity. Skin wounds are defined as physical injuries to the outer layer of the skin. Snail mucus is used to treat injuries and is well known for its analgesic properties. Studies on snail mucus have confirmed the presence of natural substances such proteins, glycolic acid, and allantoin that are therapeutic and beneficial for human skin [1]. Thyme oil also exhibits antibacterial and antiviral properties [2]. Literature review exhibits that there is no investigation on wound dressing materials that combine snail mucus and thyme oil. The purpose of the study is to develop a chitosan-based hydrogel incorporating thyme oil and snail mucus.
In this study, we developed novel hydrogels with enhanced wound healing by utilizing biomolecules such as chitosan, snail mucus, and thyme oil. Hydrogels are three-dimensional hydrophilic polymer networks that have a high capacity for absorbing water and can be derived from natural or synthetic polymers [3]. Natural hydrogels, such as chitosan, are derived from chitin, the main component of the shells of crustaceans. We synthesized the hydrogels using N-isopropylacrylamide and N,N'-methylene bisacrylamide with different molar ratios of chitosan. Hydrogels including chitosan, snail mucus, and thyme oil were successfully synthesized and characterized using SEM and FTIR Spectroscopy. Swelling profiles and degradation characteristics were also investigated.
The development of a chitosan-based hydrogel incorporating thyme oil and snail mucus represents a promising approach for enhanced wound healing. This novel hydrogel combines the beneficial properties of its constituents, offering a multifunctional wound dressing material that addresses both infection control and pain management. Further studies are needed to evaluate the in vivo efficacy and safety of the hydrogel in clinical settings.

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Keyword: *Hydrogel, Chitosan, Wound Healing*

ID: 127

Development of Lignid Derived Biobased Epoxy Resins

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Epoxy resins are widely used in various industrial applications, such as coatings, adhesives, and composites. Bisphenol A (BPA), one of the most commonly used compounds in the production of these resins, poses significant health risks. The adverse effects of BPA on the endocrine system, the female and male reproductive systems, and its role in triggering certain types of cancer have been extensively researched and confirmed in numerous studies over the decades. Consequently, the development of safer and more environmentally friendly alternatives to BPA is of paramount importance.
In this context, bisguaiacol-f (BGF), a compound synthesized from guaiacol and vanillyl alcohol, has emerged as a promising alternative to BPA. Literature studies show that BGF possesses structural properties similar to BPA but is significantly less toxic.
This study explores the synthesis of bisguaiacol F (BGF) and its impact on semi-bio-based epoxy resins. Initially, BGF was synthesized through the reaction of guaiacol and vanillyl alcohol under specific temperature and pressure conditions, yielding a pure form of BGF. Subsequently, a semi-bio-based epoxy resin was synthesized by reacting 50% BPA and 50% BGF with epichlorohydrin. Application tests demonstrated that the new resin containing BGF exhibited performance characteristics very similar to BPA-based resins. Tests on mechanical strength, adhesion properties, and chemical resistance confirmed the suitability of the new resin for industrial applications.
In conclusion, our findings show that bisguaiacol F (BGF) holds substantial potential as an alternative to BPA in the development of environmentally friendly epoxy resins. The findings of this study promote the use of safer and more sustainable materials in industrial applications.

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Keyword: *Biobased epoxy resin, Lignin, Bisguaiacol F*

ID: 124

Development of Isosorbide Based Bio-epoxy Resin

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Epoxy resins are one of the most preferred polymeric materials in industrial applications. While Bisphenol A (BPA), which is frequently used in the synthesis of epoxy resins, is responsible for many positive properties of the final material, its negative effects on human health have been the subject of many studies conducted for years. Its negative effects on the endocrine system have been proven by these studies. In literature, mostly used alternatives for BPA-based epoxies can be lignin derivative monophenols and diols and reaction products of these can be extracted from lignocellulosic biomass. However, these compounds do not have sufficient physical, chemical and mechanical properties when compared with BPA based epoxy resins. Apart from these compounds, the use of alternative substances such as isosorbide containing two hydroxyl groups in a cyclic structure that does not harm human health was emphasized. In this study, new methods for the synthesis of isosorbide-based epoxy resins were developed and the properties of the resins were extensively characterized. By optimizing isosorbide-based epoxy resin synthesis processes, isosorbide-based epoxy resin was obtained with the appearance, viscosity and eew (epoxy equivalent weight) values which are very closed to BPA-based epoxy resin. The optimized recipe was used in coating studies on different surfaces and the performance of these coatings was compared with BPA-based epoxy resin coatings. surface adhesion, yellowing stability and surface wettability test results showed that isosorbide based epoxy resin is promising for coating applications. In addition, the curing trend analysis, was applied to BPA and isosorbide-based epoxy resin to determine application areas of epoxy resins.
This study shows that isosorbide-based epoxy resins will be a good candidate for the development of environmentally friendly coatings and composite materials for industrial applications.

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Keyword: *biobased epoxy resin, isosorbide, coating*

ID: 119

Development of Biguanidine Based Fixing Agent using in Textile Applications

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The application of reactive dyes boasts a comprehensive array of colors, vibrant color characteristics, excellent evenness, and cost-effectiveness. It has emerged as the favored dye category for cellulosic fiber fabrics. Currently, the annual production of reactive dyes stands at 200 thousand tons, constituting approximately 20% of the global dye output. While water-soluble reactive dyes can establish covalent bonds with cotton fibers, dye reacts by a hydrolysis reaction with water. Hydrolyzed dye tends to be resistant to removal and may exhibit a certain affinity for fibers. Hence, there exists a necessity for firmly anchored colors post-dyeing to enhance color fastness . With the escalating demand for superior color fastness and reduced formaldehyde content in textiles across domestic and international markets, researchers worldwide are actively pursuing the development of environmentally friendly dyeing and fixing agents. As per the current scenario, the utilization of formaldehyde-free fastness enhancers predominantly relies on amines and polycationic fixing agents derived from epoxy chloropropane. With a focus on sustainability, the textile industry is adopting eco-friendly pretreatment and dyeing processes, including the use of cationic fixing agents to reduce environmental impact.The objective of this study is to formulate a reactive fixing agent that is devoid of formaldehyde and diverges from polyamine-based compositions. The present invention relates to non-formaldehyde cat ionic or multiply cationic charged guanidine or polyguani dine products. These compounds are prepared from aninorganic armnonium salt. such as ammonium halide, ammonium sulfate, and ammonium nitrate. After synthesizing the polymer, we conducted performance tests, including assessments of washing and rubbing fastness, to characterize the biguanidine-based polymers in comparison to others.

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Keyword: *biguanidine based polymer, fixing agent*

Farklı Bitki Temelli Bileşenler Kullanılarak Nişasta Bazlı Biyoplastiklerin Sentezi ve Karakterizasyonu

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Plastik malzemeler, sektörel uygulama kolaylığı, düşük maliyet, kolayca şekillendirilebilme ve uzun ömürlü olma gibi avantajlar sunmaktadır. Ancak, bu malzemelerin çevreye verdiği zararlar, özellikle plastik malzemelerin üretiminden, atıklarının bertaraf edilmesine kadar olan süreçte, ciddi bir endişe oluşturmaktadır. Yılda 150 milyon ton petrolün kullanılması nedeniyle 500 milyon tonun üzerinde toksik atığın ortaya çıkması ile birlikte oluşabilecek çevresel zararın önüne geçmek amacıyla alternatif üretim yöntemleri ve ham madde kaynağı arayışı hızlanmıştır [1,2]. Bu kapsamda biyoplastikler; biyolojik tabanlı olmaları, yüksek çözünürlük avantajı sunmaları ve geri dönüştürülebilirlik gibi özellikleriyle öne çıkmaktadır. Biyoplastikler; yenilenebilir bitkisel hammaddelerden, selüloz, lignin, protein gibi kaynaklardan veya bazı hayvansal kaynaklardan elde edilebilmektedir [3]. Biyoplastikler toksik madde içermemesi, düşük sera gazı emisyonu ve daha az enerji tüketimi sebebiyle tercih edilse de yapılan çalışmalarda yüksek maliyet ve mekanik/termal özelliklerdeki zayıflıklar gibi dezavantajları da tespit edilmiştir [3]. Bu zayıf özellikleri geliştirmek için kullanılan çeşitli katkı maddeleri, stabilizatörler, renklendiriciler, işleme yardımcıları kullanılabilmekte ve farklı üretim yöntemleri bulunmaktadır. Bu yöntemler arasında çözelti dökümü, eriyik karışım, elektro-eğirme, ekstrüzyon üfleme, termopresleme ve döküm gibi biyopolimer üretim yöntemleri tercih edilmektedir [4,5].
Yapılan çalışmanın amacı günlük hayatta her alanda sıklıkla kullanılan, çoğunlukla petrol ve türevlerinden elde edilen ve özellikle su ve toprak ekosistemlerinde çevre kirliliğin temel sebeplerinden biri olan plastik ürünlerin yerine bitkisel kaynaklardan üretilebilen, çevreye daha az zarar verdiği yapılan çalışmalarla ortaya çıkarılmış biyoplastiklerin kullanım alanlarının genişletilmesine katkıda bulunmak üzere biyobozunur ürünlerin hazırlanmasında kullanılabilecek hammadde üretimi sağlamaktır. Bu çalışmada, yerli üretimi olan ulaşılabilirliği kolay ve düşük maliyetli mısır ve buğday nişastası; çözelti döküm yöntemiyle üzüm sirkesi ve deiyonize su varlığında polimerleştirilerek ürün geliştirilmesine yönelik hammadde olma potansiyeli yüksek biyoplastikler sentezlenmiştir. Polimerlerin hazırlanması sırasında plastikleştirici olarak gliserol ve sorbitol tercih edilmiş olup plastikleştirici miktarının termoplastik nişasta üzerindeki etkisi incelenmiştir. Geliştirilen biyoplastik malzemelerin mekanik, morfolojik ve termal özellikleri analiz edilmiştir. Bu malzemelerin su ve toprak ekosistemlerinde bozunma süreci laboratuvar ölçekli simüle edilmiştir.

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Keyword: *Termoplastik Nişasta, Biyoplastik, Biyopolimer, Biyobozunma, Nişasta, Gliserol, Sorbitol*

Advancing Polymerization with Recycled Monomers for Sustainability

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The application of plastics in various fields has significantly increased over recent decades, leading to a substantial rise in production volumes to meet the growing demand. The majority of plastics are industrially produced from fossil-based raw materials. Additionally, numerous reports have highlighted concerns about plastics that are not recycled at the end of their lifecycle, instead ending up in landfills or the oceans. There is a growing trend towards producing plastics more sustainably due to environmental concerns, stricter regulations, and the fear of depleting fossil fuels. Several strategies were investigated to decrease the reliance on fossil-based feedstocks. Chemical recycling technologies can address our global resource challenge by boosting the recycling rate of end-of-life plastics and supplying alternative feedstock to replace traditional fossil-based sources.

Recycled monomers obtained through chemical recycling are promising candidates to decrease the dependence on primary fossil-based resources. In general, recycled monomers containing higher levels of impurities than the corresponding virgin monomers are produced by chemical recycling. Recycled methyl methacrylate (rMMA) can be obtained in an industrial scale via thermal cracking of poly (methy lmethacrylate) (PMMA) waste. In this study, the use of rMMA as a sustainable raw material to develop waterborne polymer dispersions with lower environmental impact was investigated. Impurities in rMMA have been characterized through GC-MS. It has been found that the concentration of specific impurities in rMMA is higher than in industrial-grade conventional MMA. The polymerization efficiency of rMMA was studied in several methyl methacrylate copolymers. It has been shown that the use of rMMA yielded copolymers possessing the same performance as copolymers synthesized with conventional MMA. Cradle-to-gate life cycle assessment indicated that copolymers comprising rMMA have lower global warming potential than copolymers comprising conventional MMA.

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Keyword: *chemical recycling, poly (methyl methacrylate), circular economy*

ID: 111

Kenevir Biyokütlesinden Multifonksiyonel Manyetik Biyokompozit ve Karakterizasyonu

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Lignoselülozik biyokütlenin ana yapısal bileşeni olan selüloz, yüksek talep gören kimyasal bileşiklerin üretimi için değerli bir kimyasal hammaddedir [1]. Selüloz bazlı malzemeler, mükemmel ıslanabilirlik, yüksek gözeneklilik, hafiflik, doğal/çevresel koşullar altında biyolojik olarak parçalanabilirlik ve biyouyumluluk gibi benzersiz özelliklerinden dolayı gıda, ilaç ve kimya endüstrilerinde yaygın uygulama alanı bulmaktadır [2,3]. Çok sayıda selüloz türevi arasında sülfat grubu içeren ürünler özellikle dikkat çekmektedir. Selüloz sülfatlar endüstride yoğunlaştırıcı, adsorbent, iyon değiştirici malzemeler vb. olarak kullanılır [4]. Son yıllarda farklı biyokütlelerden çok sayıda selüloz bazlı fonksiyonel materyaller geliştirilmiştir. Bu çalışmada kenevir biyokütlesinden asit aktivasyonu, aşı kopolimerizasyonu, modifikasyon ve birlikte çöktürme teknikleri ile selüloz bazlı multifonksiyonel manyetik biyokompozit hazırlandı ve çeşitli tekniklerle (FTIR, FESEM-EDX, STEM, XRD, TG/DTG, VSM ve BET) karakterize edildi.

Karakterizasyon çalışma sonuçlarından hazırlanan biyokompozitin (MKB) selüloz destekli sülfonil ve karboksilik asit grupları içerdiği, mıknatıslanma değerinin 19,10 emu/g ve negatif yüzey yüke sahip olduğu belirlendi. Ayrıca yüzey analiz sonuçlarından MKB'nin BET yüzey alanının (156 m^2/g) toplam gözenek hacminin (0,247 cm^3/g), ortalama gözenek yarıçapının (3,168 nm) literatürle kıyaslandığında kayda değer büyüklükte ve yüksek termal kararlılıkta olduğu belirlendi

Bu çalışma Yozgat Bozok Üniversitesi Bilimsel Araştırma Projeleri birimi tarafından FDK-2024-1309 kodlu proje ile desteklenmiştir.

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Keyword: *Manyetik Biyokompozit,, Biyokütle, Karakterizasyon*

ID: 109

Synthesis and Characterization of Phenyl Urea Propyl Imidazole

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This study investigates the formulation and curing behavior of a one-component epoxy resin (OCER). The OCER was formulated using phenylurea propyl imidazole (PUPI) as thermal latent curing agent and diglycidylether bisphenol A (DGEBA). PUPI was synthesized by reacting phenyl isocyanate with 1-(3-aminopropyl)imidazole and characterized using ^{1}H NMR, FTIR, TGA, and DSC. PUPI and DGEBA were mixed with a homogenizer at ambient temperature. Cure kinetics studies were conducted using DSC and a rheometer. The OCER achieved conversions of 97.1% and 99.2% at 120°C and 140 °C in 5.17 min. and 1.95 min., respectively, and exhibited stability of three days at ambient temperature. Furthermore, PUPI acted as an accelerator for the dicyandiamide curing agent in the curing of DGEBA. Upon the incorporation of PUPI at various amounts (1%, 5%, and 10% by weight), the left limit and peak temperatures of curing were significantly lowered from 173 °C and 204 °C to 72-111 °C and 122-155 °C, respectively.

Keyword: *epoxy curing, latent curing agent, urea based latent curing agent*

ID: 108

Synthesis and Characterization of EPI-DMA Based Cationic Polyamines: Evaluating Fixing Properties in Textile Applications

Not Presented

ID: 107

Electric-Field Responsive Smart Fluid from Black Cumin Seed Biomass in Polydimethylsiloxane

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Electric-field responsive smart fluids or electrorheological (ER) fluids are heterogeneous intelligent systems of polarizable particles dispersed in an insulating carrier fluid. When a sufficiently large electric field (E) is applied to an ER fluid, the randomly dispersed particles are polarized and orientated along the direction of the E, resulting in the formation of a fibrillar/columnar or continuous network structure within a few milliseconds. This rapid alteration in their microstructure upon E leads to a dramatic change in their rheological properties. When the E is removed, the dispersion in the Bingham fluid state returns to its initial Newtonian fluid state [1].

In recent years, studies on the evaluation of large amounts of agricultural industrial waste and the prevention of environmental pollution have come to the fore for a sustainable life. In this study, an ER fluid was developed by using black cumin seed biomass powder as the dispersed phase and polydimethylsiloxane as the dispersing medium. The black cumin seed biomass (BCB) obtained from black cumin (Nigella sativa) seed by cold pressing was washed with water, dried, and ground before the ER fluid preparation stage. The obtained BCB powder was characterized by structural, elemental, and morphological analyses. Then, the dispersions were prepared in various particle mass percent concentrations, and the shear rate-controlled rheological properties of the dispersions were examined under various externally applied electric fields. The yield stresses of the BCB/polydimethylsiloxane dispersions increased with increasing the concentration and the E without significant leakage current during the rheological measurements. The rheological and dielectric measurements revealed that small molecules remaining in the structure after the cold pressing process played an important role in polarizing the BCB under the E. Thus, the BCB powder, a cheap, easily accessible biomass source released in large quantities as waste in our country, has been evaluated in a new area of use as a sustainable dispersed phase in ER fluids.

Acknowledgments
The authors thank the 2209-A-Research Project Support Programme for Undergraduate Students (TÜBİTAK-BİDEB) for the financial support to this work and Prof. H.I. Unal for allowing us to use the laboratory facility for rheological and dielectric studies.

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Keyword: *Sustainability, Agricultural industry waste, Black cumin seed biomass, Electrorheological fluids, Upcycling*

ID: 104

Encapsulated Different N-Alkanes with Methylmethacrylate-Based Copolymer Shells as Phase Change Materials for Thermal Energy Storage

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Phase change materials are important functional materials that allow thermal energy to be stored as latent heat at constant temperature during phase change and released to the environment when necessary. Phase changing substances are generally classified under three headings: organic, inorganic and eutectic.

Materials such as paraffins, fatty acids and polyethylene glycol are frequently preferred as latent heat storage materials and used in heating-cooling applications. The paraffins in the organic class of phase change materials are remarkable with their high latent heat storage capacity, superior phase change performance and good thermal and chemical stability [1].

In recent years, encapsulation of PCMs has been widely used to effectively reduce the leakage of PCMs during the solid-liquid phase transition and prevent the PCM from reacting with the surrounding environment. Encapsulation technology, which provides constant volume and large heat transfer area for PCM-based thermal storage, can also provide relatively high thermal cycling stability [2].

In this study, PCM materials were encapsulated by the emulsion polymerization method. Methylmethacrylate was chosen to form the shell, and various types of PCM were examined as core materials. The effect of the type of PCM used on the heat capacity of the capsules, particle size distribution, and encapsulation efficiency of each experiment was examined.

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Keyword: *phase change materials, paraffin, encapsulation*

ID: 103

An Investigation to Enhance Adhesion and Scrub Resistance: The Role of Functional Monomers

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The needs of the water-based paint and coating industry differ mainly in applications that can be defined as industrial and architectural applications. At a more advanced level, the type of surface to be coated, the way the coating is applied and the end use of the coating, etc. can be classified by features. Carefully examining the mentioned parameters is of vital importance in designing the binder to be used in the coating. For example, decorative paints used on interior surfaces are applied to different surfaces such as kitchens, bathrooms, walls, floors and ceilings. The important requirements for this type of paint are that it is odorless, has good color stability, dries quickly, is resistant to scrubbing during cleaning, and has good adhesion to the surface to be applied[1]. Whether a paint or coating has these properties is directly related to the properties of the binder. Improving the desired features is possible by developing different solutions. In this context, the polymer needs of the paint and coating industry are designed by taking into consideration monomer composition, minimum film formation temperature, adhesion to different surfaces, scrub resistance, color intensity and many other factors. Apart from selecting the main monomers for these needs, it is possible to provide and/or support the desired properties with existing functional monomers. The aim of this study is to synthesize binders functionalized with functional monomers functionalized with ureido, epoxy and silanol and to elucidate the final properties of these binders. Monomers selected within the scope of the study; It is in the form of epoxy-functional glycidyl methacrylate (GMA), MEEU with ureido function and another functional monomer containing silanol groups. Whether these three differently functionalized monomers can be used in binder synthesis and the effect of the functionalized polymer on the adhesion performance and wet scrubbing resistance on interior surfaces will be examined.

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Keyword: *functional monomers, polymerization, scrub resistance*

ID: 98

Development of Natural Fiber Reinforced Thermoplastic Matrix Composites Through Liquid Molding Using Acrylic Resin

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Natural fiber composites from cellulosic fibers extracted from wood and plants have received growing attention as an alternative to glass fibers due to their renewable character combined with their low cost and abundance. Natural fibers, due to their biodegradability, low cost, and high specific strength, are combined with thermoplastic matrices to produce environmentally friendly and efficient materials. This study explores the fabrication process, mechanical properties, and potential applications of flax fiber reinforced acrylic based thermoplastic composites. The liquid molding technique, utilizing acrylic resin, enables the effective impregnation of natural fibers, resulting in enhanced interfacial bonding and overall composite performance. The research focuses on optimizing processing parameters, such as resin impregnation, fiber content, and molding conditions, to achieve superior material properties. The mechanical characterization of the developed composites includes tensile, flexural, and impact testing, revealing significant improvements in strength and durability compared to traditional materials. This study demonstrates the feasibility and benefits of using natural fiber reinforced thermoplastic composites in various applications, paving the way for more sustainable and eco-friendly material solutions in industries such as automotive, construction, and consumer goods.

Keyword: *biocomposites, thermoplastic composites, natural fiber*

ID: 95

Tailoring Polymer Properties: Exploring the Impact of Amide and Hydroxy Functionality on Imide Reactions in EA-co-ACN Copolymers

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N-methylol acrylamide (NMA) functions as a cross-linking agent, improving the mechanical characteristics and stability of the resultant polymer, since it can create covalent connections between polymer chains. This study investigates the impact of N-Methylol Acrylamide (NMA) concentration on copolymer properties, particularly focusing on its influence within copolymers derived from ethyl acrylate (EA) and acrylonitrile (ACN). Through varying NMA concentrations (1.5%, 2%, and 2.5% based on total monomer composition) and adjusting main monomer compositions to achieve different glass transition temperatures (Tg: -5 ˚C and -12 ˚C), the aim is to elucidate the effects of NMA on polymer characteristics for tailored applications. Results indicate a direct relationship between NMA concentration and polymer viscosity, alongside revealing nuanced effects on tensile strength and elasticity dependent on Tg values, underscoring the intricate interplay between NMA concentration and copolymer properties.

Keyword: *crosslinking, copolymer, N-methylol acrylamide*

Çiçek Şekilli Horseradish Peroksidaz (HRP) Nano Biyokatalizörleriyle Vinil Monomerlerinin Serbest Radikal Polimerleşme Reaksiyonlarının İncelenmesi

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Enzimatik polimerleşme reaksiyonları çevreye duyarlı ve kolay uygulanabilen bir yöntem olması sebebiyle geleneksel metotlara önemli bir alternatif olarak görülmektedir. Horseradish peroksidaz (HRP) enzimi bazı vinil monomerlerinin ve aromatik bileşiklerin polimerleşmelerinde etkin olarak kullanılan bir biyokatalizördür.[1] HRP enziminin yüksek sıcaklıklarda, organik ve sulu çözeltilerde denatürasyona uğraması bu enzimle gerçekleştirilen polimerleşme reaksiyonları için önemli bir dezavantajdır.[2] Bu çalışmada, HRP enziminin Cu^{2+} iyonları ile kompleksleşmesi neticesinde elde edilen çiçek şekilli HRP-Cu^{2+} nano biyokatalizörünün, bazı vinil monomerlerinin (stiren, metilmetakrilat ve akrilamit) hidrojen peroksit ve asetilaseton varlığında polimerleştirilmesi üzerine etkisinin incelenmesi amaçlanmıştır. Suda çözünebilen akrilamit monomeri haricinde diğer iki monomer emülsiyon ortamında polimerleştirilmiştir. Katyonik, anyonik ve non-iyonik yüzey aktif madde kullanılarak gerçekleştirilen polimerleşmelerde, en yüksek verimde polimerleşmelerin non-iyonik (Tween 40) yüzey aktif madde ortamında elde edildiği gözlenmiştir. Serbest HRP enziminin 60 ºC ve üzeri sıcaklıklarda katalitik aktivitesini kaybettiği bilinmesine rağmen,[3] sentezlenen HRP-Cu^{2+} nano biyokatalizörü 70 ºC'de bile oldukça yüksek katalitik aktivite ve kararlılık göstermiştir. Artan katalitik aktivite ve kararlılığın, birçok bilimsel ve endüstriyel uygulamalarda önemli avantajlar sağlayacağı öngörülmektedir.

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Keyword: *Horseradish peroksidaz, Enzimatik polimerleşme, Vinil monomer*

ID: 93

Enhancement of Pre-Emulsion Stability and Thus the Final Performance of Product Using the Solubility Parameter Approach

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Surfactants play a crucial role in emulsion polymerization by enabling the polymerization of immiscible components, stabilizing polymer particles during nucleation and growth, and ensuring the stability and homogeneity of the resulting latex. Their primary function is to reduce the interfacial tension between water and immiscible liquids, facilitating the emulsification of reactive monomers and the formation of stable colloidal dispersions of nanosized polymer particles. Thus, surfactants are essential components of the emulsion polymerization process.

However, surfactants are only physically attached to the polymer particles, which can result in the degradation of polymer properties when they migrate to the surface of the latex coating. This migration can also negatively impact the environment, particularly aquatic ecosystems. Although recent studies have introduced new methods to counteract the negative impacts of surfactants, it is still vital to carefully select the appropriate type and amount of surfactant in cases where conventional surfactants are necessary.

In this study, we significantly enhanced the pre-emulsion stability and, consequently, the application performance of the product by using the solubility parameter approach to select the optimal type and amount of surfactant. After adjusting the type and amount of surfactant based on the solubility parameter, the pre-emulsion remained stable for more than 7 hours. Additionally, the improved thickening performance of the product, compared to the standard, indicates more efficient polymerization and consequently better performance with reduced polymer usage in the final application.

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Keyword: *solubility parameter, emulsion polymerization, pre-emulsion stability*

ID: 89

Yeşil Çay Ekstresinden Çiçek Şekilli Nano Biyokatalizörlerin Sentezi ve Peroksidaz Benzeri Aktivitelerinin Fenol Türevlerinin Polimerleşmesinde İncelenmesi

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Enzim katalizörlü reaksiyonlar birçok uygulamada kullanılabilen, çevreye dost ve kolay bir metot olarak bilinmektedir. Ancak enzimlerin yüksek maliyeti, sulu çözeltilerdeki kararsızlığı, organik çözücüler varlığında ve yüksek sıcaklıklarda denatürasyona uğraması gibi etkenler, enzimlerin geniş ölçekli uygulamalarda kullanılmasına önemli bir engel teşkil etmektedir.[1] Bu nedenden ötürü, enzim benzeri katalitik aktivite gösterebilecek yeni nesil katalizörlerin keşfi son derece önemlidir. Bu çalışmada; yeşil çay ekstresi ve bakır(II) iyonlarının kompleksleşmesi neticesinde elde edilen hibrit organik-inorganik çiçek şekilli nano biyokatalizörlerin peroksidaz benzeri aktivitelerinin polimerleşme reaksiyonlarındaki etkisi incelenmiştir.[2] Yeşil çay-Cu^{2+} nano çiçeklerinin, Fenton benzeri reaksiyon mekanizması üzerinden fenol türevi bileşiklerin (fenol, guaiacol ve salisilik asit) polimerleşmelerindeki etkisi gösterilmiştir. Elde edilen sonuçlar, yeşil çay-Cu^{2+} nano çiçeklerinin fenol ve guaiacol'ün polimerleşmesinde oldukça yüksek katalitik aktivite gösterdiğini, ancak salisilik asit'in polimerleşmesinde ise çözünürlük problemi sebebiyle oldukça düşük verimde polimerleşmenin gerçekleştiği sonucunu göstermiştir. Serbest horseradish peroksidaz (HRP) enzimi 60 ºC ve üzeri sıcaklıklarda katalitik aktivitesini kaybederken, yeşil çay-Cu^{2+} nano çiçekleri 60 ºC'de oldukça yüksek katalitik aktivite göstermiştir. Yüksek reaksiyon sıcaklıklarında gösterilen bu kararlılık, yeşil çay-Cu^{2+} nano çiçeklerinin yüksek sıcaklık gerektiren uygulamalarda HRP yerine kullanılabilirliğini göstermektedir. Bu çalışmayla, yeşil çay-Cu^{2+} nano çiçekleri ve benzeri türlerdeki nano biyokatalizörlerin özellikle radikalik polimerleşme reaksiyonlarında alternatif ve etkili katalizörler olarak polimer kimyasındaki kullanımının arttırılacağı öngörülmektedir.

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Keyword: *Yeşil çay ekstresi, nano biyokatalizör, polimerleşme*

ID: 88

PVC Geri Dönüşümünde Sürdürülebilir Çözümler: Epokside Soya Yağı (ESBO)

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Son yıllarda artan dünya nüfusu ve tüketim ihtiyacı, plastik malzemelere olan talebi ve dolayısıyla plastik tüketimini önemli ölçüde artırmıştır. Polimerik malzemelerin yaygın kullanım alanı ve üstün özellikleri (kolay işlenebilirlik, düşük maliyet, hafiflik ve dayanıklılık) nedeniyle, polimer tüketimi büyük bir hacim kaplamaktadır. Ancak bu durum, plastik atık miktarının da artmasına neden olmuş ve çevre kirliliği önemli bir sorun haline gelmiştir. PVC (Polivinil Klorür), özellikle inşaat, otomotiv ve elektronik sektörlerinde sıklıkla kullanılan bir polimerdir. Bu nedenle, PVC atıklarının geri dönüşümü büyük bir önem taşımaktadır.

PVC'nin geri dönüşümü, tekrar tekrar ısıl işleme maruz kaldığında mekanik özelliklerinin zayıflaması ve renk bozulması gibi sorunlarla karşı karşıya kalmaktadır. Bu zorlukları aşmak ve PVC'nin ömrünü uzatmak amacıyla %100 biyo kaynaklardan üretilen epokside soya yağı (ESBO) kullanımı üzerine odaklanılmıştır. Bu çalışmada, ESBO'nun PVC geri dönüşüm sürecindeki etkilerinin detaylı olarak incelenmesi amacıyla PVC formülasyonları hazırlanarak beş kez tekrarlı şekilde ekstrüde edilerek ısıl işleme tabi tutulmuş ve her bir çevrim esnasında malzemenin mekanik, reolojik ve ısıl özelliklerinde gerçekleşen değişimler incelenmiştir.

Deneysel çalışmalar sonucunda, ESBO ilavesinin prosese yardımcı olarak işlemeyi kolaylaştırdığı ve bozunmayı geciktirerek termal ve mekanik özelliklerin korunmasına yardımcı olduğu gözlemlenmiştir. ESBO'nun varlığı, PVC'nin ısıl işleme karşı direncini artırmakta ve geri dönüştürülmüş PVC'nin kalitesini iyileştirmektedir. Bu sayede, PVC atıklarının daha verimli bir şekilde geri dönüştürülmesi mümkün hale gelmektedir.

Sonuç olarak, PVC geri dönüşümünde ESBO'nun kullanımı, çevresel ve ekonomik açıdan önemli avantajlar sunmaktadır. Hem plastik atık miktarının azaltılması hem de geri dönüştürülmüş PVC'nin kalitesinin artırılması ile sürdürülebilir bir çevreye katkı sağlanacaktır. Bu çalışma, ESBO'nun PVC geri dönüşümündeki potansiyelini ortaya koyarak, daha sürdürülebilir ve verimli bir geri dönüşüm sürecine katkıda bulunmayı hedeflemektedir.

Keyword: *epokside soya yağı, PVC, geri dönüşüm*

ID: 85

Application of High-Density Polyethylene Emulsions Mixed with Hydrogenated Soy Wax on Various Fabrics

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This study investigates the application and effects of emulsions containing high-density polyethylene (HDPE) mixed with hydrogenated soy wax on various fabrics. The primary objective is to evaluate the performance, durability, and overall effectiveness of these emulsions in enhancing fabric properties such as soft touch, sewing, and texture. Different fabric types, including cotton, polyester, and blends, were treated with the HDPE-soy wax emulsions. The treated fabrics were subjected to a series of tests to assess their physical and chemical properties. Results indicate that the HDPE-soy wax emulsions significantly improved touch and sewing across all fabric types. Additionally, the treated fabrics exhibited enhanced durability and maintained their texture.. These findings suggest that HDPE-soy wax emulsions could be a viable option for improving fabric performance in various textile applications.

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Keyword: *HDPE, Soywax Emulsions, Easy Sewing*

ID: 80

Synthesis of a Novel Polymeric Drug Delivery System for Osteosarcoma Treatment

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Osteosarcoma is a type of primary bone cancer effecting mostly in adolescence but also late adulthood. Its common treatment is chemotherapy, immunotherapy or radiotherapy supported by surgical interventions if needed. It mainly produces antineoplastic caused cytotoxicity or undesired immune response by biological treatment agents. On top of these even if overall success in localized osteosarcoma is high with these treatments, metastasis is common and due to its fast course of the disease, treatment achievements and 5 years survival rates decreases. To overcome these obstacles the novel approach for over a decade is to redesigning a drug delivery system thus improving therapeutic efficacy and lower organ toxicity. Our interest is to design a stimuli responsive polymeric drug delivery system loaded with cisplatin and functionalizable monomer branches.

In this study a pH sensitive bone targeted cisplatin (CDDP) loaded polymeric drug delivery system is synthesized with triple monomeric random copolymer design. A reversible addition-fragmentation chain transfer (RAFT) polymerization is conducted on 4-cyanopentanoic acid dithiobenzoate (CPADB) RAFT agent with hydrophobic 1,1-di-tert-butyl 3-(2 (methacryloyloxy)ethyl)-butane-1,1,3-tricarboxylate (MAETC) monomer which was used to conjugate CDDP in our previous research has been supported with hydrophilic 2-hydroxyethyl methacrylate (HEMA) and conjugable 3-(trimethylsilyl)prop-2-yn-1-ylmethacrylate (TMSpMA) monomers to obtain P(MAETC-b-(HEMA-b-TMSpMA) copolymer. Our polymeric nanoparticles were characterized by using GPC, FTIR and ^{1}H-NMR analysis. After deprotection reactions, CDDP and bone targeting peptide were loaded to P(MAETC-b-(HEMA-b-TMSpMA) copolymer forming self-assembled formulations. Hydrodynamic sizes of unloaded (NP0) and CDDP (NP1) drug loaded formulations were determined by DLS. Drug release experiment was also performed at two different pH values. CDDP is released in the acidic microenvironment of the tumor site. The novel polymeric dual drug delivery system may enhance therapeutic effect, targets bone tissue and delivers the antitumor agent to the tumor site, thus increasing the safety of the drugs by limiting its side effects.

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Keyword: *polymeric drug delivery systems, cisplatin, osteosarcoma*

İpek Dokuma Yüzey Özelliklerinin Kimyasal Modifikasyon ile Geliştirilmesi

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İpek lifleri yüksek düzeyde biyouyumlu ve biyobozunur olmaları, olağanüstü mekanik özellikler göstermesi ve sahip olduğu fonksiyonel grupları ile kimyasal modifikasyonlara elverişli olması sebebiyle çok yönlü ve geniş bir uygulama alanı bulabilen biyomalzemelerin hazırlanabildiği doğal liflerdir [1]. İpek lif yüzeyinin kendi yapısından farklı fonksiyonel gruplarla işlevselleştirilmesi ile son derece ilgi çekici biyokompozitlerin hazırlanmasında kimyasal modifikasyon yöntemi olan aşı kopolimerizasyon yöntemi çok sıklıkla kullanılmaktadır. Çalışmamızda, öncelikle ipek liflerden hazırlanan dokumaların aşılamaya uygun hale getirilerek aşılama veriminin de artırılabilmesi amacıyla ipek lif/dokuma yüzeyinden serisinin uzaklaştırılması işlemi uygulanarak ön modifikasyon gerçekleştirildi. Daha sonra dokuma yüzeyine serisin ve poli(N-vinil pirolidon) (PNVP) polimerlerinin ayrı ayrı ve karışımlarının aşılanmasıyla dokuma yüzeyi kalıcı olarak değiştirildi. Bu çalışmalar sırasında seçilen polimer türünün farklılığı ile birlikte seryum amonyum sülfat (CAS) başlatıcı derişimi, polimer miktarı, sıcaklık gibi polimerizasyon koşullarının değiştirilmesi ile aşılama verimindeki değişiklikler detaylı olarak incelendi. Serisini uzaklaştırılan ipek dokuma yüzeyine daha sonra kovalent olarak serisin %35 oranında aşılanırken PNVP'nin %6'dan daha yüsek aşılanamadığı bulundu. Polimer karışım oranının değiştirilmesi ile aşılamada en yüksek %25 değerine ulaşılabildi. Hazırlanan polimer aşılı dokumanın yapısal ve morfolojik açıdan karakterizasyonları, sırasıyla ATR-FTIR ve SEM teknikleriyle incelendi. Hidrofiliklik derecesindeki değişimler temas açısı ile ölçümleri ile ortaya konuldu. Böylece zemin ipek dokumaya göre yüzey morfolojisi, hidrofilikliği, adsorpsiyon davranışı gibi özelliklerinde belirgin değişiklik/iyileştirmeler sağlandı.

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Keyword: *ipek dokuma, kompozit, aşı kopolimer*

ID: 73

Electrochemical Behaviour of Conductive Composite Film Doped with Plant-Derived Protein Fibers

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This work reports preparing a flexible and electrically conductive film using a natural/industrial soybean protein fiber (SPFs). It presents research results revealing the electrochemical behaviour of the prepared film. For this purpose, a mixture of soybean fiber and 1.0 M H_2SO_4 solution first interacted with the lithium nitrate solution. Then, in situ, chemical polymerization of aniline with ammonium persulfate solution as an initiator was carried out in this mixture. It was observed that the films prepared by pouring them onto a glass surface before and after polymerization had high flexibility and conductivity. A conductive composite with improved mechanical properties prepared from a natural biodegradable and biocompatible conductive material may be of interest for safe and eco-friendly supercapacitors for energy storage and medical materials. We evaluated ATR-FTIR spectroscopy and surface contact angle measurement results to elucidate the chemical structure of the prepared composite material. We also used photographic and optical microscope images to obtain information about film formation. After the soybean composite fibre material containing Li^+ ions, polyaniline, and their mixture were coated as a film on the glassy carbon electrode surface, its electrochemical behaviour in the H_2SO_4 solution was examined by the cyclic voltammetry technique.

Keyword: *natural fibers, polyaniline, cyclic voltammetry*

ID: 66

Poliamit 6 Varlığında Polyester Temelli Termoplastik Elastomer Ürünlerin Isıl Kararlılığının, Mekanik ve Reolojik Özelliklerinin İncelenmesi

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Son yıllarda termoplastik elastomerler (TPE), düşük kalıcı deformasyon, yüksek elastikiyet, yorulma direncinin yüksek olması gibi kauçuğumsu özellikler ve kolay işlenebilme ve geri dönüştürülebilirlik gibi termoplastik özellikler göstermelerinden dolayı polimer teknolojisi alanında hem endüstri hem de akademi camiasında sıklıkla kullanılan malzemelerden birisi olmuştur. TPE'lerin işleme süresince kürlenme veya vulkanizasyona ihtiyacı olmamakla birlikte; enjeksiyonla kalıplama, ekstrüzyon ve şişirme ile kalıplama gibi konvansiyonel termoplastik işleme teknikleri ile işlenebilmektedirler. TPE'lerin mikro yapısı, sürekli termoplastik faz içerisinde dağıtılmış kauçuk fazını içermektedir. Dayanıklılıkları, düşük yoğunlukları ve üretim maliyetlerinin düşük olması gibi üstün özellikleri sayesinde otomotiv parçaları, elektrik ve medikal endüstrisi ve ambalaj sektörü gibi çok geniş bir uygulama alanına sahiptirler. Bununla birlikte, kauçuk-plastik karışımlarından elde edilen TPE'lerin birçoğu zayıf yüksek sıcaklık performansına, yağlarda düşük şişme direncine ve düşük kalıcı deformasyona sahiptir. Bu çalışma kapsamında poliester temelli TPE'nin yüksek sıcaklık uygulamalarında kullanılabilmesi amacıyla poliamit 6 (PA6) ile karışımları oluşturulmuş ve performans özellikleri incelenmiştir. PA6/TPE karışımları bir laboratuvar ölçekli mikro-harmanlayıcı ile hazırlanmış ve ardından enjeksiyon kalıplama prosesi ile standart test çubukları üretilmiştir. Elde edilen örneklerin; reolojik, mekanik, ısıl ve morfolojik özellikleri incelenmiştir. Reoloji analiz sonuçları PA6 ilavesi ile birlikte TPE'nin depo modülünün arttığını göstermiştir. Ayrıca, TGA analiz sonuçlarından, PA6/TPE karışımındaki PA6 oranının artmasıyla birlikte %5 ve %10 kütle kaybındaki bozunma sıcaklıklarının daha yüksek değerlere kaydığı tespit edilmiştir.

Teşekkür: Bu çalışma Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından 120M718 numaralı proje ile desteklenmektedir.

Keyword: *PA6, TPE, reolojik özellikler*

ID: 56

Biyobozunur Rastgele/Blok Poli(gliserol levulinat-ko-propilen malonat) Kopoliesterlerin Sentezi ve Bozunma Davranışı

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Plastiklerin çevre üzerindeki kötü etkileri, büyük miktarlarda atık üretmeleri, sınırlı geri dönüşüm imkanı, depolama alanlarına gömülme, yakılma ve deniz ortamlarında birikme gibi faktörlerden kaynaklanmaktadır. Plastikler, döngüsel ekonomi için AB Eylem Planı'nda ana önceliklerden biridir ve kullanımlarının azaltılması, geri dönüşüm oranlarının artırılması ve piyasaya daha fazla biyobazlı ve/veya biyobozunur plastiklerin girmesi amaçlanmaktadır. Biyobozunur polimerlerin fiziksel, mekanik ve biyokimyasal özellikleri ayarlanabilir özellikte geliştirilmesi gerekmektedir.
Bu çalışmanın amacı, poli(gliserol levulinat-ko-propilen malonat) (PGL-PM) kopolimerlerinin zincir mikroyapısı ve malonat içeriğinin malzeme özellikleri ile in vitro bozunması üzerindeki etkisini incelemektir. Sentezlenen polimerlere itakonik asit eklenip kürlenerek çapraz bağlı yapı elde edilmiştir. İki aylık bir süre boyunca, en fazla kütle kaybı (%56.56) iki aşamalı yöntemle sentezlenen blok kopoliesterlerde gözlemlenmiştir. Sonuçlar, biyomedikal uygulamalar için levulinik asit bazlı kopoliesterlerin zincir mikroyapısı ve malonat içeriği ile bozunma özelliklerinin ayarlanabileceğini göstermektedir.

Bu çalışma, TÜBİTAK tarafından 220M112 numaralı proje kapsamında desteklenmiştir.

Keyword: *Biyobazlı Polimerler, Levulinik Asit, Biyomedikal Uygulamalar*

ID: 52

RAFT Polimerleşme Tekniği ile Sentezlenen Florinli Kopolimerlerin Su ve Yağ İtici Özelliklerinin Araştırılması

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Kirlenme ve özellikle hidrokarbon bazlı kirlenme; tekstil, elektronik ve ambalaj gibi endüstriyel uygulamalar için önemli bir sorun teşkil etmektedir. Yağların ve organik maddelerin yüzeylere yapışması, potansiyel olarak kaplama ve çeşitli malzemeler üzerinde olumsuz etkilere neden olan önemli bir risktir. Kirlenmeyi önlemek için hem hidrofobik hem de oleofobik özellikler sergileyen düşük yüzey enerjili malzemeler kullanılmaktadır. Düşük yüzey enerjili malzemeler arasında, flor bazlı malzemeler; örneğin perfloro silanlar, perfloro asitler ve perfloro polimerler, hidrokarbonlara kıyasla daha düşük yüzey enerjilerine sahip olmaları ve gelişmiş yağ itici özelliği göstermeleri nedeniyle çok fazla tercih edilmektedir ($CH>CH_2>CH_3>CF_2>CF_2H>CF_3$). Bu amaçla çalışmamızda glisidil metakrilat (GMA) monomerleri ile hidrofobik ve oleofobik özellik gösteren perflor bazlı metakrilat (FMA) monomerleri farklı oranlarda kullanılarak P(GMA-FMA) kopolimerler RAFT polimerleşme tekniği ile çözelti ortamında sentezlendi. GMA monomerinin kullanılmasının amacı GMA yapısında bulunan epoksi gruplarının farklı fonksiyonel gruplarla (-OH, -COOH, $-NH_2$) kolayca reaksiyona girebilmesidir. Bu nedenle, P(GMA-FMA) kopolimerleri çeşitli substratların (Si ve Al levha, filtre kağıdı, kumaş vb.) üzerine daldırma kaplama tekniği ile kaplanarak, sağlam P(GMA-FMA) fılmler hazırlandı. Elde edilen filmlerin kalınlıkları elipsometre, kimyasal yapıları Grazing Angle FT-IR, yüzey morfolojileri AFM, ıslanabilirlik özellikleri temas açısı ölçümleri ile karakterize edildi. P(GMA-FMA) filmlerinde yer alan FMA'nın filmlere önemli ölçüde su ve yağ iticilik özelliği kazandırdığı görüldü.

Keyword: *RAFT polimerizasyonu, Hidrofobik kaplama*

Porfirin Klik Çapraz Bağlayıcısı ile Tek-Zincir Polimer Nanopartiküllerin Sentezi ve Karakterizasyonu

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Son zamanlarda, fotouyarıcının kanser hücrelerinde birikmesini, uygun dalga boyundaki ışıkla ışınlamayı ve moleküler oksijenin bir arada bulunmasını içeren fotodinamik terapi (PDT) kanser tedavisinde olağanüstü protokollerden biri haline gelmiştir [1] . PDT sırasında aktive edilmiş fotouyarıcı, ışınlama altında dokudaki oksijen ile reaksiyona girerek singlet oksijen gibi sitotoksik türlerin oluşumuna ve kanser hücrelerinde toksisiteye neden olmaktadır. Bu nedenle fotouyarıcı, PDT'nin etkinliğini belirlemekte ve tedavide önemli bir rol oynamaktadır. Porfirin ve türevleri, etkili
singlet oksijen üretebildikleri ve vücutta düşük yan etkiye sahip oldukları için ikinci nesil fotouyarıcılar olarak büyük ilgi görmüştür. Bununla birlikte, porfirin fotouyarıcılarının çoğu aromatik moleküller olduğundan, seçicilik göstermediklerinden, zayıf suda çözünürlüğe sahip olduklarından ve sınırlı biyo-dağılım sergilediklerinden dolayı klinikte yaygın olarak uygulanmamaktadır. Nanoteknolojik yaklaşımlar, fotouyarıcıların vücutta hedeflenen bölgeye taşınması ve sulu ortamda gösterdikleri çözünürlük probleminin çözülmesi için etkili yöntemler olarak bilinmektedir. Günümüzde fotouyarıcıların polimerik nanotaşıyıcılar aracılığıyla verilmesi, terapötik konsantrasyonlarının tümör hücrelerine diğer dokularda herhangi zararlı bir etki oluşturmadan taşınması gibi avantajlar sunmaktadır [2]. Ayrıca, taşıyıcılar fotofiziksel, kimyasal ve biyolojik özellikleri ciddi şekilde etkileyebilen çözünürlük sorunları ve fotouyarıcının birikme eğiliminin üstesinden gelebilme açısından da önemlidir. Polimerik ilaç taşıyıcı sistemler ile ilgili yapılan çalışmalar zaman içinde hassas boyut kontrolü ve özel olarak işlevselleştirmeye izin veren nano boyutta nesnelerin üretimi için sentetik teknikler geliştirilmeye ve araştırılmaya başlanmıştır. Bu süreçte, polimer biliminde son yirmi yılda gelişmekte olan ve günümüzde hızla büyüyen bir araştırma konusu olan tek-zincir polimer nanopartiküller (SCNP), polimer zincirlerinin ayrı ayrı zincir içi çapraz bağlanma yoluyla nanoyapılara çökmesi veya katlanması ile oluşmaktadır [3]. Lineer polimer zincirlerinin ayrı ayrı katlanması veya çökmesinden dolayı tek zincir polimer nanopartiküller geleneksel polimer nanopartiküllere kıyasla çok daha küçük yaklaşık 3-30 nm boyutunda olup birçok protein ve virüsle aynı boyutta olan yapılardır.

Bu çalışma fotodinamik terapide kullanılmak üzere porfirin içeren hidrofilik veya amfifilik karakterli bir dizi yeni tek-zincir polimer nanopartiküllerin sentezlenmesi ve bu potansiyellerinin araştırılmasını kapsamaktadır. Bu amaçla porfirin fotouyarıcısı çapraz bağlayıcı molekül olarak ilk kez kullanılmış olup klik reaksiyonu ile SCNP'ler sentezlenmiş ve karakterize edilmiştir. Nanopartiküllerin singlet oksijen üretme yetenekleri incelenmiş, hücre çalışmaları ile in vitro hücre alımları, singlet-oksijen üretimleri ve fototoksisiteleri belirlenmiştir.

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Keyword: *Tek-zincir polimer nanopartiküller, Fotodinamik terapi, Porfirin*

ID: 42

Farklı Kaplama Yöntemleri ile Hazırlanan PEDOT:PSS/ITO Elektrotların Elektrokromik-Süperkapasitörlerde Kullanımı

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Çevre dostu ve stabil yapısıyla bilinen Poli(3,4-Etilendioksitiyofen) (PEDOT), polistiren sülfonat (PSS) ile birleştirilerek çözünürlüğü artırılabilmektedir [1]. Bu birleşim, PEDOT'ın çözelti işlenebilirliğini geliştirirken, elektronik cihazlarda geniş kullanım alanı bulmasını sağlayan yüksek şeffaflık, esneklik ve maliyet-etkinlik gibi üstün özellikler kazanmasını sağlamaktadır [2]. PEDOT:PSS, döndürme, püskürtme, elektro-eğirme ve elektro-sprey gibi çeşitli kaplama teknikleriyle hazırlanabilmektedir, bu da elektronik uygulamalardaki kullanım çeşitliliği artırmaktadır. Ayrıca, PEDOT:PSS elektrotların morfolojisinin ve kaplama kalınlığının ayarlanabişlmesi, elektrot stabilitesini önemli ölçüde etkilemekle birlikte filmlerin porozitesine bağlı olarak, elektrotun elektrokimyasal empedansını azaltırken, aynı zamanda yük depolama kapasitesini iyileştirmektedir [3,4].

Bu çalışmada, İndiyum kalay oksit (ITO) alt tabakası üzerine PEDOT:PSS biriktirilerek üretilen elektrotların elektrokromik-süperkapasitör (EC-SC) performansı, elektro-sprey ve sprey kaplama gibi iki farklı yöntem kullanılarak karşılaştırmalı olarak incelenmiştir. Sonuçlar, özellikle kolay uygulanabilirliği ile bilinen elektro-sprey tekniğiyle üretilen filmlerin, püskürtme yöntemiyle hazırlananlara kıyasla önemli ölçüde gelişmiş EC-SC özellikleri sergilediğini göstermektedir. Üretilen elektrotların kapasitans ölçümlerinden, 10 μA cm^{-2} akım yoğunluğunda sprey kaplama ile hazırlanan PEDOT:PSS/ITO elektrot_1 için 826.14 μF cm^{-2} ve elektro-sprey kaplama ile hazırlanan PEDOT:PSS/ITO elektrot_2 için 1678.60 μF cm^{-2} yük yoğunluğu değerleri elde etmiştir. Ayrıca, PEDOT:PSS/ITO elektrot_2 yüksek renklenme verimliliği (84.32 cm^2 C^{-1}) ve hızlı yanıt süreleri (1.36 s renklendirme ve 0.98 s açma için) sergilediği gözlenmiştir. Elde edilen sonuçlar, elektro-sprey yöntemiyle hazırlanan filmlerin geniş alan EC-SC akıllı cam uygulamaları için oldukça umut verici olduğunu göstermiştir.

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Keyword: *Optoelektronik Uygulamalar, Elektrokromik-Süperkapasitör, PEDOT:PSS*

Karbazol-Bismaleimid Esaslı Yeni Bir Konjüge Poroz Organik Polimer Sentezi ve Karakterizasyonu

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Günümüzde, yeni bir malzeme teknolojisi olarak Poroz Organik Polimerler (POP' lar), geniş yüzey alanı, düşük iskelet yoğunluğu ve yüksek kimyasal dayanıklık gibi benzersiz özellikleri nedeniyle bilimsel çevrelerince büyük ilgi görmektedir. Polimer yapıların inşa edilmesiyle oluşturulan gözenekleri içeren kimyasal kimyasal yapılara sahip olan POP' lar, gaz depolama ve ayrıştırma, heterojen katalizörler ve organik elektronik yüzeyler gibi çeşitli teknolojik uygulamalar için umut vaat eden malzemeler olmuştur [1]. Konjuge Poröz Polimerler (COP' ler), sert π-konjuge yapıları ile ayarlanabilir gözeneklilik, yüksek yüzey alanı, ve güçlü termal ve kimyasal dayanıklık gibi karakteristik özellikler sergilemektedir, ve organik elektronikler ve optik cihazlar gibi uygulamalarda önemli bir yer edinmiştir [2]. Diğer yandan, uygun monomerler ve bağlayıcılar kullanılarak, basit ve pratik inter- ve intra-moleküler çapraz bağlama reaksiyonları ile elde edilen kalıcı düzensiz mikroporöz yapılar, hiper çapraz bağlı polimerler (HÇP' ler)' in opto-elektronik malzeme uygulamaları da oldukça dikkat çekicidir. İyi termal kararlılık, yüksek yüzey alanı, düşük maliyet ve kolay hazırlama koşulları gibi avantajlar sunmaktadır [3].



Bu çalışmada, Karbazol-bismaleimid esaslı monomer (CBP-MI), 4 basamakta sentezlendi ve serbest radikal katılma polimerizasyonu ile AIBN başlatıcı varlığında polimerizasyonu gerçekleştirildi. Sentezlenen polimerin çözünür fraksiyonu üzerinden optik ve elektrokimyasal özellikleri belirlendi ve ardından, morfolojik karakterizasyonu SEM ve TEM teknikleri kullanılarak gerçekleştiridi. Gözenekli yapıya sahip olan polimerin, yapılan iyot buharı tutma testlerinde yüksek oranda iyot buharı tutabildiği gravimetrik analizler sonucu tespit edildi.

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Keyword: *Poroz Organik Polimerler, Karbazol-bismaleimid, Konjuge Poröz Polimerler*

ID: 38

Poliaminoboran, Polietilen Glikol ve Fıstık Kabuklarından Elde Edilen Aktif Karbonun Karbondioksit Yakalama ve Boya Adsorpsiyon Özelliklerinin İncelenmesi

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Su kirliliği ve karbon emisyonlarından kaynaklanan sorunlara çözüm bulmak amacıyla sürdürülebilir kimya alanında önemli çalışmalar yapılmaktadır. Yapılan çalışmalar gezegenimizin ekolojik bütünlüğüne yönelik ciddi risklerin azaltılmasında kritik bir rol oynamaktadır. Bu çalışmanın amacı ise atıkların kullanımıyla çevresel sürdürülebilirliği arttırmaktır. Çalışmada, atık olarak Antep fıstığı kabukları kullanılmıştır. Fıstık kabukları yıkanmış, kurutulmuş, öğütülmüş ve pirolize hazır hale getirilmiştir. Temizlenen fıstık kabukları 800 °C'de 2 saat boyunca azot gazı altında piroliz edilmiş ve elde edilen aktif karbon AC1 olarak kodlanmıştır. Ardından metilaminoborandan poliaminoboran sentezi yapılmıştır. Öğütülen fıstık kabuklarına %1 (a/a) poliaminoboran ilave edilmiş ve homojen olana kadar karıştırılmıştır. Hazırlanan karışım AC1 ile aynı koşullarda piroliz edilerek bor fonksiyonlu aktif karbon kalıntısı elde edilmiştir. Elde edilen aktif karbon AC2 olarak kodlanmıştır. Aynı süreç öğütülmüş fıstık kabuklarına %1 (a/a) polietilen glikol eklenerek tekrar edilmiştir. Bu aşamada elde edilen aktif karbonlar ise AC3 olarak kodlanmıştır. Elde edilen üç farklı aktif karbonun karakteristik özelliklerinin belirlenmesi için XRD, XPS, BET, SEM, FTIR analizleri yapılmıştır. Boyar madde olarak metilen mavisi ve kongo kırmızı kullanılmıştır. Yapılan testler sonucunda AC1 biyoadsorbanı metilen mavisi boyasında %93 giderim sağlarken, AC3 biyoadsorbanı kongo kırmızısı boyasında %92 giderim sağlamıştır. Karbondioksit yakalama testleri 30°C sıcaklıkta 1 bar basınçta azot gazı altında gerçekleşmiştir. AC1, AC2 ve AC3 biyoadsorbanları için adsorpsiyon kapasiteleri sırasıyla 1,74 mmol/g, 1,90 mmol/g ve 1,64 mmol/g olarak bulunmuştur. Antep fıstığı kabuğu atıklarının poliaminoboran ile pirolizinde bor nitrür yapısının oluşması elde edilen aktif karbonun (AC2) karbondioksit adsorpsiyon verimliliğini arttırdığı gözlemlenmiştir. Araştırma sonucunda üretilen biyoadsorbanların boya giderme ve CO_2 yakalamada ikili bir işlevi olduğu sonucuna varılmıştır.

Keyword: *aktif karbon, biyoadsorban, poliaminoboran*

ID: 37

Plasmonic Hollow-Microneedle Actuators for Surface-Enhanced Raman Spectroscopy (SERS) Applications

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Surface-enhanced Raman spectroscopy (SERS) is a well-established analytical technique for detecting molecular species at ultralow concentrations.[1] The electromagnetic enhancement (EM) mechanism is considered to be the most important effect for Raman signal enhancement in plasmonic SERS substrates, which relies on the excitation of localized surface plasmon resonances (LSPRs) leading to the localization and magnification of the incident electromagnetic field in regions called "hot-spots".[1] By using different approaches, the formation of hot-spots for SERS applications can be manipulated.[2,3] However, current methods for controlling and tuning these formations face significant challenges, including high process costs and difficulty producing large-scale patterns. Therefore, developing new approaches to control and manipulate hot-spot generation over larger areas is essential. This would broaden the applications of SERS platforms in molecular sensing and provide deeper insights into how hot-spots enhance Raman signals.

This study focuses on manipulating the hot-spots formations by precisely controlling the nanoscale inter-particle distance using a hollow-microneedle actuator. This manipulation significantly enhanced Surface-enhanced Raman spectroscopy (SERS) applications. Gold nanoparticles were utilized to modify the hollow microneedles, thereby facilitating hot-spot generation. The performance of these platforms in hot-spot generations was evaluated through SERS analysis using methylene blue as the Raman reporter molecule. Additionally, we demonstrated the capability of polymeric microneedles to control their motion, thereby greatly simplifying the sampling and analysis of target molecules in specific environments.

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Keyword: *Plasmonic Hollow-Microneedle, Hot-Spots Generation, Surface-Enhanced Raman Spectroscopy (SERS)*

ID: 29

Antioxidant, Antimicrobial Activity, and Phytochemical Analysis of Bacterial Nanocellulose Biopolymer Composites Incorporated with Silver Nanoparticles on Green Synthesis

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Antibiotic resistance significantly increases healthcare costs, prolongs hospital stay and increases mortality. In the European Union only, antimicrobial-resistant bacteria are estimated to be the cause of approximately 25,000 deaths and expenses more than €1.5 billion. US dollars annually on health care costs [1].
Green biosynthesis, among other synthetic methods, is characterized by clear in working and process conditions, as it uses only plant-derived metabolites and metal salts [6]. Because of them chemical, electrical and antimicrobial properties, metal particles are extensively used in various industrial fields such as pharmaceuticals, medicine, healthcare and others. [2, 3].
Bacterial nanocellulose (BNC) is a linear natural homopolymer. This material is synthesized by natural biological methods using Acetobacter culture, which is equivalent to simple growth methods. By applying these synthesis methods, extremely large quantities of such biopolymer can be obtained economically [4].
Green silver nanoparticles (AgNPs) synthesized using medical plant extracts as capping and reducing agents demonstrate broad applicability in addressing the infection threat. This study presents a sustainable, low-toxicity, and cost-effective bacterial nanocellulose composite with silver nanoparticles based on green synthesis that uses Origanum vulgare as a reducing agent due to numerous biological components. The aim of this work is to synthesize a functional bacterial nanocellulose biopolymer composite with incorporated green silver nanoparticles. The formation of AgNPs in composite and morphological properties was analyzed using scanning electron microscopy (SEM), energy-dispersive spectroscopy (EDS), and transmission electron microscopy (TEM) techniques. Antimicrobial activity was determined using the agar diffusion Kirby–Bauer method against Gram-positive and Gram-negative bacterial strains. The antimicrobial activity of bacterial nanocellulose composite/AgNPs was substantially strong against all tested bacterial cultures. The structural investigation of AgNPs by TEM presents the presence of spherical-shaped silver nanoparticles in cellulose composite. The size of obtained green AgNPs mediated by O. vulgare ~ 27.5 nm. This method of obtaining antimicrobial composites could be widely used to fight against antibiotics, antibiotic-resistant antibiotic-resistant bacteria, and other Gram-positive and Gram-negative bacteria.

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Keyword: *green silver nanoparticles, antimicrobial activity, biopolymer*

Advancing Surface Engineering: Developing a Biocompatible Electrospun Cellulose Fabric for Nanofibrous Web Design

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Electrospinning is a method of forming fibers from polymeric viscous solutions under a high electric field using an electrical driving force. Cellulose, which acts as a biocompatible polymer in electrospinning, is a rapidly renewable polymer that is abundant in nature and used in fiber production [1]. Additionally, cellulose can be derivatized or functionalized through reactions with a hydroxyl side group in the cellulose backbone [2]. Therefore, cellulose polymer has been subjected to selective oxidation (CellCOOH) to increase its solubility in electrospinning processes and to increase its reactivity by breaking the H bonds between the chains of the polymers. Since Poly(2-ethyl 2-oxazoline) (PEtOx) and hydrolyzed block copolymers (PEtOx-co-PEI) PEtOx-co-PEI polymers are biocompatible and have the potential for use in many medical fields [3], their mixture with cellulose was prepared to give nano-fibrous web texture by electrospinning method. In this study, it was aimed to create nanofibrous web textures on HPMC-modified cotton fabrics by electrospinning method by preparing blends of selectively oxidized cellulose particles and biopolymer PEtOx polymers in hybrid, Janus, and core-shell morphologies. For this purpose, we comprehensively characterized the structural properties of these materials, employing an extensive range of techniques, including ATR-FTIR, optical microscopy, contact-angle measurements, and SEM. Hereby, this study unveiled that electrospun web texture onto the cotton fabric material produced from cellulose-based nanofiber coatings can potentially be used in biomedical fields as substrates, for example, filters, biocompatible meshes, and surgical reusable mask material.

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Keyword: *PEtOx polymers, Electrospinning technique, Cellulose polymer*

ID: 27

Investigation of Nanostructures as Synergistic Therapy Agents: Release Kinetics of Multiple Drugs

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Nanoparticles have become of interest in the treatment of several diseases, such as drug delivery systems, which can be classified according to their adjustable properties, such as size, geometry, surface charge, and manufacturing technique [1]. These tunable properties offer the opportunity to select the best appropriate carrier system to administer the route for the disease. In this work, we present novel, multifunctional, biodegradable formulations, which are of great interest due to their smart advantages, such as the ability to simultaneously encapsulate active compounds into multiphasic systems, adjustable structure, surface properties, and high surface area. Furthermore, while these structures offer sequential release with independent release kinetics from their specialized compartments, traditional carrier systems can not sufficiently provide simultaneous encapsulation and release of multiple anticancer drugs with different physicochemical properties [1]. These particles were prepared at different sizes, geometries, and surface properties by changing composition and operational parameters such as surfactant and solvent types for different applications. Based on these results, these unique structures will create the potential to be used in different fields such as drug delivery, biotechnology, tissue engineering, biomedical, pharmaceutical, and countless other biological applications with/without various modifications.

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Keyword: *Synergistic Therapy, Multiple Drug Release Kinetics, Drug Delivery Systems*

Bone Tissue Engineering: Cellulose Acetate Butyrate Modified PBT

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The purpose of this research is to fabricate a graft utilizing a combination of cellulose acetate butyrate-conjugated polybutylene-terephthalate (PBT) that can aid in the regeneration of bone tissue. Damage to load-bearing bones can result in orthopedic defects that can negatively impact an individual's mobility [1]. While autografts or allografts are commonly used to treat bone defects, they come with their own limitations [2]. The objective of bone tissue engineering is to design implants or materials that can replace these grafts and facilitate the repair of bone tissue [3].
PBT is a moldable, semi-aromatic thermoplastic polymer that can either be amorphous or semi-crystalline. It possesses high strength and toughness, as well as good heat and chemical resistance, and dimensional stability [4]. For tissue engineering purposes, the scaffold's composition and structure play a crucial role in cellular activities such as cell adhesion, migration, invasion, proliferation, and gene expression. Therefore, the goal is to produce a hydrophilic scaffold that has a high-water contact angle, protein adhesion level, and polar % interaction value. To enhance PBT's biomaterial properties, it was conjugated with cellulose acetate butyrate, and lyophilization was used to fabricate spongy scaffolds. These scaffolds were characterized using H-NMR and FTIR.

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Keyword: *polybutylene-terephthalate, cellulose acetate butyrate, bone tissue*

Antibakteriyel Amfifilik Kopolimerlerin Sentezi, Karakterizasyonu ve Misel Oluşum Davranışlarının İncelenmesi

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Birçok hastalığın tedavisi ve var olan ilaçların terapötik etkinliğini arttırmak için polimerik miseller konusunda yapılan araştırmalarda büyük bir artış görülmektedir. Bu araştırmalardan bazıları da antibakteriyel ajanlar üzerinedir [1]. Patojen mikroorganizmalar, insanlar dahil olmak üzere canlı organizmalarda çeşitli istenmeyen enfeksiyonların başlıca nedenidir. Son zamanlarda artan antibiyotik kullanımı birçok mikroorganizmanın antibiyotiklere direnç geliştirmesine neden olmuştur. Mevcut ilaçlara karşı ortaya çıkan yeni ve sürekli direnç, küresel sağlık sistemine ağır bir yük getirmiştir. Bu nedenle daha etkili antibakteriyel yaklaşımlar için yeni çalışmalar yapılmaktadır [2]. Geleneksel antibiyotik tedavilerinin dışında farklı antibakteriyel mekanizmalarına sahip yeni sistemleringeliştirilmesi önem kazanmıştır. Antibakteriyel özelliğe sahip polimerik malzemeler; çok yönlülükleri, biyouyumlulukları ve immünojenik olmamaları nedeniyle bakteriyel hastalıkların önlenmesi ve/veya tedavisinde büyük ilgi görmüştür. Son yıllarda ise, polimerik antibakteriyel miseller, bakteriyel enfeksiyonların tedavisinde umut verici bir yaklaşım olarak ortaya çıkmıştır [3].

Bu çalışma, antibakteriyel özelliklere sahip özgün yapıdaki nanotaşıyıcı sistemlerin geliştirilmesinikapsamaktadır. Öncelikle, hidrofilik kısım için 4-siyano-4[(dodesilsülfaniltiyokarbonil)sülfanil] pentanoik asit, RAFT ajanı ve polietilen glikol (PEG) kullanılarak bir makroRAFT ajanı sentezlenmiştir. Sentezlenen makroRAFT ajanı kullanılarak RAFT polimerizasyonu ile glisidil metakrilat ve metil metakrilat monomerlerinden amfifilik blok kopolimerler sentezlenip glisidil metakrilat üniteleri azitlenmiştir. Polimerlere antibakteriyel özellik katmak amacıyla N-(piridin-2-il)pent-4-inamit (PPA) ve N-(kinolin-8-il)pent-4-inamit (KPA) bileşikleri sentezlenmiş ve polimer zincirlerindeki azit ünitelerine click reaksiyonu ile takılmıştır. Elde edilen polimerlerden uygun koşullarda miseller oluşturulmuş ve antibakteriyel özellikleri incelenmiştir. Sentezlenen yapılar ve oluşturulan miseller GPC, 1H NMR, 13C NMR, DSC, DLS ve TEM ile karakterize edilmiştir.

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Keyword: *RAFT polimerizasyonu, Polimerik miseller, Antibakteriyel aktivite*

ID: 20

Farklı Topolojilere Sahip Polimer-İlaç Konjugatlarının Misel Oluşumuna Etkisi

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Polimer topolojisi, polimerik malzemelerin özelliklerini ve işlevlerini geliştirmek için temel bir parametredir [1]. Topoloji etkilerinin incelenmesi ile geliştirilen çeşitli mimarideki polimerler; teşhis, biyo-görüntüleme, doku mühendisliği, gen ve ilaç taşıyıcı sistemler gibi özellikle biyomedikal uygulamalarda kullanılmaktadır. Özellikle ilaç taşıyıcı sistemler olarak zaman içerisinde lineer di/triblok kopolimerler dışında yıldız, lineer-dendritik, graft ve halkasal blok kopolimerlerden farklı boyut ve morfolojilere sahip misel yapıları rapor edilmiştir [2]. Farklı topolojilere sahip amfifilik blok kopolimerlerden elde edilen misel yapılarının ilaç taşıyıcı sistemler için önemli olan boyut, stabilite, ilaç taşıma kapatisesi, salım profili, biyolojik dağılımları ve dolaşım süreleri üzerinde değişiklikler meydana getirdiği gösterilmiştir [3]. Polimerik taşıyıcılara ilacın enkapsüle edildiği sistemlerde ortaya çıkan ilaç sızıntısı, düşük yükleme kapasitesi ve ani salım gibi bazı dezavantajların giderilmesi amacıyla polimer-ilaç konjugatları üzerine yapılan çalışmalar dikkat çekmektedir [4]. Terapötik ajanların polimerik bir taşıyıcıya kovalent olarak bağlandığı polimer-ilaç konjugatları ile yapılan çalışmalar yüksek ilaç yüklemesi, artırılmış ilaç çözünürlüğü, uzun plazma yarı ömrü, iyileştirilmiş ilaç biyoyararlanımı ve geliştirilmiş metabolik stabilite gibi etkin özellikler gösterdiğini ortaya koymuştur [5].

Bu çalışmada aynı kimyasal bileşime sahip blok, graft ve yıldız amfifilik polimer-metronidazol ilaç konjugatlarındaki polimerlerin özelliklerinin topolojik yapılarına bağlı olarak değişmesinin misel yapıları üzerindeki etkileri incelenmiştir. Elde edilen polimer-ilaç konjugatları GPC, ^{1}H NMR, FT-IR, DSC ve UV-Vis ile karakterize edilmiştir. Elde edilen amfifilik kopolimerden miseller oluşturularak DLS ve TEM ile karakterizasyonları yapılmıştır. İlaç salım çalışmaları gerçekleştirilerek ilaç taşıyıcı olarak kullanılma potansiyelleri incelenmiştir.

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Keyword: *Polimer-ilaç konjugatları, Polimer topolojisi*

ID: 19

Fotoindüklenmiş Azit Çapraz Bağlanması ile Çekirdeği Çapraz Bağlı Polimerik Misellerin Sentezi ve Karakterizasyonu

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Son zamanlarda nanotıp alanında hastalığın altında yatan patofizyolojinin daha iyi anlaşılması için hastalığın önlenmesi, teşhisi ve tedavisine yönelik nanotaşıyıcılar kullanılarak, yaşam kalitesinin arttırılması amacıyla çalışmalar yapılmaktadır. Tasarlanan polimerik taşıyıcılar, ilacın diğer moleküller ile etkileşime girmesini engelleyerek etkisinin azalmasının önüne geçerler. Bu amaçla araştırılan polimerik miseller küçük boyutları, basit üretim prosesleri, sterilizasyon kolaylıkları ve ligandlarla yapılabilecek yüzey modifikasyonu ile hedeflendirilme gibi avantajlara sahiptirler. Bu avantajların yanında polimerik misellerin vücut içerisinde stabilite problemlerinden kaynaklı kontrolsüz ilaç salımının ortaya çıkması gibi dezavantajları aktif kullanımlarını büyük ölçüde sınırlamaktadır [1]. Çapraz bağlama tekniği ile bu durumun üstesinden gelmek ve ideal bir taşıyıcı sistem geliştirmek mümkündür [2]. Bu hedefe yönelik mevcut araştırmalar ile umut verici sonuçlar elde edilmiştir. Çekirdek çapraz bağlı misellerin oluşturulmasında birçok yönteme başvurulmuştur. Bu yöntemler içinde foto-çapraz bağlama diğer yöntemlere göre toksik olmaması, uygun maliyeti ve yan ürün ortaya çıkarmaması nedeni ile üstünlük göstermektedir [3].

Bu çalışmada ışığa duyarlı çekirdeği çapraz bağlı ilaç taşıyıcı sistemler geliştirilmiştir. Öncelikle, hidrofilik kısım için 4-siyano-4[(dodesilsülfaniltiyokarbonil)sülfanil]pentanoik asit, RAFT ajanı ve polietilen glikol (PEG) kullanılarak bir makroRAFT ajanı sentezlenmiştir. MakroRAFT ajanı kullanılarak tersinir katılma-ayrılma zincir transfer (RAFT) polimerizasyonu ile stiren ve klorometil stiren monomerleri kullanılarak amfifilik bir kopolimer elde edilmiştir. Polimerin klorometil stiren üniteleri çapraz bağlanmayı sağlamak için sodyum azit ile fonksiyonlandırılmıştır. Bu amfifilik polimer ile misel oluşturulmuş ve sonrasında oluşturulan misel yapıları ışık kullanılarak fotoindüklenmiş azit çapraz bağlanmasıyla çekirdek çapraz bağlı misellere dönüştürülmüştür. Çapraz bağlanma sayesinde polimerik misellerdeki stabilite sorunu ve ani ilaç salımının önüne geçilmesi hedeflenmiştir. Oluşturulan misellere hidrofobik bir antikanser ajanı olan doksorubisin yüklenerek çapraz bağlanmanın ilaç salımına etkisi incelenmiştir. Sentezlenen polimer ve oluşturulan miseller GPC, ^{1}H NMR, FT-IR, DSC, DLS ve TEM ile karakterize edilmiştir.

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Keyword: *RAFT polimerizasyonu, Fotoindüklenmiş azit çapraz bağlanması, Doksorubusin*

ID: 18

Click Kimyası ile Redoks Duyarlı Çekirdeği Çapraz Bağlı Polimerik Misellerin Sentezi ve Karakterizasyonu

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Son yıllarda hastalıkların tedavisinde hedef bölgelerde etki gösteren ilaçlara duyulan ihtiyaç giderek artış göstermektedir. Bu nedenle ilaçların terapötik doz aralığındaki konsantrasyonlarında hedef bölgeye ulaşmasını amaçlayan ve kontrollü ilaç salımı yapan özel ilaç taşıyıcı sistemlerin geliştirilmesine yönelik çok sayıda çalışma yapılmaktadır. Bu sistemlerde kullanılan nanoteknoloji sayesinde boyutsal ve fonksiyonel açıdan geniş açılımlar sağlanmıştır [1]. Bu kapsamda en çok tercih edilen polimerik misel yapıları; nano boyutları, morfolojileri, stabiliteleri ve fonksiyonlandırılabilme özellikleri ile literatürde büyük ilgi gören ve araştırılan malzemelerdir. Amfifilik yapıya sahip misel yapıları; hidrofobik bir çekirdek ve hidrofilik bir kabuktan meydana gelmektedir. Bu yapısal özelliklerinden hidrofobik ilaçların stabilitesini sağlamak amacıyla yararlanılmaktadır [2]. Polimerik misellerin yapısal stabilitesini daha da artırmak için çapraz bağlayıcılar kullanılmaktadır. Kimyasal ya da fiziksel uyaranlara yanıt vererek çapraz bağlı hale getirilen polimerik miseller önemli taşıma sistemlerindendir. Literatürde yer alan çok sayıdaki çalışmada en stabil ve ideal sistemlerin çekirdek çapraz bağlı misel yapıları olduğu belirtilmiştir. Bu sistemlerden büyük oranda tercih edilen redoks duyarlı sistemlerin ilacı taşıması ve ilacın kontrollü salımını gerçekleştirmesi hücre içi redoks duyarlılığı sağlayan indirgeyici ajan olan glutatyon (GSH) konsantrasyonuna bağlıdır. GSH konsantrasyonu tümör hücreleri içerisinde yüksek seviyelerde seyrederken vücut sıvısında nispeten düşük seviyelerde izlenir. Bu durum ilaç taşıyıcı sistemin dolaşımda stabil kalarak özellikle hedef bölgelerdeki redoks potansiyellerine bağlı ilaç salımına neden olur. Bu mekanizmaları sayesinde hidrofobik kısımların stabilitesini ve terapötik etkiyi artırarak farmakokinetiğini büyük oranda iyileştirmektedir [3].

Bu çalışmada, tersinir katılma-ayrılma zincir transfer (RAFT) polimerizasyonu ile glisidil metakrilat ve metil metakrilat üniteleri içeren amfifilik kopolimerler sentezlenmiş, glisidil metakrilat üniteleri azit fonksiyonlu hale getirilmiş ve sentezlenen disülfit yapılı çapraz bağlayıcı ile azit grupları arasında click reaksiyonu gerçekleştirilerek çekirdek çapraz bağlı miseller oluşturulmuştur. Elde edilen çekirdeği çapraz bağlı misellere kemoterapötik bir ajan olan doksorubisin yüklenmiş ve çapraz bağlanmanın ilaç salımına etkisi incelenmiştir. Sentezlenen polimerler ve oluşturulan miseller GCP, ^{1}H NMR, FT-IR, DLS ve TEM ile karakterize edilmiştir.

Bu çalışma, TÜBİTAK 2209-A Üniversite Öğrencileri Araştırma Projeleri Destekleme Programı tarafından desteklenmiştir (başvuru numarası: 1919B012205456).

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Keyword: *RAFT Polimerizasyonu, Amfifilik polimerler, Çekirdek-çapraz bağlı miseller*

ID: 15

Gluten Türevi Proteinlerle Emülsifiye Edilmiş Su Bazlı Poliüretan Liflerin Sentezi ve Karakterizasyonu: Çevre Dostu Malzemelere Yeni Bir Yaklaşım

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Su bazlı poliüretanlar (WBPU), biyobozunur olmaları, yüksek aşınma direncine ve esnekliğe sahip olmaları gibi üstün özellikleri sayesinde biyomedikal malzemelerden otomotiv kaplamalarına kadar çeşitli endüstriyel uygulamalarda oldukça değer görmektedir [1]. Yüksek performanslı malzemelerin giderek daha fazla arandığı günümüzde, bu malzemelerin geliştirilmesinde sürdürülebilir ve çevre dostu yaklaşımların kullanılması, böylece atıkların sürece dahil edilerek katma değeri yüksek malzemelere dönüştürülmesi küresel düzeyde önemli görünmektedir. Bu çalışmada, biyouyumlu WBPU'ların hazırlanmasında, doğada bol miktarda bulunan ve özelikle atık gıdalardan ekstrakte edilebilen gluten bazlı proteinler kullanılmıştır. Bu amaçla, gluten türevi proteinlerden olan glutenin ve gliadin ile emülsifiye edilmiş biyobozunur WBPU polimerleri sentezlenmiş, ardından bu polimerlerden elektro-eğirme tekniği ile ilk kez nanolifli ağ dokular hazırlanarak sürdürülebilir malzeme geliştirilmesi alanında yenilikçi bir adım atılmıştır. Glutenden ekstra edilmiş proteinler, birçok doğal veya sentetik polimer malzeme ile etkileşime girebilecek işlevsel grupları sayesinde, polimerik malzemelerin sağlamlığını ve esnekliğini arttırabilecek özelliktedir [2]. WPBU sentezi sırasında polietilen glikol (PEG), polikaprolakton (PCL) ve lizin diizosiyanat (LDI) gibi çevreye zararsız polimerler kullanılarak yeşil kimya uygulaması yapılmıştır. WBPU nanolifli ağ dokudaki yapıyı üretmek için elektro-eğirme tekniği kullanılarak boyutsal kararlı ve homojen lifler elde etmek için voltaj, iğne ucu ve toplayıcı mesafesi ve çözelti derişimi bazı parametreler dikkatlice incelenmiştir. Gluten türevi proteinler içeren WBPU polimerlerinden ürettiğimiz elektro-eğirilmiş lifler, biyolojik olarak parçalanabilen bileşenlerin sentetik polimerlerle birleştirilmesi ile sürdürülebilir malzeme geliştirilmesi açısından önemlidir. Hazırlanan lifler ATR-FTIR, optik mikroskop, SEM, temas açısı ölçümleri ve bazı basit mekanik testlerle karakterize edilerek yapısal, morfolojik, hidrofilite ve mekanik özellikleri ortaya konuldu. Gluten bazlı WBPU'dan hazırlanmış elektro-eğirilmiş nanolifli ağ dokuların sadece tarımsal yan ürünlerin malzeme biliminde kullanımına olanak sağlaması ve böylece endüstriyel uygulamalar için potansiyel çevre dostu polimerik malzeme olması açısından önemli katkıda bulunacağı düşünülmektedir.

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Keyword: *Su bazlı poliüretan, gluten proteinleri, elektro-eğirme*

ID: 14

Dimer Diol Based Anti-Smudge Polyurethane Coatings

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Anti-smudge coatings are inherently repellent to oil and water-based liquids. These liquids do not spread on the coated surface and flow off the surface without leaving any residue. The most common method for creating such coatings is to use fluorine or polydimethylsiloxane (PDMS) that provide super repellency. However, fluorinated compounds are toxic and PDMS-containing compounds are expensive. Polyurethanes are highly preferred coating materials due to their durability, flexibility, toughness, abrasion and scratch resistance. Polyurethanes are composed of polyols and isocyanates. Most of the polyols used in commercial polyurethane coatings are of petrochemical origin and harmful to the environment. Therefore, the use of bio-based polyols are highly encouraged. In this study, it is aimed to make self-cleaning coatings that are less harmful to the environment than alternative coatings. For this purpose, dimer diacid-based polyester diol and trifunctional isocyanate were used in this study and transparent coatings with dirt-repellent properties were prepared by using a siloxane-based resin. The prepared coatings were characterized by Fourier Transform Infrared Spectroscopy (FTIR) and the contact angles of the coatings against water and oil based liquids were measured. Coating properties such as optical transmittance, pendulum hardness, solvent resistance, cross-cut adhesion, etc were evaluated.

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Keyword: *anti-smudge, biobased, polyurethane coating*

ID: 13

Preparation and Curing of Polyoxazoline-Amine Based Thermal Latent Curing Agents

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Epoxy resins are mainly used as matrices in polymer matrix composites (PMCs), available as either two-component epoxy resins or one-component epoxy resins (OCERs). In the case of two-component epoxy resins, the epoxy resins and curing agents are stored separately and mixed during the curing process. On the other hand, OCERs involve mixing the epoxy resins with a latent curing agent, providing advantages such as longer shelf life, improved energy efficiency, better control over curing temperatures, and reduced risk of human error compared to two-component epoxy resins. Among the stimulation methods of latent curing agents, thermal latent curing agents (TLCs) are the most widely used. In this study, polyoxazolines (POZs) were synthesized and used in combination with an amine-based curing agent to prepare TLCs. The POZ-amine complexes were prepared and used with diglycidyl ether bisphenol A (DGEBA) resin to develop OCERs. The POZs were characterized using techniques such as ^{1}H NMR, FTIR, GPC, TGA, and DSC. The characterization of POZ-amine-based TLCs was performed using FTIR and optical microscopy. DSC was utilized to investigate the curing behavior of the prepared OCERs. The study examined how parameters such as amine content, POZ: amine ratio, POZ molar mass, and the type and number of pendant groups affected the thermal latency behavior of OCERs. The results demonstrated that OCERs incorporating POZ-amine-based TLCs exhibited improved latency in curing compared to epoxy mixtures prepared with corresponding amine curing agent.

Keyword: *poly(2-oxazoline)s, tailor-made properties, one-component epoxy resins, polyoxazoline-imidazole complexes, thermal latent curing agents*

ID: 12

Preparation of Biocompatible Hydrogel Wound Dressings for Traumatic Injuries

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Traumatic wounds leading to uncontrolled and intense bleeding induced by surgery are among the foremost medical issues of our time. Traumatic wounds not only occur on the skin tissue but also manifest within internal organs due to factors such as explosions and firearm injuries. At this juncture, severe bleeding can result in hypothermia, hemorrhagic shock, organ failure, and fatalities due to the volumetric loss of over 40% of blood. Hence, it is imperative to swiftly halt the bleeding. Given the severity of tissue damage, tissue engineering has emerged as a promising field aimed at treating patients by repairing dysfunctional or damaged tissues to enhance life expectancy (Zhao et al., 2022). Numerous studies have been conducted on the preparation of various biomaterials in this regard. However, biomaterials compatible with wet tissues that support angiogenesis and platelet aggregation have not been encountered. In this study, alginate derivatives supporting platelet aggregation and hyaluronic acid derivatives demonstrating adherence to wet tissue and inducing angiogenesis to enhance vascularization were used. Alginate and hyaluronic acid derivatives were subjected to free radical photopolymerization to ensure crosslinking in the presence of visible light. The presented study aims to introduce a novel biomaterial containing sodium alginate and hyaluronic acid groups, exhibiting strong adhesion to wet tissues and demonstrating hemostatic effects, thus serving the purpose in its application domain. Consequently, the prevention of bleeding-related deaths, which have a significant global impact, can be achieved. The functional properties of prepared biostructures were characterized using Fourier Transform Infrared Spectroscopy (FTIR), Nuclear Magnetic Resonance Spectroscopy (NMR), and surface morphologies were examined via Scanning Electron Microscopy (SEM). In order to simulate high liquid adsorption capability in the hemorrhagic region, swelling and degradation properties were tested under appropriate conditions. The mechanical properties of the biocompatible material, aimed at exhibiting strong adhesion in a moist environment, were presented through tensile and compressive strength tests.

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References:

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Keyword: *in situ cross-linking, woung healing, hemostatic wounds*

Viyolojen Esaslı Kovalent Organik Kafes Yapılar ve Fotokatalitik Hidrojen Üretiminde Kullanımları

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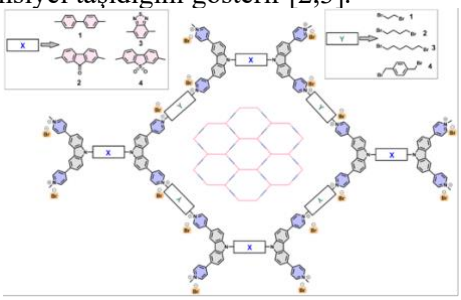
Kovalent organik kafes yapılar (COF'lar), günümüz malzeme biliminin önemli bir alanını oluşturan ve son zamanlarda büyük ilgi gören kovalent gözenekli kristalin polimerlerdir. Bu özel malzemeler, organik moleküllerin atomik düzeyde hassas bir şekilde düzenlenmesine olanak tanırlar [1]. Çeşitli moleküler tasarım özelliği sayesinde COF'lar, gözeneklilik ve kontrol edilebilir gözenek boyutu gibi benzersiz özellikler kazanırlar. Bu özellikler, COF'ları nanoteknolojiden enerji depolamaya kadar birçok alanda önemli bir malzeme sınıfı olarak konumlandırmaktadır. Geleneksel yarı iletkenlerle karşılaştırıldığında, COF'ların fotokataliz uygulamalarında kullanımı birçok avantaj sunar: (i) COF'ların yapısal tasarlanabilirliği sayesinde yüksek görünür ışık absorpsiyon özelliği taşıyan birimler kafes yapıya dahil edilebilir ve bu sayede hızlı elektron-boşluk ayrılması ve yük transferi özelliği kazandırılabilir; (ii) COF'ların geniş yüzey alanı, erişilebilir katalitik siteleri zenginleştirir ve yüksek kristal ve gözenekli yapı, COF'ları yüzeyde hızlandırılmış yük taşıma olasılığını azaltarak, elektron-boşluk rekombinasyonunu önlemeye katkıda bulunur; (iii) Güçlü kovalent bağlarla COF'lar, yüksek kimyasal ve termal stabilite gösterir ve dirençli foto-aktif üniteler, foto-korozyonu önleyerek uyarılmış durumların ömrünü artırabilir; ve (iv) Düzlemde ve yığılma yönlü olarak genişletilmiş p-konjuge yapı, yüksek yük taşıyıcı hareketliliğini sağlar. Bu dikkat çekici özellikler, COF'ların fotokatalitik enerji dönüşümü alanında büyük potansiyel taşıdığını gösterir [2,3].



Yapılan bir dizi çalışmada farklı köprü ve foto-aktif merkez gruplar içeren viyolojen esaslı COF yapıların sentezi ve karakterizasyonu gerçekleştirilmiştir [4]. Sentezlenen COF'ların optik ve elektrokimyasal özellikleri UV-Vis absorpsiyon, floresans ve voltametrik teknikler kullanılarak belirlenmiştir. Toz formdaki kafes yapıların morfolojik özellikleri SEM-EDX ve TEM teknikleri kullanılarak incelenmiştir. Viyolojen esaslı COF'ların fotokatalitik hidrojen üretiminde Pt gibi soy metal metal desteği olmaksızın ~ 5 mmol g^{-1} h^{-1} gibi yüksek bir hidrojen üretim verimliliğine ulaşılabilmiştir. Elde edilen sonuçlar, güneş enerjisi dönüşümü kullanılarak gelecekte katalitik hidrojen üretimi için COF'ların tasarımına yönelik büyük bir potansiyele sahip olabileceğini göstermiştir.

Bu çalışma Çanakkale Onsekiz Mart Üniversitesi Bilimsel Araştırma Projeleri Koordinasyon Birimi tarafından desteklenmiştir (Proje Kodu: FDK-2023-4576).

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Keyword: *Kovalent Organik Kafes Yapılar, Viyolojen, Fotokatalitik Hidrojen Üretimi*

ID: 409

Tekstil Uygulamaları İçin Solventsiz Yöntem Kullanılarak Su Bazlı Poliüretan Dispersiyon Reaksiyonu

Begüm Cura
Frimpeks Kimya ve Etiket Sanayi A.Ş.

Bu çalışmada N-metil pirilidone, aseton, metil etil keton, Proglyde DMM gibi çeşitli solventler kullanılmadan su bazlı poliüretan dispersiyonu elde edilmiştir. Yapılan çalışmada solventsiz proses metodu kullanılarak suyun içerisinde prepolimer zincir uzatıcılar yardımı ile molekül ağırlığı kazandırılmıştır. Elde edilen son nihai ürünün yıkama, mekanik, kimyasal direnç dayanımının olması için polieter bazlı poliol grupları tercih edilmiştir. Ana zinciri oluşturan bu polieter poliollerin molekül ağırlığı 1000-2000 sahip olanlar bu çalışmada tercih edilmiştir. Ana zincirde bağlanmayı sağlayan izosiyanat olarak izofron diizosiyanat (IPDI) kullanılmıştır. Solventsiz yapılan bu proseste prepolimere hidrofilikliği sağlayıp su ile disperse olması için dimetil propiyonik asit(DMPA) kullanılmıştır. Elde edilen ürün DSC, TGA, FTIR cihazları kullanılarak yapısal ve termal karakterizasyonu incelenmiştir.

Keyword: *solvent free, DMPA, textile*

Elektromanyetik Girişim Kalkanlama Özellikli Biyo Bazlı Polimerik Kompozitlerin Geliştirilmesi

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Günümüz dijital çağında elektronik cihazların ve kablosuz iletişim teknolojilerinin yaygınlaşması, elektromanyetik girişimler (EMI) ve bunların oluşturduğu kirlilik ile ilgili endişelerin artmasına neden olmuştur. Bluetooth cihazları, akıllı telefonlar, Wi-Fi ağları, baz istasyonları, askeri savunma sistemleri gibi teknolojilerin büyümesi ile EMI giderek daha kalabalık hale gelmekte ve farklı cihazlar ve sistemler arasında parazit potansiyelini artırmaktadır. Dahası bu EMI; bitki, hayvan ve insan sağlığını da tehdit eden önemli bir sorun olmaktadır. İstenmeyen EM girişimlerin engellenmesi amacı ile metalik elektromanyetik girişim kalkanlama (EMK) malzemeleri sıklıkla kullanılmaktadır. Bu çalışma metalik kalkan malzemelerine bir alternatif olarak hafif, kolay işlenebilir, ucuz ve çevre dostu biyo bazlı polimerik kompozitlerin üretilmesine odaklanmaktadır. Çalışmada biyo bazlı polimerik matris olarak poliamid 11 (PA11) ve poli (laktik asit) (PLA)'in ağırlıkça %60/40 oranında hazırlanan karışımı kullanılmıştır. PA11/PLA karışımına karbon bazlı katkılar ile elektriksel iletkenlik ve EMK performansı kazandırılması amaçlanmıştır. Bu amaçla matris mikro ölçekli karbon elyaf (KE) ile nano ölçekli çok duvarlı karbon nanotüp (ÇDKNT) ile takviye edilmiş ve çok ölçekli hibrit PA11/PLA/KE/ÇDKNT kompozitleri üretilmiştir. Laboratuvar ölçekli çift vidalı bir harmanlayıcı da hazırlanan eriyikler bir mikro enjeksiyon cihazı kullanılarak kalıplanmış ve test örnekleri elde edilmiştir. EMK verimliliği (EMKV) ve elektriksel iletkenlik ölçümleri için numuneler hidrolik pres ile hazırlanmıştır. Kompozitlerin morfolojik özellikleri taramalı elektron mikroskobu ile, ısıl özellikleri diferansiyel taramalı kalorimetre ile, özdirençleri hacimsel özdirenç, dielektrik özellikleri geniş bant dielektrik spektroskopisi ve EMKV değerleri R-bant bölgesinde vektör ağ analizörü ölçümleri ile belirlenmiştir. Sonuç olarak PA11/PLA/KE kompozitine eklenen ÇDKNT'nin sinerjik etki yaratarak elektriksel iletkenlik ve EMKV değerlerinde artış sağladığı görülmüştür.

Keyword: *polimer kompozit, sinerjik etki, elektromanyetik kalkanlama*

ID: 420

Hidrokolloid ve Zeolit İçeren Yeni PrAm/SSS Biyokompozit Hidrojellerinde Şişme Karakterizasyonu

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Günümüzde hidrokolloid, kil, zeolit ve benzeri içeriklerle desteklenerek hazırlanmış hibrit/kompozit karakterde çapraz bağlı polimerler, iyi su tutma özelliklerinden dolayı su ve atık su saflaştırma, yüzeye soğurma, geri kazanım, vb. teknolojik uygulamalarda "adsorplayıcı" olarak kullanılmaktadır [1-5]. Hidrokolloidler, yüksek miktarda su bağlayabilen, eklendikleri sistemlerin akış, şekil değiştirme vb. çok sayıda fizikokimyasal özelliklerini modifiye eden, yüksek mol kütleli, suda çözünebilen polisakkarit ve protein gibi makromoleküller/polimerlerdir [1-5]. Zeolit insanoğlunun günlük yaşamında, endüstride yoğun olarak kullanılan ve doğal alümino-silikat grubuna ilişkin bir malzemedir. Zeolitler, üzerinde taşıdığı oyuk, gözenek ve kanallar ile potansiyel bir adsorplayıcı olarak dikkat çeker. Zeolitler, iyon değişim özelliği ve düşük maliyeti ile endüstriyel-kentsel atık suların arıtılmasında daha fazla kullanılmaktadır [3-5]

Bu çalışmada hidrokolloid olarak bilinen ve doğal bir polisakkarit olan "Akasya gamı" (Acacia gum, Gum arabic) (AG)", kristal yapıya sahip bir alüminyum silikat olarak bilinen "zeolit (ZEO)" ve "sodyum stirensülfonat (SSS)" gibi hidrofilik bir yardımcı monomerin; çapraz bağlı polimer üretiminde yaygın kullanılan nötral bir monomer olan propenamid (PrAm, akrilamid) ile birlikte oluşturacakları yeni bir biyokompozit polimerik adsorbanın üretimi, karakterizasyonu ve şişme potansiyellerinin araştırılması amaçlanmıştır. AG, ZEO, SSS ve PrAm içeren yeni biyokompozit hidrojeller, sulu çözelti ortamında serbest radikalik katılma polimerleşmesi ile elde edilmiştir. Tepkimeyi başlatmak amacıyla amonyum persülfat (APS) ve tepkimenin hızla ilerlemesini sağlamak amacıyla N,N,N',N'-tetrametiletilendiamin (TEMED) kullanılmıştır. Çapraz bağlayıcı olarak, poli (etilen glikol)diakrilat (PEGDA) seçilmiştir. Polimerik sistemlere 25°C'da dinamik şişme testleri uygulanarak, şişme ve su difüzyonu ile ilgili parametreler bulunmuştur.

Bu çalışmada elde edilen biyokompozit hidrojeller için %1001-%2477 arasında değişen denge yüzde şişme değerleri ve 0,6129-0,7255 arasında değişen difüzyon üsteli değerleri hesaplanmıştır. Çalışmada üretilen PrAm/SSS hidrojelleri, PrAm/SSS/AG semi-IPN'leri, PrAm/SSS/ZEO kompozit hidrojelleri ve PrAm/SSS/AG/ZEO biyokompozit hidrojellerinin yüksek oranda su soğurabilme yeteneklerinden dolayı "su adsorplayıcı" olarak tarım, veterinerlik, biyotıp ve benzeri bazı alanlarda kullanılabileceği ileri sürülebilir.

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Keyword: *Propenamid, hidrokolloid, zeolit*

ID: 239

Kükürt İçeren Vinil Monomerlerin Radikal Polimerizasyonlarındaki Reaktivitelerinin İncelenmesi

Not Presented

ID: 362

Synthesis of Unsaturated Polyester Resin with Phosphate Based Flame Retardants and Investigating Their Thermal, Mechanical, and Flame Retardant Properties

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In this study, triethyl phosphate (TEP) and diphenyl cresyl phosphate (DPK) were used for the first time in unsaturated polyester resin as phosphorus-based flame retardants. The backbone of unsaturated polyester resin was synthesized in a prototype stainless steel reactor, and the molecular structure of the backbone was confirmed by nuclear magnetic resonance (1H-NMR) and Fourier transform infrared spectroscopy (FTIR). The synthesis of unsaturated polyester backbone based on maleic anhydride (MA), phthalic anhydride (PA), propylene glycol (PG), ethylene glycol (EG), and diethylene glycol (DEG) was carried out at 200 ± 5 °C, and the molar ratio of monomers was MA/PA/PG/EG/DEG: 1.00/1.00/1.10/0.75/0.25. Toluene was utilized to eliminate the water that was produced as a reaction byproduct, and hydroquinone was used to prevent gelation throughout the process. The synthesized backbone was diluted with the appropriate amounts of styrene, and toluhydroquinone was used as an inhibitor to avoid gelation of styrene during blending. Unsaturated polyester resin was successfully prepared and designated as UPR. Different concentrations of phosphorus-based FRs were added into UPR. The change in the molecular structure of UPR with the addition of phosphorus-based FRs were examined by FTIR. The effects of phosphorus-based FRs on the physical, mechanical, thermal and flammability properties of UPR were evaluated by viscosity, reactivity, flexural, tensile, impact, heat distortion temperature (HDT), liquid oxygen index (LOI), vertical burning (UL-94), cone calorimeter (CCT) and smoke density tests. It was stated that TEP was more effective than DPK in enhancing the properties of UPR. Therefore, TEP was selected for further studies and combined with different concentrations of aluminum hydroxide (ATH) in order to prepare UPR composites. Significant improvements were observed in the mechanical and flame retardant properties of composites due to the synergistic effect of TEP and ATH.

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Keyword: *unsaturated polyester resin, triethyl phosphate, diphenyl cresyl phosphate, alumunium hydroxide, flame retardant properties*

ID: 417

Impact Of Carbon Quantum Dots on The Electrochemical Performance Of Polymer-Mediated Cubic Cuprous Oxide

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Cuprous Oxide (Cu_2O), a p-type semiconductor with a direct bandgap of 2.2 eV, has received attention for its similar Faradaic behaviour in batteries and supercapacitors. Cu_2O can be formed in various shapes, including nanowires, octahedrons, hollow spheres, nanoboxes, and nanocubes. The polyol method, producing nanocube-shaped Cu_2O, is a simple, affordable, and versatile technique [1, 2]. The polymer acts as a stabilizer, reducing agent, and binder all at once. Therefore, the polyol method enables regulated growth and reduces particle agglomeration during synthesis. Additionally, carbon quantum dots (CDs) are attractive for energy storage applications because of their low cost, simple production procedures, excellent chemical stability, and massive surface defects. CDs include hydrophilic surface functional groups such as -COOH, -COOR, and -OH, making them an ideal interface for electrolyte-electrode interactions, particularly in water-based electrolytes. This study investigated the impacts of CDs on polymer-mediated cubic Cu_2O for supercapacitor applications.

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Keyword: *Carbon Dots, Cu2O, Polyol Method*

ID: 419

Modification of Hyaluronic Acid into Polyampholytes and Phase Separation with Enzymes

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Complex coacervation involves liquid-liquid phase separation into a dilute supernatant and a dense coacervate. This method protects active substances like enzymes from environmental factors such as pH, salt, and temperature. While oppositely charged polyelectrolytes are commonly used, polyampholytes—polyelectrolytes with both positive and negative charges— are interesting due to their similarity to intrinsically disordered proteins. This study aims to modify hyaluronic acid to obtain polyampholytes with varying grafting ratios using 1,4-Diaminobutane dihydrochloride (DN), adipic dihydrazide (ADH) and ethylenediamine dihydrochloride (EDA) via carbodiimide chemistry. The chemical structure was characterized by 1 H-NMR and FTIR spectroscopy, and zeta potential experiments determined the isoelectric points (pI). These polyampholytes were used to encapsulate enzymes with different pI values such as pI=8.76[1] for alpha-chymotrypsin (αCT), pI= 5.9[2] for carbonic anhydrase (CA), and pI=11[3] for lysozyme (LYS). Turbidimetric titration experiments were performed to identify the phase separation range under varying pH and NaCl concentrations.

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Keyword: *complex coacervation, polyampholytes, enzyme encapsulation*

Synthesis and Characterization of Triphenylamine-Based Conjugated Polymers for High-Performance Supercapacitors

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To achieve sustainable energy usage and minimize environmental impact, it is essential to reduce fossil fuel consumption and carbon emissions. Significant research has focused on developing advanced energy storage solutions such as electrochemical capacitors and batteries, which efficiently convert chemical energy into electrical energy. Among these, supercapacitors (SCs) have emerged as promising alternatives to traditional capacitors, batteries, and fuel cells due to their high power density, rapid charge/discharge rates, long cycle life, and minimal environmental impact.

Triphenylamine (TPA)-based conjugated polymers (CPs) are promising for SC devices due to their ultrafast electron-transfer rates, effective hole-transporting properties, and high redox activity. Incorporating 3,4-ethylenedioxythiophene (EDOT) and thiophene derivatives into these polymers enhances their charge transport, electrochemical stability, and reversibility. This results in high theoretical capacitance and diverse electrochromic features.

In this study, monomers were synthesized using the Stille cross-coupling reaction, incorporating thiophene as a π-bridge between TPA and EDOT. These monomers were electropolymerized on Indium tin oxide (ITO) glass using cyclic voltammetry and characterized by cyclic voltammetry (CV) and galvanostatic charge-discharge (GCD) methods. The research aims to characterize these polymers, assess the impact of various modifications on their capacitance, and contribute to the development of novel molecules with optimized properties for chemical, electrochromic, and energy storage applications.

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Keyword: *Conjugated Polymers, Energy Storage, Specific Capacitance*

ID: 439

Improvement of corrosion performance of titanium and its alloy with phytochemicals and surface coating

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Day by day, we should prefer natural and healthier products as an alternative to ready-to-eat foods and beverages taken by mouth. However, the mechanism of the behaviour of some components in these foods is not yet known. For this reason, in this study, the corrosion effect of some components (α/β-pinene, β-caryophyllene) on biocompatible titanium and titanium alloy (Ti6%Al%4V) widely used in dentistry was investigated by electrochemical methods, surface (SEM/EDX) and solution analysis (ICP-MS/OES). According to the results obtained, there is a significant difference in corrosion performance between α/β-pinene and β-caryophyllene in citric acid ($C_6H_8O_7.H_2O$) medium according to electrochemical methods. The components were able to change the physicochemical properties of the material as a result of adsorption on the surface. This favourable inhibition affect (46% for β-caryophyllene and 76% α/β-pinene) is due to the formation of polymeric structure on the surface at pH 5.0, 37°C. In the presence of metal chloride ($FeCl_2.6H_2O$, $ZnCl_2$) this effect was significantly (>90%) enhanced.

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Keyword: *Corrosion, Titanium alloy, α/β-pinene*

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Siklodekstrin ile Çapraz Bağlanmış Supramoleküler Hidrojeller

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Kesik koni benzeri yapılar olarak tasvir edilen siklodekstrinler (CD), polar bir dış yüzeye ve nispeten polar olmayan bir iç boşluğa sahiptir. Bu benzersiz yapı, çeşitli düşük molekül ağırlıklı bileşiklerin yanı sıra polimer zincirleriyle inklüzyon kompleksleri oluşturmalarına olanak tanır. Poli(etilen glikol) (PEG) ve α-CD bazlı inklüzyon kompleksasyonu ile supramoleküler bileşimler elde edilmesi ilk olarak 1990 yılında Harada ve arkadaşları tarafından bildirilmiştir [1]. CD bazlı supramoleküler jeller, CD'nin iç boşluğu ile polimerin enine kesit alanı arasındaki boyut uyumuna ilişkin çeşitli kovalent olmayan etkileşimler yoluyla oluşturulmuştur. Bu komplekslere, CD moleküllerinin suya daldırıldığında polimer zincirinden yeniden geçirilebildiği psödopolirotaksan (PPR) adı verilir. PPR sistemlerine dayalı CD jelleri, belirli koşullar altında CD'lerin polimer zincirlerinden ayrılmasıyla oluşan sol-jel dönüşümü nedeniyle genellikle zayıf bir stabiliteye sahiptir.

Bu çalışmada, CD molekülleri, PEG ve poli(N-vinilpirolidon) (PVP) zincirlerini fiziksel bir ağ yapısı içinde tutan çapraz bağlama alanları olarak kullanılmıştır [2]. Literatür çalışmalarından farklı olarak, PVP'nin varlığı ve dolayısıyla ek ikincil kuvvetler, fiziksel olarak çapraz bağlanmış CD/PVP/PEG ağlarındaki etkileşimleri güçlendirmiştir. CD ve PEG arasındaki inklüzyon komplekslerinin oluşumu sırasında ve daha sonra yapıyı destekleyen PVP varlığında komplekslerin kendi kendine birleşmesinde yalnızca fiziksel etkileşimler sorumludur. PEG zincirlerinin moleküler ağırlığı, reaksiyon bileşenlerinin besleme oranları ve CD birimlerinin boyutunun, son ağların özelliklerini belirlemek ve kendi kendini iyileştirme yeteneğine sahip çözünmeyen ağlar elde etmek için önemli olduğu bulunmuştur. Sisteme poli(etilen glikol) dimetakrilat (PEGDMA) eklenerek fiziksel ve kimyasal çapraz bağlamanın sinerjik etkisi de değişen konsantrasyonlarda incelenmiştir.

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Keyword: *hidrojel, siklodekstrin, Poli(etilen glikol)*

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A Study on Enhancing Electromagnetic Shielding Properties of Semi-Integral Polyurethane via Spray Coating Method

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In modern automotive applications, electromagnetic shielding is critical for safeguarding electronic systems from electromagnetic interference (EMI) and ensuring reliable vehicle performance. This need has become more pressing as vehicles integrate increasingly complex electronics, such as advanced driver-assistance systems (ADAS), wireless communication technologies, and engine control units (ECUs). Polyurethane components offer the automotive industry lightweight, flexible, and durable solutions. In recent years, there has been a growing number of studies focused on providing polyurethane components with electromagnetic shielding properties.

The spray coating method can be a promising technique for tailoring the electromagnetic characteristics of polyurethane-based materials in addition to adding shielding capabilities with conductive fillers. This method involves depositing thin layers of selected electromagnetic enhancement agents onto polyurethane molds before manufacturing. The electromagnetic properties, including shielding efficiency, are systematically analyzed across a range of frequencies. The experimental design involves varying key parameters, such as the type of coating material, concentration, and application method, to optimize the electromagnetic performance of the polyurethane structure. These findings have significant implications for the development of lightweight, durable, and customizable materials for electromagnetic shielding, particularly for blocking electromagnetic noise in electric vehicles (EVs).

In this study a variety of conductive materials, including graphene, Mxene, polyaniline (PANI), and carbon black (CB), were used to study the electromagnetic shielding properties. Following up on our earlier research, which found that CB has better shielding compare to PANI, and graphene, this study the concentration effect of CB examined by adding 0.5%, 2%, and 5%. Furthermore, conductive additives such as graphene and Mxene were chosen for surface coating, and samples with and without filler added were contrasted. The samples with surface coatings were shown to have improved electromagnetic shielding capabilities, and promising shielding results were found even with less amount of Mxene.

Keyword: *Electromagnetic Interference, Polyurethane, Spray Coating*

Palladium/Polyhistidine-Based Electrodes for Electroanalytical Applications

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Amino acids are compounds consisting of functional groups and they play an important role in various biochemical and physiological processes. Besides these properties, amino acid-based polymers can be produced by using various electrochemical methods. Amino acid-based polymers are widely used due to their ease of production, low cost, electrochemical stability, and biocompatibility. Functional groups of the structures can also facilitate electron transfer at the electrode-solution interface in the presence of an analyte. In order to improve the analytical performance of polymeric structures, many types of materials such as carbon-based nanomaterials and metal nanoparticles can be employed. By using these materials, the electrode stability is improved and the electroactive surface area is increased [1-3]. In this study, electrochemical preparation of polyhistidine-based electrodes is presented. For this purpose, pencil graphite electrode surfaces were coated by using L-histidine via cyclic voltammetry (CV) technique. Following the modification of the pencil graphite electrode with polyhistidine, palladium on activated charcoal was modified on this electrode. The parameters of electropolymerization cyclic scans, pH of the medium and the concentration of histidine were optimized. The coated electrodes were used to investigate the electroanalytical response of formaldehyde, which is a toxic molecule [4,5]. The results demonstrated that palladium-polyhistidine modified electrode enhances the sensitivity to the analyte in comparison to bare electrode. Characterization studies were elucidated using cyclic voltammetry, differential pulse voltammetry (DPV) and electrochemical impedance spectroscopy (EIS).

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Keyword: *Electrochemistry, electrochemical deposition and characterization, formaldehyde*ß

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Utilizing SAMs in Semi-Transparent Organic Solar Cells

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Organic solar cells present notable opportunity for solar energy sector due to their cost-efficient manufacturing and ability to generate flexible and thin solar cells that allow light transmission. In recent years, semi-transparent organic solar cells (ST-OSC) gain attention due to their ability to generate electricity and enable light transmission simultaneously. Thus, ST-OSC's become promising candidates for design of building-integrated photovoltaics by combining solar energy harvesting with several building materials. Additional to the PCE, FF, J_{sc} and V_{oc} parameters, Average visible light transmission (AVT) value is also an important parameter for characterization of ST-OSCs. In this work, ST-OSC's were fabricated with device structure of ITO / 2PACz / D18:Y6 / PDINN / Au /Ag. The best performance semitransparent OSC exhibits power conversion efficiency (PCE) of 9.74 %, short circuit current density (J_{sc}) of 15.77 mA/cm^2, open circuit voltage (V_{oc}) of 0.86 V, fill factor of 72% and AVT of 22.77%.

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Keyword: *Organic photovoltaics, Semi- Transparent OSC's, SAM*

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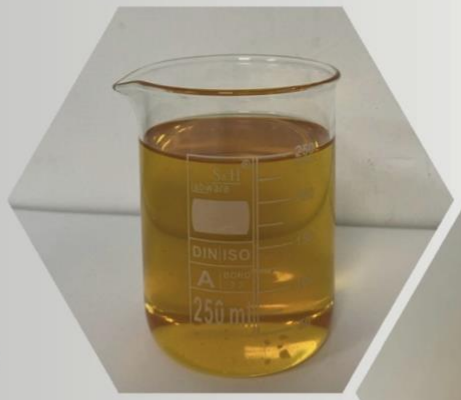





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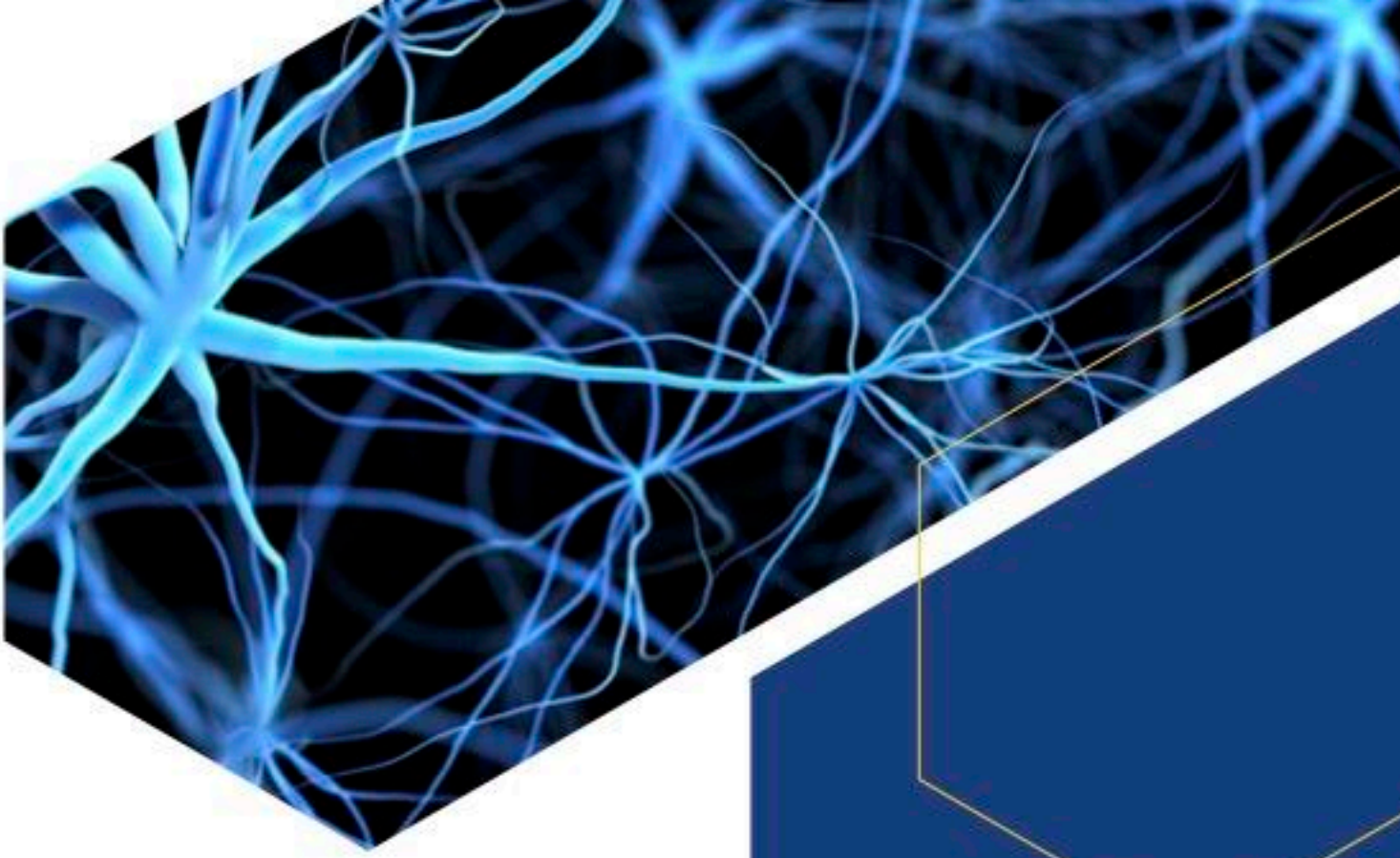

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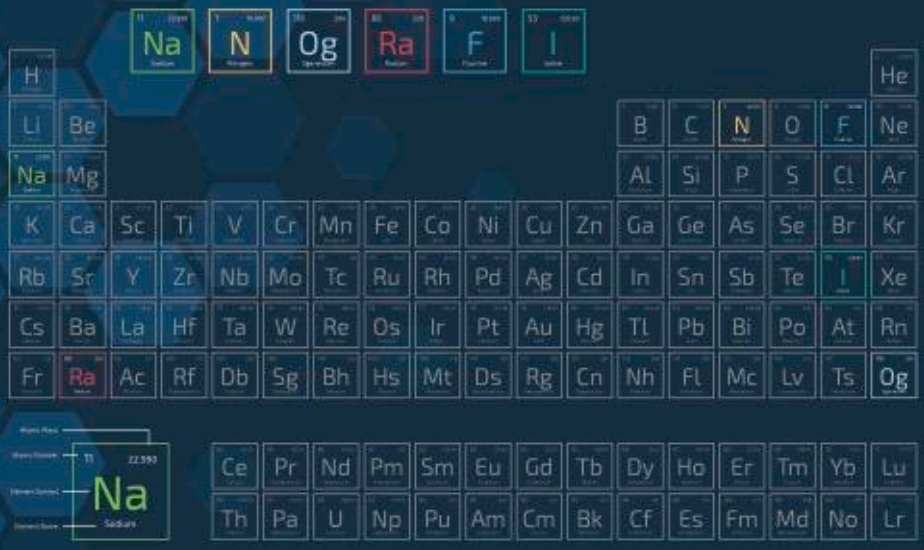
nanografi

Nanografi
İleri Malzemeler

Nanografi bünyesinde faaliyet gösteren Nanografi İleri Malzemeler departmanı, yüksek teknoloji laboratuvarları ve esnek kapasiteli üretim tesisleri ile **periyodik tablodaki tüm elementleri nano ve mikron boyutlarında** geliştirerek, inovasyonu teşvik eden **özelleştirilmiş çözümler** sunuyor.



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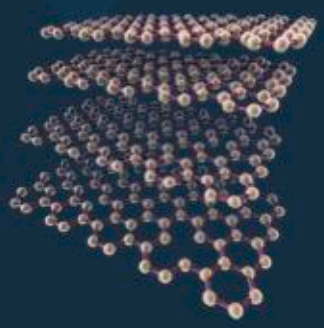
Grafen 2.0: Teknolojinin Yeni Gücü

Nanografi İleri Malzemeler'in son teknoloji ürünü olan **Holey Süper Grafen**, uniform delikli yapısı sayesinde geleneksel grafeni geride bırakarak performans ve sürdürülebilirlikte yeni standartlar belirliyor.



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