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# Green Polyurethanes and Biocomposites

Molecular Design and Characterization

NOVA

# Green Polyurethanes Biocomposites Molecular Characterization

**Samy A. Madbouly, Chaoqun Zhang**



## **Green Polyurethanes Biocomposites Molecular Characterization:**

**Green Polyurethanes and Biocomposites** Hyoe Hatakeyama, Tatsuko Hatakeyama, 2015-12 Over the last ten years circumstances surrounding nature friendly materials have changed not only in research fields but also in practical fields all over the world Biomass conversion is one of the major scientific projects In order to develop the utilisation of residual bioresources the authors research strategy is as follows 1 renewable plant resources are used as starting material for the preparation of industrial products 2 industrial residues of plant resources are utilised as they are without further modification as starting materials while taking into consideration cost performance 3 a certain amount of contaminants is accepted as long as it does not disturb the chemical reaction or characteristic properties of products 4 however necessary pre treatments such as dehydration are carried out in order to proceed with the chemical reaction 5 the physical properties of obtained products are similar or better than those derived from petroleum and currently sold on the market and 6 considering practical application the processing facilities used in the present stage of production can be used without any modification Based on the above principles this book describes the results of work on green polyurethanes derived from residual materials obtained from small and large scale industries over a wide area including Costa Rica Colombia Indonesia Japan Malaysia New Zealand Russia Sweden the UK and the USA In Chapter One the general background for conversion of plant residues to useful green polymers is introduced In Chapter Two preparation methods of polyurethanes and biocomposites derived from plant resources such as lignin molasses plant oil and glycerol are described The focus is on the detailed procedure of synthesis and processing of bio polyurethane and biocomposites in laboratory scale with a traceable note of chemical compounds and experimental conditions To target practical applications cost performance is also taken into consideration in the above preparation conditions In Chapter Three characterisation of physical properties such as thermal mechanical and spectroscopic properties of polyurethanes and biocomposites using analytical apparatuses found in standard laboratories is described Characteristic features of plant components which affect the molecular relaxation phenomena are mentioned Long term properties are predicted based on thermal and mechanical data In Chapter Four polyurethanes derived from plant resources such as lignin molasses plant oil and glycerol obtained from various countries are introduced In Chapter Five biocomposites filled with various plant materials such as microcrystalline cellulose coffee grounds and wood powder are described Chapter Six presents a brief conclusion

**Chitosan** Khalid Mahmood Zia, 2025-05-26 This book highlights the latest advances and novel technologies for the preparation functionalization and green derivitization of chitosan nanoparticles The modification biomedical applications regulatory status and clinical trials of chitosan and its derivatives are also presented Effective and innovative strategies enable increased influence on final characteristics stability and sustainability of chitosan nanoparticles The book begins by examining chitosan nanoparticles preparation and functionalization of the chitosan derivatives This is followed by in depth coverage of green derivatization and modification of

chitosan nanoparticles CSNPs regulatory status and clinical trials of chitosan and derivatives characterization techniques for the chitosan nanoparticles and derivatives along with key applications of modified CSNPs in water food and agriculture industries and biomedical applications including chemotherapy The final chapters provide detailed discussions on chitosan as tools to combat COVID 19 and recent challenges and future prospectus of green derivatized chitosan nanoparticles

*Handbook of Composites from Renewable Materials, Physico-Chemical and Mechanical Characterization* Vijay Kumar Thakur, Manju Kumari Thakur, Michael R. Kessler, 2017-01-26 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 3rd volume of the Handbook is solely focused on the Physico Chemical and Mechanical Characterization of renewable materials Some of the important topics include but not limited to structural and biodegradation characterization of supramolecular PCL HAP nano composites different characterization of solid bio fillers based agricultural waste material poly ethylene terephthalate reinforced with hemp fibers poly lactic acid thermoplastic composites from renewable materials chitosan based composite materials fabrication and characterization the use of flax fiber reinforced polymer FFRP composites in the externally reinforced structures for seismic retrofitting monitored by transient thermography and optical techniques recycling and reuse of fiber reinforced polymer wastes in concrete composite materials analysis of damage in hybrid composites subjected to ballistic impacts biofiber reinforced acrylated epoxidized soybean oil AESO biocomposites biopolyamides and high performance natural fiber reinforced biocomposites impact of recycling on the mechanical and thermo mechanical properties of wood fiber based HDPE and PLA composites lignocellulosic fibers composites an overview biodiesel derived raw glycerol to value added products thermo mechanical characterization of sustainable structural composites novel pH sensitive composite hydrogel based on functionalized starch clay for the controlled release of amoxicillin preparation and characterization of biobased thermoset polymers from renewable resources influence of natural fillers size and shape into mechanical and barrier properties of biocomposites composite of biodegradable polymer blends of PCL PLLA and coconut fiber the effects of ionizing radiation packaging composite materials from renewable resources physicochemical properties of ash based geopolymer concrete a biopolymer derived from castor oil polyurethane natural polymer based biomaterials physical and mechanical properties of polymer membranes from renewable resources

Biopolymers and Composites Samy A. Madbouly, Chaoqun Zhang, 2021-10-04 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      Handbook of Composites from Renewable Materials, Polymeric Composites Vijay Kumar Thakur, Manju Kumari Thakur, Michael R. Kessler, 2017-03-27 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 6 is solely focused on the 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 wastewater treatments study of chitosan cross linking 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      Composites from the Aquatic Environment Sapuan S. M., Imran Ahmad, 2023-01-13 This book provides a methodical compilation of deriving composites from the hidden treasure of the aquatic world Continuous and rapid progress in the composite industries have increased the demand for resilient economically viable and sustainable composite materials having enhanced mechanical thermal and electrical properties which better suits there respective applications If the materials organisms used for the production or conversion of composites are renewable degradable and easily and abundantly available then it gives great opportunity to the researchers to work on different options or processes to make them a viable technology This work describes the organisms and materials present in the aquatic environment for the production of composite materials Elaborating the versatile green expedients and their potential applications in the field of composites Since growing ecological and environmental

consciousness has driven efforts for development of new innovative materials for various end use applications Therefore the LCA an circular bio economy will be discussed to be efficient and sustainable This book is ideal for the students academicians researchers and industry players It also cover the present scenario applications and future perspectives of composites derived from aquatic organisms This compiled book features chapters that discuss the conversion of different materials and organisms present in aquatic environment to composite materials like micro algae seaweeds chitosan collagen agar cyanobacteria etc in a viable manner

**Natural Fiber-Reinforced Biodegradable and Bioresorbable Polymer Composites** Alan Kin-tak Lau, Ada Pui Yan Hung, 2017-02-28 Natural Fiber Reinforced Biodegradable and Bioresorbable Polymer Composites focuses on key areas of fundamental research and applications of biocomposites Several key elements that affect the usage of these composites in real life applications are discussed There will be a comprehensive review on the different kinds of biocomposites at the beginning of the book then the different types of natural fibers bio polymers and green nanoparticle biocomposites are discussed as well as their potential for future development and use in engineering biomedical and domestic products Recently mankind has realized that unless the environment is protected he himself will be threatened by the over consumption of natural resources as well as a substantial reduction in the amount of fresh air produced in the world Conservation of forests and the optimal utilization of agricultural and other renewable resources like solar wind and tidal energy have become important topics worldwide With such concern the use of renewable resources such as plant and animal based fiber reinforced polymeric composites are now becoming an important design criterion for designing and manufacturing components for a broad range of different industrial products Research on biodegradable polymeric composites can contribute to some extent to a much greener and safer environment For example in the biomedical and bioengineering fields the use of natural fiber mixed with biodegradable and bioresorbable polymers can produce joint and bone fixtures to alleviate pain in patients Includes comprehensive information about the sources properties and biodegradability of natural fibers Discusses failure mechanisms and modeling of natural fibers composites Analyzes the effectiveness of using natural materials for enhancing mechanical thermal and biodegradable properties

**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

**Polyurethane Polymers: Composites and Nanocomposites** Sabu Thomas, Janusz Datta, Jozef T. Haponiuk, Arunima Reghunadhan, 2017-08-17 Polyurethane Polymers Composites and Nanocomposites concentrates on the composites and nanocomposites of polyurethane based materials Polyurethane composites are a very important class of materials widely used in the biomedical and industrial field that offer numerous potential applications in many areas This book discusses current research and identifies future research needs in the area Provides an elaborate coverage of the chemistry of polyurethane its synthesis and properties Includes available characterization techniques Relates types of polyurethanes to their potential properties Discusses composites nanocomposites options and PU recycling

**Eco-Friendly Waterborne Polyurethanes** Ram K. Gupta, Ajay Kumar Mishra, 2022-01-24 The polyurethane industry is among the fastest growing with polyurethanes used in consumer as well as industrial sectors Waterborne polyurethanes WPU exhibit many advantages over conventional volatile organic compounds VOCs based polyurethanes and have emerged as an environmentally friendly alternative WPU offer an opportunity to use sustainable raw materials to produce environmentally sustainable polymers particularly polyols derived from vegetable oils Eco Friendly Waterborne Polyurethanes Synthesis Properties and Applications provides state of the art knowledge of the synthesis application and property enhancement of WPU Covers various types of eco friendly materials and technologies used to synthesize WPU Presents an overview and applications of WPU in several advanced research areas Provides fundamentals of synthetic processes and their chemistries for specific applications Elaborates on advanced approaches used to convert renewable resources into polymers Offers new direction to scientists researchers and students to better understand the chemistry technologies and applications Written for polymer chemists materials scientists and other

researchers and industry this book serves as a comprehensive reference for readers interested in the development and application of sustainable polymers      **Biomass with Culture and Geography** Tatsuko Hatakeyama,Hyoe Hatakeyama,2024-05-31 This book introduces biomass which is utilized all over the world based on geographical cultural and historical background It covers 18 major biomass types and several specific plants categorized into 3 groups based on their usage The present and historical background of representative materials from biomass such as cellulose lignin chitin sugar molasses amylose and other interesting natural biopolymers such as hyaluronan gum Arabic and others are introduced Furthermore characteristic features of representative and influential plants such as rice eucalyptus and oil palm are described together with historical episodes Although physicochemical characteristic properties of each material and plant have been published over many decades scarcely a comprehensive introduction on biomass together with Asian European and Latin American cultural backgrounds In this book biomass familiar to everybody s life is introduced based on scientific and cultural viewpoints It guides readers to gain background knowledge of targeting biomass to be developed as industrial resources In addition to students scientists and lecturers the book will be useful for industrial engineers both specialists in polymer science and technology and materials experts      *Nanomaterials for Energy Applications* L. Syam Sundar,Shaik Feroz,Faramarz Djavanroodi,2023-12-01 Nanomaterials for Energy Applications provides readers with an in depth understanding of advanced nanomaterials and their applications in energy generation and utilization concepts It focuses on emerging nanomaterials and applications in various energy related fields Describes nanomaterials for use in photovoltaic cells solid state lighting fuel cells electrochemical batteries electrochemical capacitors superconductors hydrogen storage and photocatalysts Focuses on commercial and economic aspects Includes case studies drawn from practical research This book is aimed at researchers advanced students and practicing engineers in the disciplines of materials mechanical electrical and related fields of engineering      *Kenaf Fibers and Composites* S. M. Sapuan,M.R. Ishak,J. Sahari,Muhammed Sanyang,2018-06-14 Kenaf fiber is gaining attention as an alternative reinforcement for composite products due to low cost reduced environmental impact and attractive mechanical properties Kenaf Fibers and Composites covers the breadth of these exciting materials from raw material preparation to application in a variety of products It discusses fiber characterization and properties how to prepare kenaf based composites and design manufacturing and applications It also covers hybrid fiber composites kenaf fiber thermosetting composites kenaf fiber thermoplastic composites kenaf fibers in various lengths and forms and arrangements such as particulates continuous roving and woven fabrics Cellulose based kenaf composites and kenaf fiber filled biopolymer composites are presented      *Fiber Reinforced Composites* Kuruvilla Joseph,Kristiina Oksman,George Gejo,Runcy Wilson,Saritha Appukuttan,2021-03-20 Polymer based fibre reinforced composites FRC s have now come out as a major class of structural materials being used or regarded as substituent s for metals in several critical components in space automotive and other industries marine and sports goods owing to their low



density strength weight ratio and fatigue strength FRC s have several commercial as well as industrial applications ranging from aircraft space automotive sporting goods marine and infrastructure The above mentioned applications of FRC s clearly reveal that FRC s have the potential to be used in a broad range of different engineering fields with the added advantages of low density and resistance to corrosion compared to conventional metallic and ceramic composites However for scientists researchers R D s to fabricate FRC s with such potential there should be careful and precise design followed by suitable process development based on properties like mechanical physical and thermal that are unique to each application Hence the last few decades have witnessed considerable research on fibre reinforced composites Fibre Reinforced Composites Constituents Compatibility Perspectives and Applications presents a widespread all inclusive review on fibre reinforced composites ranging from the different types of processing techniques to chemical modification of the fibre surface to enhance the interfacial adhesion between the matrix and fibre and the structure property relationship It illustrates how high value composites can be produced by efficient and sustainable processing methods by selecting different constituents fibres and resins Researchers in academia working in composites and accompanying areas materials characterisation and industrial manufacturers who need information on composite constituents and how they relate to each other for a certain application will find the book extremely useful when they need to make decisions about materials selection for their products Focuses on the different types of FRC s that are currently available e g from polymeric matrices to metallic and ceramic matrices from carbon fibre to different types of natural fibres and from short to long fibre reinforced their processing techniques characterization of different properties and how to improve the interfacial adhesion between an incompatible fibre and matrix and their applications Looks at crisis areas such as how to incorporate incompatible fibres and matrices together e g Non polar polypropylene matrix is not compatible with that of polar natural fibres and hence suitable surface modifications are required to make them compatible with each other along with low cost processing methods low density and high strength Uncover clarifications to both elementary and practical problems related to the fabrication of FRCs Schematic representations depicting the interaction between different fibre types and matrices will be provided in some chapters

*Polymers, Composites, Nanomaterials and Biomass Processing* Mohd Zamri Mohd Yusop, Ali Alnaser, Wanlop

Kitisatorn, 2024-12-23 Special topic volume with invited peer reviewed papers only **Value-Added Biocomposites**

Malinee Sriariyanun, Sanjay Mavinkere Rangappa, Suchart Siengchin, Hom Nath Dhakal, 2021-09-06 Value Added

Biocomposites Technology Innovation and Opportunity explores advances in research processing manufacturing and novel applications of biocomposites It describes the current market situation commercial competition and societal and economic impacts and advantages of substituting biocomposites for conventional composites including natural fibers and bioplastics

**FEATURES** Discusses manufacturing and processing procedures that focus on improving physical mechanical thermal electrical chemical and biological properties and achieving required specifications of downstream industries and customers

Analyzes the wide range of available base materials and fillers of biocomposites and bioplastics in terms of the strength and weaknesses of materials and economic potential in the market Displays special and unique properties of biocomposites in different market sectors Showcases the insight of expert scientists and engineers with first hand experience working with biocomposites across various industries Covers environmental factors life cycle assessment and waste recovery Combining technical economic and environmental topics this work provides researchers advanced students and industry professionals a holistic overview of the value that biocomposites add across a variety of engineering applications and how to balance research and development with practical results **Biomedical Index to PHS-supported Research** ,1989

Biocomposites: Design and Mechanical Performance Manjusri Misra,Jitendra Kumar Pandey,Amar Mohanty,2015-08-07 Biocomposites Design and Mechanical Performance describes recent research on cost effective ways to improve the mechanical toughness and durability of biocomposites while also reducing their weight Beginning with an introduction to commercially competitive natural fiber based composites chapters then move on to explore the mechanical properties of a wide range of biocomposite materials including polylactic polyethylene polycarbonate oil palm natural fiber epoxy polyhydroxyalkanoate polyvinyl acetate polyurethane starch flax poly propylene carbonate based biocomposites and biocomposites from biodegradable polymer blends natural fibers and green plastics giving the reader a deep understanding of the potential of these materials Describes recent research to improve the mechanical properties and performance of a wide range of biocomposite materials Explores the mechanical properties of a wide range of biocomposite materials including polylactic polyethylene polycarbonate oil palm natural fiber epoxy polyhydroxyalkanoate polyvinyl acetate and polyurethane Evaluates the potential of biocomposites as substitutes for petroleum based plastics in industries such as packaging electronic automotive aerospace and construction Includes contributions from leading experts in this field

*Dynamic Mechanical and Creep-Recovery Behavior of Polymer-Based Composites* Akarsh Verma,Naman Jain,Sanjay M. R,Danuta Matykiewicz,Suchart Siengchin,2024-01-11 Dynamic Mechanical and Creep Recovery Behaviour of Polymer Based Composites Mechanical and Mathematical Modeling covers mathematical modelling dynamic mechanical analysis and the ways in which various factors impact the creep recovery behaviour of polymer composites The effects of polymer molecular weight plasticizers cross linking agents and chemical treatment of filler material are addressed and information on thermoplastic and thermosetting polymer based composites is also covered including their various applications and the advantages and disadvantages of their use in different settings The final 2 chapters of the book cover mathematical modeling of creep recovery behavior for polymer composites and software based simulation of creep recovery in polymer composites respectively Dynamic Mechanical and Creep Recovery Behaviour of Polymer Based Composites Mechanical and Mathematical Modeling covers mathematical modelling dynamic mechanical analysis and the ways in which various factors impact the creep recovery behaviour of polymer composites The effects of polymer molecular weight plasticizers cross

linking agents and chemical treatment of filler material are addressed and information on thermoplastic and thermosetting polymer based composites is also covered including their various applications and the advantages and disadvantages of their use in different settings The final 2 chapters of the book cover mathematical modeling of creep recovery behavior for polymer composites and software based simulation of creep recovery in polymer composites respectively Analyzes the dynamic mechanical and creep recovery behaviors of thermoplastic and thermosetting polymer composites in a variety of applications Features diverse mechanical mathematical models utilized to fit data collected from creep recovery studies Covers various factors that influence dynamic mechanical properties Discusses the advantages and disadvantages of using these materials in different settings

### **Synthesis and Applications of Biopolymer Composites**

Ana María Díez-Pascual, Patrizia Cinelli, 2019-07-23 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

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