Development of Polymer Science in Last Five Year

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Abstract

Since polymers have been developed during the past five years, organic photovoltaics (OPVs) with polymers in the active layer have become more and more significant in terms of their sustainable energy conversion efficiency, a development that has sparked a lot of interest in research. Additionally, polymeric solar cells may be mass-produced with ease to attain great durability and efficiency. The primary obstacles facing OPV devices to enhance their solar cells, architecture, polymer structure development, performance, and stability are identified in this research. Thus, research has been focused on creating new, affordable photovoltaic technologies, such third-generation solar cells, that are more durable, more efficient, and easy to produce. This study shows that organic solar cells (OPVs) containing polymers in the active layer have a higher sustainable energy conversion efficiency, which has sparked a lot of interest in the field. Additionally, polymeric solar cells may be mass-produced with ease to attain great durability and efficiency. The primary obstacles facing OPV devices to enhance their solar cells, architecture, polymer structure development, performance, and stability are identified in this research.

Keywords: Polymer Science, Organic Photovoltaics, Polymeric Solar Cells

Introduction

The third generation of solar cells is a class of solar cells that resulted from efforts to lower the cost of photovoltaic technology, employ more readily available materials, and enhance large-scale manufacturing because of improved processability. (Fang, Maeda, and Makimoto,

2021a) Devices with layers of organic semiconductors (OSCs) are unique. These kinds of systems are known as "organic solar cells," sometimes known as "organic photovoltaics," or "OPVs." The first steps towards producing OPV devices with anthracene crystals serving as the energy conversion material Achieving a power conversion efficiency (PCE) of 0.9%, OPVs were first produced utilizing a bilayer device (small molecule (SM)/fullerene) configuration. Later, because of the benefits of processing the OPV main layer in solution, it garnered a lot of attention. Mass manufacturing of flexible and lightweight solar panels using inexpensive printing processes is conceivable, particularly if conjugated polymers are used in the active layer. This is because polymer materials can easily be formed into high-quality films of nanometer-thickness. Consequently, photosensitive Polymer semiconductors are included into the layers to create broad, even, smooth films. Here, OPVs are referred to as plastic solar cells. Moreover, plastic film, such as polyethylene terephthalate PET, may be used as the substrate in place of glass, giving the solar panel flexibility and reduced weight. Poly [2-methoxy-5-(2'-ethyl-hexyloxy)-1, 4-phenylene-vinylene] (MEH-PPV), poly[2-methoxy-5-(3', 7'-dimethyloctyloxy)-1,4-phenylene Vilene) (MDMO-PPV), and other PPV-based materials are the polymers that were first employed in OPV. The large band gap (over 1.9 eV) of these polymers prevents effective photon collecting, which severely restricts further device performance optimization. As a result, the efficiency does not surpass 3%. Highlighted were polythiophenes, particularly poly[3-hexylthiophene-2,5-diyl] (P3HT), which demonstrated a 5% performance. These findings spur the creation of ever-more sophisticated technologies to enhance solar cells, which continue to confront several obstacles, such as enhancing the devices' longevity and efficiency. The effectiveness of OPVs has increased dramatically with the discovery of bulk heterojunction (BHJ) active layers and the fabrication of soluble fullerene derivatives. In this instance, the modified fullerene (A) and the electron donor polymer (D) are dissolved in the same solution. After processing the films straight from this solution, active films with numerous D/A interfaces—which produce charges upon photoexcitation—that resemble p-n interfaces in conventional semiconductors were produced. Therefore, a film consisting of a combination of two organic elements is equivalent to an active BHJ-type layer. The first is a conjugated polymer that functions as an electron donor to transfer positive charges, or holes, to the anode (p-OSC) by absorbing light, producing excitons, and diffusing them to the p-n junction. Electrons are transported to the electrode (cathode) via electron acceptors, or n-OSCs. The interpenetrating network created by these two steps offers a three-dimensional structure that improves charge transfer and exciton diffusion. To further advance the development of organic solar cells, a variety of conjugated polymers have been studied as photoactive donor materials in organic photovoltaics (OPVs) with conversion efficiencies (PCEs) higher than 10%. But after 2015, organic photovoltaic cells' efficiency skyrocketed to above 13%, and they now attain a PCE of over 18%. Non-fullerene acceptors, or NFAs, have replaced fullerenes with electron acceptor materials; some of these NFAs are polymers (n-semiconductors). Understanding OPV devices and their architectures—which are usually made up of several nanometers placed on flexible substrates like polysilicon or glass—is essential to comprehending the influence of polymeric materials on these devices. PET (ethylene terephthalate) that forms layers. By adding novel buffer layers to enhance interlayer adhesion, decrease roughness, and effectively extract charges from molecular orbitals in active layer materials, significant efforts have been made

to boost the efficiency of OPV cells. At least five elements make up the conventional OPV architecture as it stands today: The holes are collected by a transparent layer of indium tin oxide (ITO), which serves as the anode. The hole transport layer (HTL) is where the hole injection and electron injection occur. The active layer is made up of conjugated electron-donor polymers (e-) mixed with electron acceptor materials that are derived from fullerenes or other n-type semiconductors, usually 1:1 by mass. The electron transport layer (ETL) uses materials like Ca or LiF to adjust the energy levels. The cathode and electron collector are low work function metal electrodes (Al, Ca/Al).These devices, which have better PCE and stronger ageing resistance, are often made of substrate/ITO (transparent cathode)/ZnO (ETL)/active layer/MoO3 (HTL)/Ag (anode). A high work function metal serving as the top electrode is linked to this increased stability and may assist save costs by using less complicated production methods. Furthermore, the inverted structure provides more photocurrent and flexibility. However, the kind of ETL material and how it interfaces with the photoactive layer BHJ are what primarily determine this device's performance. The replacement of the PEDOT:PSS layer with metal oxides and nanoparticles, such as WO3, NiOx, MoO3, and V2O5, which have superior electrical characteristics and low visible light wavelengths, is also connected to the enhanced stability in the inverted structure. high degree of technological compatibility and light absorption. PEDOT:PSS (mass ratio: depending on supplier, 1.00:6.11 or 1.00:6.92). When paired with the HOMO levels of frequently used donor polymers, mixtures that have been utilised extensively in traditional setups have high work functions in the visible region. It may lessen the ITO layer's surface roughness and has excellent electrical conductivity and high transparency (more than 80%). Low electrical characteristics have also been documented, despite the fact that the interface between ITO and PEDOT:PSS is unstable and might cause chemical reactions and device degradation because of the hydrophilicity and poor film morphology of PEDOT:PSS. On the surface of PEDOT:PSS, ITO dissociates into In and Sn atoms because of its high acidity. After thermal annealing, these atoms may readily migrate to the PEDOT:PSS layer, which can lead to instability in the device. Conjugated polymers are used as effective hole transport materials in the active and secondary layers of OPV devices, as can be observed. (Makimoto et al., 2021a; Makimoto et al., 2021b; Skorulska et al., 2021; Khodakarami & Bagheri, 2021)

The following discusses current research using OPV and polymer technology, as well as appropriate qualities for its use.

1. Recent advances in polymer blend membranes for gas separation and pervaporation.

Molecular transport features in gas separation and pervaporation have been developed due to the recent interest in creating high-performance polymer membranes. The performance of membranes for separation may be enhanced by the production of polymers with novel architectures. But there are always unknown hazards associated with it, such development time and cost. Polymer blends have garnered attention from a wide range of disciplines as a potentially effective modification technique because of their affordability, ease of use, and adaptability. They are also a quick and inexpensive way to create membranes with desired separation qualities. In spite of these benefits, polymer blends have significant molecular compatibility issues, which lead to subpar membrane separation performance. Polymer

blends' thermodynamic characteristics give rise to several phase behaviours in the finished product, including partial miscibility, immiscibility, and miscibility. Because compatibility is crucial for polymer blends, this article provides an overview of the relative phase behaviour and molecular interactions. Polymer blend membrane separation characteristics and prediction models. Furthermore, a review of current developments in cutting-edge polymer mixes membranes for a range of energy-related applications, including gas separation and pervaporation, will be conducted. Lastly, viewpoints on the difficulties facing polymer mix films now and their prospects for the future will be explored.

2. Advances in composite polymer electrolytes for lithium batteries and beyond.

The limitations of conventional lithium-ion batteries' capacity and energy density are drawing near. Lithium metal anodes may be used to create high-energy batteries. However, safe electrolytes must take the place of flammable liquids due to safety issues with lithium metal and the production of lithium dendrites. In recent years, solid-state electrolytes have garnered a lot of interest. Among them, the various compositions of composite polymer electrolytes (CPEs) provide distinct benefits such excellent flexibility, strong ionic conductivity, and low interfacial resistance. Here, fundamental characteristics and analytical techniques pertaining to CPE are covered. Subsequently, the materials included into the polymer matrix, including rapid ion conducting inorganics, organic solvents, and nanostructured ceramics, are categorized. A short discussion of CPEs for inexpensive sodium and potassium batteries is given. It is intended that this study will help researchers in this area advance their understanding of the fundamentals and offer direction for the development of CPE in lithium battery systems and other applications.

3. Latium-ion batteries

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4. Polymerized small-molecule acceptors for high-performance all-polymer solar cells

All-polymer solar cells, or all-PSCs, have garnered a lot of attention in research lately because of their many benefits, which include stable morphology, mechanical flexibility, and excellent film formation. Prior to 2017, the naphthalene diimide-based D-A copolymer N2200 was the most typical and often used n-CP acceptor. In 2016, the power conversion efficiency (PCE) of the whole PSC based on N2200 exceeded 8%. The near-infrared (NIR) region of N2200's low

absorption coefficient prevents it from increasing in PCE any more. In order to create a novel class of polymeric receptors, we suggested a method in 2017 for polymerizing small molecule receptors (SMAs). Due to their excellent near-infrared absorption and narrow band gaps, polymerized SMAs (PSMAs) have garnered a lot of interest and have recently increased the PCE of all-PSCs to over 15%. In this Minireview, we outline the latest developments in research and provide an explanation of the design approach used for PSMA's molecular structure. Finally, an analysis and discussion of PSMA's present difficulties and potential are provided.

5. MXenes for polymer matrix electromagnetic interference shielding composites: A review

The rapid advancement of wireless communication and electronic devices raises awareness of electromagnetic radiation's detrimental effects and concealment, which has a major impact on electrical equipment's ability to function normally. The development of novel electromagnetic interference (EMI) shielding materials with superior all-around qualities is thus necessary. Two-dimensional layered transition metal carbides, also known as nitrides or carbonitrides (MXenes), have surfaced recently.

6. Development of a novel micro-bead force spectroscopy approach to measure the ability of a thermo-active polymer to remove bacteria from a corneal model

Bacterial or fungal infections of the cornea result in microbial keratitis. 3.5% (36 million) of blind individuals worldwide still have it as one of the most prevalent causes of permanent blindness as of 2015. This study examines the use of a polymer that binds bacteria to eliminate S. aureus from the surface of the cornea. Highly branched poly(N-isopropyl) acrylamide, functionalized with a modified vancomycin end group (HB-PNIPAM-Van), was the thermoactivated bacteria-binding polymer that was probed mechanically disassociation measurements, and the interaction with bacteria placed on the surface of the rabbit cornea was studied in vitro. This was carried out when HB-PNIPAM-Van-S was undergoing a continuous temperature phase change. With the use of a unique microbead force spectroscopy (MBFS) technique, Staphylococcus aureus was examined in vitro in three stages: below, above, and below the lower critical solution temperature (LCST) using atomic force microscopy (AFM). Investigate. Temperature-dependent HB-PNIPAM-Van-S. aureus activity revealed that polymer-bacterial complexes demonstrated reversibility at $T < LCST$ ($p < 0.05$) and decreased the effort required to remove bacterial aggregates at $T > LCST$ ($p < 0.05$). The proportion of fitting fragments in both short and long lengths, the number of unbound events, the fracture force, and the percentage of unbound events occurring in long distances (> 2.5 μm) all increased ($p < 0.05$) when $T < LCST$. Additionally, it was shown that, in comparison to aggregates containing solely S. aureus, the LCST phase transition temperature was 100 times greater in long-range z-lengths (> 2.5 μm).

7. Development of ionic liquid-based electroactive polymer composites using nanotechnology

An overview of the development and manufacturing of ionic liquid-based ionic electroactive polymer (IL-iEAP) transducers for cutting-edge uses in the biological and electrical domains

is what these paper aims to provide. A type of smart materials known as iEAPs is able to regulate the mobility of cations and anions in the active layer to carry out sensing or actuating tasks. Because of ion redistribution during mechanical deformation, this kind of material may create electrical signals and deform when stimulated with low voltages. The deformation processes and their potential for energy harvesting, sensing, and actuation applications have drawn a lot of research interest. The non-volatile IL-iEAP offers a larger electrochemical window and more stable actuation performance in comparison to the conventional water-based iEAP. This work first describes the categorization of iEAP with distinct actuation mechanisms, then introduces several preparation techniques, such as nanotechnology for IL-iEAPs, and discusses the main parameters affecting their actuation performance. Furthermore discussed are the sophisticated sensing and actuation capabilities of IL-iEAP (Khodakarami & Bagheri, 2021), particularly self-sensing in applications involving bionics and electromechanical equipment. Lastly, new nanotechnologies for the fabrication of IL-iEAPs are presented, along with the potential applications of these technologies in microelectromechanical systems (MEMS).

8. Progress in polymers and polymer composites used as efficient materials for EMI shielding

The unfavorable electromagnetic pollution known as electromagnetic interference is a consequence of the rapid expansion of electronic gadgets and communication networks. Electromagnetic radiation buildup in space has the potential to harm people's health as well as malfunction commercial and military electronics. As a result, protecting against unwanted electromagnetic interference has always been a highly promising field of study and development and has grown to be a severe concern in contemporary life. The development trend of several polymer-based materials with EMI shielding properties is described in depth in this article. The theoretical underpinnings of shielding are first described. The conductive, dielectric, magnetic, and shielding properties of polymers that are intrinsically conductive, polymers that are filled with various kinds of inorganic and organic fillers, and multifunctional polymer structures are then presented along with a thorough description of their structure, morphology, and functionalization.

9. Achieving over 17% efficiency of ternary all-polymer solar cells with two well-compatible polymer acceptors

In recent years, the field of all-polymer solar cells, or all-PSCs, has rapidly advanced due in large part to the development of high-efficiency polymer acceptors, or PAs. In terms of power conversion efficiency (PCE), polymer/polymer mix systems still trail significantly behind their counterparts that use small molecules as acceptors. In order to create complete PSCs with a 15.0% PCE, we created a near-infrared PA PY2F-T and combined it with the polymer donor PM6. PYT was subsequently included as a third component to the PM6:PY2F-T host system. Outside the visible and near-infrared spectrum ranges, the PCE is enhanced by 17.2% and the quantum efficiency exceeds 80% because of the complementary absorption bands and well calibrated microstructure of the ternary mixture. Remarkably, when compared to the analogous binary system, the ternary combination shows decreased energy loss, better light soaking (Ahmad et al., 2021; Khodakarami & Bagheri, 2021; Skorulska et al., 2021), and

photothermal stability. With this study, the development of high-performance ternary all-polymer systems is advanced, and the potential uses of all-PSC systems are anticipated to accelerate in the near future.

10. Development of sustained release baricitinib loaded lipid-polymer hybrid nanoparticles with improved oral bioavailability

(BTB) is a Janus kinase inhibitor used orally for the treatment of rheumatoid arthritis. It was recently approved to treat COVID-19 infection as well. This work used a one-step nanoprecipitation approach to generate four distinct BTB-loaded lipid)-polymer (poly(D,L-lactide-co-glycosides)) hybrid nanoparticles (B-PLN1 to B-PLN4). Following that, they were described in terms of physicochemical characteristics, including drug loading (DL), entrapping efficiency (EE), polydispersity index (PDI), zeta potential (μP), and particle size. Preliminary analysis indicated that B-PLN4 was the best formulation, with particle size of 272 ± 7.6 nm, PDI of 0.225, ζP of 36.5 ± 3.1 mV, %EE of 71.6 ± 1.5%, and %DL of 2.87 ± 0.42%. Further assessments of the morphology, in vitro release, and in vivo pharmacokinetic investigations in rats were conducted with this formulation (B-PLN4). The sustained release pattern (R2 = 0.879) shown by the in vitro release profile was in excellent accord with the Korsmeyer-Peppas kinetic model. Increased bioavailability (2.92-fold+) was seen in in vivo pharmacokinetic data when compared to the standard solution of pure BTB. Based on these findings, manufactured lipid-polymer hybrid nanoparticles have the potential to be a useful medication delivery method for increasing BTB bioavailability. All things considered; this work offers a solid scientific foundation for further research on the effectiveness of lipid-polymer hybrid systems as viable carriers to get beyond pharmacokinetic constraints.

11. Fibrous polymer-based composites

Currently, a number of materials and techniques are being used in a substantial field of tissue engineering research connected to the production of polymer-based materials with a microenvironment ideal for enabling cell adhesion and stimulating cell differentiation and proliferation. The goal of biomimetic techniques in tissue engineering is to create a highly biocompatible and bioactive material that, when combined with certain arrangement of fibrous structures, will most closely resemble the structural characteristics of the extracellular matrix found in nature. This paper discusses potential fibrous materials for bone tissue regeneration that are produced by electrospinning methods because of this. In this concise analysis, we concentrate on newly suggested natural and synthetic polymers, their combinations, and inorganic bioactive incorporations to create composite electrospinning scaffolds. involves several electrospinning applications for different polymer types. In addition, the effectiveness of nanofiber composites for bone tissue engineering is examined in light of their physicochemical and bioactive characteristics.

12. Plastic Waste Assessment and Its Potential Use as Building Construction Material

The ecosystem is now seriously threatened by plastic garbage, and improper disposal methods make the problem worse. All kinds of plastic are building up in landfills, blocking drainage systems, and now finding their way into our food chain as fish and animals consume it. Since plastic takes millions of years to naturally dissolve, it also affects the ocean and its

aquatic life. Burning plastic debris outside may lead to major health issues including discomfort, asthma attacks, and sometimes even cancer. According to recent research, plastic trash has a significant role in both the fast extinction of native species and global warming. Other Exhibitions of Research. How to get raw materials and raw materials to suit the demands of the building sector. However, some towns in different areas have come up with innovative solutions to cope with the issue and material requirements; for example, they are employing different kinds of plastic garbage for different kinds of construction and building materials. Studies reveal a significant improvement in the environmental effect as a consequence. By working with the informal sector, large amounts of resource plastic trash may be kept out of landfills and kept out of the construction material pipeline, which benefits both the economy and the livable environment.

13.A Review on Plastic Waste Assessment and Its Potential Use as Building Construction Material

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14. Influence of different universal adhesives on fracture resistance of endodontically treated teeth

Objective

To investigate how various universal adhesives affect the endodontically repaired teeth's resistance to breakage.

Materials and Methods:

A collection of fifty complete maxillary premolars was made. Only forty teeth had root canals and MOD cavities. One-third of the occlusal portion's interrupted distance and one-third of the proximal box buccolingual breadth make up the cavity's width. A 1 mm incision has been made in the cavity bottom towards the coronal CEJ. Trim the margins of the hollow at the butt joints. Five equal groups were created from all samples (N=10): Initial group: unrestored, prepared teeth (+ve control), followed by fourth, third, and first groups: teeth that are intact. Five teams: These groups received a standardized MOD cavity, root canal therapy, and a final

resin composite repair (Filtek Z350 XT) utilizing Tetric N-Bond Universal, All-Bond Universal, and Single Bond Universal adhesive systems. The teeth underwent a compressive stress at a crosshead speed of 0.5 mm/min while being installed on a universal testing machine. Examine fracture patterns at a 12X magnification with a stereomicroscope. Statistical evaluation using SPSS.

Results
Although it did not achieve the fracture resistance of healthy teeth (group I), the fracture resistance of restored teeth (groups III, IV, and V) was much better than that of unrestored teeth (group II). There are no notable differences between the rehabilitation groups.

Conclusions:
The limitations of this investigation indicate that the fracture resistance of teeth that have undergone endodontic treatment may be enhanced by resin composite restorations utilizing various universal adhesives.

15. Microplastics in marine sediments Highlights from a review of microplastics in marine sediments
Microplastics (MPs) are widely distributed and have been seen in both terrestrial and marine settings throughout many parts of the Earth. The cycle of plastic waste terminates in marine environments, and marine sediments are becoming more widely acknowledged as sinks for plastic debris that may have a negative impact on seabed ecosystems. However, accurate analysis is challenging due to the low quantities of MPs in complex matrices like marine sediments. Comparisons are challenging since different extraction methods and optical, spectroscopic, or mass spectrometry techniques are often used to quantify MP quantities in marine sediments. As a result, it is difficult to determine MPs in sediments with any degree of reliability. Here, we address the benefits of the various approaches used while providing a quick overview of works pertaining to analytical assay procedures and MP detection in marine sediments. The majority of the 70 investigations, according to a review of the literature, were carried out in coastal regions of Asia and Europe. For the various stages of separation, digestion, and identification, respectively, the most widely used methods are hydrogen peroxide (H2O2), Fourier transform infrared spectroscopy (FTIR), and NaCl-saturated solutions. We provide suggestions and recommendations for future study based on this literature in order to increase the accuracy of the findings and encourage.

16. Progress in the development of bead foamsConducting polymer and metal-based sensors for the detection of vapours and toxic gases: A concise review
Monitoring the levels of gases and volatile chemicals in the environment has significant implications for sustainable human growth as a result of global industrialization. Gas sensors have been used to monitor humidity and atmospheric composition, as well as to identify dangerous gases and gas leaks, since the 1970s. It is difficult to create small, portable gas/vapor sensors with selectivity, sensitivity, reversibility, and quick reaction times. Similarly, advances in nanotechnology have prompted researchers to design nano sensors. Classic semiconductors, solid electrolytes, insulators, metals, etc. are used to make sensor

devices. But the emergence of conducting polymer-based sensors has expanded the scope of sensing by making it possible to detect hazardous gases and/or chemical/water vapour in a larger variety of settings, including complicated ones. On the other hand, it was found that metal oxide-based sensors worked well for identifying harmful gases. Our work on metal and conductive polymer sensors for ammonia, alcohol, chloroform, humidity, poisonous gases, and other substances is briefly presented in this review. In addition, this research outlines the difficulties and potential applications for conducting polymer sensors, enabling them to improve their sensing efficiency.

17. Progress in the development of bead foams–A review

For a very long time, the only bead foam variations that were accessible were made of standard polymers, which restricted their uses to packaging, shock absorption, and thermal insulation (such as in building). Standard polymers, including expanded polystyrene, expanded polyethylene, and expanded polypropylene, are specifically used for low-cost components that need to have strong energy absorption and excellent insulating qualities. Polymer variations have mostly joined the bead foam industry in the last 20 years, and they are currently adding additional properties including flame reentry, sustainability, increased thermal stability, and improved mechanical performance (such as improved impact resistance and energy absorption). Open and flexible application domains that are transforming the industrial and design fields. Specific advancements in innovative bead foams and associated processing methods are highlighted in this review paper. Prospects for digital modelling and simulation techniques in the future.

18. A review on magnetically assisted abrasive flow machining and abrasive material type

Today's industry has significant challenges in developing flawless fine surface finishes, and finishing activities pose a serious risk to the fabrication of precision components. Polishing and finishing difficult-to-reach surfaces, internal surfaces, and complicated geometries is challenging with current finishing techniques. A tried-and-true advanced finishing method that may satisfy the necessary finishing standards is abrasive flow machining (AFM). However, this process's primary drawbacks are its lengthy processing durations, low surface integrity, and poor surface polish. MAAFM, or magnetic assisted abrasive flow machining, is one of the non-traditional machining methods that may effectively solve these problems. The method was created in the early 2000s as a way to apply magnetic abrasive polymer media for deburring, polishing, and filleting over hard-to-reach surfaces such intricate structures and edges/boundaries. The primary machining factors that determine surface finish characteristics include magnetic flux density (MFD), extrusion pressure, flow rate, abrasive type, particle size, number of process cycles, media, and workpiece design. Through the transit that the workpiece and tool make, the medium is compressed forward and backward between two hydraulic cylinders that are vertically opposed to one another. Anywhere the medium passes past a height constraint, the workpiece will abrade. The machine, the tool, and the magnetic abrasive holding the media are the three primary components of the MAAFM process. MAAFM in the fields of electronics, precision mould, automotive, aviation, and medical

It is difficult to treat wounds when there is microbial colonization. In this paper, we reviewed the comparison of several herbal plant bioactive loaded polymer electrospun nanofiber wound dressings with respect to their bacterial inhibition zone. Preferred Reporting Project for Systematic Reviews and Meta-Analysis (PRISMA) systematic literature search was utilised to examine the bacterial inhibition zone of various herbal plant bioactive laden polymer electrospun nanofiber mats intended for use as wound dressings. Searches of PubMed, Scopus, Web of Science, Google Scholar, and other English-language literature from 2010 to 2021 yielded a total of 200 papers; 93 of them were chosen for analysis of their inhibition zones, with 8 of them having the greatest inhibition zone. More than or equivalent to 20 mm. The strongest antibacterial qualities are seen in PVA/Tridax procumbensviz (42 mm and 35 mm).

19. Recent development in carbon nanotubes based gas sensors

A new generation of functional organic nanomaterials with well-defined characteristics and controlled forms for a wide range of potential applications has surged in response to the technical advancements in nanotechnology. To maintain the highest level of health and safety, innovative detection systems for the prompt and accurate monitoring of hazardous gases in industrial processes and surroundings are crucial. In this case, the materials employed for gas sensing applications are typically carbon-based materials, polymers, and semiconducting metal oxides. Although they are very sensitive and inexpensive, metal oxide gas sensors often need to operate at temperatures exceeding 120 C. Conversely, polymer-based gas sensors—which are often used to identify volatile organic compounds (VOCs)—have a quick reaction time and great sensitivity, but they are unstable and prone to irreversibility over time. Gas sensors based on carbon are becoming more and more common because of their special qualities and high sensitivity. Most people agree that carbon nanostructures, including carbon nanotubes (CNTs), are promising nanomaterials for the creation of cutting-edge gas sensors with significant nanotechnological implications. Because of their outstanding surface area-to-volume ratio, chemical inertness, nanoscale structure, and hollow core, carbon nanotubes have garnered a lot of attention for both present and prospective uses in nanotechnology. The present condition is covered by this review study.

20. Production of 100% bio-based semiaromatic nylon by aerobic oxidation of 5 hydroxymethylfurfural to 2 and 5-furandicarboxylic acid with bio aliphatic diamine

In both academia and business, the creation of sustainable polymers from biomass has gained a lot of attention. This work reports on the first-ever aerobic oxidation of 5-hydroxymethylfurfural to 2,5-furandicarboxylic acid (FDCA), supported on fluorosilica gel and catalyzed by perfluorinated gold nanoparticles. This very active catalyst was able to achieve 100% maximum HMF conversion and 91% FDCA selectivity. It was also able to be employed three times without experiencing any appreciable activity loss. The single crystal structures of the nylon salts 5F (1,5-pentanediamine-FDCA) and 10F (1,10-decanediamine-FDCA) were originally ascertained by single X-ray diffraction before they were synthesized via crystallization. Ultimately, melt polymerization of nylon 5F and 10 salts produced 100% bio-based semi-aromatic nylons 5F and 10F, whose structures and thermodynamic characteristics were thoroughly examined. The findings imply that these clear, bio-based

nylon materials may find utility in catheters and other domestic plastic devices as general-purpose plastics, temperature-responsive polymers, or functional additives.

21. Development of Nylon 6 nanofibers modified with Cyanex-272 for cobalt recover

In order to meet the growing global demand for metals, particularly in the production of electronics and batteries, it is necessary to develop more effective and efficient materials in addition to recovering these materials concurrently from subsequent waste streams. Solid phase extraction is an environmentally benign method of recovering metals that shows great promise as a replacement for conventional methods. The creation of unique nanofibers altered with Cyanex 272 and their use in the extraction of cobalt from aqueous solutions are the subjects of this study. SEM, FT-IR, and TGA were used to characterize the forced spinning-produced nanofibers, and cobalt extraction was assessed by adjusting the cobalt extraction rate. pH, extraction duration, solid-liquid (S:L) ratio, and amount of Cyanex 272 in the nanofibers. The following parameters were met to get the best extraction efficiency of 99.96%: pH 8, (S:L) ratio of 1:200, 25% of Cyanex 272, and 60 minutes of extraction time. With regard to nanofibers, the highest extraction capacity of 15.46 mg Co/g and 70.15 mg Co/g extractant was achieved. The findings demonstrated that the extraction efficiency remained over 85% during the course of subsequent reuse cycles. According to the findings, Nylon 6/Cyanex 272 nanofibers are a novel, reliable material that shows promise for recovering heavy metals from aqueous solutions. The nanofibers also exhibit efficiencies comparable to those of classic liquid-liquid extraction, but without producing volatile organic compounds. drawbacks of using organic diluents to mitigate compound emissions.

22. Development and Fabrication of Nylon six Standard and Asymmetric Spur Gear Using Injection Maudling

In this work, injection moulding technique has been used to make normal and asymmetric nylon 6 spur gears. This paper specifically focuses on and discusses the issues associated with the development and production of these gears. Specific diameters of normal and asymmetric nylon 6 spur gears are produced using distinct moulds (core-cavity). Numerous tests are conducted throughout the injection-molded gear production process in order to get the ideal set of operating characteristics. Three categories comprise these combinations of operational parameters: injector settings, barrel temperature, and process optimization. Lastly, a study and introduction are given to fundamental operational parameters such injection pressure, dwell duration, cycle time, and barrel temperature. Similar operational characteristics were discovered, with the asymmetric gear having an injection time variation of 02 seconds higher than the normal gear. Furthermore, it was noted that appropriately sized injection gate apertures promoted appropriate dispersion of the melted polymer around the borders of the gear cavity. During mould creation, a gate size aperture with a cross-sectional area of 0.18 mm2 was taken into consideration. It has a significant impact on the final part's surface polish around the gea (Skorulska et al., 2021). Additionally, a 0.06 mm-wide groove was seen on the side of the completed gear teeth. (Ohama, 2011; Skorulska et al., 2021; Werkneh & Rene, 2019; Ahmad et al., 2021; Khodakarami & Bagheri, 2021; Makimoto, Fang, & Maeda, 2021a, 2021b)

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