

Edited by Jim Huang, Peter R. Chang,  
Ning Lin, and Alain Dufresne

# Polysaccharide-Based Nanocrystals

Chemistry and Applications



Chemical Industry Press

# Polysaccharide Based Nanocrystals Chemistry And Applications

**JA Banks**



## **Polysaccharide Based Nanocrystals Chemistry And Applications:**

Polysaccharide-Based Nanocrystals Jin Huang, Peter R. Chang, Ning Lin, Alain Dufresne, 2015-03-09 Polysaccharide nanocrystals are an emerging green nanoinredient nanomaterial with high crystallinity obtained by acid hydrolysis of biomass based polysaccharides are of scientific and economic significance owing to their abundance biodegradation potential and fascinating functional performance This versatile class of materials can be used in nanocomposites such as rubber or polyester and in functional materials such as drug carriers bio inspired mechanically adaptive materials or membranes to name but a few This book encompasses the extraction structure properties surface modification theory and mechanism of diverse functional systems derived from polysaccharide nanocrystals This highly sought after trendy book is currently the only monograph devoted to the most current knowledge pertaining to this exciting subject area It is ideal for researchers and stakeholders who wish to broaden and deepen their knowledge in the fast moving and rapidly expanding R D field of polymeric materials

**Polysaccharide-based Nanocrystals** Peter R. Chang, Ning Lin, Alain Dufresne, 2014 Polysaccharide nanocrystals can be derived from the renewable resources cellulose chitin or starch which makes them ideal candidates for Green Materials Science This versatile material class can be used in nanocomposites such as rubber or polyester and in functional materials such as drug carriers bio inspired mechanically adaptive materials or membranes Moreover polysaccharide based nanomaterials are environmentally friendly due to their intrinsic biodegradability With its interdisciplinary approach the book gives a thorough introduction to extraction structure properties surfac

*Sustainability of Biomass through Bio-based Chemistry* Valentin Popa, 2021-03-21 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

*Green Micro- and Nanocomposites* Sabu Thomas, Abitha V. K., Hanna J Maria, 2023-10-20 Green materials derived from renewable resources are

increasingly being advocated for sustainable development due to rising environmental consciousness waste management difficulties depleting fossil resources and rising oil prices to name a few Renewable green resources such as starch and cellulose polymers natural fibers vegetable oils wood bark cotton wool and silk have been utilized for food furniture and clothing for thousands of years They have only recently undergone a revival as one of the most cost effective alternatives to synthetic polymers in a variety of industrial applications including building and construction automotive packaging films and paper coating as well as biomedical uses The primary drawbacks of synthetic polymers such as the release of toxic gases and vapors during incineration and the difficulty in disposing of them have prompted extensive research on new green polymeric materials with special focus on the use of biopolymers derived from renewable resources for green composite applications This book gives a true reflection of the vast area of research in green composites as it has contributions from internationally recognized experts in the field of green polymer materials representing a wide range of disciplines backgrounds and expertise

*Biopolymer Grafting: Synthesis and Properties* Vijay Kumar Thakur, 2017-09-27 Biopolymer Grafting Synthesis and Properties presents the latest research and developments in fundamental of synthesis and properties of biopolymer based graft copolymers The book presents a broad overview of the biopolymer grafting process along with trends in the field It also introduces a range of grafting methods which lead to materials with enhanced properties for a range of practical applications along with the positives and limitations of these techniques The book bridges the knowledge gap between the scientific principles and industrial applications of polymer grafting This book covers synthesis and characterization of graft copolymers of plant polysaccharides functional separation membranes from grafted biopolymers and polysaccharides in alternative methods for insulin delivery Recent trends and advances in this area are discussed assisting materials scientists and researchers in mapping out the future of these new green materials through value addition to enhance their use Introduces polymer researchers to a promising rapidly developing method for modifying naturally derived biopolymers Provides a one stop shop covering synthesis properties characterization and graft copolymerization of bio based polymeric materials Increases familiarity with a range of biopolymer grafting processes enabling materials scientists and engineers to improve material properties and widen the range of potential biopolymer applications

*Handbook of Composites from Renewable Materials, Nanocomposites* Vijay Kumar Thakur, Manju Kumari Thakur, Michael R. Kessler, 2017-03-28 This unique multidisciplinary 8 volume set focuses on the emerging issues concerning synthesis characterization design manufacturing and various other aspects of composite materials from renewable materials and provides a shared platform for both researcher and industry The Handbook of Composites from Renewable Materials comprises a set of 8 individual volumes that brings an interdisciplinary perspective to accomplish a more detailed understanding of the interplay between the synthesis structure characterization processing applications and performance of these advanced materials The Handbook comprises 169 chapters from world renowned experts covering a multitude of natural polymers reinforcement fillers and biodegradable

materials Volume 7 is solely focused on the Nanocomposites Science and Fundamentals of renewable materials Some of the important topics include but not limited to Preparation characterization and applications of nanomaterials from renewable resources hydrogels and its nanocomposites from renewable resources preparation of chitin based nanocomposite materials through gelation with ionic liquid starch based bionanocomposites biorenewable nanofiber and nanocrystal investigation of wear characteristics of dental composite reinforced with rice husk derived nanosilica filler particles performance of regenerated cellulose vermiculite nanocomposites fabricated via ionic liquid preparation structure properties and interactions of the PVA cellulose composites green composites with cellulose nanoreinforcements biomass composites from bamboo based micro nanofibers synthesis and medicinal properties of polycarbonates and resins from renewable sources nanostructured polymer composites with modified carbon nanotubes organic inorganic nanocomposites derived from polysaccharides natural polymer based nanocomposites cellulose whisker based green polymer composites poly lactic acid nanocomposites reinforced with different additives nanocrystalline cellulose halloysite based bionanocomposites nanostructured composites based on biodegradable polymers and silver nanoparticles starch based biomaterials and nanocomposites green nanocomposites based on PLA and natural organic fillers and chitin and chitosan based nanocomposites

**Handbook of Nanocellulose and Cellulose Nanocomposites** Hanieh Kargarzadeh, Ishak Ahmad, Sabu Thomas, Alain Dufresne, 2017-03-02 An up to date and comprehensive overview summarizing recent achievements the state of the art and trends in research into nanocellulose and cellulose nanocomposites Following an introduction this ready references discusses the characterization as well surface modification of cellulose nanocomposites before going into details of the manufacturing and the self assembly of such compounds After a description of various alternatives including thermoplastic thermosetting rubber and fully green cellulose nanocomposites the book continues with their mechanic and thermal properties as well as crystallization and rheology behavior A summary of spectroscopic and water sorption properties precedes a look at environmental health and safety of these nanocomposites With its coverage of a wide variety of materials important characterization tools and resulting applications this is an essential reference for beginners as well as experienced researchers

**Handbook of Nanocelluloses** Ahmed Barhoum, 2022-07-15 This Handbook covers the fundamental aspects experimental setup synthesis properties and characterization of different nanocelluloses It also explores the technology challenges of nanocelluloses and the emerging applications and the global markets of nanocelluloses based systems In particular this book Covers the history of nanocelluloses types and classifications fabrication techniques critical processing parameters physical and chemical properties surface functionalization and other treatments to allow practical applications Covers all recent aspects of nanocelluloses technologies from experimental set up to industrial applications Includes new physical chemical and biological techniques for nanocelluloses fabrication in depth treatment of their surface functionalization and characterization Discusses the unique properties of nanocelluloses that can

be obtained by modifying their diameter morphology composition and dispersion in other materials Discusses the properties and morphology of several kinds of dispersion in polymeric materials such as micro nanofiberlased cellulose cellulose nanofibers cellulose nanocrystals amorphous cellulose nanoparticles and hybrid cellulose nanomaterials Presents the different techniques for dispersion and self assembly of polymeric materials critical parameters of synthesis modelling and simulation and characterization methods Highlights a wide range of emerging applications of nanocelluloses e g drug delivery tissue engineering medical implants medical diagnostics and therapy biosensors catalysis energy harvesting energy storage water waste treatment papermaking textiles construction industry automotive aerospace and many more Provides an outlook on the opportunities and challenges for the fabrication and manufacturing of nanocelluloses in industry Provides an in depth look at the nature of nanocelluloses in terms of their applicability for industrial uses Provides in depth insight and review on most recent types of nanocelluloses based systems of unique structures and compositions Highlights the challenges and interdisciplinary perspective of nanocelluloses based systems in science biology engineering medicine and technology incorporating both fundamentals and applications Demonstrates how cutting edge developments in nanofibers translate into real world innovations in a range of industry sectors This Handbook is a valuable reference for materials scientists biologists physicians chemical biomedical manufacturing and mechanical engineers working in R D industry and academia who want to learn more about how nanocelluloses based systems are commercially applied

**Advances in Physicochemical Properties of Biopolymers (Part 1)** Martin Masuelli, Denis Renard, 2017-07-05 The last two decades have seen a number of significant advances in the methodology for evaluating the molecular weight distributions of polydispersed macromolecular systems in solution at the molecular level This reference presents reviews on the progress in different analytical and characterization methods of biopolymers Readers will find useful information about combinations of complex biopolymer analysis such as chromatographic or membrane based fractionation procedures combined with multiple detectors on line multi angle laser light scattering or MALLS Key topics include refractive index UV Vis absorbance and intrinsic viscosity detection systems advances in SEC MALLS size exclusion chromatography coupled to multi angle laser light scattering and FFF MALLS field flow fractionation coupled on line to MALLS HPSEC A4F MALLS matrix assisted laser desorption ionization MALDI electrospray ionization ESI mass spectrometry nuclear magnetic resonance NMR spectroscopy This reference is intended for students of applied chemistry and biochemistry who require information about biopolymer analysis and characterization

**Gold Nanoparticles, Nanomaterials and Nanocomposites** S. K. Khadheer Pasha, Kalim Deshmukh, Chaudhery Mustansar Hussain, 2024-11-30 Gold Nanoparticles Nanomaterials and Nanocomposites Science Technology and Applications provides a comprehensive review of recent research developments in the synthesis processing functionalization characterization and properties of gold nanoparticles Au NPs for a broad range of different applications Emphasis is placed on the fundamental chemistry different synthesis approaches strategies for stabilization and control of

shape size and morphology surface chemistry and physicochemical characteristics as well as surface functionalization and applications of Au NPs The book also covers important topics such as biocompatibility biodegradability cytotoxicity and the health and environmental impact of Au NPs The book will be a valuable reference resource for academic and industrial researchers working in the fields of materials science and engineering nanomaterials polymer composites and biomedical engineering It will help them to find solutions to both fundamental and applied problems associated with this important research field and it will also enable new researchers to become acquainted with this field within a short period Covers current and emerging research trends in the synthesis processing functionalization characterization and performance of gold nanoparticles Au NPs Includes comprehensive coverage of a broad range of applications such as sensing and biosensing electronic devices electro and photocatalysis solar cells supercapacitors point of care diagnostic tools and devices drug delivery and controlled drug release antimicrobial antifungal and antiviral applications cancer diagnostics and therapy tissue engineering bioimaging as well as for bioremediation and pharmaceutical applications Contains contributions from leading researchers across the globe from academic industrial government and private research institutions

Biocompatible Hybrid Oxide Nanoparticles for Human Health Inna V. Melnyk, Miroslava Vaclavikova, Gulaim A. Seisenbaeva, Vadim G. Kessler, 2019-06-30 Biocompatible Hybrid Oxide Nanoparticles for Human Health From Synthesis to Applications explores the synthesis structure properties and applications of functionalized oxide nanoparticles The book shows the applications of materials depending on their composition and structure with a focus on silicon titanium and iron oxides each of which was chosen because of their unique features including silica because it is chemically resistant to most organic solvents harmless to living organisms can thicken flowable formulations and increase the strength of materials titania for its unique chemical optical electrophysical and bactericidal properties and iron containing materials because they possess important magnetic properties Shows how oxide nanoparticles are being used to solve current problems in the fields of environmental protection medicine and in the creation of smart materials Includes case studies that explore the major characteristics and applications of silica titania and iron oxide nanomaterials Discusses the use of biocompatible oxide nanostructures in the development of new sensing technology

**Bioinspired and Biomimetic Polymer Systems for Drug and Gene Delivery** Zhongwei Gu, 2015-03-09 Here front line researchers in the booming field of nanobiotechnology describe the most promising approaches for bioinspired drug delivery encompassing small molecule delivery delivery of therapeutic proteins and gene delivery The carriers surveyed include polymeric proteinaceous and lipid systems on the nanoscale with a focus on their adaptability for different cargoes and target tissues Thanks to the broad coverage of carriers as well as cargoes discussed every researcher in the field will find valuable information here

Functionalized Nanomaterials Vineet Kumar, Praveen Guleria, Nandita Dasgupta, Shivendu Ranjan, 2021-07-28 Nanomaterials contain some unique properties due to their nanometric size and surface functionalization Nanomaterial functionalization also affects their compatibility to

biocompatibility and toxicity behaviors environment and living organism This makes functionalized nanomaterials a material with huge scope and few challenges This book provides detailed information about the nanomaterial functionalization and their application Recent advancements challenges and opportunities in the preparation and applications of functionalized nanomaterials are also highlighted This book can serve as a reference book for scientific investigators doctoral and post doctoral scholars undergrad and grad This book is very useful for multidisciplinary researchers industry personnel s journalists and policy makers Features Covers all aspects of Nanomaterial functionalization and its applications Describes and methods of functionalized nanomaterials synthesis for different applications Discusses the challenges recent findings and cutting edge global research trends on functionalization of nanomaterials and its applications It discusses the regulatory frameworks for the safe use of functionalized nanomaterials It contains contributions from international experts from multiple disciplines      *Polysaccharide based Nano-Biocarrier in Drug Delivery* Tapan Kumar Giri,Bijaya Ghosh,2018-09-03

This book discusses various fundamental aspects of polysaccharide based nano biocarrier drug delivery systems and its application in the delivery of small molecules proteins peptides oligonucleotides and genes It also discusses advances in drug delivery systems in treatment of cancer cardiovascular pulmonary and infectious diseases      **Polysaccharide Based**

**Hybrid Materials** Carla Vilela,Ricardo João Borges Pinto,Susana Pinto,Paula Marques,Armando Silvestre,Carmen Sofia da Rocha Freire Barros,2018-09-26 This brief explores polysaccharides the most abundant family of naturally occurring polymers and explains how they have gained considerable attention in recent decades as a source of innovative bio based materials The authors present a range of material including an extensive array of polysaccharide hybrid nanomaterials with distinct applications The most recent knowledge regarding polysaccharide based hybrid nanomaterials with metal and metal oxide nanoparticles NPs carbon nanotubes and graphene is presented as well as the main polysaccharides namely cellulose chitin and chitosan starch and their most relevant derivatives The book features a description of important production methodologies properties and applications of these types of hybrids      *Biopolymer-Based Metal Nanoparticle Chemistry for Sustainable Applications* Mahmoud Nasrollahzadeh,2021-03-05 Biopolymers are becoming an increasingly important area of research as traditional chemical feedstocks run low and concerns about environmental impacts increase One area of particular interest is their use for more sustainable development of metal nanoparticles Biopolymer Based Metal Nanoparticle Chemistry for Sustainability Applications Volume 2 reviews key uses of biopolymers and biopolymer based metal nanoparticles for a range of key sustainability focused applications After providing contextual examples of applications across the fields of food science biomedicine and biochemistry the book goes on to explore further sustainability focused applications of Biopolymer Based Metal Nanoparticles in such important areas as catalysis environmental science biosensing and energy Provides an overview of biopolymer based metal nanoparticles for a wide range of applications Provides technological details on the synthesis of natural polymer based metal nanoparticles Explores the role of biopolymer based

metal nanoparticles for more sustainable catalytic processes      **Polysaccharide Building Blocks** Youssef Habibi, Lucian A. Lucia, 2012-04-17 This book is an archival reference for the evolving field of biomaterials and their applications in society focusing on their composition properties characterization chemistry and applications in bioenergy chemicals and novel materials and biomaterials It has broad appeal due to the recent heightened awareness around bioenergy and biomass as potential replacements for petroleum feedstocks The book is divided into three parts cellulose based biomaterials chitin and chitosan biomaterials and hemicelluloses and other polysaccharides Each chapter addresses a separate biomaterial discussing its chemical physical and biological attributes and hones in on each compound's intrinsic tunability for numerous chemical transformations In the current quest for a green economy and resources this book will help inspire scientists towards novel sources for chemicals materials and energy in the years to come      **Functional Starch and Applications in Food** Zhengyu Jin, 2018-09-19 This book discusses functional starch and its applications in food focusing on starches with possible health benefits or novel applications Covering slowly digested starch resistant starch porous starch starch microemulsions microcrystalline starch and noncrystallization starch and their applications this book provides a valuable reference for graduate students and research professionals in the food and chemical industries      **Food Hydrocolloids** Yapeng Fang, Hongbin Zhang, Katsuyoshi Nishinari, 2021-05-18 The book introduces the definition classification source and structure of hydrocolloids and provides a comprehensive description of their functionalities and food related applications The emphasis is put on the basic concepts and mechanisms underlying functionalities and the new developments in fundamental knowledge and practice The book would be useful for students or professionals working in the fields of food science technology and biopolymers etc It would help to organize hydrocolloids knowledge in a more systematic framework and enlighten further profound investigations      **Advances in Physical Organic Chemistry**, 2024-11-12 Advances in Physical Organic Chemistry Volume 58 is the latest release in this definitive resource for authoritative reviews of work in physical organic chemistry It aims to provide a valuable source of information not only for physical organic chemists applying their expertise to both novel and traditional problems but also for non specialists across diverse areas Its hallmark is quantitative molecular level understanding of phenomena across a diverse range of disciplines Sample chapters in this new release include Coacervate formation and the partitioning of molecules into these phases and The area of artificial signal transduction systems Provides the only regularly published resource for reviews in physical organic chemistry Includes chapters written by authoritative experts

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