Cellulose Chitosan And Keratin Composite Materials

Edible Films and Coatings
Proceedings of 19th World Congress on Materials Science and Engineering 2018
Handbook of Composites from Renewable Materials, Structure and Chemistry
Green Chemistry in Industry
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Functional Polysaccharides for Biomedical Applications examines the fundamentals and properties of these natural materials and their potential biomedical applications. With an emphasis on therapeutic and sensing applications, the book also reviews how polysaccharides can be modified for tissue engineering applications. Sections discuss the basics of polysaccharides, give an overview of the potential applications, look at novel materials and technologies for use in tissue regeneration and therapeutics, and detail current biomedical applications. With a strong focus on materials, engineering and applications, this book is a valuable resource for those with an interest in harnessing the biomedical potential of natural polymers. Describes strategies for developing polysaccharides-based biomedical devices Illustrates concepts and encompasses scope for clinical development Provides advanced and comprehensive information on biomedical constructs

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The generation of tridimensional tissues, assembled from scaffolding materials populated with biologically functional cells, is the great challenge and hope of tissue bioengineering and regenerative medicine. The generation of biomaterials capable of harnessing the immune system has been particularly successful. This book provides a comprehensive view of how immune cells can be manipulated to suppresses inflammation, deliver vaccines, fight cancer cells, promote tissue regeneration or inhibit blood clotting and bacterial infections by functionally engineered biomaterials. However, long-lived polymers, such as those employed in orthopedic surgery or vascular stents, can often induce an immune reaction to their basic components. As a result, this book is also an important step towards coming to understand how to manipulate biomaterials to optimize their beneficial effects and downplay detrimental immune responses.
Among the modern materials, the composites have a few decades of history. However, there has been a tremendous advancement of this class of material in science and technology. During recent decades, composite materials have steadily gained ground in nearly all sectors. The composite materials have been used in various industrial applications such as buildings and constructions, aerospace, automotive and sports equipment, consumer products etc. Nanotechnology is rapidly evolving, and science, engineering, and technology have merged to bring nanoscale materials that much closer to reality. It is one of the fastest growing areas for research. Nanocomposite materials are helping improve products that we use every day and creating new, exciting products for the future. Composites and nanocomposites composed of reinforcements, nano-reinforcements, and matrices are well-known engineering materials. Keeping in mind the advantages of composite and nanocomposite materials, this book covers fundamental effects, product development, properties, and applications of the materials including material chemistry, designing, and manufacturing. The book also summarizes the recent developments made in the area of advanced composite and nanocomposite materials. A number of critical issues and suggestions for future work are discussed, underscoring the roles of researchers for the efficient development of composites and nanocomposites through value additions to enhance their use.

Green Chemistry in Industry

The Handbook of Composites From Renewable Materials comprises a set of 8 individual volumes that brings an interdisciplinary perspective to accomplish a more detailed understanding of the interplay between the synthesis, structure, characterization, processing, applications and performance of these advanced materials. The handbook covers a multitude of natural polymers/reinforcement/fillers and biodegradable materials. Together, the 8
volumes total at least 5000 pages and offers a unique publication. This 6th volume Handbook is solely focused on Polymeric Composites. Some of the important topics include but not limited to: Keratin as renewable material for developing polymer composites; natural and synthetic matrices; hydrogels in tissue engineering; smart hydrogels: application in bioethanol production; principle renewable biopolymers; application of hydrogel biocomposites for multiple drug delivery; nontoxic holographic materials; bioplasticizer - epoxidized vegetable oils-based poly (lactic acid) blends and nanocomposites; preparation, characterization and adsorption properties of poly (DMAEA) – cross-linked starch gel copolymer in waste water treatments; study of chitosan crosslinking hydrogels for absorption of antifungal drugs using molecular modelling; pharmaceutical delivery systems composed of chitosan; eco-friendly polymers for food packaging; influence of surface modification on the thermal stability and percentage of crystallinity of natural abaca fiber; influence of the use of natural fibers in composite materials assessed on a life cycle perspective; plant polysaccharides-blended ionotropically-gelled alginate multiple-unit systems for sustained drug release; vegetable oil based polymer composites; applications of chitosan derivatives in wastewater treatment; novel lignin-based materials as a products for various applications; biopolymers from renewable resources and thermoplastic starch matrix as polymer units of multi-component polymer systems for advanced applications; chitosan composites: preparation and applications in removing water pollutants and recent advancements in biopolymer composites for addressing environmental issues.

Handbook of Composites from Renewable Materials, Polymeric Composites

This book explores in depth the latest enabling technologies for regenerative medicine. The opening section examines advances in 3D bioprinting and the fabrication of electrospun and electrosprayed scaffolds. The potential applications of intelligent nanocomposites are then considered, covering, for example, graphene-based
nanocomposites, intrinsically conductive polymer nanocomposites, and smart diagnostic contact lens systems. The third section is devoted to various drug delivery systems and strategies for regenerative medicine. Finally, a wide range of future enabling technologies are discussed. Examples include temperature-responsive cell culture surfaces, nanopatterned scaffolds for neural tissue engineering, and process system engineering methodologies for application in tissue development. This is one of two books to be based on contributions from leading experts that were delivered at the 2018 Asia University Symposium on Biomedical Engineering in Seoul, Korea – the companion book examines in depth novel biomaterials for regenerative medicine.

Handbook of Composites from Renewable Materials, Polymeric Composites

The extracellular matrix (ECM) is an acellular three-dimensional network composed of proteins, glycoproteins, proteoglycans and exopolysaccharides. It primarily serves as a structural component in the tissues and organs of plants and animals, or forms biofilms in which bacterial cells are embedded. ECMs are highly dynamic structures that undergo continuous remodeling, and disruptions are frequently the result of pathological processes associated with severe diseases such as arteriosclerosis, neurodegenerative illness or cancer. In turn, bacterial biofilms are a source of concern for human health, as they are associated with resistance to antibiotics. Although exopolysaccharides are crucial for ECM formation and function, they have received considerably little attention to date. The respective chapters of this book comprehensively address such issues, and provide reviews on the structural, biochemical, molecular and biophysical properties of exopolysaccharides. These components are abundantly produced by virtually all taxa including bacteria, algae, plants, fungi, invertebrates and vertebrates. They include long unbranched homopolymers (cellulose, chitin/chitosan), linear copolymers (alginate, agarose), peptoglycans such as murein, heteropolymers like a variety of glycosaminoglycans (hyaluronan,
dermatan, keratin, heparin, Pel), and branched heteropolymers such as pectin and hemicellulose. A separate chapter is dedicated to modern industrial and biomedical applications of exopolysaccharides and polysaccharide-based biocomposites. Their unique chemical, physical and mechanical properties have attracted considerable interest, inspired basic and applied research, and have already been harnessed to form structural biocomposite hybrids for tailor-made applications in regenerative medicine, bioengineering and biosensor design. Given its scope, this book provides a substantial source of basic and applied information for a wide range of scientists, as well as valuable textbook for graduate and advanced undergraduate students.

**Nano Hydrogels**

Surface bio-contamination has become a severe problem that contributes to outbreaks of community acquired and nosocomial infections through contiguous fomite transmission of diseases. Every year, thousands of patients die due to nosocomial infections by pathogens. It is therefore essential to develop novel strategies to prevent or improve the treatment of biomaterial concomitant infections. The concept of antimicrobial materials is becoming increasingly important not only in the hospital and healthcare environments, but also for laboratories, home appliances, and certain industrial applications. Materials are now being developed to prevent the buildup, spread and transfer of harmful microbes, and to dynamically deactivate them. Drawing on research and examples from around the world, this book highlights the latest advances in, and applications of, antibacterial biomaterials for biomedical devices, and focuses on metals with antibacterial coatings/surfaces, antibacterial stainless steels and other commonly used antibacterial materials. It also discusses the role of innovative approaches and provides a comprehensive overview of cutting-edge research on the processing, properties and technologies involved in the development of antimicrobial applications. Given its scope, the book will be of interest to researchers and policymakers, as well as undergraduate
and graduate students of biochemistry, microbiology, and environmental chemistry.

Chitin-Chitosan

This book provides information about the sources, structure, and properties of keratin as well as its applications. The extraction from different biomass sources (e.g. feathers, hairs, nails, horn, hoof, and claws) as well as the characterization methods of these extracted materials are explained. The development of bioproducts from keratins is challenging and limited since they are neither soluble in polar solvents nor in non-polar solvents. Therefore, the utilization of different microorganisms for the degradation of keratin is also discussed. The main aim of this book is to highlight the unique features of keratin and to update readers with the possible prospects to develop various value-added products from keratins. The book is highly interesting to researchers working in industry and academia on bioproducts, tissue engineering, biocomposites, biofilm, and biofibers.

Chitin and Chitosan: Properties and Applications

This book includes chapters based on the potential uses of polysaccharides such as fibers in food and non-food applications. The complexity of their synthesis in plants, the highly multidisciplinary character of polysaccharide research, and the wide variety of applications from food to clothing to energy are addressed in this volume. The authors describe in detail how these latter grand challenges are of great importance in research, especially in the midst of enormous overpopulation and economic issues. Therefore, the volume contributes additional information to the chemical, nutritional, medical, and energy roles of these bio-based products, finding applications in diverse fields of their raw and composite forms. This volume is a useful resource for graduate students and contains themes for instructors and senior research leaders. Written by internationally renowned experts, it is aimed at workers in
polymer laboratories, classrooms, and policy makers.

**Biomass and Biofuels**

This book collects the articles published in the Special Issue “Polymeric Materials: Surfaces, Interfaces and Bioapplications”. It shows the advances in polymeric materials, which have tremendous applications in agricultural films, food packaging, dental restoration, antimicrobial systems, and tissue engineering. These polymeric materials are presented as films, coatings, particles, fibers, hydrogels, or networks. The potential to modify and modulate their surfaces or their content by different techniques, such as click chemistry, ozonation, breath figures, wrinkle formation, or electrospay, are also explained, taking into account the relationship between the structure and properties in the final application. Moreover, new trends in the development of such materials are presented, using more environmental friendly and safe methods, which, at the same time, have a high impact on our society.

**Composite and Nanocomposite Materials**

This book includes over three hundred and seventy-five short papers presented during the second EMCEI, which was held in Sousse, Tunisia in October 2019. After the success of the first EMCEI in 2017, the second installment tackled emerging environmental issues together with new challenges, e.g. by focusing on innovative approaches that contribute to achieving a sustainable environment in the Mediterranean and surrounding regions and by highlighting to decision makers from related sectors the environmental considerations that should be integrated into their respective activities. Presenting a wide range of environmental topics and new findings relevant to a variety of problems in these regions, this volume will appeal to anyone working in the subject area and particularly to students interested in learning more about new advances in environmental research initiatives in view of the worsening environmental degradation of the Mediterranean and
surrounding regions, which has made environmental and resource protection into an increasingly important issue hampering sustainable development and social welfare.

**Biological Macromolecules**

This book describes the latest research on nanopolysaccharides in the development of functional materials, from their preparation, properties and functional modifications to the architecture of diverse functional materials. Polysaccharide-based nanoparticles, including nanocellulose, nanochitin, and nanostarch have attracted interest in the field of nanoscience, nanotechnology, and materials science that encompasses various industrial sectors, such as biomedicine, catalyst, coating, energy, optical materials, environmental materials, construction materials, and antibacterial materials. This book establishes a fundamental framework, highlighting the architecture strategies of typical functional systems based on nanopolysaccharides and integrated analysis of their significant influence and properties to various functional behaviors of materials, to help readers to fully understand the fundamental features of nanopolysaccharides and functional materials. Addressing the potential for practical applications, the book also covers the related industrial interests and reports on highly valued products from nanopolysaccharides, providing ideas for future studies in the area. Intended both for academics and professionals who are interested in nanopolysaccharides, it is also a valuable resource for postgraduate students, researchers, and engineers involved in R&D of natural polymers, nanotechnology, and functional materials.

**Advanced Antimicrobial Materials and Applications**

Covering fundamentals through applications, this book discusses environmentally friendly polymer nanocomposites and alternatives to traditional nanocomposites through detailed reviews of a variety of materials procured from different resources, their synthesis, and applications using alternative green approaches. The text: Describes
green polymeric nanocomposites that show greater properties in terms of degradability, biocompatibility, synthesis process, cost effectiveness, mechanical strength, high surface area, nontoxicity, and environmental friendliness Explains the basics of eco-friendly polymer nanocomposites from different natural resources and their chemistry Discusses practical applications that present future directions in the biomedical, pharmaceutical, and automotive industries This book is aimed at scientists, researchers, and academics working in nanotechnology, biomaterials, polymer science, and those studying products derived from eco-friendly nanomaterials.

Chitosan in Biomedical Applications

Sustainability, defined as the way to meet the needs of the present generation without compromising the ability of future ones to meet their own, is one of the main challenges of modern society. Within this context, chemistry plays a significant role, and solvent nature as well as its environmental impact are pivotal issues frequently addressed. Ionic liquids, i.e. organic salts that have melting temperatures lower than 100 °C, have been frequently hailed as alternatives to conventional organic solvents. Their greenness has been mainly ascribed to their low vapor pressure and flammability. However, in addition to this, their high solubilizing ability and low miscibility with conventional organic solvents frequently allow for reducing the amount used, as well as for their recycling. Ionic liquids, especially the ones featured by aromatic cations, are frequently described as “polymeric supramolecular fluids” constructed through the establishment of feeble but cooperative supramolecular interactions like Coulomb and π-π interactions, as well as hydrogen bonds. In general, ionic liquids are also indicated as “designer solvents” as it is possible to tailor their features to specific applications by simply modifying their cation or anion structure. In this way, small changes in the ion’s structure can give rise to solvents showing very different properties. The above premises widely justify the growing interest in the properties and applications of ionic
liquids, seen in recent literature (according to Scopus, more than 27,000 papers published in the last five years have “ionic liquids” as a keyword). Thanks to their properties, they have been variously used as solvent media, solvents for the obtainment of gel phases, components in the building of dye-sensitized solar cells, media for the preparation of thermochromic materials, etc. This Research Topic aims to present how structural features can determine not only the properties of ionic liquids, but also their possible employment. In this latter case, the interest arises from their ability to affect the outcome of a given reaction in terms of rate, yield, and nature of the products obtained for general use in the field of materials chemistry. This article collection is dedicated to Prof. Kenneth R. Seddon for his outstanding contribution to the formation and development of the ionic liquids community.

Green Composites

This book introduces the reader to important aspects of the nano-hydrogels. It covers the development of hydrogels and their biology, chemistry and properties. Focus is also given to innovative characterization techniques and advances in structural design, with special emphasis on molecular structure, dynamic behavior and structural modifications of hydrogels. This book serves as a consolidated reference work for the diverse aspects of hydrogels, creating a valuable resource for students and researchers in academia and industry.

Advances in Chitin/Chitosan Characterization and Applications

The Handbook of Composites From Renewable Materials comprises a set of 8 individual volumes that brings an interdisciplinary perspective to accomplish a more detailed understanding of the interplay between the synthesis, structure, characterization, processing, applications and performance of these advanced materials. The handbook covers a multitude of natural polymers/
reinforcement/fillers and biodegradable materials. Together, the 8 volumes total at least 5000 pages and offers a unique publication. Volume 1 is solely focused on the Structure and Chemistry of renewable materials. Some of the important topics include but not limited to: carbon fibers from sustainable resources; polylactic acid composites and composite foams based on natural fibres; composites materials from other than cellulosic resources; microcrystalline cellulose and related polymer composites; tannin-based foam; renewable feedstock vanillin derived polymer and composites; silk biocomposites; bio-derived adhesives and matrix polymers; biomass based formaldehyde-free bio-resin; isolation and characterization of water soluble polysaccharide; bio-based fillers; keratin based materials in biotechnology; structure of proteins adsorbed onto bioactive glasses for sustainable composite; effect of filler properties on the antioxidant response of starch composites; composite of chitosan and its derivate; magnetic biochar from discarded agricultural biomass; biodegradable polymers for protein and peptide conjugation; polyurethanes and polyurethane composites from bio-based/recycled components.

Functional Polysaccharides for Biomedical Applications

Chitin is the second most abundant biopolymer after cellulose and is a resourceful copious and cheap biomaterial discovered in 1859 owing to significant industrial and technological utility. Raw chitin-chitosan resembles keratin in its biological functions. Chitin chemistry vastly developed via innate unparalleled biological features and exceptional physicochemical characters. Chitosan endures assorted chemical/physical modifications easily at free proactive functionalities, yet intact bulk properties are achieved through processing, viz., film, membrane, composite, hybrid, nanofibre, nanoparticle, hydrogel and scaffolds. Rapidly lessen bioresources signify chitosan as an option due to renewable eco-friendliness and drive embryonic myriad applications in S
The papers included in this issue of ECS Transactions were originally presented in the symposium “Molten Salts and Ionic Liquids 16”, held during the PRiME 2008 joint international meeting of The Electrochemical Society and The Electrochemical Society of Japan, with the technical cosponsorship of the Japan Society of Applied Physics, the Korean Electrochemical Society, the Electrochemistry Division of the Royal Australian Chemical Institute, and the Chinese Society of Electrochemistry. This meeting was held in Honolulu, Hawaii, from October 12 to 17, 2008.

Molten Salts and Ionic Liquids 16

This book comprehensively addresses surface modification of natural fibers to make them more effective, cost-efficient, and environmentally friendly. Topics include the elucidation of important aspects surrounding chemical and green approaches for the surface modification of natural fibers, the use of recycled waste, properties of biodegradable polyesters, methods such as electrospinning, and applications of hybrid composite materials.

Polysaccharide-based Fibers and Composites

Encyclopedia of Renewable and Sustainable Materials provides a comprehensive overview, covering research and development on all aspects of renewable, recyclable and sustainable materials. The use of renewable and sustainable materials in building construction, the automotive sector, energy, textiles and others can create markets for agricultural products and additional revenue streams for farmers, as well as significantly reduce carbon dioxide (CO2) emissions, manufacturing energy requirements, manufacturing costs and waste. This book provides researchers, students and professionals in materials science and engineering with tactics and information as they face increasingly complex challenges around the development, selection and use of construction and manufacturing materials. Covers a broad range of topics not available elsewhere in one resource Arranged thematically for ease of navigation Discusses key
features on processing, use, application and the environmental benefits of renewable and sustainable materials. Contains a special focus on sustainability that will lead to the reduction of carbon emissions and enhance protection of the natural environment with regard to sustainable materials.

**Hybrid Organic-Inorganic Interfaces**

Hybrid organic-inorganic materials and the rational design of their interfaces open up the access to a wide spectrum of functionalities not achievable with traditional concepts of materials science. This innovative class of materials has a major impact in many application domains such as optics, electronics, mechanics, energy storage, and conversion, protective coatings, catalysis, sensing, and nanomedicine. The properties of these materials do not only depend on the chemical structure, and the mutual interaction between their nano-scale building blocks, but are also strongly influenced by the interfaces they share. This handbook focuses on the most recent investigations concerning the design, control, and dynamics of hybrid organic-inorganic interfaces, covering: (i) characterization methods of interfaces, (ii) innovative computational approaches and simulation of interaction processes, (iii) in-situ studies of dynamic aspects controlling the formation of these interfaces, and (iv) the role of the interface for process optimization, devices, and applications in such areas as optics, electronics, energy, and medicine.

**Recent Advances in Environmental Science from the Euro-Mediterranean and Surrounding Regions (2nd Edition)**

Functional advanced biopolymers have received far less attention than renewable biomass (cellulose, rubber, etc.) used for energy production. Among the most advanced biopolymers known is chitosan. The term chitosan refers to a family of polysaccharides obtained by partial de-N-acetylation from chitin, one of the most abundant renewable resources in the biosphere. Chitosan has been firmly established as having unique material properties as well as
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biological activities. Either in its native form or as a chemical derivative, chitosan is amenable to being processed—typically under mild conditions—into soft materials such as hydrogels, colloidal nanoparticles, or nanofibers. Given its multiple biological properties, including biodegradability, antimicrobial effects, gene transfectability, and metal adsorption—to name but a few—chitosan is regarded as a widely versatile building block in various sectors (e.g., agriculture, food, cosmetics, pharmacy) and for various applications (medical devices, metal adsorption, catalysis, etc.). This Special Issue presents an updated account addressing some of the major applications, including also chemical and enzymatic modifications of oligos and polymers. A better understanding of the properties that underpin the use of chitin and chitosan in different fields is key for boosting their more extensive industrial utilization, as well as to aid regulatory agencies in establishing specifications, guidelines, and standards for the different types of products and applications.

Keratin as a Protein Biopolymer

Biopolymer Membranes and Films: Health, Food, Environment, and Energy Applications presents the latest techniques for the design and preparation of biopolymer-based membranes and films, leading to a range of cutting-edge applications. The first part of the book introduces the fundamentals of biopolymers, two-dimensional systems, and the characterization of biopolymer membranes and films, considering physicochemical, mechanical and barrier properties. Subsequent sections are organized by application area, with each chapter explaining how biopolymer-based membranes or films can be developed for specific innovative uses across the health, food, environmental and energy sectors. This book is a valuable resource for researchers, scientists and advanced students involved in biopolymer science, polymer membranes and films, polymer chemistry and materials science, as well as for those in industry and academia who are looking to develop materials for advanced applications in the health, food science, environment or energy
industries. Presents detailed coverage of a range of novel applications in key strategic areas across health, food, environment and energy. Considers the difficulties associated with two-dimensional materials. Assists the reader in selecting the best materials and properties for specific applications. Helps researchers, scientists and engineers combine the enhanced properties of membranes and films with the sustainable characteristics of biopolymer-based materials.

**Extracellular Sugar-Based Biopolymers Matrices**

The book introduces readers to the unique aspects of keratin and opportunities to develop various bioproducts and biomaterials from keratins. It discusses the structure, properties and specific applications of keratins extracted from different sources. Applications include keratins as absorbents, reinforcements or matrices for composites, hydrogels and fibres.

**Handbook of Composites from Renewable Materials, Nanocomposites**

Hybrid Polymer Composite Materials: Applications provides a clear understanding of the present state-of-the-art and the growing utility of hybrid polymer composite materials. It includes contributions from world renowned experts and discusses the combination of different kinds of materials procured from diverse resources. In addition, this volume from the four volume series provides deep insights on the potential of hybrid polymer composite materials for advanced applications. Provides a clear understanding of the present state-of-the-art and the growing utility of hybrid polymer composite materials. Includes contributions from world renowned experts and discusses the combination of different kinds of materials procured from diverse resources. Discusses their synthesis, chemistry, processing, fundamental properties, and applications. Provides insights on the potential of hybrid polymer composite materials for advanced applications.
Cutting-Edge Enabling Technologies for Regenerative Medicine

Chitosan in Biomedical Applications provides a thorough insight into the complete chitosan chemistry, collection, chemical modifications, characterization and applications of chitosan in biomedical applications and healthcare fields. Chitosan, a biopolymer of natural origin, has been explored for its variety of applications in biomedical research, medical diagnostic aids and material science. It is the second most abundant natural biopolymer after cellulose, and considered as an excellent excipient because of its non-toxic, stable, biodegradable properties. Several research innovations have been made on applications of chitosan in biomedical applications. The book explores key topics, such as molecular weight, degree of deacetylation, and molecular geometry, along with an emphasis on recent advances in the field written by academic, industry, and clinical researchers. Chitosan in Biomedical Applications will be of interest to those in biomedical fields including the biomaterials and tissue engineering community investigating and developing biomaterials for biomedical applications, particularly graduate students, young faculty and others exploring chitosan-based materials. Provides methodology for the design, development and selection of chitosan in biomedical applications for particular therapeutic applications Includes illustrations demonstrating the mechanism of biological interaction of chitosan Discusses the regulatory aspects and demonstrates the clinical efficacy of chitosan

Biopolymer Membranes and Films

Value-Added Biocomposites

The “greening” of industry processes, i.e. making them more sustainable, is a popular and often lucrative trend which has emerged over recent years. The 3rd volume of Green Chemical Processing considers sustainable chemistry in the context of corporate interests.
The long-held tenets of the energy sector are being rewritten in the twenty-first century. The rise of unconventional oil and gas and of renewables is transforming our economies and improving our understanding of the distribution of the world’s energy resources and their impacts. A complete knowledge of the dynamics underpinning energy markets is necessary for decision-makers reconciling economic, energy, and environmental objectives. Those that anticipate global energy developments successfully can derive an advantage, while those that fail to do so risk making poor policy and investment decisions. Focused on solving the key challenges impeding the realization of advanced cellulosic biofuels and bioproducts in rural areas, Biomass and Biofuels: Advanced Biorefineries for Sustainable Production and Distribution provides comprehensive information on sustainable production of biomass feedstock, supply chain management of feedstocks to the biorefinery site, advanced conversion processes, and catalysts/biocatalysts for production of fuels and chemicals using conventional and integrated technologies. The book also presents detailed coverage of downstream processing, and ecological considerations for refineries processing lignocellulosic
and algal biomass resources. Discussions of feedstock raw materials, methods for biomass conversion, and its effective integration to make biorefinery more sustainable – economically, environmentally, and socially – give you the tools to make informed decisions.

Advances and Challenges in Pharmaceutical Technology

Value-Added Biocomposites: Technology, Innovation, and Opportunity explores advances in research, processing, manufacturing, and novel applications of biocomposites. It describes the current market situation, commercial competition, and societal and economic impacts and advantages of substituting biocomposites for conventional composites, including natural fibers and bioplastics. FEATURES Discusses manufacturing and processing procedures that focus on improving physical, mechanical, thermal, electrical, chemical, and biological properties and achieving required specifications of downstream industries and customers Analyzes the wide range of available base materials and fillers of biocomposites and bioplastics in terms of the strength and weaknesses of materials and economic potential in the market Displays special and unique properties of biocomposites in different market sectors Showcases the insight of expert scientists and engineers with first-hand experience working with biocomposites across various industries Covers environmental factors, life cycle assessment, and waste recovery Combining technical, economic, and environmental topics, this work provides researchers, advanced students, and industry professionals a holistic overview of the value that biocomposites add across a variety of engineering applications and how to balance research and development with practical results.

Ionic Liquids: Properties and Applications

This book provides an overview of biocomposite chemistry, chemical modifications, characterization and applications in biomedicine, with emphasis on recent advances in the field. Authored by experts, the chapters discuss the design, development and selection of biomedical
composites for a particular therapeutic application, as well as providing insight into the regulatory and clinical aspects of biomedical composite use. While this book is primarily intended for scientists from the fields of medical, pharmaceutical, biotechnological and biomedical engineering, it is also useful as an advanced text for students and research scholars.

Biomedical Composites

The Handbook of Composites From Renewable Materials comprises a set of 8 individual volumes that brings an interdisciplinary perspective to accomplish a more detailed understanding of the interplay between the synthesis, structure, characterization, processing, applications and performance of these advanced materials. The handbook covers a multitude of natural polymers/ reinforcement/ fillers and biodegradable materials. Together, the 8 volumes total at least 5000 pages and offers a unique publication. This 8th volume of the Handbook is solely focused on the Nanocomposites: Advanced Applications. Some of the important topics include but not limited to: virgin and recycled polymers applied to advanced nanocomposites; biodegradable polymer-carbon nanotube composites for water and wastewater treatment; eco-friendly nanocomposites of chitosan with natural extracts, antimicrobial agents and nanomaterials; controllable generation of renewable nanofibrils from green materials and their application in nanocomposites; nanocellulose and nanocellulose composites; poly (lactic acid) biopolymer composites and nanocomposites for biomedical and biopackaging applications; impact of nanotechnology in water treatment: carbon nanotube and graphene; nanomaterials in energy generation; sustainable green nanocomposites from bacterial bioplastics for food packaging applications; PLA-nanocomposites: a promising material for future from renewable resources; bio-composites from renewable resources: preparation and applications of chitosan-clay nanocomposites; nano materials: an advanced and versatile nano additive for kraft and paper industries; composites and nanocomposites based on polylactic acid obtaining; cellulose-
containing scaffolds fabricated by electrospinning: applications in tissue engineering and drug delivery; biopolymer-based nanocomposites for environmental applications; calcium phosphate nanocomposites for biomedical and dental applications: recent developments; chitosan-metal nanocomposites: synthesis, characterization and applications; multi-carboxyl functionalized nano-cellulose/nano-bentonite composite for the effective removal and recovery of metal ions; biomimetic gelatin nanocomposite as a scaffold for bone tissue repair; natural starches-blended ionotropically-gelled microparticles/beads for sustained drug release and ferrogels: smart materials for biomedical and remediation applications.

Biomaterials in Regenerative Medicine and the Immune System

Advances and Challenges in Pharmaceutical Technology: Materials, Process Development and Drug Delivery Strategies examines recent advancements in pharmaceutical technology. The book discusses common formulation strategies, including the use of tools for statistical formulation optimization, Quality by design (QbD), process analytical technology, and the uses of various pharmaceutical biomaterials, including natural polymers, synthetic polymers, modified natural polymers, bioceramics, and other bioinorganics. In addition, the book covers rapid advancements in the field by providing a thorough understanding of pharmaceutical processes, formulation developments, explorations, and exploitation of various pharmaceutical biomaterials to formulate pharmaceutical dosage forms. Provides extensive information and analysis on recent advancements in the field of pharmaceutical technology Includes contributions from global leaders and experts in academia, industry and regulatory agencies Uses high quality illustrations, flow charts and tables to explain concepts and text to readers, along with practical examples and research case studies

Advanced Functional Materials from Nanopolysaccharides
The search for better strategies to preserve foods with minimal changes during processing has been of great interest in recent decades. Traditionally, edible films and coatings have been used as a partial barrier to moisture, oxygen, and carbon dioxide through selective permeability to gases, as well as improving mechanical handling properties. The advances in this area have been breathtaking, and in fact their implementation in the industry is already a reality. Even so, there are still new developments in various fields and from various perspectives worth reporting. Edible Films and Coatings: Fundamentals and Applications discusses the newest generation of edible films and coatings that are being especially designed to allow the incorporation and/or controlled release of specific additives by means of nanoencapsulation, layer-by-layer assembly, and other promising technologies. Covering the latest novelties in research conducted in the field of edible packaging, it considers state-of-the-art innovations in coatings and films; novel applications, particularly in the design of gourmet foods; new advances in the incorporation of bioactive compounds; and potential applications in agronomy, as an as yet little explored area, which could provide considerable advances in the preservation and quality of foods in the field.

Keratin-based Materials

The Handbook of Composites From Renewable Materials comprises a set of 8 individual volumes that brings an interdisciplinary perspective to accomplish a more detailed understanding of the interplay between the synthesis, structure, characterization, processing, applications and performance of these advanced materials. The handbook covers a multitude of natural polymers/reinforcement/fillers and biodegradable materials. Together, the 8 volumes total at least 5000 pages and offers a unique publication. This 6th volume Handbook is solely focused on Polymeric Composites. Some of the important topics include but not limited to: Keratin as renewable material for developing polymer composites; natural and synthetic matrices; hydrogels in tissue engineering;
smart hydrogels: application in bioethanol production; principle renewable biopolymers; application of hydrogel biocomposites for multiple drug delivery; nontoxic holographic materials; bioplasticizer - epoxidized vegetable oils-based poly (lactic acid) blends and nanocomposites; preparation, characterization and adsorption properties of poly (DMAEA) – cross-linked starch gel copolymer in waste water treatments; study of chitosan crosslinking hydrogels for absorption of antifungal drugs using molecular modelling; pharmaceutical delivery systems composed of chitosan; eco-friendly polymers for food packaging; influence of surface modification on the thermal stability and percentage of crystallinity of natural abaca fiber; influence of the use of natural fibers in composite materials assessed on a life cycle perspective; plant polysaccharides-blended ionotropically-gelled alginate multiple-unit systems for sustained drug release; vegetable oil based polymer composites; applications of chitosan derivatives in wastewater treatment; novel lignin-based materials as a products for various applications; biopolymers from renewable resources and thermoplastic starch matrix as polymer units of multi-component polymer systems for advanced applications; chitosan composites: preparation and applications in removing water pollutants and recent advancements in biopolymer composites for addressing environmental issues.

Molten Salts and Ionic Liquids 19

There is an increasing movement of scientists and engineers who are dedicated to minimising the environmental impact of polymer composite production. Life cycle assessment is of paramount importance at every stage of a product’s life, from initial synthesis through to final disposal and a sustainable society needs environmentally safe materials and processing methods. With an internationally recognised team of contributors, Green Composites examines fibre reinforced polymer composite production and explains how environmental footprints can be diminished at every stage of the life cycle. The introductory chapters look at why we should consider green composites, their design and life cycle
access. The properties of natural fibre sources such as cellulose and wood are then discussed. Chapter 6 examines recyclable synthetic fibre-thermoplastic composites as an alternative solution and polymers derived from natural sources are covered in Chapter 7. The factors that influence the properties of these natural composites and natural fibre thermoplastic composites are detailed in Chapters 8 and 9. The final four chapters consider clean processing, applications, recycling, degradation and reprocessing. Green composites is an essential guide for agricultural crop producers, government agricultural departments, automotive companies, composite producers and material scientists all dedicated to the promotion and practice of eco-friendly materials and production methods. Reviews fibre reinforced polymer composite production Explains how environmental footprints can be diminished at every stage of the life-cycle

Polymeric Materials

Offers a comprehensive guide to the isolation, properties and applications of chitin and chitosan Chitin and Chitosan: Properties and Applications presents a comprehensive review of the isolation, properties and applications of chitin and chitosan. These promising biomaterials have the potential to be broadly applied and there is a growing market for these biopolymers in areas such as medical and pharmaceutical, packaging, agricultural, textile, cosmetics, nanoparticles and more. The authors – noted experts in the field – explore the isolation, characterization and the physical and chemical properties of chitin and chitosan. They also examine their properties such as hydrogels, immunomodulation and biotechnology, antimicrobial activity and chemical enzymatic modifications. The book offers an analysis of the myriad medical and pharmaceutical applications as well as a review of applications in other areas. In addition, the authors discuss regulations, markets and perspectives for the use of chitin and chitosan. This important book: Offers a thorough review of the isolation, properties and applications of chitin and chitosan. Contains information on the wide-ranging applications
and growing market demand for chitin and chitosan. Includes a discussion of current regulations and the outlook for the future. Written for Researchers in academia and industry who are working in the fields of chitin and chitosan, Chitin and Chitosan: Properties and Applications offers a review of these promising biomaterials that have great potential due to their material properties and biological functionalities.

Hybrid Polymer Composite Materials

Biological Macromolecules: Bioactivity and Biomedical Applications presents a comprehensive study of biomacromolecules and their potential use in various biomedical applications. Consisting of four sections, the book begins with an overview of the key sources, properties and functions of biomacromolecules, covering the foundational knowledge required for study on the topic. It then progresses to a discussion of the various bioactive components of biomacromolecules. Individual chapters explore a range of potential bioactivities, considering the use of biomacromolecules as nutraceuticals, antioxidants, antimicrobials, anticancer agents, and antidiabetics, among others. The third section of the book focuses on specific applications of biomacromolecules, ranging from drug delivery and wound management to tissue engineering and enzyme immobilization. This focus on the various practical uses of biological macromolecules provide an interdisciplinary assessment of their function in practice. The final section explores the key challenges and future perspectives on biological macromolecules in biomedicine. Covers a variety of different biomacromolecules, including carbohydrates, lipids, proteins, and nucleic acids in plants, fungi, animals, and microbiological resources. Discusses a range of applicable areas where biomacromolecules play a significant role, such as drug delivery, wound management, and regenerative medicine. Includes a detailed overview of biomacromolecule bioactivity and properties. Features chapters on research challenges, evolving applications, and future perspectives.
Biodegradable Green Composites

This volume presents the recent developments on the biomedical applications of chitosan and its derivatives. Chitosan exhibits unique properties such as non-toxicity, biodegradability and biocompatibility. Since its chemical structure and properties can be easily modified, it can be an ideal candidate as a biomaterial. Consequently, chitosan and its derivatives are being developed in different forms such as nanoparticles, micelles, nanofibers, hydrogels, films and 3D porous materials for various biomedical applications, ranging from drug and gene delivery to tissue engineering and regenerative medicine. The chapters of this volume focus on the potential use of chitosan and its derivatives as a hemostatic agent, tissue sealants, tissue engineering scaffolds, delivery carriers for bioactive molecules in bone tissue engineering and wound dressings. Some chapter’s deal with recent advancements of chitosan-based biomaterials as a drug, gene and transdermal drug delivery carrier. In addition, the volume focusses on the prospects of chitosan-based systems for the treatment of cancer, eye and other infectious diseases. The volume will be of interest to material scientists, chemists and biotechnologists by providing a better understanding of the physicochemical and biological characteristics of chitosan and its derivatives to develop more appropriate and innovative chitosan-based materials modified for unlimited practical applications in biomedical fields.

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