

Cellulose Based Hydrogels Designing Concepts Properties

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.

With the prospect of revolutionizing specific technologies, this book highlights the most exciting and impactful current research in the fields of cellulose-based superabsorbent hydrogels with their smart applications. The book assembles the newest synthetic routes, characterization methods, and applications in the emergent area. Leading experts in the field have contributed chapters representative of their most recent research results, shedding light on the enormous potential of this field and thoroughly presenting cellulose-based hydrogel functioning materials. The book is intended for the polymer chemists, academic and industrial scientists and engineers, pharmaceutical and biomedical scientists and agricultural engineers engaged in research and development on absorbency, absorbent products and superabsorbent hydrogels. It can also be supportive for undergraduate and graduate students.

Nanostructures for Novel Therapy: Synthesis, Characterization and Applications focuses on the fabrication and characterization of therapeutic nanostructures, in particular, synthesis, design, and in vitro and in vivo therapeutic evaluation. The chapters provide a cogent overview of recent therapeutic applications of nanostructured materials that includes applications of nanostructured materials for wound healing in plastic surgery and stem cell therapy. The book explores the promise for more effective

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therapy through the use of nanostructured materials, while also assessing the challenges their use might pose from both an economic and medicinal point of view. This innovative look at how nanostructured materials are used in therapeutics will be of great benefit to researchers, providing a greater understanding of the different ways nanomaterials could improve medical treatment, along with a discussion of the obstacles that need to be overcome in order to guarantee widespread availability. Outlines how the characteristics of nanostructures made from different materials gives particular properties that can be successfully used in therapeutics Compares the properties of different nanostructures, allowing medicinal chemists and engineers to select which are most appropriate for their needs Highlights new uses of nanostructures within the therapeutic field, enabling the discovery of new, more effective drugs This book presents the aspects of cellulose obtained in correlation with its integration into the new concept of biorefining. The authors detail the individual steps of pulp manufacture as well as properties and fiber characterization techniques for paper, cellulose derivatives and processing by-products. This book is of interest to scientists and advanced students working in the fields of renewable resources and biorefining. The growing interest in replacing petroleum-based products by inexpensive, renewable, natural materials will have a significant impact on sustainability, environment, and the polymer industry. This book provides scientists a useful framework to help take advantage of the latest research conducted in this rapidly advancing field enabling them to develop and commercialize their own products quickly and more successfully. This book provides comprehensive coverage of smart biomaterials and their potential applications, a field that is developing at a very rapid pace. Because smart biomaterials are an emerging class of biomaterials that respond to small changes in external stimuli with large discontinuous changes in their physical properties, they have been designed to act as an “on–off” switch for, among others, bio separation, immunoanalysis, drug delivery technologies, gene therapy, diagnostics, bio sensors and artificial muscles. After an introduction to the topic and the history of smart biomaterials, the author gives the reader an in-depth look at the properties, mechanics, and characterization of smart biomaterials including hydrogels, particles, assemblies, surfaces, fibers and conjugates. Information on the wide range of applications for these materials follows, including drug delivery, tissue engineering, diagnostics, biosensors, bio separation and actuators. In addition, recent advances in shape memory biomaterials as active components of medical devices are also presented.

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

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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.

This book explores the potential of hydrogels as a multiutility system and their benefits (biocompatibility, degradability, and supporting scaffolds) for a wide range of applications in diagnostics and therapeutics. It also discusses the future prospects and challenges facing hydrogels. A wide variety of smart hydrogels (conducting, stimuli responsive, and others) with possible biomedical applications are elaborated. The book demonstrates the effectiveness of hydrogels in diagnostics of diseases in various in vivo and in vitro environments and highlights the engineering/functionalization of hydrogels for everyday drug dosage as an efficient drug carrier, scaffold, and sensing application. Explores the potential of hydrogels as a multifunctional system and their benefits, particularly for biomedical applications in diagnostics as well as therapeutics. Highlights the designing and engineering of hydrogels for everyday drug dosage and possible functionalization to fabricate an efficient drug carrier. Examines the significance of biopolymer-based hydrogels and their responsiveness in different physiological fluids. Demonstrates the effectiveness of hydrogels in diagnostics of diseases in various in,vivo and in,vitro environments. Presents challenges associated with the hydrogels and discusses possible in-hand modifications at length. Dr. Anujit Ghosal worked in the School of Biotechnology, Jawaharlal Nehru University, India. Currently, he is affiliated with the School of Life Sciences, Beijing Institute of Technology, Beijing, PRC. Dr. Ghosal researches in biochemistry, polymer chemistry, and nanotechnology. He has been the recipient of prestigious fellowships throughout his research career. His research ability is proven by his published peer-reviewed research and review articles and contributed book chapters. Dr. Ajeet Kaushik works as an assistant professor of chemistry and is exploring advanced electrochemical sensing systems and nanomedicine for personalized health wellness at the Department of Natural Sciences of the Division of Science, Arts, and Mathematics at Florida Polytechnic University, Lakeland, US. He is the recipient of various reputed awards for his service in the area of nanobiotechnology for health care. His excellent research credentials are reflected by his four edited books, 100 international research peer-reviewed publications, and three patents in the area of nanomedicine and smart biosensors for personalized health care.

Hydrogels are a fascinating class of polymers which show an immense ability of swelling under the influence of temperature, pH value or concentrations of different species in aqueous solutions. The volume change can amount up to several hundred percent. This unique behaviour is already used in such applications like disposable diapers, contact lenses or drug-delivery systems. The ability to perform mechanical work has been shifted the technical interest more and more towards sensors and actuators exploiting the thermo-chemo-mechano-electrical coupling within hydrogels. The accuracy requirements for such devices are much more demanding than for previous applications. Therefore, a deep knowledge of both the material and the functional properties of hydrogel sensors and actuators is needed. The monograph describes state of the art and recent developments for these materials in sensor

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and actuator technology.

This book on advanced functional textiles and polymers will offer a comprehensive view of cutting-edge research in newly discovered areas such as flame retardant textiles, antimicrobial textiles, insect repellent textiles, aroma textiles, medical-textiles, smart textiles, and nano-textiles etc. The second part the book provides innovative fabrication strategies, unique methodologies and overview of latest novel agents employed in the research and development of functional polymers.

Sustainable Nanocellulose and Nanohydrogels from Natural Sources explores the use of biopolymers in specific application areas such as electronics, energy, consumer goods, packaging materials, therapeutics, water treatment and engineering, and what makes the particular polymer to engage it in these applications. This is an important reference source for those who would like to learn more about how biopolymeric nanocomposites are used in sustainability and environmental protection. Biopolymers, including plant and sea-based polymers, play an important role in the formation and maintaining the stability of industrial nanocomposites; their common functions being the surface modification and protection for the highly oxidative-unstable cores, as stable base for holding multiple targets, and as a shield for the inorganic and highly toxic metals. These biopolymer-based nanocomposites are being used for applications in the electronics, automobile, construction and biomedical sectors.

Explains the major design and development techniques of novel biopolymer-based nanocomposites Demonstrates how Nanocelluloses and Nanohydrogels are being used for environmental health and safety Explores how biopolymer-infused nanocellulose and nanogels are less toxic than their conventional counterparts

Plant and Algal Hydrogels for Drug Delivery and Regenerative Medicine Woodhead Publishing
The Handbook of Chitin and Chitosan: Preparation and Properties, Volume One, is a must-read for polymer chemists, physicists and engineers interested in the development of ecofriendly micro and nanostructured functional materials based on chitin and their various applications. The book addresses the entirety of working with these materials, from their isolation, preparation and properties, through composites, nanomaterials, manufacturing and characterizations. This is the first of three volumes in a series that contains the latest on the major applications of chitin and chitosan based IPN's, blends, gels, composites and nanocomposites, including environmental remediation, biomedical applications and smart material applications. Provides a comprehensive overview of Chitin and Chitosan materials, from their synthesis and nanomaterials, to their manufacture and applications Volume One focuses on the synthesis and properties of Chitosan and/or Chitin Includes contributions from leading researchers across the globe and from industry, academia, government and private research institutions Highlights current status and future opportunities

Polymer-based smart materials have become attractive in recent years due to the fact that polymers are flexible and provide many advantages compared to inorganic smart materials: they are low cost, they are easy to process, and they exhibit good performance at nano- and microscale levels. This volume focuses on a different class of polymers that are used as smart materials in the areas of biotechnology, medicine, and engineering. The volume aims to answer these questions: How do we distinguish 'smart materials'? and How do they work? The chapters lay the groundwork for assimilation and exploitation of this technological advancement. Four of the key aspects of the approach that the authors have developed throughout this book are highlighted, namely the multidisciplinary exchange of knowledge, exploration of the relationships between multiple scales and their different behaviors, understanding that material properties are dictated at the smallest scale, and, therefore, the recognition that macroscale behavior can be controlled by nanoscale design.

Hydrogels, as three-dimensional polymer networks, are able to retain a large amount of water in their swollen state. The biomedical application of hydrogels was initially hampered by the

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toxicity of cross-linking agents and the limitations of hydrogel formation under physiological conditions. However, emerging knowledge in polymer chemistry and an increased understanding of biological processes have resulted in the design of versatile materials and minimally invasive therapies. The novel but challenging properties of hydrogels are attracting the attention of researchers in the biological, medical, and pharmaceutical fields. In the last few years, new methods have been developed for the preparation of hydrophilic polymers and hydrogels, which may be used in future biomedical and drug delivery applications. Such efforts include the synthesis of self-organized nanostructures based on triblock copolymers with applications in controlled drug delivery. These hydrogels could be used as carriers for drug delivery when combined with the techniques of drug imprinting and subsequent release. Engineered protein hydrogels have many potential advantages. They are excellent biomaterials and biodegradables. Furthermore, they could encapsulate drugs and be used in injectable forms to replace surgery, to repair damaged cartilage, in regenerative medicine, or in tissue engineering. Also, they have potential applications in gene therapy, although this field is relatively new.

Delivery of Therapeutics for Biogerontological Interventions: From Concepts to Experimental Design provides tactics on how to facilitate planning and research in interventive biogerontology. The book helps create clearer directions for the translation of existing advances in delivery technologies, from lab to practice. It is ideal as a starting point for scientists, clinicians and those interested in the field of biogerontology, biomedicine or nanotechnology, comprehensively discussing how to translate bench works to practicable tactics that retard the aging process. Using support from recent advances reported in literature, this title takes advantage of delivery technologies to develop biogerontological interventions, from concept to experimental design. Provides the first comprehensive reference to guide researchers through the process of intervention development, from concepts, to practicable interventions Covers the information needed to exploit the use of delivery technologies in intervention biogerontology Presents complete coverage of advances in the field, all of which are supported by full color photographs, figures and references

Hydrogels are networks of polymer chains which can produce a colloidal gel containing over 99 per cent water. The superabsorbency and permeability of naturally occurring and synthetic hydrogels give this class of materials an amazing array of uses. These uses range from wound dressings and skin grafts to oxygen-permeable contact lenses to biodegradable delivery systems for drugs or pesticides and scaffolds for tissue engineering and regenerative medicine.

Biomedical Applications of Hydrogels Handbook provides a comprehensive description of this diverse class of materials, covering both synthesis and properties and a broad range of research and commercial applications. The Handbook is divided into four sections: Stimuli-Sensitive Hydrogels, Hydrogels for Drug Delivery, Hydrogels for Tissue Engineering, and Hydrogels with Unique Properties. Key Features: Provides comprehensive coverage of the basic science and applications of a diverse class of materials Includes both naturally occurring and synthetic hydrogels Edited and written by world leaders in the field.

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

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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.

This book provides the whole spectrum of polysaccharides from basic concepts to commercial market applications. Chapters cover various types of sources, classification, properties, characterization, processing, rheology and fabrication of polysaccharide-based materials and their composites and gels. The applications of polysaccharides include in cosmetics, food science, drug delivery, biomedicine, biofuel production, marine, packaging, chromatography and environmental remediation. It also reviews the fabrication of inorganic and carbon nanomaterials from polysaccharides. The book incorporates industrial applications and will fill the gap between the exploration works in the laboratory and viable applications in related ventures.

Nanocellulose, a unique and promising natural material extracted from native cellulose, has received immense interest for its broad spectrum of applications owing to its remarkable physical properties, special surface chemistry, and excellent biological properties (biocompatibility, biodegradability and low toxicity). In attempts to meet the requirements of humanity's well-being, biomaterials scientists taking advantage of the structure and properties of nanocellulose aim to develop new and formerly non-existing materials with novel and multifunctional properties. This book highlights the importance of nanocellulose and reviews its synthesis, types, structure and properties. Further, it discusses various biofabrication approaches and applications of nanocellulose-based biomaterials in various fields such as the environment, biomedicine, optoelectronics, pharmaceuticals, paper, renewable energy and the food industry. Devised to have a broad appeal, this book will be useful to beginners, who will appreciate its comprehensive approach, as well as active researchers, who will find the focus on recent advancements highly valuable.

This book presents emerging economical and environmentally friendly polymer composites that are free of the side effects observed in traditional composites. It focuses on eco-friendly composite materials using granulated cork, a by-product of the cork industry; cellulose pulp from the recycling of paper residues; hemp

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fibers; and a range of other environmentally friendly materials procured from various sources. The book presents the manufacturing methods, properties and characterization techniques of these eco-friendly composites. The respective chapters address classical and recent aspects of eco-friendly polymer composites and their chemistry, along with practical applications in the biomedical, pharmaceutical, automotive and other sectors. Topics addressed include the fundamentals, processing, properties, practicality, drawbacks and advantages of eco-friendly polymer composites. Featuring contributions by experts in the field with a variety of backgrounds and specialties, the book will appeal to researchers and students in the fields of materials science and environmental science. Moreover, it fills the gap between research work in the laboratory and practical applications in related industries.

Micro and Nanolignin in Aqueous Dispersions and Polymers: Interactions, Properties, and Applications presents the very latest research on lignin biorefinery treatments, production, chemistry, and refining, exploring a range of innovative applications of lignin and lignin-based composites at both the micro and the nanoscale. The book begins by presenting the latest developments in extraction methods and properties, with topics including methods for value-added microlignin, color characteristics, refining and functionalization, depolymerization for phenolic monomer production, and production of sulphur-free lignin nanoparticles. This is followed by in-depth sections focusing on the preparation of lignin for advanced applications at the microscale, then at the nanoscale, covering a range of areas such as construction, fiber manufacturing, food packaging, biomedicine, wood preservation, wastewater treatment, and agriculture. This valuable resource enables the reader to identify the high added value of a biomass residue and supports possible development and use for mass and niche high impact application sectors. This information is of interest to researchers, scientists, and advanced students, across bio-based polymers and bio-composites, polymer science and engineering, nanomaterials, chemistry, sustainable materials, materials science, and chemical engineering. Moreover, it is also addressed to the professionals that as well as those in an R&D industrial setting to are looking on ideas and perspectives on how to utilize bio-based materials in advanced industrial applications. Provides detailed information on extraction methods, properties, refining and functionalization processes Guides the reader through the preparation of lignin both at the micro and nanoscale, as a filler, a matrix, and in all-lignin composites Takes a design-for-application approach, opening the door to high value applications across a range of sectors This first book on nanocellulose and nanohydrogels for biomedical applications is unique in discussing recent advancements in the field, resulting in a comprehensive, well-structured overview of nanocellulose and nanohydrogel materials based nanocomposites. The book covers different types of nanocellulose materials and their recent developments in the drug delivery and nanomedicine sector, along with synthesis, characterization, as well as

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applications in the biotechnological and biomedical fields. The book also covers the current status and future perspectives of bacterial cellulose and polyester hydrogel matrices, their preparation, characterization, and tissue engineering applications of water soluble hydrogel matrices obtained from biodegradable sources. In addition, the chitosan-based hydrogel and nanogel matrices, their involvement in the current biofabrication technologies, and influencing factors towards the biomedical sector of biosensors, biopharmaceuticals, tissue engineering appliances, implant materials, diagnostic probes and surgical aids are very well documented. Further, the history of cellulose-based and conducting polymer-based nanohydrogels, their classification, synthesis methods and applicability to different sectors, the challenges associated with their use, recent advances on the inhibitors of apoptosis proteins are also included. The recent developments and applications in the drug delivery sector gives an overview of facts about the nanofibrillated cellulose and copoly(amino acid) hydrogel matrices in the biotechnology and biomedicine field. This book serves as an essential reference for researchers and academics in chemistry, pharmacy, microbiology, materials science and biomedical engineering.

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

Functional foods and nutraceuticals are food products that naturally offer or have been modified to offer additional health benefits beyond basic nutrition. As such products have surged in popularity in recent years, it is crucial that researchers and manufacturers understand the concepts underpinning functional foods and the opportunity they represent to improve human health, reduce healthcare costs, and support economic development worldwide. **Functional Foods and Nutraceuticals: Bioactive Components, Formulations and Innovations** presents a guide to functional foods from experienced professionals in key institutions around the world. The text provides background information on the health benefits, bioavailability, and safety measurements of functional foods and nutraceuticals. Subsequent chapters detail the bioactive components in functional foods responsible for these health benefits, as well as the different formulations of these products and recent innovations spurred by consumer demands. Authors emphasize product development for increased marketability, taking into account safety issues associated with functional food adulteration and solutions to

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be found in GMP adherence. Various food preservation methods aimed at enhancing the quality and shelf life of functional food are also highlighted. *Functional Foods and Nutraceuticals: Bioactive Components, Formulations and Innovations* is the first of its kind, designed to be useful to students, teachers, nutritionists, food scientists, food technologists and public health regulators alike.

The process of photosynthesis is a potential source of energy and bioproducts. Renewable sources of polymeric materials offer an answer to maintaining sustainable development of economically and ecologically attractive technology. The innovations in the development of materials from biopolymers, preservation of fossil-based raw materials, complete biological degradability, reduction in the volume of garbage and compostability in the natural cycle, climate protection through reduction of carbon dioxide released, and the application possibilities of agricultural resources for the production of bio/green materials are some of the reasons why such materials are attracting public interest. *FEATURES* Discusses waste from urban areas, forestry and agricultural processes, specifically grown crops such as trees, starch crops, sugar crops hydrocarbon plants and oils, and finally aquatic plants such as water seaweeds and algae, which can be used as raw materials for sustainable development. Presents recent advances in the development of some specifically chemical components of biomasses for a sustainable future. Focuses on lignocellulose as a source of bio-based products. Draws upon expertise from various countries. Describes how upgraded and integrated biomass processing may reduce the risks associated with the COVID-19 pandemic. Valentin I. Popa is professor emeritus of Wood Chemistry and Biotechnology at Gheorghe Asachi Technical University of Iasi, Romania.

Plant and Algal Hydrogels for Drug Delivery and Regenerative Medicine offers a materials-focused and systematic overview of biopolymeric hydrogels utilized for biomedical applications. The book details the synthesis and characterization of plant and algal-based hydrogels, with each chapter addressing a separate polysaccharide hydrogel type. Specific applications in drug delivery and regenerative medicine are also discussed, highlighting the efficacy, biocompatibility, benefits and challenges for each polysaccharide hydrogel subtype. There is increasing demand for biomaterials which reduce/prevent the host response, inflammation and rejection, hence this book provides a timely resource. Biopolymeric hydrogels have skyrocketed because of their necessity in in vivo applications. They create an environment similar to living tissue, which is both biocompatible and biodegradable. Plant and algal polysaccharides in particular are well-equipped with functional groups that are easily modified for beneficial results. Systematically covers each plant and algal polysaccharide hydrogel subtype, from starch-based hydrogels to pectin and alginate-based hydrogels Provides an end-to-end description of the synthesis, characterization and application of biopolymeric hydrogels for drug delivery and regenerative medicine Appeals to a diverse readership, including those in biomedicine, pharmacy, polymer chemistry, biochemistry, materials science, biomedical engineering, and other biotechnology related disciplines

Bioinspired and Biomimetic Materials for Drug Delivery delves into the potential of bioinspired materials in drug delivery, detailing each material type and its latest developments. In the last decade, biomimetic and bioinspired materials and technology has garnered increased attention in drug delivery research. Various material types including polymer, small molecular, protein, peptide, cholesterol, polysaccharide, nano-crystal and hybrid materials are widely considered in drug delivery research. However, biomimetic and bioinspired materials and technology have shown promising results for use in therapeutics, due to their high biocompatibility and reduced immunogenicity. Such materials include dopamine, extracellular exosome, bile acids, ionic liquids, and red blood cell. This book covers each of these materials in detail, reviewing their potential and usage in drug delivery. As such, this book will be a great source of information for biomaterials scientists, biomedical engineers and those working in pharmaceutical research.

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Explores latest developments for a broad range of bioinspired and biomimetic materials for drug delivery applications Helps researchers overcome the challenges of biocompatibility and immunogenicity in drug development Provides both theoretical and practical knowledge in regards to materials characterization and use in a range of drugs

This volume provides readers with the basic principles and fundamentals of extrusion technology and a detailed description of the practical applications of a variety of extrusion processes, including various pharma grade extruders. In addition, the downstream production of films, pellets and tablets, for example, for oral and other delivery routes, are presented and discussed utilizing melt extrusion. This book is the first of its kind that discusses extensively the well-developed science of extrusion technology as applied to pharmaceutical drug product development and manufacturing. By covering a wide range of relevant topics, the text brings together all technical information necessary to develop and market pharmaceutical dosage forms that meet current quality and regulatory requirements. As extrusion technology continues to be refined further, usage of extruder systems and the array of applications will continue to expand, but the core technologies will remain the same.

This book addresses a range of synthesis and characterization techniques that are critical for tailoring and broadening the various aspects of polymer gels, as well as the numerous advantages that polymer gel-based materials offer. It presents a comprehensive collection of chapters on the recent advances and developments in the science and fundamentals of both synthetic and natural polymer-based gels. Topics covered include: synthesis and structure of physically/chemically cross-linked polymer-gels/polymeric nanogels; gel formation through non-covalent cross-linking; molecular design and characterization; polysaccharide-based polymer gels: synthesis, characterization, and properties; modified polysaccharide gels: silica-based polymeric gels as platforms for the delivery of pharmaceuticals; gel-based approaches in genomic and proteomic sciences; emulgels in drug delivery; and organogels. The book provides a cutting-edge resource for researchers and scientists working in various fields involving polymers, biomaterials, bio-nanotechnology and functional materials.

The first book dedicated to the potential applications and unique properties of bacterial cellulose (BC), this seminal work covers the basic science, technology, and economic impact of this bulk chemical as well as the companies and patents that are driving the field. It reviews the biosynthesis and properties of BC, including genetics and characterization; discusses the advancing technology as it relates to product development, bioreactors, and production; and analyzes the economic impact of BC on a diverse range of industry applications, including materials and biomaterials, biological and polymer sciences, and electromechanical engineering.

Hydrogels are an emerging area of interest in medicine as well as pharmaceuticals, and their physico-chemical characterization is fundamental to their practical applications. Compared with synthetic polymers, polysaccharides that are widely present in living organisms and come from renewable sources are extremely advantageous for hydrogel formation. Furthermore, polysaccharides are usually non-toxic and biocompatible and show a number of peculiar physico-chemical properties that make them suitable for a wide variety of biomedical applications. This book bridges the gap between the preparation of hydrogels and their characterization techniques. It aims to offer a valid support that can help the readers find appropriate keys to open the doors to the complex world of polysaccharide hydrogels.

Hydrogels Based on Natural Polymers presents the latest research on natural polymer-based hydrogels, covering fundamentals, preparation methods, synthetic pathways, advanced properties, major application areas, and novel characterization techniques. The advantages and disadvantages of each natural polymer-based hydrogel are also discussed, enabling preparation tactics for

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specific properties and applications. Sections cover fundamentals, development, characteristics, structures and properties. Additional chapters cover presentation methods and properties based on natural polymers, including physical and chemical properties, stimuli-responsive properties, self-healing properties, and biological properties. The final section presents major applications areas, including the biomedical field, agriculture, water treatments, and the food industry. This is a highly valuable resource for academic researchers, scientists and advanced students working with hydrogels and natural polymers, as well as across the fields of polymer science, polymer chemistry, plastics engineering, biopolymers and biomaterials. The detailed information will also be of great interest to scientists and R&D professionals, product designers, technicians and engineers across industries. Provides systematic coverage of all aspects of hydrogels based on natural polymers, including fundamentals, preparation methods, properties and characterization Offers a balanced assessment of the specific properties and possibilities offered by different natural polymer-based hydrogels, drawing on innovative research Examines cutting-edge applications across biomedicine, agriculture, water treatments, and the food industry

This book, consisting of 21 articles, including three review papers, written by research groups of experts in the field, considers recent research on reinforced polymer composites. Most of them relate to the fiber-reinforced polymer composites, which are a real hot topic in the field. Depending on the reinforcing fiber nature, such composites are divided into synthetic and natural fiber-reinforced ones. Synthetic fibers, such as carbon, glass, or basalt, provide more stiffness, while natural fibers, such as jute, flax, bamboo, kenaf, and others, are inexpensive and biodegradable, making them environmentally friendly. To acquire the benefits of design flexibility and recycling possibilities, natural reinforcers can be hybridized with small amounts of synthetic fibers to make them more desirable for technical applications. Elaborated composites have great potential as structural materials in automotive, marine and aerospace application, as fire resistant concrete, in bridge systems, as mechanical gear pair, as biomedical materials for dentistry and orthopedic application and tissue engineering, as well as functional materials such as proton-exchange membranes, biodegradable superabsorbent resins and polymer electrolytes. The world faces significant challenges as the population and consumption continue to grow while nonrenewable fossil fuels and other raw materials are depleted at ever-increasing rates. This informative volume provides a technical approach to address these issues using green design and analysis. It takes an interdisciplinary look at concepts that can be applied across engineering disciplines in the development of products, processes, and systems to minimize environmental impacts across all life cycle phases. Topics include polymers for pollutant removal, wood-based biopolymers, bio-based polymers for drug formulations, biomaterial-based medical implants, biodegradability of biopolymer materials, bio-based polymers for food packaging applications, biodegradable

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polymers for tissue engineering applications, and more.

This timely, one-stop reference is the first on an emerging and interdisciplinary topic. Covering both established and recently developed ligation chemistries, the book is divided into two didactic parts: a section that focuses on the details of bioorthogonal and chemoselective ligation reactions at the level of fundamental organic chemistry, and a section that focuses on applications, particularly in the areas of chemical biology, biomaterials, and bioanalysis, highlighting the capabilities and benefits of the ligation reactions. With chapters authored by outstanding scientists who range from trailblazers in the field to young and emerging leaders, this book on a highly interdisciplinary topic will be of great interest for biochemists, biologists, materials scientists, pharmaceutical chemists, organic chemists, and many others.

With contributions from many of the leaders in the field, this volume describes polysaccharide derivatives and new methods with unusual derivatives. It also highlights methods for modifying cellulose, nature's most abundant polymer, to make it accessible for numerous materials and products.

This book is an Up-to-date and authoritative account on physicochemical principles, pharmaceutical and biomedical applications of hydrogels. It consists of eight contributions from different authors highlighting properties and synthesis of hydrogels, their characterization by various instrumental methods of analysis, comprehensive review on stimuli-responsive hydrogels and their diverse applications, and a special section on self-healing hydrogels. Thus, this book will equip academia and industry with adequate basic and applied principles related to hydrogels.

This book presents an exhaustive review on the use of polymers for food applications. Polymer-based systems for food applications such as: films, foams, nano- and micro-encapsulated, emulsions, hydrogels, prebiotics, 3D food printing, edible polymers for the development of foods for people with special feeding regimes, sensors, among others, have been analyzed in this work.

Biomass as Renewable Raw Material to Obtain Bioproducts of High-tech Value examines the use of biomass as a raw material, including terrestrial and aquatic sources to obtain extracts (e.g. polyphenols), biofuels, and/or intermediates (furfural, levulinates) through chemical and biochemical processes. The book also covers the production of natural polymers using biomass and the biosynthetic process, cellulose modified by biochemical and chemical methods, and other biochemicals that can be used in the synthesis of various pharmaceuticals. Featuring case studies, discussions of sustainability, and nanomedical, biomedical, and pharmaceutical applications, *Biomass as Renewable Raw Material to Obtain Bioproducts of High-tech Value* is a crucial resource for biotechnologists, biochemical engineers, biochemists, microbiologists, and research students in these areas, as well as entrepreneurs, policy makers, stakeholders, and politicians. Reviews biomass resources and compounds with bioactive properties Describes chemical and biochemical

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processes for creating biofuels from biomass Outlines production of polysaccharides and cellulose derivatives Features applications in the fields of medicine and pharmacy

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