Microwave Assisted Degradation Of Lignin To Monolignols

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Reactive and functional polymers are manufactured with the aim of improving the performance of unmodified polymers or providing functionality for different applications. These polymers are created mainly through chemical reactions, but there are other important modifications that can be carried out by physical alterations in order to obtain reactive and functional polymers. This volume presents a comprehensive analysis of these reactive and functional polymers. Reactive and Functional Polymers Volume One provides the principles and foundations for the design, development, manufacture and processing of reactive and functional polymers based primarily on biopolymers, polyesters and polyurethanes. The text provides an in-depth review of updated sources on reactive resins and silicones. In this book, world-renowned researchers have participated, including Dr. Runcang Sun (Associate editor for the journal ‘Carbohydrate Polymers’). With its comprehensive scope and up-to-date coverage of issues and trends in Reactive and Functional Polymers, this is an outstanding book for students, professors, researchers and industrialists working in the field of polymers and plastic materials.

This book presents a comprehensive overview on origin, structure, properties, modification strategies and applications of the biopolymer lignin. It is organized into four themed parts. The first part focuses on the analysis and characterization of the second most abundant biopolymer. The following part is devoted to the biological aspects of lignin such as biosynthesis and degradation. In the third part, chemical modification strategies and the preparation of composites as well as nano- and microparticles are discussed. The final part addresses the industrial application of lignin and its derivatives, as well as lignin materials. The usage for synthesis of biofuels, fine chemicals and in agriculture and food industry is covered. This book is a comprehensive source for researchers, scientists and engineers working in the field of biopolymers as well as renewable materials and sources.

This book offers a broad understanding of bioethanol production from sugarcane, although a few other substrates, except corn, will also be mentioned. The 10 chapters are grouped in five sections. The Fuel Ethanol Production from Sugarcane in Brazil section consists of two chapters dealing with the first-generation ethanol Brazilian industrial process. The Strategies for Sugarcane Bagasse Pretreatment section deals with emerging physicochemical methods for biomass pretreatment, and the non-conventional biomass source for lignocellulosic ethanol production addresses the potential of weedy biomass as alternative feedstock. In the Recent Approaches for Increasing Fermentation Efficiency of Lignocellulosic Ethanol section, potential and research progress using thermophiles bacteria and yeasts is presented, taking advantage of microorganisms involved in consolidating or simultaneous hydrolysis and fermentation processes. Finally, the Recent Advances in Ethanol Fermentation section presents the use of cold plasma and hydrostatic pressure to increase ethanol production efficiency. Also in this section the use of metabolic-engineered autotrophic cyanobacteria to produce ethanol from carbon dioxide is mentioned.

This edited book discusses various processes of feedstocks bioconversion such as bioconversion of food waste, human manure, industrial waste, beverage waste, kitchen waste, organic waste, fruit and vegetable, poultry waste, solid waste, agro-industrial waste, cow dung, steroid, lignocellulosic residue, biomass, natural gas etc. Nowadays, the industrial revolution and urbanization have made human life comfortable. However, this requires excess usage of natural resources starting from food and food products, to energy resources, materials as well as chemicals. The excess use of natural resources for human comfort is expected to high fuel prices, decline natural resources as well as cause a huge hike in the cost of raw materials. These factors are pushing researchers to grow environmentally friendly processes and techniques based on inexpensive and sustainable feedstock to accomplish such worldwide targets.

Bioconversion, otherwise called biotransformation, is the change of natural materials, for example, plant or animal waste, into usable items or energy sources by microorganisms. Bioconversion is an environmentally friendly benevolent choice to supplant the well-established chemical procedures utilized these days for the production of chemicals and fuels. A variety of alternatives advancements are being considered and are directly accessible to acquire diverse valuable end-products through bioprocesses.
This book discusses in detail the process and techniques of bioconversion by focusing on the organic feedstock of animal and plant origin. It brings solutions to the bioconversion of various feedstock into value-added products.

This book is a comprehensive introduction to "green" or environmentally friendly polymer composites developed using renewable polymers of natural origin such as starch, lignin, cellulose acetate, poly-lactic acid (PLA), polyhydroxylalkanoates (PHA), polyhydroxybutyrate (PHB), etc., and the development of modern technologies for preparing green composites with various applications. The book also discusses major applications of green polymer composites in industries such as medicine, biotechnology, fine chemicals and engineering.

Microwaves in Chemistry: Applications: Fundamentals, Methods and Future Trends offers a number of benefits over conventional heating technologies, including acceleration of reaction rates, milder reaction conditions, higher chemical yields, lower energy usage and different reaction selectivity, all of which can improve the sustainability of processes. The book provides valuable insights into the underlying chemistry at play in microwave-assisted processes, introducing fundamental concepts, discussing the modeling of reactions in such processes, and also highlighting a range of key methods and applications of microwaves in chemistry for improved sustainability. Beginning with an introduction to microwave chemistry, Part One discusses foundational principles, equipment and approaches for modeling reactions and assessing the outputs of those models. Methods in microwave chemistry are then the focus of Part Two, with microwave-assisted synthesis, catalysis, reduction and reactions all explored in detail. Part Three reflects on the practical usage of these methods to address specific issues, covering a number of interesting applications. Provides guidance on the modeling and interpretation of microwave effects Discusses microwave chemistry in the context of green chemistry principles Outlines a range of important microwave methods, including microwave-assisted synthesis, catalysis, reactions and reductions


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 favor 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

Increased environmental consciousness within the scientific community has spurred the search for environmentally friendly processes as alternatives to conventional organic solvents. In the past two decades, numerous advances—including the use of ionic liquids—have made it possible to develop substitutes for some toxic solvents. Ionic liquids are widely recognized as suitable for use in organic reactions and can also improve the control of product distribution, enhanced reactivity, ease of product recovery, catalyst immobilization, and recycling. Environmentally Friendly Syntheses Using Ionic Liquids presents the latest developments in the field. It also reviews the latest applications in a wide range of fields including biotechnology, nuclear science, medicine, pharmaceuticals, environmental science, and organic and inorganic chemistry—all from the standpoint of green sustainable chemistry. Growing interest in the field of ionic liquids will define newer and unexplored areas of applications, expanding possible use of these environmentally friendly chemicals. The information presented in this book will undoubtedly help motivate readers to further explore the field.

This book focuses on chemical syntheses and processes for biofuel production mediated by microwave energy. This is the first contribution in this area serving as a resource and guidance manual for understanding the principles, mechanisms, design, and applications of microwaves in biofuel process chemistry. Green chemistry of microwave-mediated biofuel reactions and thermodynamic potentials for the process biochemistry are the focus of this book. Microwave generation, wave propagation, process design, development and configurations, and biofuel applications are discussed in detail.

This open access book addresses a wide variety of events and technologies concerning the sago palm, ranging from its botanical characteristics, culture and use to social conditions in the places where it is grown, in order to provide a record of research findings and to benefit society. It discusses various subjects, including the sago palm and related species; differentiation of species of starch-producing
palm; habitat, morphological, physiological and growth characteristics; culture and management; productivity of carbon dioxide; starch extraction and manufacture; characteristics and utilization of starch; and cultural anthropological and folkloristic aspects. Problems such as food shortages due to increasing populations, global warming and climate change, and decreasing reserves of oil and other underground resources, have become more pressing in recent years. In the context of these problems, the book examines the role of the sago palm in sustainable food production, in the manufacture of other foodstuffs, as a raw material for ethanol and in the manufacture of biodegradable plastics. In addition to academics, this book will be useful to researchers and government officials working for international agencies, national governments, municipalities, and other research organizations; technicians, researchers, managers, entrepreneurs, and others working in industries such as agriculture, plant production, food production, manufacturing, chemical engineering, energy production, and distribution.

The interest in biofuel production and application is governed by the depletion of fossil fuel resources and the threatening pollution of the atmosphere because of the extensive emissions of greenhouse gases, which the present global vegetation cannot cope with. A remedy against the greenhouse gas emissions is the use of biomass presently grown as a source for biofuels. Biofuels can be further utilized as substrates for bulk chemical products. This approach is known as the biorefinery concept as an analogue to the oil-based refineries. The present book offers some examples and new ideas for the broader applications of biofuels and the resulting raw materials for energy and chemical products as alternatives to the traditional fossil fuels.

This book covers the applications of fungi used in biorefinery technology. As a great many different varieties of fungal species are available, the text focuses on the various applications of fungi for production of useful products including organic acids (lactic, citric, fumaric); hydrolytic enzymes (amylase, cellulases, xylanases, ligninases, lipases, pectinases, proteases); advanced biofuels (ethanol, single cell oils); polyols (xylitol); single cell protein (animal feed); secondary metabolites; and much more.

With increasing energy prices and the drive to reduce CO2 emissions, food industries are challenged to find new technologies in order to reduce energy consumption, to meet legal requirements on emissions, product/process safety and control, and for cost reduction and increased quality as well as functionality. Extraction is one of the promising innovation themes that could contribute to sustainable growth in the chemical and food industries. For example, existing extraction technologies have considerable technological and scientific bottlenecks to overcome, such as often requiring up to 50% of investments in a new plant and more than 70% of total process energy used in food, fine chemicals and pharmaceutical industries. These shortcomings have led to the consideration of the use of new “green” techniques in extraction, which typically use less solvent and energy, such as microwave extraction. Extraction under extreme or non-classical conditions is currently a dynamically developing area in applied research and industry. Using microwaves, extraction and distillation can now be completed in minutes instead of hours with high reproducibility, reducing the consumption of solvent, simplifying manipulation and work-up, giving higher purity of the final product, eliminating post-treatment of waste water and consuming only a fraction of the energy normally needed for a conventional extraction method. Several classes of compounds such as essential oils, aromas, anti-oxidants, pigments, colours, fats and oils, carbohydrates, and other bioactive compounds have been extracted efficiently from a variety of matrices (mainly animal tissues, food, and plant materials). The advantages of using microwave energy, which is a non-contact heat source, includes more effective heating, faster energy transfer, reduced thermal gradients, selective heating, longer useful equipment size, faster response to process heating control, faster start-up, increased production, and elimination of process steps. This book will present a complete picture of the current knowledge on microwave-assisted extraction (MAE) of bioactive compounds from food and natural products. It will provide the necessary theoretical background and details about extraction by microwaves, including information on the technique, the mechanism, protocols, industrial applications, safety precautions, and environmental impacts.

This book contains selected papers presented during the World Renewable Energy Network’s 28th anniversary congress at the University of Kingston in London. The forum highlighted the integration of renewables and sustainable buildings as the best means to combat climate change. In-depth chapters written by the world’s leading experts highlight the most current research and technological breakthroughs and discuss policy, renewable energy technologies and applications in all sectors – for heating and cooling, agricultural applications, water, desalination, industrial applications and for the transport sectors. Presents cutting-edge research in green building and renewable energy from all over the world; Covers the most up-to-date research developments, government policies, business models, best practices and innovations; Contains case studies and examples to enhance practical application of the technologies.

The valorization of lignocellulosic biomass, in the form of forest and agricultural wastes, industrial processing side-streems, and dedicated energy crops, toward chemicals, fuels and added-value products has become a major research area with increasing exploitation potential. The efficient and tailored depolymerization of biomass or its primary structural components (hemicellulose, cellulose, and lignin) to platform chemicals, i.e., sugars, phenolics, furans, ketones, organic acids, etc. is highly dependent on the development of novel or modified chemo- and bio-catalytic processes that take into account the peculiarities and recalcitrance of biomass as feedstock, compared for example to petroleum fractions. The present Research Topic in Frontiers in Chemistry, Section of Green and Sustainable Chemistry, entitled “Nano-(bio)catalysis in lignocellulosic biomass valorization” aims to further contribute to the momentum of research and development in the (bio)catalytic conversion of biomass, by featuring original research papers as well as two review papers, authored and reviewed by experts in the field. The Research Topic addresses various representative reactions and processes in biomass valorization, highlighting the
importance of developing novel, efficient and stable nano-(bio)catalysts with tailored properties according to the nature of the reactant/feedstock and the targeted products.

This book provides a knowledge-based view to the dynamic capabilities in an organization. The author integrates two existing views on gaining competitive advantage: the Knowledge View which suggests that the capability of organizations to learn faster than competitors is the only source of competitiveness; and the Dynamic Capability View which speculates that a firm’s competitive advantage rests on its ability to adapt to changes in the business environment. Using the IT sector in India as a case study, this book provides and tests a new framework—Knowledge-Based Dynamic Capabilities—in the prediction of competitive advantage in organizations.

Alternative energy sources have become a hot topic in recent years. The supply of fossil fuel, which provides about 95 percent of total energy demand today, will eventually run out in a few decades. By contrast, biomass and biofuel have the potential to become one of the major global primary energy source along with other alternate energy sources in the years to come. A wide variety of biomass conversion options with different performance characteristics exists. The goal of this book is to provide the readers with current state of art about biomass and bioenergy production and some other environmental technologies such as Wastewater treatment, Biosorption and Bio-economics. Organized around providing recent methodology, current state of modelling and techniques of parameter estimation in gasification process are presented at length. As such, this volume can be used by undergraduate and graduate students as a reference book and by the researchers and environmental engineers for reviewing the current state of knowledge on biomass and bioenergy production, biosorption and wastewater treatment.

A comprehensive reference to the use of innovative catalysts and processes to turn biomass into value-added chemicals Chemical Catalysts for Biomass Upgrading offers detailed descriptions of catalysts and catalytic processes employed in the synthesis of chemicals and fuels from the most abundant and important biomass types. The contributors? noted experts on the topic? focus on the application of catalysts to the pyrolysis of whole biomass and to the upgrading of bio-oils. The authors discuss catalytic approaches to the processing of biomass-derived oxygenates, as exemplified by sugars, via reactions such as reforming, hydrogenation, oxidation, and condensation reactions. Additionally, the book provides an overview of catalysts for lignin valorization via oxidative and reductive methods and considers the conversion of fats and oils to fuels and terminal olefins by means of esterification/transesterification, hydrodeoxygenation, and decarboxylation/decarbonylation processes. The authors also provide an overview of conversion processes based on terpenes and chitin, two emerging feedstocks with a rich chemistry, and summarize some of the emerging trends in the field. This important book: - Provides a comprehensive review of innovative catalysts, catalytic processes, and catalyst design - Offers a guide to one of the most promising ways to find useful alternatives for fossil fuel resources - Includes information on the most abundant and important types of biomass feedstocks - Examines fields such as catalytic cracking, pyrolysis, depolymerization, and many more - Written for catalytic chemists, process engineers, environmental chemists, bioengineers, organic chemists, and polymer chemists. Chemical Catalysts for Biomass Upgrading presents deep insights on the most important aspects of biomass upgrading and their various types.

Bioreactors: Sustainable Design and Industrial Applications in Mitigation of GHG Emissions presents and compares the foundational concepts, state-of-the-art design and Fabrication of bioreactors. Solidly based on theoretical fundamentals, the book examines various aspects of the commercially available bioreactors, such as construction and fabrication, design, modeling and simulation, development, operation, maintenance, management and target applications for biofuels production and bio-waste management. Emerging issues in commercial feasibility are explored, constraints and pathways for upscaling, and techno-economic assessment are also covered. This book provides researchers and engineers in the biofuels and waste management sectors a clear, at-a-glance understanding of the actual potential of different advanced bioreactors for their requirements. It is a must-have reference for better-informed decisions when selecting the appropriate technology models for sustainable systems development and commercialization.

Lignocellulosic biomass has great potentials as an alternative feedstock for fuels and chemicals. For effective utilization of biomass, biomass recalcitrance, which is inherent resistance of plant cell walls to biological deconstruction, needs to be reduced. Among many factors in biomass, lignin is significantly related to biomass recalcitrance. Lignin, a complex aromatic polymer, is the largest non-carbohydrate component (15-40% dry weight) in most terrestrial plants. In nature, it provides a structural integrity, facilitates water and nutrient transport, and protects plants from microbial attack. From a different angle, lignin significantly contributes to biomass recalcitrance, so it is necessary to reduce and/or modify the lignin for effective conversion of biomass. Genetic modifications of the lignin biosynthetic pathway and lignin-targeting pretreatments have been developed to minimize the lignin-induced biomass recalcitrance. High carbon content of lignin also renders it an attractive feedstock for many applications. About 100,000 to 200,000 tons of lignin can be generated per year as a byproduct from cellululosic ethanol production, so valorization of these lignins could be one of keys for achieving economic biorefinery. However, investigations of lignin conversion have not been accomplished as the utilization of carbohydrates in biomass. Depolymerization of lignin is still challenging because of its broad distribution of bond strengths, recondensation of low-molecular species, and poor product selectivity. Diverse biological and thermochemical depolymerization methods have been investigated to overcome these barriers. In this Research Topic, recent advancements in biomass recalcitrance by effective utilization of lignin are introduced.

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

Synthesis Using Vilsmeier Reagents presents a comprehensive account of the whole of Vilsmeier chemistry, including the formation of over 50 functional groups and over 50 different ring systems by means of Vilsmeier reagents. The highly structured organization by means of functional groups and extensive cross-referencing, enables even the non-specialist to gain an immediate grasp of the subject matter. The potential and versatility of Vilsmeier chemistry makes this major reference work essential for every industrial and academic chemistry library. It should be consulted by every practicing organic chemist and owned by every specialist.

Bioenergy Research: Advances and Applications brings biology and engineering together to address the challenges of future energy needs. The book consolidates the most recent research on current technologies, concepts, and commercial developments in various types of widely used biofuels and integrated biorefineries, across the disciplines of biochemistry, biotechnology, phytochemistry, and microbiology. All the chapters in the book are derived from international scientific experts in their respective research areas. They provide you with clear and concise information on both standard and more recent bioenergy production methods, including hydrolysis and microbial fermentation. Chapters are also designed to facilitate early stage researchers, and enables you to easily grasp the concepts, methodologies and application of bioenergy technologies. Each chapter in the book describes the merits and drawbacks of each technology as well as its usefulness. The book provides information on recent approaches to graduates, post-graduates, researchers and practitioners studying and working in field of the bioenergy. It is an invaluable information resource on biomass-based biofuels for fundamental and applied research, catering to researchers in the areas of bio-hydrogen, bioethanol, bio-methane and biorefineries, and the use of microbial processes in the conversion of biomass into biofuels. Reviews all existing and promising technologies for production of advanced biofuels in addition to bioenergy policies and research funding Cutting-edge research concepts for biofuels production using biological and biochemical routes, including microbial fuel cells Includes production methods and conversion processes for all types of biofuels, including bioethanol and biogas, and outlines the pros and cons of each technology.

As a substrate, cellulose plays a crucial role in the biomass-based biofuel production process, and is essential to enzyme and sugar production. Accordingly, ensuring maximum availability of cellulose for enzyme production and biocconversion for sugar generation is one of the major challenges for sustainable biofuels production. To date there has been extensive research on biofuel production using lignocellulosic biomass, but there is a huge gap when it comes to the critical analysis of cellulose content, structural feasibility, availability, and economic processing, so that it can be converted for enzyme and fuel production at low cost. Consequently, this book discusses the availability of lignocellulosic substrate for biofuel production in light of the challenges that the biofuels industry is currently facing. After identifying the major substrate selection challenges for the practical biofuel production process, the book addresses said challenges by focusing on various issues such as: potential substrates that have high cellulotic content, structural feasibility, and low-cost & effective processing to remedy the structural complexity of biomass structure and create added value. In addition, it covers recent advancements in cellulase production and outlines future prospects. Given its scope, it offers a valuable guide for research students and industry practitioners alike.

Explores the use of conventional and novel technologies to enhance fermentation processes Fermentation Processes reviews the application of both conventional and emerging technologies for enhancing fermentation conditions, examining the principles and mechanisms of fermentation processes, the microorganisms used in bioprocesses, their implementation in industrial fermentation, and more. Designed for scientists and industry professionals alike, this authoritative and up-to-date volume describes how non-conventional technologies can be used to increase accessibility and bioavailability of substrates by microorganisms during fermentation, which in turn promotes microbial growth and can improve processes and productivity across the agri-food, nutraceutical, pharmaceutical, and beverage industries. The text begins by covering the conventional fermentation process, discussing cell division and growth kinetics, current technologies and developments in industrial fermentation processes, the parameters and modes of fermentation, various culture media, and the impact of culture conditions on fermentation processes. Subsequent chapters provide in-depth examination of the use of emerging technologies—such as pulsed electric fields, ultrasound, high-hydrostatic pressure, and microwave irradiation—for biomass fractionation and microbial stimulation. This authoritative resource: Explores emerging technologies that shorten fermentation time, accelerate substrate consumption, and increase microbial biomass Describes enhancing fermentation at conventional conditions by changing oxygenation, agitation, temperature, and other medium conditions Highlights the advantages of new technologies, such as reduced energy consumption and increased efficiency Discusses the integration and implementation of conventional and emerging technologies to meet consumer and industry demand Offers perspectives on the future direction of fermentation technologies and applications Fermentation Processes: Emerging and Conventional Technologies is ideal for microbiologists and bioprocess technologists in need of an up-to-date overview of the subject, and for instructors and students in courses such as bioprocess technology, microbiology, new product development, fermentation, food processing, biotechnology, and bioprocess engineering.

This book offers insights into the current focus and recent advances in bioremediation and green technology applications for waste minimization and pollution control. Increasing urbanization has an impact on the environment, agriculture and industry, exacerbating the pollution problem and creating an urgent need for sustainable and green eco-friendly remediation technology. Currently, there is heightened interest in environmental research, especially in the area of pollution remediation and waste conversion, and alternative, eco-friendly methods involving better usage of agricultural residues as economically
viable substrates for environmental cleanup are still required. The book offers researchers and scholars inspiration, and suggests directions for specific waste management and pollution control. The research presented makes a valuable contribution toward a sustainable and eco-friendly societal environment.

This book is intended to serve as a compendium on the state-of-the-art research in the field of biofuels. The book includes chapters on different aspects of biofuels from renowned international experts in the field. The book looks at current research on all aspects of biofuels from raw materials to production techniques. It also includes chapters on analysis of performance of biofuels, particularly biodiesel, in engines. The book incorporates case studies that provide insights into the performance of biofuels in applications such as automotive engines and diesel generators. The contents of the book will be useful to graduate students and researchers working on all aspects of biofuels. The book will also be of use to professionals and policymakers interested in biofuels.

Conversion of biomass into chemicals and biofuels is an active research and development area as trends move to replace traditional fossil fuels with renewable resources. By integrating processing methods with microwave and ultrasound irradiation into biorefineries, the time-scale of many operations can be greatly reduced while the efficiency of the reactions can be remarkably increased so that process intensification can be achieved. "Production of Biofuels and Chemicals with Microwave" and "Production of Biofuels and Chemicals with Ultrasound" are two independent volumes in the Biofuels and Biorefineries series that take different, but complementary approaches for the pretreatment and chemical transformation of biomass into chemicals and biofuels. The volume "Microwave" provides current research advances and prospects in theoretical and practical aspects of microwave irradiation including properties, effects and temperature monitoring, design of chemical reactors, synergistic effects on combining microwave, ultrasound, hydrodynamic cavitation and high-shear mixing into processes, chemical and catalytic conversion of lignin into chemicals, pyrolysis and gasification, syngas production from wastes, platform chemicals, algal biodiesel, cellulose-based nanocomposites, lignocellulosic biomass pretreatment, green chemistry metrics and energy consumption and techno-economic analysis for a catalytic pyrolysis facility that processes pellets into aromatics. Each of the 12 chapters has been peer-reviewed and edited to improve both the quality of the text and the scope and coverage of the topics. Both volumes "Microwave" and "Ultrasound" are references designed for students, researchers, academicians and industrialists in the fields of chemistry and chemical engineering and include introductory chapters to highlight present concepts of the fundamental technologies and their application.

A comprehensive overview covering the principles and preparation of catalysts, as well as reactor technology and applications in the field of organic synthesis, energy production, and environmental catalysis. Edited and authored by renowned and experienced scientists, this reference focuses on successful reaction procedures for applications in industry. Topics include catalyst preparation, the treatment of waste water and air, biomass and waste valorisation, hydrogen production, oil refining as well as organic synthesis in the presence of heterogeneous and homogeneous catalysts and continuous-flow reactions. With its practical relevance and successful methodologies, this is a valuable guide for chemists at universities working in the field of catalysis, organic synthesis, pharmaceutical or green chemistry, as well as researchers and engineers in the chemical industry.

This will be a comprehensive multi-contributed reference work, with the Editors being highly regarded alternative fuels experts from India and Switzerland. There will be a strong orientation toward production of biofuels covering such topics as biodiesel from renewable sources, biofuels from biomass, vegetable based feedstocks from biofuel production, global demand for biofuels and economic aspects of biofuel production. Book covers the latest advances in all product areas relative to biofuels. Discusses coverage of public opinion related to biofuels. Chapters will be authored by world class researchers and practitioners in various aspects of biofuels. Provides good comprehensive coverage of biofuel quality and environmental impact. Extensive discussion of future prospects in biofuels.

Agro-industrial wastes are end-products emerging after industrial processing operations and also from their treatment and disposal e.g. solid fruit wastes and sludge. The agro-industrial wastes are often present in multistage and comprise multicomponent. Nevertheless, these wastes are a goldmine as they possess valuable organic matter which can be diverted towards high value products ranging from polymers to antibiotics to platform chemicals. There have been plenty of books published on bioenergy, enzymes and organic acids, among others. However, this emerging field of biochemical has not yet been covered so far which is an important entity of the biorefinery model from waste biomass and needs to be understood from fundamental, applied as well as commercial perspective which has been laid out in this book.

Recent Advances in Bioconversion of Lignocellulose to Biofuels and Value Added Chemicals within the Biorefinery Concept covers the latest developments on biorefineries, along with their potential use for the transformation of residues into a broad range of more valuable products. Within this context, the book discusses the enzymatic conversion process of lignocellulosic biomass to generate fuels and other products. It is a unique approach to increase the bioco-based production by microorganisms, the action of microbial inhibitors, and strategies for their removal. Furthermore, it outlines the benefits of this integrated approach for generating value-added products and the benefits to social and economic aspects, circular bio economy, HUBs and perspectives. Covers the mechanisms of enzymatic conversion of biomass into value-added products Discusses bioproducts derived from environmental cleanup are still required. The book offers researchers and scholars a comprehensive understanding of industrial processing operations and also from their treatment and disposal. The agro-industrial wastes are often present in multistage and comprise multicomponent. Nevertheless, these wastes are a goldmine as they possess valuable organic matter which can be diverted towards high value products ranging from polymers to antibiotics to platform chemicals. There have been plenty of books published on bioenergy, enzymes and organic acids, among others. However, this emerging field of biochemical has not yet been covered so far which is an important entity of the biorefinery model from waste biomass and needs to be understood from fundamental, applied as well as commercial perspective which has been laid out in this book.

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lignocellulose and their applications. Includes discussions on design, development and the technologies needed for the sustainable manufacture of materials and chemicals. Offers a techno-economic evaluation of biorefineries for integrated sustainability assessments. Discusses the socioeconomic and cultural-economic perspectives of the lignocellulosic biorefinery. Presents a virtual biorefinery as an integrated approach to evaluate the lignocellulose production chain.

**Nanotechnology in Industrial Wastewater Treatment** is a state of the art reference book. The book is particularly useful for wastewater technology development laboratories and organizations. All professional and academic areas connected with environmental engineering, nanotechnology based wastewater treatment and related product design are incorporated and provide an essential resource. The book describes the application and synthesis of Ca-based and magnetic nano-materials and their potential application for removal/treatment of heavy metals from wastewater. Nanotechnology in Industrial Wastewater Treatment discusses the rapid wastewater treatment methods using Ca-based nanomaterials and magnetic nanomaterials. This is an emerging area of new science and technology in wastewater treatment. The main audiences for the book are water industry professionals, research scholars and students in the area of Environmental Engineering and Nanotechnology. Authors: Dr. Arup Roy, Department of Mining Engineering, Geo-Environmental Lab., Indian Institute of Technology, Kharagpur, India; and Professor Jayanta Bhattacharya, Department of Mining Engineering, Geo-Environmental Lab., Indian Institute of Technology, Kharagpur, India.

This Microbiology Monographs volume covers the latest advances in laccase applications in bioremediation and waste valorisation. The first three chapters provide a comprehensive introduction to fungal and bacterial laccases (the two most important enzyme groups from an application viewpoint) and their practical use in bioremediation and lignocellulosic waste valorisation. Subsequent chapters discuss possible combinations of laccases and further potentially collaborating enzymes, and offer in-depth insights into laccase immobilisation for wastewater treatment and environmental biosensor applications of laccases. Lastly, the book addresses the quest for enzymes with improved and better-fitting properties, covering laccase engineering by directed and computational evolution, and novel enzymes from extreme environments. As such, it is a fascinating read for microbiologists in both industry and academia.

**Renewable Resources and Biorefineries** presents an authoritative and comprehensive overview of biobased technologies for the production of fuels, food/feed, and materials. This book provides an insight into future developments in each field and an extensive bibliography. It will be an essential resource for researchers and academic and industry professionals in the renewable resources field.

This book examines bioremediation technologies as a tool for environmental protection and management. It provides global perspectives on recent advances in the bioremediation of various environmental pollutants. Topics covered include comparative analysis of bio-gas electrification from anaerobic digesters, mathematical modeling in bioremediation, the evaluation of next-generation sequencing technologies for environmental monitoring in wastewater abatement; and the impact of diverse wastewater remediation techniques such as the use of nanofibers, microbes and genetically modified organisms; bioelectrochemical treatment; phytoremediation; and biosorption strategies. The book is targeted at scientists and researchers working in the field of bioremediation.

This book provides an overview of eco-friendly resins and their composite materials covering their synthesis, sources, structures and properties for different industrial applications to support the ongoing research and development in eco-friendly and renewable commercial products. It provides comparative discussions on the properties of eco-friendly resins with other polymer composites. It is a useful reference on bio-based eco-friendly polymer resins, wood-based composites, natural fibers and biomass materials for the polymer scientists, engineers and material scientists.

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