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## Biopolymers and Their Industrial Applications From Plant, Animal, and Marine Sources, to Functional Products

*Elsevier* **Biopolymers and Their Industrial Applications: From Plant, Animal, and Marine Sources to Functional Products** is a detailed guide to the use of biopolymers for advanced applications across a range of key industries. In terms of

processing and cost, bio-based polymers are becoming increasingly viable for an ever-broadening range of novel industrial applications. The book begins with an overview of biopolymers, explaining resources, demands, sustainability, life cycle assessment (LCA) modeling and simulation, and classifications. Further in-depth chapters explore the latest techniques and methodologies for isolation and physicochemical characterization, materials selection, and processing for blends and composites. Chapters 6 to 14 each focus on the preparation and applications of biopolymers in a specific industrial area, including food science and nutraceuticals, medicine and pharmaceuticals, textiles, cosmeceutical, packaging, adhesives and automotive, 3D printing, super capacitor and energy storage devices, and environmental applications. The final chapter compares and analyzes biopolymers alongside synthetic polymers, also offering valuable insight into social, economic, and environmental aspects. This is an essential resource for those seeking to understand, research, or utilize biopolymers in industrial applications. This includes researchers, scientists, and advanced students working in biopolymers, polymer science, polymer chemistry, biomaterials, materials science, nanotechnology, composites, and biotechnology. This is a highly valuable book for scientists, R&D professionals, designers, and engineers across multiple industries and disciplines, who are looking to utilize biopolymers for components and products. Introduces a broad range of industrial application areas, including food, medicine, textiles, cosmetics, packaging, automotive, 3D printing, energy, and more Offers an industry-oriented approach, addressing challenges and explaining the preparation and application of biopolymers for functional products and parts Considers important factors such as resources, classification, sustainability, and life cycle assessment (LCA) modeling and simulation Compares and analyzes biopolymers alongside synthetic polymers, also offering valuable insight into social, economic, and environmental aspects

## Industrial Applications of Marine Biopolymers

## Industrial Applications of Marine Biopolymers

*CRC Press* **Industrial Applications of Marine Biopolymers** presents different classes of marine biopolymers and their industrial applications, demonstrating the precious value of ocean resources to society. This timely volume discusses the exceedingly useful polymers derived from these materials that are biodegradable, biocompatible, and at times water soluble. Direct use or chemically modified forms of such biomaterials have many chemical sites, making them

suitable for varied types of industrial applications. In addition, this book also addresses current global challenges of conservation, including extended drought conditions and the need for improved agricultural methods, together with new bio-medical developments. It is suitable for anyone who has an interest in the industrial applications of biopolymers.

## Aquatic Biopolymers

# Understanding their Industrial Significance and Environmental Implications

*Springer Nature* This book presents a comprehensive survey about the most recent developments in industrial applications, processing techniques and modifications of polymers from marine sources. It systematically introduces the reader to the biomaterials Chitin, Collagen, Alginates, Cellulose and Polyesters and links their interwoven industrial significance and environmental implications. The book elucidates the impact of industrial sourcing of the aquatic system for organic and inorganic matter on the environment and deepens the understanding of the industrial and economic significance of aquatic biopolymers. Further it addresses the question of how to balance the conservation of aquatic life and the industrial and economic interest in developing biodegradable alternatives for plastic. Thus the book will appeal to scientists in the field of chemistry, materials and polymer science as well as engineering.

## Advances in Applications of Industrial Biomaterials

*Springer* This book presents recent advances in the development of biomaterials for industrial applications, and discusses the potential for substituting environmentally hazardous substances with environmentally friendly and degradable components. Focusing on both the material development and production technologies, it reviews different materials, as well as new production technologies and application areas. It also highlights the importance of incorporating organic materials into different composites to enable consumption of otherwise waste materials. Further

it addresses biopolymers for the food industry, e.g. edible films and coatings in food production and biodegradable materials; the automotive industry; bio fuels, such as biodiesel based on organic constituents; and green composites in marine applications. Environmental protection aspects related to the protection of cultural heritage, and new nanoparticles, such as nano zerovalent iron, are also reviewed. Aimed at young researchers, professionals, chemical engineers and marine engineers, the book is the result of the joint efforts of different academic and research institutions participating in the WIMB Tempus project, 543898-TEMPUS-1-2013-1-ES-TEMPUS-JPHES, "Development of Sustainable Interrelations between Education, Research and Innovation at WBC Universities in Nanotechnologies and Advanced Materials where Innovation Means Business", co-funded by the European Union Tempus Program.

## Sustainable Food Packaging Technology

*John Wiley & Sons* **Towards more sustainable packaging with biodegradable materials!** The combination of the continuously increasing food packaging waste with the non-biodegradable nature of the plastic materials that have a big slice of the packaging market makes it necessary to move towards sustainable packaging for the benefit of the environment and human health. Sustainable packaging is the type of packaging that can provide to food the necessary protection conditions, but at the same time is biodegradable and can be disposed as organic waste to the landfills in order to biodegrade through a natural procedure. In this way, sustainable packaging becomes part of the circular economy. **?Sustainable Food Packaging Technology?** deals with packaging solutions that use engineered biopolymers or biocomposites that have suitable physicochemical properties for food contact and protection and originate both from renewable or non-renewable resources, but in both cases are compostable or edible. Modified paper and cardboard with increased protective properties towards food while keeping their compostability are presented as well. The book also covers natural components that can make the packaging functional, e.g., by providing active protection to the food indicating food spoilage. **\* Addresses urgent problems: food packaging creates a lot of hard-to-recycle waste - this book puts forward more sustainable solutions using biodegradable materials \* State-of-the-art: ?Sustainable Food Packaging Technology? provides knowledge on new developments in functional packaging \* From lab to large-scale applications: expert authors report on the technology aspects of sustainable packaging**

# Industrial Applications of Marine Biopolymers

*CRC Press* **Industrial Applications of Marine Biopolymers** presents different classes of marine biopolymers and their industrial applications, demonstrating the precious value of ocean resources to society. This timely volume discusses the exceedingly useful polymers derived from these materials that are biodegradable, biocompatible, and at times water soluble. Direct use or chemically modified forms of such biomaterials have many chemical sites, making them suitable for varied types of industrial applications. In addition, this book also addresses current global challenges of conservation, including extended drought conditions and the need for improved agricultural methods, together with new bio-medical developments. It is suitable for anyone who has an interest in the industrial applications of biopolymers.

## Biopolymers

## Biomedical and Environmental Applications

*John Wiley & Sons* This handbook focuses on biopolymers for both environmental and biomedical applications. It shows recent advances in technology in all areas from chemical synthesis or biosynthesis to end use applications. These areas have not been covered in a single book before and they include biopolymers for chemical and biotechnological modifications, material structures, characterization, processing, properties, and applications. After the introduction which summarizes the importance of biopolymer in the market, the book covers almost all the topics related to polysaccharides, biofibers, bioplastics, biocomposites, natural rubber, gums, bacterial and blood compatible polymers, and applications of biopolymers in various fields.

## Sustainable Biopolymer Composites

# Biocompatibility, Self-Healing, Modeling, Repair and Recyclability

*Woodhead Publishing* **Sustainable Biopolymer Composites: Biocompatibility, Self-healing, Modeling, Repair and Recyclability** focuses on sustainable polymer composites also referred to as bio-composites. Vital aspects such as biodegradability, biocompatibility, repair and recyclability are discussed in detail. In addition, complexities like rapid and scalable processing, onsite repair, and minimal environmental effects are also covered along with the appropriateness of advanced polymer composites for structural applications in automotive, aviation and marine industries. This book will be an indispensable resource for scientists, engineers, physicists and chemists who are interested in the preparation, applications and repair analysis of bio-based composites and nano-composites for different types of applications. The composites repair process is extremely complex, hence it is essential to have a comprehensive understanding of damage mechanisms to apply the most suitable repair technique. Damage assessment using onsite inspection, e.g., NDT, THz techniques and the automated repair process for reliability and repeatability, are vital parameters when executing bonded composite repair. Furthermore, overall integrity and structural health monitoring of composites repair is also necessary. Features detailed information on damage detection, failure analysis and repair of advanced bio-polymer composites Emphasizes biocompatibility, degradation and recyclability of these materials Features key chapters on molecular dynamics, multi-scale modeling and self-healing Presents a roadmap for materials selection, processing and industrial utilization for a broad range of applications

## Biopolymeric Nanomaterials

### Fundamentals and Applications

*Elsevier* **Biopolymeric Nanomaterials: Fundamentals and Applications** outlines the fundamental design concepts and emerging applications of biopolymeric nanomaterials. The book also provides information on emerging applications of

biopolymeric nanomaterials, including in biomedicine, manufacturing and water purification, as well as assessing their physical, chemical and biological properties. This is an important reference source for materials scientists, engineers and biomedical scientists who are seeking to increase their understanding of how polymeric nanomaterials are being used for a range of biomedical and industrial applications. Biopolymeric nanomaterials refer to biocompatible nanomaterials, consisting of biopolymers, such as protein (silk, collagen, gelatin,  $\beta$ -casein, zein, and albumin), protein-mimicked polypeptides and polysaccharides (chitosan, alginate, pullulan, starch, and heparin). Biopolymeric nanomaterials may be used as i) delivery systems for bioactive compounds in food application, (ii) for delivery of therapeutic molecules (drugs and genes), or for (iii) tissue engineering. Provides information on the design concepts and synthesis of biopolymeric nanomaterials in biomedical and industrial applications Highlights the major properties and processing methods for biopolymeric nanomaterials Assesses the major challenges of producing biopolymeric nanomaterials on an industrial scale

## Industrial Applications of Biopolymers and their Environmental Impact

*CRC Press* **Biopolymers represent a carbon emission solution: they are green and eco-friendly with a variety of uses in biomedical engineering, the automotive industry, the packaging and paper industries, and for the development of new building materials. This book describes the various raw materials of biopolymers and their chemical and physical properties, the polymerization process, and the chemical structure and properties of biopolymers. Furthermore, this book identifies the drawbacks of biopolymers and how to overcome them through modification methods to enhance the compatibility, flexibility, physicochemical properties, thermal stability, impact response, and rigidity.**

## Handbook of Biopolymers

# Advances and Multifaceted Applications

**Biopolymers have the potential to cut carbon emissions and reduce carbon dioxide in the atmosphere. The carbon dioxide released when they degrade can be reabsorbed by plants, which makes them close to carbon neutral. Biopolymers are biodegradable and some are compostable, too. This book presents key topics on biopolymers, including their synthesis, characterization, and physiochemical properties, and discusses their applications in key areas such as biomedicine, agriculture, and environmental engineering. It will serve as an in-depth reference for the biopolymer industry--material suppliers and processors, producers, and fabricators--and engineers and scientists who are designing biopolymers or evaluating options for switching from traditional plastics to biopolymers.**

## Food biopolymers: Structural, functional and nutraceutical properties

*Springer Nature* **Food biopolymers: Structural, functional and nutraceutical properties provides valuable coverage of all major food biopolymers from plant, animal and marine sources. The text focuses on the structural characteristics of biopolymers including starch, non-starch polysaccharides, proteins and fats. A full section is dedicated to the nutraceutical potential and applications of these polymers. Further sections provide comprehensive overviews of the development of functional food products and important data on biopolymer behavior and nutraceutical potential during processing. Researchers hoping to gain a basic understanding of the techno-functional, nutraceutical potential and applications of food biopolymers will find a singular source with this text. The first section of this work focuses on the the structure, functions, bioactivity and applications of starches. The next chapters cover non-starch polysaccharides. Further sections are dedicated to proteins, lipids and oils. A detailed overview is provided for each, followed by application procedures, specifics on individual types, proteins and enzymes, and nutraceutical properties. This work can be used as a singular source for all relevant information on food biopolymers and their structural and functional properties, including their potential to increase food quality, improve shelf life, and reduce pollution and waste in the food industry.**

# Rheology of Industrial Polysaccharides: Theory and Applications

*Springer Science & Business Media* **Industrial uses of polysaccharides centre on their ability to thicken or structure many times their own weight of water, or in other words to control the rheology of hydrated systems. Until comparatively recently, however, objective characterisation of polysaccharide rheology, except in a few specialist research laboratories, was largely confined to compression of gels, simple measurements of solution viscosity, often in ill-defined geometries, and imitative tests intended to reflect product performance in specific areas of end-use. Several factors have combined to bring a wider range of rheological techniques into common use. One is the increasing practical importance of systems that cannot adequately be described as solids or liquids, such as 'weak gels' and spreadable pastes. In parallel, routine characterisation of such systems has become economically feasible with the development of a new generation of comparatively inexpensive computer-controlled instruments. There has also been a change of emphasis from phenomenological description of product texture towards the use of rheological measurements to probe the underlying molecular and supramolecular structures and the processes by which they are formed. As a result, even the most pragmatic producers and users of industrial polysaccharides are probably now familiar with terms such as creep compliance, stress overshoot and the ubiquitous  $G'$  and  $G''$ , although perhaps not fully understanding their precise meaning or practical significance. A definitive text giving a rigorous description of the rheological approaches relevant to polysaccharide systems is therefore appropriate and timely. Romano Lapasin and Sabrina Priel are to be congratulated for tackling the daunting but worthwhile task of producing such a volume.**

## Marine Polysaccharides

## Food Applications

*CRC Press* **Increased public awareness of the importance of healthy living presents new challenges for the commercial food processing sector. The industry is always on the hunt for novel and safe additives with functional properties that**

can be used to impart healthy and appealing properties to foods. While the ocean is known as a conventional source of fish proteins and lipids, it is yet to be tapped as a source of polysaccharides. A clear exposition on how these resources can be developed, *Marine Polysaccharides: Food Applications* compiles recent data on the food applications of marine polysaccharides from such diverse sources as fishery products, seaweeds, microalgae, microorganisms, and corals. The book begins with discussions on the isolation of polysaccharides from marine sources and their properties, particularly those important from a food technology point of view. It then focuses on the actual food applications of these compounds and concludes with a brief examination of biomedical applications. The author presents an overview of the general functional properties of polysaccharides, including their structure; their hydration, gelation, emulsification, and rheological properties; and interactions among themselves and with other food components such as proteins that are relevant to food processing. He then explores the isolation and food-related properties of various marine polysaccharides, use of these polysaccharides in food product and biopackaging, recent developments in composite films and nanotechnology, and safety and regulatory issues. While there are many books available on polysaccharides, few address the applications of marine polysaccharide food product development. Written from a realistic, practical point of view avoiding technical jargon, this book highlights the ocean not as a conventional source of fish protein and lipids, but as a major supplier of versatile carbohydrates that can have diverse food applications.

## Marine Skeletal Biopolymers and Proteins, and Their Biomedical Application

*Mdpi AG* This book covers recent trends in all aspects of basic and applied scientific research on marine skeletal proteins and biopolymers (e.g., chitin, collagen), and their derivatives. Some recent innovations of marine proteins have been incorporated in this book that could be potentially applied in scientific and industrial research. Due to their broad array of biological functions in biopolymer- and protein-based drugs, such as anticancer, antimicrobial, bone tissue regeneration, antioxidant, and anti-aging functions, bioactive skeletal proteins and biopolymers have recently attracted a great amount of interest in the pharmaceutical, nutraceutical, and cosmeceutical industries (including anti-aging drugs).

# Novel Applications of Marine Biopolymers

April 13, 1989, Cambridge, Massachusetts

## Engineering Biopolymers

## Markets, Manufacturing, Properties, and Applications

**This book is unique in its focus on market-relevant bio/renewable materials. It is based on comprehensive research projects, during which these materials were systematically analyzed and characterized. For the first time the interested reader will find comparable data not only for biogenic polymers and biological macromolecules such as proteins, but also for engineering materials. The reader will also find valuable information regarding micro-structure, manufacturing, and processing-, application-, and recycling properties of biopolymers.**

## Marine Biomaterials

## Therapeutic Potential

*Springer Nature* **This book provides updated information on marine-based biomedical carriers and their therapeutic potential. Marine biomaterials and bio-based carriers show wide application in pharmaceutical and biomedical fields to deliver small and large molecules. Biomaterial-based composites, scaffolds, or matrix systems are sound systems for controlled and prolonged drug release in target sites and control the premature release of drugs or bioactive compounds. This book discusses essential topics such as the therapeutic potential of marine collagen, management of bone disorders, gene delivery, natural marine compounds in immunomodulation, theranostic applications, tissue engineering, and regeneration. It also describes the use of marine biopolymers in cancer therapy. Different chapters**

describe the tissue engineering techniques to develop these carriers. Marine biomaterial-based systems are popular for tissue engineering and biomedical imaging. This book is ideal for industry experts, students, and researchers in pharmaceutical sciences and pharmacology.

## Advanced Green Materials

# Fabrication, Characterization and Applications of Biopolymers and Biocomposites

*Woodhead Publishing* **Advanced Green Materials: Fabrication, Characterization and Applications of Biopolymers and Biocomposites** looks at their extraction, purification, modification, and processing for various industrial, biomedical, pharmaceutical, and construction applications. The book comprehensively summarizes recent technical research accomplishments in natural materials and discusses various aspects of natural materials from a chemistry/engineering point of view. The book is unique with contributions from experts working on hybrid biopolymers and bio-composites, bioactive and biodegradable materials, bio-inert polymers and composites, natural polymer and composites, and metallic natural materials. The book will be a useful reference for scientists, academicians, research scholars, and biotechnologists. Advanced biocomposite materials continue to become increasingly popular and important for a broad range of different science and engineering applications. In the race to exploit the unique mechanical, thermal, and electrical properties of these materials, researchers must also address new challenges to predict, understand, and manage the potentially adverse effects they could have on the environment and human lives. The book describes recent developments and applications of biopolymers and biocomposites for applications in various industrial fields. Chapters include original research and the latest reviews in similar fields. Biopolymers and biocomposites occupy an exceptional position in the exciting new world of novel biomaterials. Considering their sustainability, non-toxic properties, and their ability to have tailored properties and functions, they should be considered as a smart candidate in the advancement of biomaterials technology. Covers all types of biopolymers and advanced industrial applications, from packaging to biomedical therapeutics Discusses the shift from research to industrial large-scale application of biopolymers and biocomposites Emphasizes new strategic trends, such as bio-based and biodegradable additives for

bioplastics, PHAs, new lignin-based biopolymers, and new polymers based on terpenes and biosensor applications

## Seaweed Polysaccharides

### Isolation, Biological and Biomedical Applications

*Elsevier Seaweed Polysaccharides: Isolation, Biological, and Biomedical Applications* examines the isolation and characterization of algal biopolymers, including a range of new biological and biomedical applications. In recent years, significant developments have been made in algae-based polymers (commonly called polysaccharides), and in biomedical applications such as drug delivery, wound dressings, and tissue engineering. Demand for algae-based polymers is increasing and represent a potential—very inexpensive—resource for these applications. The structure and chemical modification of algal polymers are covered, as well as the biological properties of these materials - including antithrombic, anti-inflammatory, anticoagulant, and antiviral aspects. Toxicity of algal biopolymers is also covered. Finally, the book introduces and explains real world applications of algal-based biopolymers in biomedical applications, including tissue engineering, drug delivery, and biosensors. This is the first book to cover the extraction techniques, biomedical applications, and the economic perspective of seaweed polysaccharides. It is an essential text for researchers and industry professionals looking to work with this renewable resource. Provides comprehensive coverage of the research currently taking place in biomedical applications of algae biopolymers Includes practical guidance on the isolation, extraction, and characterization of polysaccharides from sustainable marine sources Covers the extraction techniques, biomedical applications, and economic outlook of seaweed polysaccharides

## Polymers for Food Applications

*Springer* 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.

# Synthesis and Applications of Biopolymer Composites

*MDPI* This book, as a collection of 17 research articles, provides a selection of the most recent advances in the synthesis, characterization, and applications of environmentally friendly and biodegradable biopolymer composites and nanocomposites. Recently, the demand has been growing for a clean and pollution-free environment and an evident target regarding the minimization of fossil fuel usage. Therefore, much attention has been focused on research to replace petroleum-based commodity plastics by biodegradable materials arising from biological and renewable resources. Biopolymers—polymers produced from natural sources either chemically from a biological material or biosynthesized by living organisms—are suitable alternatives for addressing these issues due to their outstanding properties, including good barrier performance, biodegradation ability, and low weight. However, they generally possess poor mechanical properties, a short fatigue life, low chemical resistance, poor long-term durability, and limited processing capability. In order to overcome these deficiencies, biopolymers can be reinforced with fillers or nanofillers (with at least one of their dimensions in the nanometer range). Bionanocomposites are advantageous for a wide range of applications, such as in medicine, pharmaceuticals, cosmetics, food packaging, agriculture, forestry, electronics, transport, construction, and many more.

# Handbook of Functionalized Nanomaterials for Industrial Applications

*Elsevier* Functionalized nanomaterials have extremely useful properties, which can outperform their conventional counterparts because of their superior chemical, physical, and mechanical properties and exceptional formability. They are being used for the development and innovation in a range of industrial sectors. However, the use of functionalized nanomaterials is still in its infancy in many industrial settings. Functionalized nanomaterials have the potential to create cheaper and more effective consumer products and industrial processes. However, they also could have adverse effects on the environment, human health, and safety, and their sustainability is questionable, if used incorrectly. This book discusses the opportunities and challenges of using functionalized nanomaterials in a variety of major industrial sectors. Handbook of Functionalized Nanomaterials for Industrial Applications provides a concise summary of the

major applications of functionalized nanomaterials in industry today. It covers the enhancements in industrial techniques and processes, due to functionalized nanomaterials, showing how they substantially improve the performance of existing procedures, and how they can deliver exciting consumer products more cheaply. Emphasis is given to greener approaches, leading to more sustainable products and devices. The legal, economical, and toxicity aspects of functionalized nanomaterials are also discussed in detail.

## Biopolymers and Biomaterials

*CRC Press* Biopolymers are attracting immense attention of late because of their diverse applications that can address growing environmental concerns and energy demands. The development of various biomaterials creates significant advancements in the medical field as well, and many biopolymers are used for the fabrication of biomaterials. Together, biopolymers and biomaterials create great potential for new materials, applications, and uses. This new volume, *Biopolymers and Biomaterials*, covers the science and application of biopolymers and biomaterials. It presents an array of different studies on biopolymers and biomaterials, along with their results, interpretation, and the conclusions arrived at through investigations. It includes biopolymer synthesis, their characterizations, and their potential applications. The book begins with an explanation of the different biopolymers used in the textile industry, their advantages and disadvantages, and their applications.

## Marine Biotechnology, Revealing an Ocean of Opportunities

*Frontiers Media SA*

## Polysaccharides

# Properties and Applications

*John Wiley & Sons* 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.

## Chitin, Chitosan, Oligosaccharides and Their Derivatives

### Biological Activities and Applications

*CRC Press* Biopolymers found in marine animals and plants offer tremendous, largely untapped pharmaceutical potential. Research shows that these biopolymers can be used to combat various infectious as well as inflammatory, oxidative, and carcinogenic factors. **Chitin, Chitosan, Oligosaccharides and Their Derivatives: Biological Activities and Applications** covers the key aspects of these therapeutically valuable biopolymers and their derivatives, namely, their properties, sources, production, and applications in food science and technology as well as biological, biomedical, industrial, and agricultural fields. Contains more than 100 Tables & Figures and more than 800 References Written by 40 international contributors who are leading experts in the field of natural biomaterials, this book provides an overview of the sources and production of chitin and chitosan derivatives. It also covers their: Physical and chemical aspects Structural modifications for biomedical applications Biological activities, in particular, antimicrobial, anti-inflammatory, antioxidant, antihypertensive, anticancer, and antidiabetic activities Biomedical applications, including their possible implications as drug, vaccine, and gene carriers Industrial and agricultural applications With their wide range of applications, the world is looking to biopolymers to serve as the basis for functional food- and drug development. This book is an important resource for those leading this effort.

# Biopolymers

## Recent Updates, Challenges and Opportunities

*Springer Nature*

### Handbook of Composites from Renewable Materials, Polymeric Composites

*John Wiley & Sons* **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.

## Seaweed Biotechnology

# Biodiversity and Biotechnology of Seaweeds and Their Applications

*CRC Press* **Seaweeds are known for their rich bioactive compounds, which promote health in human beings and are good for the ecosystem as well. They are also natural resources that are a major source of raw material for different industries. There are still undiscovered and unexploited compounds synthesized by seaweeds that may have potential applications in the pharmaceutical, nutraceutical, food, and cosmetics industries. This book serves as a comprehensive knowledge source for the predominant roles of seaweeds in various sectors, particularly in the areas of health, environment, and agriculture. It explores the diverse biodiversity aspects of seaweeds and their derivatives. The book critically reviews the present industrial challenges to investigate the novel compounds synthesized by seaweeds and their unique characteristics and benefits. The volume covers the various biodiversity attributes of tropical seaweeds, their cultivation and bioactive compounds, and the diverse agricultural and biomedical applications of new seaweed derivatives. The authors also discuss the current challenges, emerging markets, and latest developments in extracting the useful biomolecules from seaweeds as well as the role of seaweeds in food security and environmental mitigation. With chapters written by experts and professionals in the field, this volume, *Seaweed Biotechnology: Biodiversity and Biotechnology of Seaweeds and Their Applications*, provides a deep understanding of the biodiversity of seaweeds around the world and their industrial, biomedical, and environmental applications.**

# Alginates

## Recent Uses of This Natural Polymer

*BoD - Books on Demand* **Alginates are polysaccharides found in both the intercellular matrix of brown algae and extracellularly covering some species of bacteria. Alginate varies in composition of the algae from 20% to 60% dry matter, but on average brown algae species has 40% alginate. Alginate from brown algae occurs as gels containing sodium, calcium, strontium, magnesium, and barium ions. They are widely used by the food industry, giving foods texture properties such as thickening, adhesion, emulsification, gelling, or fullness. This book covers the latest uses of this phycocolloid in the pharmaceutical, medical, and technological fields, namely bioink for 3D bioprinting in tissue engineering and regenerative medicine, and the application of artificial intelligence in modern healthcare systems.**

## Products and Applications of Biopolymers

*BoD - Books on Demand* **It is interesting to consider that biopolymers are by no means new to this world. It is only because of our fascination with petrochemical products that these wonderful materials have been neglected for so long. Today we face a different challenge. Environmental pressure is pushing away from synthetic or petro-chemically derived products, while economic factors are pulling back from often more expensive "green" options. This book presents two aspects of biopolymers; potential products and some applications of biopolymers covering the current relevance of biopolymers.**

## Natural Polymers

## Industry Techniques and Applications

*Springer* **This book introduces the most recent innovations in natural polymer applications in the food, construction, electronics, biomedical, pharmaceutical, and engineering industries. The authors provide perspectives from their**

respective range of industries covering classification, extraction, modification, and application of natural polymers from various sources in nature. They discuss the techniques used in analysis of natural polymers in various systems incorporating natural polymers as well as their intrinsic properties.

# Handbook of Composites from Renewable Materials, Nanocomposites Advanced Applications

*John Wiley & Sons* **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 nanometals; 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.

## Biopolymers for Medical Applications

*CRC Press* This book presents an experimental and computational account of the applications of biopolymers in the field of medicine. Biopolymers are macromolecules produced by living systems, such as proteins, polypeptides, nucleic acids, and polysaccharides. Their advantages over polymers produced using synthetic chemistry include: diversity, abundance, relatively low cost, and sustainability. This book explains techniques for the production of different biodevices, such as scaffolds, hydrogels, functional nanoparticles, microcapsules, and nanocapsules. Furthermore, developments in nanodrug delivery, gene therapy, and tissue engineering are described.

## Biological Activities and Application of Marine Polysaccharides

*BoD - Books on Demand* Marine organisms have been under research for the last decades as a source for different active compounds with various biological activities and application in agriculture, pharmacy, medicine, environment, and industries. Marine polysaccharides from these active compounds are used as antibacterial, antiviral, antioxidant, anti-inflammation, bioremediations, etc. During the last three decades, several important factors that control the production of phytoplankton polysaccharides have been identified such as chemical concentrations, temperature, light, etc. The current book includes 14 chapters contributed by experts around the world; the chapters are categorized into three sections: Marine Polysaccharides and Agriculture, Marine Polysaccharides and Biological Activities, and Marine Polysaccharides and Industries.

# Recent Advances in Biopolymers

*BoD - Books on Demand* This book contains 10 Chapters divided into three Sections. Section A covers synthesis of biopolymers. Lignocellulosic feedstock contains cellulose, hemicellulose, and lignin, which are used for synthesis of biopolymers. Polymer-coated noble metal nanoparticles are used in nanobiomedicine and fundamental biomaterials. Section B describes applications of biopolymers in biomedical, antimicrobial, industrial, nanotechnology, laser-based thin films, and regenerative medicines. Section C is dedicated for advancement and engineering in biopolymers for personal protective garments, equipments, membrane separation processes, purifications, and new generation of high-performance biomaterials. A new numerical-cum-graphical method called TI2BioP (Topological Indices to BioPolymers) has been developed to estimate topological indices (TIs) from two-dimensional (2D) graphical approaches for the natural biopolymers DNA, RNA, and proteins.

## Biomass, Biopolymer-Based Materials, and Bioenergy

### Construction, Biomedical, and other Industrial Applications

*Woodhead Publishing* **Biomass, Biopolymer-Based Materials and Bioenergy: Construction, Biomedical and Other Industrial Applications** covers a broad range of material types, including natural fiber reinforced polymer composites, particulate composites, fiberboard, wood fiber composites, and plywood composite that utilize natural, renewable and biodegradable agricultural biomass. In terms of bioenergy, the authors explore not only the well-known processing methods of biofuels, but also the kinetics of biofuels production pathways, a techno-economic analysis on biomass gasification, and biomass gasification with further upgrading into diesel additives and hybrid renewable energy systems for power generation. Further chapters discuss advanced techniques for the development of biomass-based composites, biopolymer-based composites, biomass gasification, thermal kinetic design and techno-economic analysis of biomass gasification. By introducing these topics, the book highlights a totally new research theme in biopolymer-

based composite materials and bioenergy. Covers a broad range of different research fields, including biopolymer and natural fiber reinforcement used in the development of composites Demonstrates key research themes in materials science and engineering, including materials processing, polymer science, biofuel processing, and thermal and kinetic studies Presents valuable information for those working in research and development departments, and for graduate students (Masters and PhDs)

## Biopolymers from Renewable Resources

*Springer Science & Business Media* The beneficial aspects of utilizing polymers from renewable resources, when considering synthesis, processing, disposal, and overall material lifecycle issues, suggests that this will continue to be an important and growing area of interest. The focus on greener chemistries in industry can be in part satisfied by exploring the range of polymers available from Nature. The information for each type of polymer includes aspects of synthesis, processing and properties. The wide range of polymers and their properties, including polyamides, polysaccharides, polyesters and polyphenols, among others, illustrates this diversity of materials. The reader will have a single volume which provides a resource from which to gain initial insights into this diverse field and from which key references and contacts can be drawn.