

Lignin And Lignans As Renewable Raw Materials Chemistry Technology And Applications Wiley Series In Renewable Resource

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

Lignin forms the woody cell walls of plants and the cement material between the plant walls, and after cellulose, it is the second most abundant biopolymer in the world. This book examines the biochemistry of lignin formation, lignin modification and utilization as a polymer, lignin in pulping and bleaching, chemical and physical properties of lignin, and lignin biodegradation.

Since their initial accidental synthesis and characterization in Scotland in the late 1920s, there has been a strong research focus on the use of phthalocyanines (Pcs) as dyes and pigments. In recent years, active research fields have included their use in electrophotography, photovoltaic and solar cells, molecular electronics, Langmuir-Blodgett films, photosensitizers, electrochromic display devices, gas sensors, liquid crystals, low-dimensional conductors, and optical disks. Phthalocyanines possess interesting biological, electronic, optical, catalytic, and structural properties. The main disadvantage is their insolubility in common solvents due to strong intermolecular - interactions. The solubility of phthalocyanines can be increased by various methods such as the formation of anionic and cationic species and both axial and peripheral substitution. Substitution at the nonperipheral and peripheral positions of the benzo moieties usually enhances their solubility in organic solvents. The most important advantage of phthalocyanines compared to porphyrins is that their Q bands lie at longer wavelengths and are considerably more intense. In this book, you will find synthesis and some applications of various phthalocyanine derivatives.

A guide to the wide-variety of waste valorisation techniques related to various biomass, waste materials and by products Waste Valorisation provides a comprehensive review of waste chemistry and its application to the generation of value-added products. The authors – noted experts on the topic – offer a clear understanding of waste diversity, drivers and policies governing its valorisation based on the location. The book provides information on the principles behind various valorisation schemes and offers a description of general treatment options with their evaluation guidelines in terms of cost, energy consumption and waste generation. Each of the book's chapters contain an introduction which summarises the current production and processing methods, yields, energy sources and other pertinent information for each specific type of waste. The authors focus on the most relevant novel technologies for value-added processing of waste streams or industrial by-products which can readily be integrated into current waste management systems. They also provide the pertinent technical, economic, social and environmental evaluations of bioconversions as future sustainable technologies in a biorefinery. This important book: Presents the most current technologies which integrate waste and/or by-product valorisation Includes discussions on end-product purity and life-cycle assessment challenges Explores relevant novel technologies for value-added processing of waste streams or industrial by-products which can be integrated into current waste management systems Offers a guide to waste reuse, a key sustainability goal for existing biorefineries wishing to reduce material and environmental costs Written for academic researchers and industrial scientists working in agricultural and food production, bioconversions and waste management professionals, Waste Valorisation is an authoritative guide to the chemistry and applications of waste materials and provides an overview of the most recent developments in the field.

Over the past four decades, there has been immense progress in every area of lignin science, ranging from the enzymology of lignin biodegradation, to the delignification of wood fiber during pulping and bleaching, to advances in spectroscopy. Lignin and Lignans: Advances in Chemistry captures the developments that have been achieved by world-class scientists in the most critical aspects of this burgeoning field. Tools for the characterization of lignin and lignans After an overview of the topic, the book discusses the significance and comparative performances of the most commonly used chemical degradation methods and presents lignin structural information based on the use of these methods. Next, the book explores spectroscopic methods, including UV-visible absorption, fluorescence, Raman, infra red (IR), near-infrared (NIR), nuclear magnetic resonance (NMR), and heteronuclear NMR spectroscopy. It then compares the results of studies of lignin in situ with studies of isolated lignins. Predicting reactivity The authors discuss polymer

properties related to thermal stability and molecular motion of lignin in the solid state. They describe applications of electronic structure calculations to the chemistry of lignin, and they explore lignin reactions that occur during the chemical pulping of wood by soda, kraft, AQ, and polysulfide processes. Chemistry associated with industrial processes The book describes chemical pulp bleaching, oxidative and reductive lignin-retaining bleaching, and lignin biodegradation. It also examines the application of microorganisms and the enzymes they produce in the manufacturing of chemical and mechanical pulp. The book closes with chapters on photodegradation and chromophore formation and the pharmacological properties of lignans. Highlighting significant developments on selected topics, this essential reference for those in industry and academia is designed to fuel further research and discovery in this specialized area, especially in the emerging field of biorefining.

This volume gives a detailed account into how renewables can be transformed into value-added products via homogeneous catalysis, especially via transition metal homogeneous catalysis. The most important catalytic reactions of oleochemicals, isoprenoids, carbohydrates, lignin, proteins and carbon dioxide are described. Special emphasis is placed on carbon-carbon linkage reactions (hydroformylations, dimerisations, telomerisations, metathesis, polymerisations etc.), hydrogenations, oxidations and other important homogeneous reactions (such as isomerisations, hydrosilylations etc.). Also, tandem reactions including isomerising hydroformylations are presented. Wherever possible, the authors have included mechanistic, kinetic, and technical aspects. The reader is therefore given a total overview of the status quo of homogeneous catalysis directed to the most important renewables.

Biomass, Biofuels, Biochemicals: Recent Advances in Development of Platform Chemicals provides a detailed overview on the experimentally developed methods that facilitate platform chemicals derivation from biomass-based substrates with robust catalyst systems. In addition, the book highlights the green chemistry approach towards platform chemical production. Chapters discuss platform chemicals and global market volumes, the optimization of process schemes and reaction parameters with respect to achieving a high yield of targeted platform chemicals, such as sugars and furonic compounds by modifying the respective catalytic system, the influence of solvents on reaction selectivity and product distribution, and the long-term stability of employed catalysts. Overall, the objectives of the book are to provide the reader with an understanding of the societal importance of platform chemicals, an assessment of the techno-economic viability of biomass valorization processes, catalyst design for a specific reaction, and the design of a catalytic system. Covers recent developments on platform chemicals Provides comprehensive technological developments on specific platform chemicals Covers organic transformations, catalytic synthesis, thermal stability, reaction parameters and solvent effect Includes case studies on the production of a number of chemicals, such as Levulinic acid, glycerol, phenol derivatives, and more

Horizons in Sustainable Industrial Chemistry and Catalysis, Volume 178, presents a comprehensive picture of recent developments in terms of sustainable industrial processes and the catalytic needs and opportunities to develop these novel routes. Each chapter includes an introduction and state-of-the-art in the field, along with a series of specific aspects and examples. The book identifies new opportunities for research that will help us transition to low carbon and sustainable energy and chemical production. Users will find an integrated view of the new possibilities in this area that unleashes new possibilities in energy and chemistry. Combines an analysis of each scenario, the state-of-the art, and specific examples to help users better understand needs, opportunities, gaps and challenges Offers an integrated view of new catalytic technologies that are needed for future use Presents an interdisciplinary approach that combines broad expertise Brings together experts in the area of sustainable industrial chemistry

This book provides new information on the control of monofunctional coupling and on modifying the biochemical steps in their formation and configuration. The text provides a critical assessment of recent advances in delineating the relationships and biosynthetic pathways of lignins and lignans. The discussion emphasizes lignin and lignan formation, particularly the templates for lignin assembly and the control of stereochemical coupling.

A comprehensive overview of current developments and applications in biofuels production Process Systems Engineering for Biofuels Development brings together the latest and most cutting-edge research on the production of biofuels. As the first book specifically devoted to process systems engineering for the production of biofuels, Process Systems Engineering for Biofuels Development covers theoretical, computational and experimental issues in biofuels process engineering. Written for researchers and postgraduate students working on biomass conversion and sustainable process design, as well as industrial practitioners and engineers involved in process design, modeling and optimization, this book is an indispensable guide to the newest developments in areas including: Enzyme-catalyzed biodiesel production Process analysis of biodiesel production (including kinetic modeling, simulation and optimization) The use of ultrasonication in biodiesel production Thermochemical processes for biomass transformation to biofuels Production of alternative biofuels In addition to the comprehensive overview of the subject of biofuels found in the Introduction of the book, the authors of various chapters have provided extensive discussions of the production and separation of biofuels via novel applications and techniques.

Plant polyphenols are secondary metabolites that constitute one of the most common and widespread groups of natural products. They are crucial constituents of a large and diverse range of biological functions and processes, and provide many benefits to both plants and humans. Many polyphenols, from their structurally simplest representatives to their oligo/polymeric versions, are notably known as phytoestrogens, plant pigments, potent antioxidants, and protein interacting agents. This sixth volume of the highly regarded Recent Advances in Polyphenol Research series is edited by Heidi Halbwirth, Karl Stich, Véronique Cheynier and Stéphane Quideau, and is a continuance of the series' tradition of compiling a cornucopia of cutting-edge chapters, written by some of the leading experts in their respective fields of polyphenol sciences. Highlighted herein are some of the most recent and pertinent developments in polyphenol research, covering such major areas as: Chemistry and physicochemistry Biosynthesis, genetics & metabolic engineering Roles in plants and ecosystems Food, nutrition & health Applied polyphenols

This book is a distillation of the most current information, and as such, will surely prove an invaluable source for chemists, biochemists, plant scientists, pharmacognosists and pharmacologists, biologists, ecologists, food scientists and nutritionists.

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

Introduction to Chemicals from Biomass, Second Edition presents an overview of the use of biorenewable resources in the 21st century for the manufacture of chemical products, materials and energy. The book demonstrates that biomass is essentially a rich mixture of chemicals and materials and, as such, has a tremendous potential as feedstock for making a wide range of chemicals and materials with applications in industries from pharmaceuticals to furniture. Completely revised and updated to reflect recent developments, this new edition begins with an introduction to the biorefinery concept, followed by chapters addressing the various types of available biomass feedstocks, including waste, and the different pre-treatment and processing technologies being developed to turn these feedstocks into platform chemicals, polymers, materials and energy. The book concludes with a discussion on the policies and strategies being put in place for delivering the so-called Bioeconomy. *Introduction to Chemicals from Biomass* is a valuable resource for academics, industrial scientists and policy-makers working in the areas of industrial biotechnology, biorenewables, chemical engineering, fine and bulk chemical production, agriculture technologies, plant science, and energy and power generation. We need to reduce our dependence on fossil resources and increasingly derive all the chemicals we take for granted and use in our daily life from biomass – and we must make sure that we do this using green chemistry and sustainable technologies! For more information on the Wiley Series in Renewable Resources, visit www.wiley.com/go/rrs Topics covered include: • The biorefinery concept • Biomass feedstocks • Pre-treatment technologies • Platform molecules from renewable resources • Polymers from bio-based monomers • Biomaterials • Bio-based energy production Praise for the 1st edition: “Drawing on the expertise of the authors the book involves a degree of plant biology and chemical engineering, which illustrates the multidisciplinary nature of the topic beautifully” - Chemistry World

As naturally occurring and abundant sources of non-fossil carbon, lignin and lignans offer exciting possibilities as a source of commercially valuable products, moving away from petrochemical-based feedstocks in favour of renewable raw materials. Lignin can be used directly in fields such as agriculture, livestock, soil rehabilitation, bioremediation and the polymer industry, or it can be chemically modified for the fabrication of specialty and high-value chemicals such as resins, adhesives, fuels and greases. *Lignin and Lignans as Renewable Raw Materials* presents a multidisciplinary overview of the state-of-the-art and future prospects of lignin and lignans. The book discusses the origin, structure, function and applications of both types of compounds, describing the main resources and values of these products as carbon raw materials. Topics covered include: • Structure and physicochemical properties • Lignin detection methods • Biosynthesis of lignin • Isolation methods • Characterization and modification of lignins • Applications of modified and unmodified lignins • Lignans: structure, chemical and biological properties • Future perspectives This book is a comprehensive resource for researchers, scientists and engineers in academia and industry working on new possibilities for the application of renewable raw materials. For more information on the Wiley Series in Renewable Resources, visit www.wiley.com/go/rrs

Bio-Based Packaging An authoritative and up-to-date review of sustainable packaging development and applications *Bio-Based Packaging* explores using renewable and biodegradable materials as sustainable alternatives to non-renewable, petroleum-based packaging. This comprehensive volume surveys the properties of biopolymers, the environmental and economic impact of bio-based packaging, and new and emerging technologies that are increasing the number of potential applications of green materials in the packaging industry. Contributions address the advantages and challenges of bio-based packaging, discuss new materials to be used for food packaging, and highlight cutting-edge research on polymers such as starch, protein, polylactic acid (PLA), pectin, nanocellulose, and their nanocomposites. In-depth yet accessible chapters provide balanced coverage of a broad range of practical topics, including life cycle assessment (LCA) of bio-based packaging products, consumer perceptions and preferences, supply chains, business strategies and markets in biodegradable food packaging, manufacturing of bio-based packaging materials, and regulations for food packaging materials. Detailed discussions provide valuable insight into the opportunities for biopolymers in end-use sectors, the barriers to biopolymer-based concepts in the packaging market, recent advances made in the field of biopolymeric composite materials, the future of bio-plastics in commercial food packaging, and more. This book: Provides deep coverage of the bio-based packaging development, characterization, regulations and environmental and socio-economic impact Contains real-world case studies of bio-based packaging applications Includes an overview of recent advances and emerging aspects of nanotechnology for development of sustainable composites for packaging Discusses renewable sources for packaging material and the reuse and recycling of bio-based packaging products *Bio-Based Packaging* is essential reading for academics, researchers, and industry professionals working in packaging materials, renewable resources, sustainability, polymerization technology, food technology, material engineering, and related fields. For more information on the Wiley Series in Renewable Resources, visit www.wiley.com/go/rrs

A multidisciplinary overview of bio-derived solvent applications, life cycle analysis, and strategies required for industrial commercialization This book provides the first and only comprehensive review of the state-of-the-science in bio-derived solvents. Drawing on their own pioneering work in the field, as well as an exhaustive survey of the world literature on the subject, the authors cover all the bases—from bio-derived solvent applications to life cycle analysis to strategies for industrial commercialization—for researchers and professional chemists working across a range of industries. In the increasingly critical area of sustainable chemistry, the search for new and better green solvents has become a top priority. Thanks to their renewability, biodegradability and low toxicity, as well as their potential to promote advantageous organic reactions, green solvents offer the promise of significantly reducing the pernicious effects of chemical processes on human health and the environment. Following an overview of the current solvents markets and the challenges and opportunities presented by bio-derived solvents, a series of dedicated chapters cover all significant classes of solvent arranged by origin and/or chemical structure. Throughout, real-world examples are used to help demonstrate the various advantages, drawbacks, and limitations of each class of solvent. Topics covered include: The commercial potential of various renewably sourced solvents, such as glycerol The various advantages and disadvantages of bio-derived versus petroleum-based solvents Renewably-sourced and waste-derived solvents in the design of eco-efficient processes Life cycle assessment and predictive methods for bio-based solvents Industrial and commercial viability of bio-based solvents now and in the years ahead Potential and limitations of methodologies involving bio-derived solvents New developments and emerging trends in the field and the shape of things to come Considering the vast potential for new and better products suggested by recent developments in this exciting field, *Bio-Based Solvents* will be a welcome resource among students and researchers in catalysis, organic synthesis, electrochemistry, and pharmaceuticals, as well as industrial chemists involved in manufacturing processes and formulation, and policy makers.

Introduces readers to the chemical biology of plant biostimulants This book brings together different aspects of biostimulants, providing an overview of the variety of materials exploited as biostimulants, their biological activity, and agricultural applications. As different groups of biostimulants display different bioactivity and specificity, advances in biostimulant research is illustrated by different examples of biostimulants, such as humic substance, seaweed extracts, and substances with hormone-like activities. The book also reports on methods used to screen for new biostimulant compounds by exploring natural sources. Combining the expertise of internationally-renowned scientists and entrepreneurs in the area of biostimulants and biofertilisers, *The Chemical Biology of Plant Biostimulants* offers in-depth chapters that look at: agricultural functions and action mechanisms of plant biostimulants (PBs); plant biostimulants from seaweed; seaweed carbohydrates; and the possible role for electron shuttling capacity in elicitation of PB activity of humic substances on plant growth enhancement. The subject of auxins is covered next, followed closely by a chapter on plant biostimulants in vermicomposts. Other topics include: exploring natural resources for biostimulants; the impact of biostimulants on whole plant and cellular levels; the impact of PBs on molecular level; and the use of use of plant metabolites to mitigate stress effects in crops. Provides an insightful introduction to the subject of biostimulants Discusses biostimulant modes of actions Covers microbial biostimulatory activities and biostimulant application strategies Offers unique and varied perspectives on the subject by a team of international contributors Features summaries of publications on biostimulants and biostimulant activity *The Chemical Biology of Plant Biostimulants* will appeal to a wide range of readers, including scientists and agricultural practitioners looking for more knowledge about the development and application of biostimulants.

This book offers a comprehensive overview of nanocrystalline cellulose (NCC) and the development of advanced materials based on NCC for industrial and medical applications. The contents provide unique information on the physics, chemistry, biology and technology of NCC and NCC-based advanced materials, in addition to detailed coverage of the engineering aspects, addressing the challenges involved in nanomanufacturing on a large industrial scale. Contents include: A detailed treatment of the structure, morphology and synthesis of NCC. The science and engineering of producing NCC and how surface/interface modifications of NCC could lead to developing novel biomaterials with attractive structural and functional properties. The scientific bases for developing NCC-based nanomaterials with advanced functionalities for industrial/medical applications. A detailed coverage of the eco-efficient engineering processes and technical modifications required for the potential manufacture of these functional bionanomaterials for applications such as packaging and utilization in heavy industries (e.g., automobiles). This book is for audiences in the physical, chemical and biological sciences as well as engineering disciplines. It is of critical interest to industrialists seeking to develop new materials for the advanced industrial economies of the 21st century, ranging from adaptive “smart” packaging materials, to new chiral inorganic materials for pharmaceutical applications, to high-performance nanocomposites for structural applications.

This fundamental book provides a cross-sectoral, multi-disciplinary view on the biobased economy. It explains opportunities for the value-adding production and use of bioresources, while also discussing the main drivers and obstacles involved. The book is divided into three major parts, the first of which introduces readers to the basics of bioresource economics and engineering. In terms of economics, it discusses decision-making from the policy, producer, investor, and citizen perspectives; in terms of engineering, it addresses key technologies and the processing of bioresources, as well as the development of biorefineries for high-value products on large and small scales. In turn, the book's second part presents cases focused on different types of energy use, and written by practitioners. The cases illustrate the businesses and technologies involved, as well as the roles of citizens, social organisations and policies. The book's third and last part highlights opportunities in sustainable agriculture, valuable industrial products and innovative services, while also outlining key conditions for success. Written by a team of scholars and practitioners from various engineering, natural-science and social-science disciplines, the book is primarily intended for undergraduate and graduate students, and for practitioners in business and policy who wish to explore the sustainable production and use of bioresources. All theoretical issues are explained with the aid of real-world examples, making the content highly accessible.

This widely respected and frequently consulted reference work provides a wealth of information and guidance on industrial chemistry and biotechnology. Industries covered span the spectrum from salt and soda ash to advanced dyes chemistry, the nuclear industry, the rapidly evolving biotechnology industry, and, most recently, electrochemical energy storage devices and fuel cell science and technology. Other topics of surpassing interest to the world at large are covered in chapters on fertilizers and food production, pesticide manufacture and use, and the principles of sustainable chemical practice, referred to as green chemistry. Finally, considerable space and attention in the Handbook are devoted to the subjects of safety and emergency preparedness. It is worth noting that virtually all of the chapters are written by individuals who are embedded in the industries whereof they write so knowledgeably.

Provides complete coverage of the recovery of mineral nutrients from biomass and organic waste This book presents a comprehensive overview of the potential for mineral recovery from wastes, addressing technological issues as well as economic, ecological, and agronomic full-scale field assessments. It serves as a complete reference work for experts in the field and provides teaching material for future experts specializing in environmental technology sectors. *Biorefinery of Inorganics: Recovering Mineral Nutrients from Biomass and Organic Waste* starts by explaining the concept of using anaerobic digestion as a biorefinery for production of an energy carrier in addition to mineral secondary resources. It then discusses the current state of mineral fertilizer use throughout the world, offering readers a complete look at the resource availability and energy intensity. Technical aspects of mineral recovery organic (waste-)streams is discussed next, followed by an examination of the economics of biobased

products and their mineral counterparts. The book also covers the environmental impact assessment of the production and use of bio-based fertilizers; modelling and optimization of nutrient recovery from wastes; and more. Discusses global production and consumption of mineral fertilizers Introduces technologies for the recovery of mineral NPK from organic wastes and residues Covers chemical characterization and speciation of refined secondary resources, and shows readers how to assess biobased mineral resources Discusses applications of recovered minerals in the inorganic chemistry sector Compares the economics of biobased products with current fossil-based counterparts Offers an ecological assessment of introducing biobased products in the current fertilizer industry Edited by leading experts in the field Biorefinery of Inorganics: Recovering Mineral Nutrients from Biomass and Organic Waste is an ideal book for scientists, environmental engineers, and end-users in the agro-industry, the waste industry, water and wastewater treatment, and agriculture. It will also be of great benefit to policy makers and regulators working in these fields.

This book offers the state of the art on the progress and accomplishments of 25 years of research at the Associate Laboratory LSRE-LCM - Laboratory of Separation and Reaction Engineering - Laboratory of Catalysis and Materials on lignin conversion to value-added products and their downstream separation. The first valorisation pathway presented for lignin is its partial depolymerisation by oxidation for the production of low molecular weight phenolic compounds, such as vanillin and syringaldehyde, and the second one is the lignin application as macromonomer for polyurethane synthesis. In this book, the authors present the integration of these two valorisation pathways as an exclusive vision of LSRE-LCM resulting from hands-on experience on reaction and separation processes: the integrated process for lignin valorisation. In this perspective, the lignin is oxidized to simultaneously produce syringaldehyde and vanillin, and the obtained by-products to produce a polyol for lignin-based polyurethanes, completing the lignin value chain. On the perspective of pulp mill-related biorefineries, a valorisation route for eucalyptus bark is also presented, focusing on LSRE-LCM experience on extraction and separation of bioactive polyphenols, giving some insights about further integration of extracted bark on biorefining operations.

BioPolymers could be either natural polymers – polymer naturally occurring in Nature, such as cellulose or starch..., or biobased polymers that are artificially synthesized from natural resources. Since the late 1990s, the polymer industry has faced two serious problems: global warming and anticipation of limitation to the access to fossil resources. One solution consists in the use of sustainable resources instead of fossil-based resources. Hence, biomass feedstocks are a promising resource and biopolymers are one of the most dynamic polymer area. Additionally, biodegradability is a special functionality conferred to a material, bio-based or not. Very recently, facing the awareness of the volumes of plastic wastes, biodegradable polymers are gaining increasing attention from the market and industrial community. This special issue of *Molecules* deals with the current scientific and industrial challenges of Natural and Biobased Polymers, through the access of new biobased monomers, improved thermo-mechanical properties, and by substitution of harmful substances. This themed issue can be considered as collection of highlights within the field of Natural Polymers and Biobased Polymers which clearly demonstrate the increased interest in this field. We hope that this will inspire researchers to further develop this area and thus contribute to futures more sustainable society.”

Natural Polymers-Based Green Adsorbents for Water Treatment focuses on the recent development of novel polymeric adsorbents that are green and eco-friendly or biodegradable in nature. The book reviews the synthesis, properties and adsorption applications of natural and green polymer-based adsorbents. It discusses adsorption processes in biopolymer systems, remediation technologies developed to remove environmental pollutants, the usage of natural polymer-based cost-effective and green novel adsorbent materials for the removal of organic and inorganic contaminants, and the efficiency of functionalized polymers, nanosorbents, hydrogels, composites, graft copolymers in the sorption of various pollutants from the environment as well as from the industrial effluents. Researchers working on environmental remediation need a single book, where all data on natural and green adsorbents for water treatment are discussed comprehensively. *Natural Polymers-Based Green Adsorbents for Water Treatment* addresses this need by providing world-wide leading experts' observations and research. So, this book is a valuable reference for early-career scientist, academic researchers and graduate students in chemical engineering and material science. Presents step-by-step review of processing and modification of natural polymers and their applications in water remediation Analyzes data on natural and green adsorbents for water treatment, meanwhile provides world-wide experts' knowledge to pave the way for further research Includes extensive tables, graphs, figures, bibliographies and references to enhance key concepts

Covers the entire evolutionary spectrum of biomass, from its genetic modification and harvesting, to conversion technologies, life cycle analysis, and its value to the current global economy This original textbook introduces readers to biomass—a renewable resource derived from forest, agriculture, and organic-based materials—which has attracted significant attention as a sustainable alternative to petrochemicals for large-scale production of fuels, materials, and chemicals. The current renaissance in the manipulation and uses of biomass has been so abrupt and focused, that very few educational textbooks actually cover these topics to any great extent. That's why this interdisciplinary text is a welcome resource for those seeking a better understanding of this new discipline. It combines the underpinning science of biomass with technology applications and sustainability considerations to provide a broad focus to its readers. *Introduction to Renewable Biomaterials: First Principles and Concepts* consists of eight chapters on the following topics: fundamental biochemical & biotechnological principles; principles and methodologies controlling plant growth and silviculture; fundamental science and engineering considerations; critical considerations and strategies for harvesting; first principles of pretreatment; conversion technologies; characterization methods and techniques; and life cycle analysis. Each chapter includes a glossary of terms, two to three problem sets, and boxes to highlight novel discoveries and instruments. Chapters also offer questions for further consideration and suggestions for further reading. Developed from a successful USDA funded course, run by a partnership of three US universities: BioSUCCEED - BioProducts Sustainability, a University Cooperative Center for Excellence in Education Covers the entire evolutionary spectrum of biomass, from genetic modification to life cycle analysis Presents the key chemistry, biology, technology, and sustainability aspects of biomaterials Edited by a highly regarded academic team, with extensive research and teaching experience in the field *Introduction to Renewable Biomaterials: First Principles and Concepts* is an ideal text for advanced academics and industry professionals involved with biomass and renewable resources, bioenergy, biorefining, biotechnology, materials science, sustainable chemistry, chemical engineering, crop science and technology, agriculture.

This textbook introduces the industrial production and processing of natural resources. It is divided into six major topics (fats and oils, carbohydrates, lignin, terpenoids, other natural products, biorefinery), which are divided into a total of 20 chapters. Each chapter is self-contained and therefore a compact learning unit, which can be worked on by students in self-study or presented by lecturers. Clear illustrations, flow diagrams, apparatus drawings and photos facilitate the understanding of the subject matter. All chapters end with a succinct summary, the "Take Home Messages". Each chapter is supplemented by ten short test questions, which can be solved quickly after working through the chapter; the answers are at the end of the book. All chapters contain bibliographical references that focus on essential textbooks and reference works. As a prior knowledge, only basic knowledge of chemistry is required.

Lignin and Lignans as Renewable Raw Materials Chemistry, Technology and Applications John Wiley & Sons

The recent explosion of interdisciplinary research has fragmented the knowledge base surrounding renewable polymers. The *Chemistry of Bio-based Polymers* 2nd edition brings together, in one volume, the research and work of Professor Johannes Fink, focusing on biopolymers that can be synthesized from renewable polymers. After introducing general aspects of the field, the book's subsequent chapters

examine the chemistry of biodegradable polymeric types sorted by their chemical compounds, including the synthesis of low molecular compounds. Various categories of biopolymers are detailed including vinyl-based polymers, acid and lactone polymers, ester and amide polymers, carbohydrate-related polymers and others. Procedures for the preparation of biopolymers and biodegradable nanocomposites are arranged by chemical methods and in vitro biological methods, with discussion of the issue of "plastics from bacteria." The factors influencing the degradation and biodegradation of polymers used in food packaging, exposed to various environments, are detailed at length. The book covers the medical applications of bio-based polymers, concentrating on controlled drug delivery, temporary prostheses, and scaffolds for tissue engineering. Professor Fink also addresses renewable resources for fabricating biofuels and argues for localized biorefineries, as biomass feedstocks are more efficiently handled locally. A comprehensive examination of the large number of possible pathways for converting biomass into fuels and power through thermochemical processes Bringing together a widely scattered body of information into a single volume, this book provides complete coverage of the many ways that thermochemical processes are used to transform biomass into fuels, chemicals and power. Fully revised and updated, this new edition highlights the substantial progress and recent developments that have been made in this rapidly growing field since publication of the first edition and incorporates up-to-date information in each chapter. Thermochemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, 2nd Edition incorporates two new chapters covering: condensed phased reactions of thermal deconstruction of biomass and life cycle analysis of thermochemical processing systems. It offers a new introductory chapter that provides a more comprehensive overview of thermochemical technologies. The book also features fresh perspectives from new authors covering such evolving areas as solvent liquefaction and hybrid processing. Other chapters cover combustion, gasification, fast pyrolysis, upgrading of syngas and bio-oil to liquid transportation fuels, and the economics of thermochemically producing fuels and power, and more. Features contributions by a distinguished group of European and American researchers offering a broad and unified description of thermochemical processing options for biomass Combines an overview of the current status of thermochemical biomass conversion as well as engineering aspects to appeal to the broadest audience Edited by one of Biofuels Digest's "Top 100 People" in bioenergy for six consecutive years Thermochemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, 2nd Edition will appeal to all academic researchers, process chemists, and engineers working in the field of biomass conversion to fuels and chemicals. It is also an excellent book for graduate and advanced undergraduate students studying biomass, biofuels, renewable resources, and energy and power generation.

Lignin in Polymer Composites presents the latest information on lignin, a natural polymer derived from renewable resources that has great potential as a reinforcement material in composites because it is non-toxic, inexpensive, available in large amounts, and is starting to be deployed in various materials applications due to its advantages over more traditional oil-based materials. This book reviews the state-of-the-art on the topic and their applications to composites, including thermoplastic, thermosets, rubber, foams, bioplastics, nanocomposites, and lignin-based carbon fiber composites. In addition, the book covers critical assessments on the economics of lignin, including a cost-performance analysis that discusses its strengths and weaknesses as a reinforcement material. Finally, the huge potential applications of lignin in industry are explored with respect to its low cost, recyclable properties, and fully biodegradable composites, and the way they apply to the automotive, construction, and packaging industries. Reviews the state-of-the-art on the topic and their applications to composites, including thermoplastic, thermosets, rubber, foams, bioplastics, nanocomposites, and lignin-based carbon fiber composites Presents the essential processing and properties information for engineers and materials scientists, enabling the use of lignin in composites Provides critical insight into the applications and future trends of lignin-based composites, including advantages, shortcomings, and economics Includes a thorough coverage of extraction, modification, processing, and applications of the material

A comprehensive introduction to the design, synthesis, characterization, and catalytic properties of nanoporous catalysts for the biomass conversion With the specter of peak oil demand looming on the horizon, and mounting concerns over the environmental impact of greenhouse gas emissions, biomass has taken on a prominent role as a sustainable alternative fuel source. One critical aspect of the biomass challenge is the development of novel catalytic materials for effective and controllable biomass conversion. Edited by two scientists recognized internationally for their pioneering work in the field, this book focuses on nanoporous catalysts, the most promising class of catalytic materials for the conversion of biomass into fuel and other products. Although various catalysts have been used in the conversion of biomass-derived feedstocks, nanoporous catalysts exhibit high catalytic activities and/or unique product selectivities due to their large surface area, open nanopores, and highly dispersed active sites. This book covers an array of nanoporous catalysts currently in use for biomass conversion, including resins, metal oxides, carbons, mesoporous silicates, polydivinylbenzene, and zeolites. The authors summarize the design, synthesis, characterization and catalytic properties of these nanoporous catalysts for biomass conversions, discussing the features of these catalysts and considering future opportunities for developing more efficient catalysts. Topics covered include: Resins for biomass conversion Supported metal oxides/sulfides for biomass oxidation and hydrogenation Nanoporous metal oxides Ordered mesoporous silica-based catalysts Sulfonated carbon catalysts Porous polydivinylbenzene Aluminosilicate zeolites for bio-oil upgrading Rice straw Hydrogenation for sugar conversion Lignin depolymerization Timely, authoritative, and comprehensive, Nanoporous Catalysts for Biomass Conversion is a valuable working resource for academic researchers, industrial scientists and graduate students working in the fields of biomass conversion, catalysis, materials science, green and sustainable chemistry, and chemical/process engineering.

An extensive update and sequel to the successful title Renewables-Based Technology: Sustainability Assessment. Over the past decade, the field of renewable resources has grown tremendously and sustainability assessment methods have undergone significant changes and improvements. This book brings together the wide range of sustainability assessment methods in current use, together with case studies to demonstrate their applications. The book is divided into four sections as follows: Part 1 - Introduction: Discusses the growing role of renewables as resources and their applications, together with an introduction to the principles of sustainability assessment Part 2 - Assessment Methods: Presents a wide variety of sustainability assessment methods and tools that are currently used. This includes land, water-and material use analysis, energy and exergy use, carbon footprints, life cycle analysis, ecological footprints, life cycle costing, social sustainability analysis, Prosuite methodology and Seebalance (the SocioEcoEfficiency Analysis developed by BASF. Part 3 - Case Studies: Provides context buy demonstrating the application of these methods within the major industries benefiting from renewables. The case studies apply sustainability assessment methods to the production of renewable energy (wind energy, solar energy and biofuels), bio-based chemicals and bio-based materials. Part 4 - Conclusions This book addresses different aspects of green biocomposite manufacture from natural fibres and bioplastics, including the manufacturing procedures and the physical, mechanical, thermal and electrical properties of green biocomposites. Featuring illustrations and tables that maximize reader insights into the current research on biocomposites, it emphasises the role of green technology in the manufacture of biocomposites and analysis of properties of biocomposites for different applications. It is a valuable resource for researchers and scientists in industry wanting to understand the need for biocomposites in the development of green, biodegradable and sustainable products for different applications.

A comprehensive, interdisciplinary picture of how lignocellulosic biorefineries could potentially employ lignin valorization technologies.

Fuels, Chemicals and Materials from the Oceans and Aquatic Sources provides a holistic view of fuels, chemicals and materials from renewable sources in the oceans and other aquatic media. It presents established and recent results regarding the use of water-based biomass, both plants and animals, for value-added applications beyond food. The book begins with an introductory chapter which provides an overview of ocean and aquatic sources for the production of chemicals and materials. Subsequent chapters focus on the use of various ocean bioresources and feedstocks, including microalgae, macroalgae,

and waste from aquaculture and fishing industries, including fish oils, crustacean and mollusc shells. Fuels, Chemicals and Materials from the Oceans and Aquatic Sources serves as a valuable reference for academic and industrial professionals working on the production of chemicals, materials and fuels from renewable feedstocks. It will also prove useful for researchers in the fields of green and sustainable chemistry, marine sciences and biotechnology. Topics covered include: • Production and conversion of green macroalgae • Marine macroalgal biomass as an energy feedstock • Microalgae bioproduction • Bioproduction and utilization of chitin and chitosan • Applications of mollusc shells • Crude fish oil as a potential fuel

Handbook of Nanotechnology Applications: Environment, Energy, Agriculture and Medicine presents a comprehensive overview on recent developments and prospects surrounding nanotechnology use in water/wastewater separation and purification, energy storage and conversion, agricultural and food process, and effective diagnoses and treatments in medical fields. The book includes detailed overviews of nanotechnology, including nanofiltration membrane for water/wastewater treatment, nanomedicine and nanosensor development for medical implementation, advanced nanomaterials of different structural dimensions (0D, 1D, 2D and 3D) for energy applications, as well as food and agricultural utilization. Other sections discuss the challenges of lab-based research transitioning towards practical industrial use. Helps scientists and researchers quickly learn and understand the key role of nanotechnology in important industrial applications Takes an interdisciplinary approach, demonstrating how nanotechnology is being used in a wide range of industry sectors Outlines the role nanotechnology plays in creating safer, cheaper and more energy-efficient projects and devices

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, β -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

This book offers a comprehensive review on biomass resources, examples of biorefineries and corresponding products. The first part of this book covers topics such as different biorefinery resources from agriculture, wood processing residues and transport logistics of plant biomass. In the second part, expert contributors present biorefinery concepts of different biomass feedstocks, including vegetable-oils, sugarcane, starch, lignocellulose and microalgae. Readers will find here a summary of the syngas utilization and the bio-oil characterization and potential use as an alternative renewable fuel and source for chemical feedstocks. Particular attention is also given to the anaerobic digestion-based and Organosolv biorefineries. The last part of the book examines relevant products and components such as alcohols, hydrocarbons, bioplastics and lignin, and offers a sustainability evaluation of biorefineries.

This book provides a comprehensive overview on the most recent knowledge in dermatophytic infection biology. Topics covered range from taxonomy, biology and genetics of most common skin disease causing fungi over immunology of dermatophytosis to diagnosis and treatment approaches. Furthermore epidemiology of skin diseases caused by pathogenic fungi is discussed. The book is aimed at researchers and advanced students in infection biology, microbiology and dermatology.

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