

Biofuels And Bioenergy Processes And Technologies Green Chemistry And Chemical Engineering

Biomass, Biofuels, Biochemicals: Biofuels: Alternative Feedstocks and Conversion Processes for the Production of Liquid and Gaseous Biofuels, Second Edition, provides general information, basic data and knowledge on one of the most promising renewable energy sources—liquid and gaseous biofuels—and their production and application. The book delineates green technologies for abating environmental crisis and enabling the transformation into a sustainable future. It provides date-based scientific information on the most advanced and innovative technology on biofuels, as well as the process scale-up and commercialization of various liquid and gaseous biofuels, detailing the functional mechanisms involved, various operational configurations, influencing factors and integration strategies. All chapters have been updated, with new chapters covering topics of current interest, including sustainability and biohydrogen. Presents a holistic view of biofuels in research, operation, scale-up and application Widens the scope of the existing technologies, providing state-of-the-art information and knowledge Provides strategic integrations of various bioprocesses that are essential in establishing a circular biorefinery Contains interdisciplinary knowledge on the environment, molecular biology, engineering, biotechnology, microbiology and economic aspects Integrates various subjects, including biotechnology, bioengineering, molecular biology, environmental science, sustainability science and chemical engineering

Advanced Technology for the Conversion of Waste into Fuels and Chemicals: Volume 1: Biological Processes presents advanced and combined techniques that can be used to convert waste to energy, including combustion, gasification, pyrolysis, anaerobic digestion and fermentation. The book focuses on solid waste conversion to fuel and energy and presents the latest advances in the design, manufacture, and application of conversion technologies. Contributors from the fields of physics, chemistry, metallurgy, engineering and manufacturing present a truly trans-disciplinary picture of the field. Chapters cover important aspects surrounding the conversion of solid waste into fuel and chemicals, describing how valuable energy can be recouped from various waste materials. As huge volumes of solid waste are produced globally while huge amounts of energy are produced from fossil fuels, the technologies described in this comprehensive book provide the information necessary to pursue clean, sustainable power from waste material. Presents the latest advances in waste to energy techniques for converting solid waste to valuable fuel and energy Brings together contributors from physics, chemistry, metallurgy, engineering and the manufacturing industry Includes advanced techniques such as combustion, gasification, pyrolysis, anaerobic digestion and fermentation Goes far beyond municipal waste, including discussions on recouping valuable energy from a variety of industrial waste materials Describes how waste to energy technologies present an enormous opportunity for clean, sustainable energy

Focusing on fundamentals of biofuel production from renewable energy sources and biohydrogen production, this book offers a complete understanding of the bioconversion processes. Each chapter begins with a fundamental explanation for general readers and ends with in-depth scientific details suitable for expert readers. It discusses different types of production technologies covering basic concepts, production strategies, commercial usage, and advances.

Biomass to Renewable Energy Processes, Second Edition, explains the theories of biological processes, biomass materials and logistics, and conversion technologies for bioenergy products such as biogas, ethanol, butanol, biodiesel, and synthetic gases. The book discusses anaerobic digestion of waste materials for biogas and hydrogen production, bioethanol and biobutanol production from starch and cellulose, and biodiesel production from plant oils. It addresses thermal processes, including gasification and pyrolysis of agricultural residues and woody biomass. The text also covers pretreatment technologies, enzymatic reactions, fermentation, and microbiological metabolisms and pathways.

Biomass can be used to produce renewable electricity, thermal energy, transportation fuels (biofuels), and high-value functional chemicals. As an energy source, biomass can be used either directly via combustion to produce heat or indirectly after it is converted to one of many forms of bioenergy and biofuel via thermochemical or biochemical pathways. The conversion of biomass can be achieved using various advanced methods, which are broadly classified into thermochemical conversion, biochemical conversion, electrochemical conversion, and so on. Advanced development technologies and processes are able to convert biomass into alternative energy sources in solid (e.g., charcoal, biochar, and RDF), liquid (biodiesel, algae biofuel, bioethanol, and pyrolysis and liquefaction bio-oils), and gaseous (e.g., biogas, syngas, and biohydrogen) forms. Because of the merits of biomass energy for environmental sustainability, biofuel and bioenergy technologies play a crucial role in renewable energy development and the replacement of chemicals by highly functional biomass. This book provides a comprehensive overview and in-depth technical research addressing recent progress in biomass conversion processes. It also covers studies on advanced techniques and methods for bioenergy and biofuel production.

The increasing deployment of bioenergy frequently raises issues regarding the use of land and raw materials, infrastructure and logistics. In light of these sometimes conflicting interests **Advances in Bioenergy** provides an objective and wide-ranging overview of the technology, economics and policy of bioenergy. Offering an authoritative multidisciplinary summary of the opportunities and challenges associated with bioenergy utilization, with international researchers give up-to-date and detailed information on key issues for biomass production and conversion to energy. Key features: *Discusses different bioenergy uses such as transportation fuels, electricity and heat production. *Assesses emerging fields such as bio-based chemicals and bio-refineries. *Debates conditions for the mobilization of sustainable bioenergy supply chains and outlines governance systems to support this mobilization. * Dedicated chapters to sustainability governance and emerging tools such as certification systems and standards supporting growth of a sustainable bioenergy industry. *Considers the political, environmental, social and cultural context related to the demand for energy resources, the impact of this demand on the world around us, and the choices and behaviours of consumers. This book will be a vital reference to engineers, researchers and students that need an accessible overview of the bioenergy area. It will also be of high value for politicians, policymakers and industry leaders that need to stay up to date with the state-of-the-art science and technology in this area.

Biofuels for a More Sustainable Future: Life Cycle Sustainability Assessment and Multi-criteria Decision Making provides a comprehensive sustainability analysis of biofuels based on life cycle thinking and develops various multi-dimensional decision-making techniques for prioritizing biofuel production technologies. Taking a transversal approach, the book combines life cycle sustainability assessment, life cycle assessment, life cycle costing analysis, social life cycle assessment, sustainability metrics, triple bottom line, operations research methods, and supply chain design for investigating the critical factors and key enablers that influence the sustainable development of biofuel industry. This book will equip researchers and policymakers in the energy sector with the scientific methodology and metrics needed to develop strategies for viable sustainability transition. It will be a key resource for students, researchers and practitioners seeking to deepen their knowledge on energy planning and current and future trends of biofuel as an alternative fuel. Provides an innovative approach to promoting sustainable development in biofuel production by linking supply chain design and decision support with the life cycle perspective Features case studies and examples that illustrate the theory and methods developed Includes material on corporate social responsibility and economic analysis of biofuels that is highly useful to policy-makers and administrators in both government and enterprise sectors **Handbook of Biofuels Production, Second Edition**, discusses advanced chemical, biochemical, and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage. Research and development in this field is aimed at improving the quality and environmental impact of biofuels production, as well as the overall efficiency and output of biofuels production

plants. The book provides a comprehensive and systematic reference on the range of biomass conversion processes and technology. Key changes for this second edition include increased coverage of emerging feedstocks, including microalgae, more emphasis on by-product valorization for biofuels' production, additional chapters on emerging biofuel production methods, and discussion of the emissions associated with biofuel use in engines. The editorial team is strengthened by the addition of two extra members, and a number of new contributors have been invited to work with authors from the first edition to revise existing chapters, thus offering fresh perspectives. Provides systematic and detailed coverage of the processes and technologies being used for biofuel production Discusses advanced chemical, biochemical, and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage Reviews the production of both first and second generation biofuels Addresses integrated biofuel production in biorefineries and the use of waste materials as feedstocks

The search for alternative, renewable sources of fuel and energy from plants, algae, and waste materials has catalyzed in recent years. With the growing interest in bioenergy development and production there has been increasing demand for a broad ranging introductory text in the field. Bioenergy: Principles and Practices provides an invaluable introduction to the fundamentals of bioenergy feedstocks, processing, and industry. Bioenergy provides readers with an understanding of foundational information on 1st, 2nd, and 3rd generation biofuels. Coverage spans from feedstock production of key energy sources such as grasses, canes, and woody plants through chemical conversion processes and industrial application. Each chapter provides a thorough description of fundamental concepts, definitions of key terms, case studies and practical examples and exercises. Bioenergy: Principles and Practices will be an essential resource for students, bioengineers, chemists, and industry personnel tying key concepts of bioenergy science to valuable real world application.

This book fulfills a long needed review of bio-mass conversion to supply the needs of the energy and fuels sector of our society. The current state of the conversion of bio-mass to energy and fuels is covered in a comprehensive way. Requirements for future process developments to ensure economic viability are clearly stated. After an overview of the subject, the book discusses crop oils, biodiesel, and algae fuels. It examines ethanol from corn and from lignocelluloses and then explores fast pyrolysis and gasification of biomass. Discussing the future of biofuel production, it also describes the conversion of waste to biofuels, bioproducts, and bioenergy and concludes with a discussion of mixed feedstock. Written for readers with college-level backgrounds in chemistry, biology, physics, and engineering, this reference explores the science and technology involved in developing biofuels and bioenergy. It addresses the application of these and other disciplines, covering key issues of special interest to fuel process engineers, fuel scientists, and energy technologists, among others.

Explore a Major Component of Renewable Energy Introduction to Bioenergy takes a look at energy from biomass (thermal energy, power, liquid fuels, and biogas) and envisions a sustainable future fueled by renewable energy. From production to conversion to heat, power, and biofuel, this book breaks down the science of bioenergy and explains the major processes for its production, conversion, and use. Covers Solar Energy, Bioenergy, and Biomass Resources The book begins with an introduction to solar energy (the source of bioenergy) and then moves on to describe bioenergy, biomass, chemical conversion, and the renewable energy processes involved. The authors cover measurement energy parameters, analysis of data, and the prediction of energy production for different bio products. They also consider the institutional, environmental, and economic concerns surrounding bioenergy. An all-inclusive resource covering a rapidly-advancing field, this book: Explores the impact of climate change and global warming on the production of biomass Describes the positive and negative effects of biomass production on ecosystems and biodiversity Illustrates the use of biomass for the production of electricity Considers the replacement of fossil fuels with biofuels, biofuel production, and emerging technologies Addresses institutional and environmental issues relevant to bioenergy Discusses factors impacting the economic feasibility of renewable energy systems Introduction to Bioenergy defines major processes for the production, conversion, and use of bioenergy. A book suitable for coursework or self-study, this essential work serves students and practicing professionals in the renewable energy, environmental science, agriculture engineering, and biology fields.

Innovations in Thermochemical Technologies for Biofuel Processing broadly covers current technologies in alternate fuels and chemical production, a few of which include biomass-to-liquid, biomass-to-gas and gas-to-liquid biomass conversion technologies. The topics in this book include elaborative discussions on biomass feedstocks, biomass-to-liquid technologies (liquefaction, pyrolysis and transesterification), biomass-to-gas technologies (gasification), gas-to-liquid technologies (syngas fermentation and Fischer-Tropsch synthesis), co-processing technologies, fuel upgrading technologies (hydrotreating and reforming), novel catalyst development for biorefining, biorefining process optimization, unit operations, reaction kinetics, artificial neural network, and much more. The book comprehensively discusses the strengths, weaknesses, opportunities and threats of notable biofuels (e.g., bio-oil, biocrude oil, biodiesel, bioethanol, biobutanol, bio-jet fuels, biohydrogen, biomethane, synthesis gas, hydrocarbon fuels, etc.). Addresses solutions for clean fuel, energy security, waste management, waste valorization, reduced greenhouse gas emissions, carbon capture and sequestration, circular economy and climate change mitigation Includes applications of thermochemical conversion and reforming technologies for waste biomass to biofuels Covers current technologies in alternate fuels and chemicals production, a few of which include conversion technologies (i.e., liquefaction, gasification, pyrolysis, torrefaction, transesterification, organic transformation, carbon-carbon and carbon-heteroatom coupling reactions, oxidation, and reforming processes, etc.), hydrotreating technologies (i.e., hydrogenation, hydrodesulfurization, hydrodenitrogenation, hydrodearomatization and hydrodemetalization) and catalytic processes.

Biomass use is growing globally. Biomass is biological material derived from living, or recently living organisms. It most often refers to plants or plant-based materials which are specifically called lignocellulosic biomass. Biomass (organic matter that can be converted into energy) may include food crops, crops for energy, crop residues, wood waste and byproducts, and animal manure. It is one of the most plentiful and well-utilized sources of renewable energy in the world. Broadly speaking, it is organic material produced by the photosynthesis of light. The chemical materials (organic compounds of carbons) are stored and can then be used to generate energy. The most common biomass used for energy is wood from trees. Wood has been used by humans for producing energy for heating and cooking for a very long time. As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Conversion of biomass to biofuel can be achieved by different methods which are broadly classified into: thermal, chemical, and biochemical methods. Biomass gasification is the conversion of solid fuels like wood and agricultural residues into a combustible gas mixture. The gasification system basically consists of a gasifier unit, a purification system and energy converters- burner or engine. This book offers comprehensive coverage of the design and analysis of biomass gasification, the key technology enabling the production of biofuels from all viable sources like sugar beet and sweet sorghum. It aims at creating an understanding of the nature of biomass resources for energy and fuels, the variety of processes that are available for conversion of the wastes into energy or fuels. The book discusses the overview of the Biomass Energy along with their Properties, Composition, Benefits, Characteristics and Manufacturing Process of Biomass based products. Also it contains suppliers contact details of plant & machinery with their photographs. The content includes biomass renewable energy, prospective renewable resources for bio-based processes, biochemical from biomass, biomass based chemicals, biofuel production from biomass crops, biomass gasification, reuse of bio-genic iron oxides and woody biomass fly ash in cement based materials and agricultural areas, biofuel briquettes from biomass, biomass based activated carbon, environmental aspects. It will be a standard reference book for Professionals, Decision-makers, Engineers, those studying and researching in this important area and others interested in the field of biomass based products. Professionals in academia and industry will appreciate this comprehensive and practical reference book, due to its multidisciplinary nature.

The newest addition to the Green Chemistry and Chemical Engineering series from CRC Press, *Biofuels and Bioenergy: Processes and Technologies* provides a succinct but in-depth introduction to methods of development and use of biofuels and bioenergy. The book illustrates their great appeal as tools for solving the economic and environmental challenge

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 ultrasound and microwave 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 Ultrasound" and "Production of Biofuels and Chemicals with Microwave" 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 "Ultrasound" provides current research advances and prospects in mechanistic principles of acoustic cavitation in sonochemistry, physical and chemical mechanisms in biofuel synthesis, reactor design for transesterification and esterification reactions, lipid extraction from algal biomass, microalgae extraction, biodiesel and bioethanol synthesis, practical technologies and systems, pretreatment of biomass waste sources including lignocellulosic materials, manures and sludges for biogas production, vibration-assisted pelleting, combined chemical-mechanical methods, valorization of starch-based wastes and techno-economic methodology. 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 "Ultrasound" and "Microwave" 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. Dr. Zhen Fang is Professor in Bioenergy, Leader and founder of biomass group, Chinese Academy of Sciences, Xishuangbanna Tropical Botanical Garden and is also adjunct Professor of Life Sciences, University of Science and Technology of China. Dr. Richard L Smith, Jr. is Professor of Chemical Engineering, Graduate School of Environmental Studies, Research Center of Supercritical Fluid Technology, Tohoku University, Japan. Dr. Xinhua Qi is Professor of Environmental Science, Nankai University, China.

Details energy and exergy efficiencies of all major aspects of bioenergy systems Covers all major bioenergy processes starting from photosynthesis and cultivation of biomass feedstocks and ending with final bioenergy products, like power, biofuels, and chemicals Each chapter includes historical developments, chemistry, major technologies, applications as well as energy, environmental and economic aspects in order to serve as an introduction to biomass and bioenergy A separate chapter introduces a beginner in easy accessible way to exergy analysis and the similarities and differences between energy and exergy efficiencies are underlined Includes case studies and illustrative examples of 1st, 2nd, and 3rd generation biofuels production, power and heat generation (thermal plants, fuel cells, boilers), and biorefineries Traditional fossil fuels-based technologies are also described in order to compare with the corresponding bioenergy systems This book provides general information and data on one of the most promising renewable energy sources: biomass for its thermochemical conversion. During the last few years, there has been increasing focus on developing the processes and technologies for the conversion of biomass to liquid and gaseous fuels and chemicals, in particular to develop low-cost technologies. This book provides date-based scientific information on the most advanced and innovative processing of biomass as well as the process development elements on thermochemical processing of biomass for the production of biofuels and bio-products on (biomass-based biorefinery). The conversion of biomass to biofuels and other value-added products on the principle biorefinery offers potential from technological perspectives as alternate energy. The book covers intensive R&D and technological developments done during the last few years in the area of renewable energy utilizing biomass as feedstock and will be highly beneficial for the researchers, scientists and engineers working in the area of biomass-biofuels- biorefinery. Provides the most advanced and innovative thermochemical conversion technology for biomass Provides information on large scales such as thermochemical biorefinery Useful for researchers intending to study scale up Serves as both a textbook for graduate students and a reference book for researchers Provides information on integration of process and technology on thermochemical conversion of biomass

Biofuels, Bioenergy and Food Security: Technology, Institutions and Policies explores the popular 'Food versus Fuel' debates, discussing the complex relationship between the biofuel and agricultural markets. From the importance of bioenergy in the context of climate change, to the potentially positive environmental consequences of growing second generation biofuels crops, this book provides important insights into the impact of policy, the technical implementation and the resulting impact of biofuels. The discussion of existing issues hindering the growth of the cellulosic biofuel industry and their remedies are particularly relevant for policy makers and others associated with the biofuel industry. Transferring information on bioenergy economy through the discussion of the current and emerging biofuel market, country specific case studies explain the existing biofuel policy and its consequences to both the energy and agricultural markets. Economic simulation models explain the future of the bioenergy markets. *Biofuels, Bioenergy and Food Security: Technology, Institutions and Policies* is an invaluable resource to the students, scientific community, policy makers, and investors in the bioenergy industry. Students will benefit from a variety of perspectives on major societal questions in context of the interaction between food security and bioenergy. Its review of existing literature on the biofuel market, investment opportunities, and energy independence provides a broad overview to allow informed decision making regarding the industry. Provides an integrated overview of the world biofuel market by country, including a summary of the existing biofuel policies, role of investment opportunities, and rural development potential Discusses the impact of biofuels on efforts by developing countries to become more energy self-sufficient Examines the environmental consequences of biomass-based biofuel use.

Bioconversion of lignocellulosic biomass to biofuel is materially obstructed by the compositional and chemical complexity of biomaterials, resulting in a challenge in using these as raw materials for the biofuel production process. This book explains various lignocellulosic biomass pre-treatment methods with emphasis on concepts, practicability, mechanisms of action, and advantages and disadvantages and potential for industrial applications. It also highlights the main challenges and suggests possible ways to make these pre-treatment technologies feasible for the biofuel industry. Features Presents different pre-treatment technologies available for lignocellulosic biomass in a concise manner. Covers use of different pre-treatment methods in laboratory to industrial scales. Includes combined pre-treatment and deep eutectic solvents methods. Discusses problems related to industrial adaptation and corresponding economics of different techniques. Explores significant fuels and chemicals derived from lignocellulosic biomass. This book is aimed at graduate

students and researchers working on biomass conversion, characterization, cellulose, hemicellulose, lignin, microbial enzymes, fermentation technology, and industrial biotechnology.

This book aims to understand the processes and technologies involved in the fields of bioenergy and biofuels. It contains important chapters that discuss the most vital concepts and emerging trends in this area of study. Biofuels and bioenergy became the focal point for researchers while they were searching for alternative sources of energy other than the existing non-renewable sources. As the already existing resources are limited, biofuels can be termed as one of the substitutes. They are available in forms such as biodiesel and bioethanol. Considerable amount of research is going on this area to produce cleaner fuels with high efficiency for example ethanol biofuels, algae biofuels, jatropha tree oil, etc. The various sub-fields of bioenergy along with technological progress that have future implications are glanced at in this book.

Scientists, engineers, environmentalists, climatologists, researchers and students actively engaged in this field will find this book full of crucial and unexplored concepts.

Sustainable Bioenergy: Advances and Impacts presents a careful overview of advances and promising innovation in the development of various bioenergy technologies. It covers the production of bio-jet fuel, algal biofuels, recent developments in bioprocesses, nanotechnology applications for energy conversion, the role of different catalysts in the production of biofuels, and the impacts of those fuels on society. The book brings together global experts to form a big picture of cutting-edge research in sustainable bioenergy and biofuels. It is an ideal resource for researchers, students, energy analysts and policymakers who will benefit from the book's overview of impacts and innovative needs. Explores the most recent advances in biofuels and related energy systems, including innovations in catalysts and biocatalysts Provides an overview of the impacts of bioenergy and its sustainability aspects Discusses real-life cases of implementation of bioenergy systems on an industrial scale

Biofuel and bioenergy produced from biowastes and biomass is a clean energy source which can be produced renewably. The 21 chapters of this book provide state-of-the-art reviews, current research, and technology developments with respect to 1st, 2nd, and 3rd generation biofuels and bioenergy. The book focuses on the biological/ biochemical pathway, as this option has been reported to be the most cost-effective method for biofuel/bioenergy production. The opening chapter covers the overview of the current status of biofuel and bioenergy production. The rest of the chapters are grouped into seven categories; they cover biomethane production, microbial fuel cells, feedstock production, preprocessing, biomass pretreatment, enzyme hydrolysis, and syngas fermentation. Algal processes for biofuel production, biobutanol production, bioreactor systems, and value-added processing of biofuel residues are included. This book addresses life cycle analyses (LCA) of 1st and 2nd generation biofuels (from corn, soybean, jatropha, and cellulosic biomass) and the emerging applications of nanotechnology in biofuel/bioenergy production. The book is organized in such a way that each preceding chapter builds a foundation for the following one. At the end of each chapter, current research trends and further research needs are outlined. This is one of the first books in this emerging field of biofuel/bioenergy that provides in-depth technical information on the broad topics of biofuel and bioenergy with extensive illustrations, case studies, summary tables, and up-to-date references. This book will be valuable to researchers, instructors, senior undergraduate and graduate students, decision-makers, professionals, and others interested in the field of biofuel/bioenergy.

Biofuels and Bioenergy: Opportunities and Challenges is the first of two volumes that address the technological developments and challenges in the production of a broad range of biofuels and bioenergy products from renewable feedstock. The book emphasizes the opportunities and challenges involved in various processes including fermentation, transesterification, microbial fuels cells, liquefaction, gasification, and pyrolysis. These are also considered from a biorefinery perspective and discuss all common biomass feedstocks. In addition, the book presents new research on microalgae from waste water treatment, large scale production of microalgae, microbial biooil production, biogas production, computational tools for manipulation of metabolic pathway for enhanced biogas production, production of biofuel from genetically modified microalgal biomass, techno-economic analysis, environmental impact and life cycle analysis. **Biofuels and Bioenergy** is an ideal reference on the latest research for researchers and students working in the area of biofuels and renewable energy. Addresses biological and chemical methods of biofuel and bioenergy production Provides industry case studies alongside in-depth techno-economic analysis, environmental impact, and life cycle assessment of biofuels production Focuses on the commercial viability of production processes

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, phytology, 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 biohydrogen, and outlines the pros and cons of each

The worldwide consumption of fossil fuel continues to increase at unsustainable levels, which will lead to progressive scarcity, if immediate and innovative measures are not taken for its sustainable use. This scarcity necessitates the development of renewable and sustainable alternatives for fossil fuels. A possible solution to today's energy challenges can be provided by biofuels. This book intends to provide the reader with a comprehensive overview of the current status and the future implications of biofuels. Diverse and aptly covered comprehensive information in this book will directly enhance both basic and applied research in biofuels and will particularly be useful for students, scientists, breeders, growers, ecologists, industrialists and policy makers. It will be a valuable reference point to improve biofuels in the areas of ecologically and economically sustainable bioenergy research.

Sustainable production of hydrocarbon biofuels from biomass, fuels that are fully compatible with existing internal combustion engines, will allow the global transport economy to transition to a sustainable energy source without the need for capital-intensive new infrastructures. *Hydrocarbon Biorefinery: Sustainable Processing of Biomass for Hydrocarbon Biofuels* presents a comprehensive and easy to understand consolidation of existing knowledge for the production of hydrocarbon biofuels from biomass. Three major areas for the conversion of biomass to hydrocarbon biofuels are addressed: i) Chemical and thermochemical conversion processes, ii) Biological and biochemical conversion processes, and iii) Conversion processes of biomass-derived compounds. Additionally, the book includes process design, life cycle analysis of various processes, reaction engineering, catalysts, process conditions and process concepts, and is supported with detailed case studies. The economic viability of each process is specifically addressed to provide a clear guide for the economic development of future hydrocarbon biofuels. *Hydrocarbon Biorefinery: Sustainable Processing of Biomass for Hydrocarbon Biofuels* offers an all-in-one resource for researchers, graduate students, and industry professionals working in the area of bioenergy and will be of interest to energy engineers, chemical engineers, bioengineers, chemists, agricultural researchers, and mechanical engineers. Furthermore, this book provides structured foundational content on biorefineries for undergraduate and graduate students. Presents fundamental concepts and processes of hydrocarbon biofuel production, covering chemical, biological, and biomass-derived conversion processes Synthesizes the state-of-the-art research and commercial initiatives of this emerging concept into stand-alone chapters, serving as a structured resource for researchers and practitioners Emphasizes the process design and economic feasibility of each process using life cycle assessments to support commercial development

The importance of biofuels in greening the transport sector in the future is unquestionable, given the limited available fossil energy resources, the environmental issues associated to the utilization of fossil fuels, and the increasing attention to security of supply. This comprehensive reference presents the latest technology in all aspects of biofuels production, processing, properties, raw materials, and related economic and environmental aspects. Presenting the application of methods and technology with minimum math and theory, it compiles a wide range of topics not usually covered in one single book. It discusses development of new catalysts, reactors, controllers, simulators, online analyzers, and waste minimization as well as design and operational aspects of processing units and financial and economic aspects. The book rounds out by describing properties, specifications, and quality of various biofuel products and new advances and trends towards future technology.

This book aims to inform readers about the recent developments in bioenergy and biofuels covering current issues from an interdisciplinary approach. It will also feature coverage of anticipated future trends related to each particular biofuel. Chapters will consist of original research presented by world class experts in their respective fields. A number of interdisciplinary areas will be incorporated such as Energy & Fuels, Biotechnology, Genomics, Economics, Optimization, Chemical Engineering, Mechanical Engineering and Algae Science. Examples will relate to a matrix of biofuel and energy types such as bioethanol, biobutanol, and biomethane.

Focusing on the conversion of biomass into gas or liquid fuels the book covers physical pre-treatment technologies, thermal, chemical and biochemical conversion technologies • Details the latest biomass characterization techniques • Explains the biochemical and thermochemical conversion processes • Discusses the development of integrated biorefineries, which are similar to petroleum refineries in concept, covering such topics as reactor configurations and downstream processing • Describes how to mitigate the environmental risks when using biomass as fuel • Includes many problems, small projects, sample calculations and industrial application examples

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.

Industrial Enzymes for Biofuels Production: Recent Updates and Future Trends focuses on resolving existing bottlenecks in enzymes mediated biomass to biofuels production processes through updating recent scientific knowledge and technology developments. The book provides low cost sustainable approaches to lower the cost of enzymes production following different approaches. It is specifically focused on industrial aspects of enzymes used in biofuels production processes by presenting in-depth study of existing issues related to practical viability and long-term sustainability. The book covers detailed discussions on market scenario of industrial enzymes used in biofuels production processes and compares them on both lab and industrial scale. Users will find this to be a great resource that also helps them develop low cost green technologies for enzyme development in biofuels production.

The subject of this book is "Biofuel and Bioenergy Technology". It aims to publish high-quality review and research papers, addressing recent advances in biofuel and bioenergy. State-of-the-art studies of advanced techniques of biorefinery for biofuel production are also included. Research involving experimental studies, recent developments, and novel and emerging technologies in this field are covered. This book contains twenty-seven technical papers which cover diversified biofuel and bioenergy technology-related research that have shown critical results and contributed significant findings to the fields of biomass processing, pyrolysis, bio-oil and its emulsification; transesterification and biodiesel, gasification and syngas, fermentation and biogas/methane, bioethanol and alcohol-based fuels, solid fuel and biochar, and microbial fuel cell and power generation development. The published contents relate to the most important techniques and analyses applied in the biofuel and bioenergy technology.

Engineering the physical, chemical, and energy properties of lignocellulosic biomass is important to produce high-quality consistent feedstocks with reduced variability for biofuels production. The emphasis of this book will be the beneficial impacts that mechanical, chemical, and thermal preprocessing methods can have on lignocellulosic biomass quality attributes or specifications for solid and liquid biofuels and biopower production technologies. "Preprocessing" refers to treatments that can occur at a distance from conversion and result in an intermediate with added value, with improved conversion performance and efficiency. This book explores the effects of mechanical, chemical, and thermal preprocessing methods on lignocellulosic biomass physical properties and chemical composition and their suitability for biofuels production. For example, biomass mechanical preprocessing methods like size reduction (which impacts the particle size and distribution) and densification (density and size and shape) are important for feedstocks to meet the quality requirements for both biochemical and thermochemical conversion methods like enzymatic conversion, gasification, and pyrolysis process. Thermal preprocessing methods like drying, deep drying, torrefaction, steam explosion, hydrothermal carbonization, and hydrothermal liquefaction effect feedstock's proximate, ultimate and energy property, making biomass suitable for both solid and liquid fuel production. Chemical preprocessing which includes washing, leaching, acid, alkali, and ammonia fiber explosion that can enable biochemical composition, such as modification of lignin and hemicellulose, and impacts the enzymatic conversion application for liquid fuels production. This book also explores the integration of these preprocessing technologies to achieve desired lignocellulosic biomass quality attributes for biofuels production.

Oil price increases have also increased the level of interest in bioenergy. The rapid rise in the price of crude oil, the decrease in oil reserves, security concerns and greater recognition of the environmental impacts of fossil fuels have generated considerable interest in biofuels as an alternative energy source. Bioenergy is already making a substantial contribution to meeting global energy demand. This contribution can be expanded very significantly in the future, providing greenhouse gas savings and other environmental benefits, as well as contributing to energy security, improving trade balances, providing opportunities for social and economic development in rural communities, and improving the management of resources and wastes. The revolution in transportation that occurred at the beginning of the last century created dependence of Western economies on the combustion of hydrocarbon fuels. 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 sources along with other alternate energy sources in the years to come. A wide range of additional conversion technologies are under development, offering prospects of improved efficiencies, lower costs and improved environmental performance. *Biofuels and Bioenergy Processes and Technologies* presents the selected topics on characterization, production, and uses of bioenergy, biofuels, and coproducts. It gives an overview of the amount of energy that can be harvested from the sun for contemporary biomass production, both for food and for bioenergy. This book is intended 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, providing recent methodology, current state of modelling and techniques of parameter estimation in gasification process are also presented. Providing an insight into future developments in each field and extensive bibliography, this book will be an essential resource for researchers and academic and industry professionals for reviewing the current state of knowledge on biomass and bioenergy production.

With increased public and scientific attention driven by factors such as oil price spikes, the need for increased energy security, and concerns over greenhouse gas emissions from fossil fuels, the production of fuels by biological systems is becoming increasingly important as the world seeks to move towards renewable, sustainable energy sources. *Biofuels and Bioenergy* presents a broad, wide-ranging and informative treatment of biofuels. The book covers historical, economic, industrial, sociological and ecological/environmental perspectives as well as dealing with all the major scientific issues associated with this important topic. With contributions from a range of leading experts covering key aspects, including:

- Conventional biofuels.
- Basic biology, biochemistry and chemistry of different types and classes of biofuel.
- Current research in synthetic biology and GM in the development and exploitation of new biofuel sources.
- Aspects relating to ecology and land use, including the fuel v food dilemma.
- Sustainability of different types of biofuel.
- Ethical aspects of biofuel production.

Biofuels and Bioenergy provides students and researchers in biology, chemistry, biochemistry and chemical engineering with an accessible review of this increasingly important subject.

Biofuels are a renewable source of energy used mainly for transportation. They link together food, energy and natural resources sectors, and involve ecological, social and inequality issues. They are an emblematic example of the interactions between economic, environmental, social and political decisions and, as a recent and complex issue, require updated and detailed information to be understood. This book aims to shed light on several economic, social and environmental issues connected to biofuel production and policies. The Economics of Biofuels adopts detailed descriptions, rigorous data analysis and precise econometric methods to estimate the effects of biofuel on different socio-economic factors, avoiding complicated and sometimes ineffective models based on context-specific parameters. In particular, the book focuses on the impact of bioenergy policy on biocommodity production and trade, and on the related phenomenon of land acquisitions to grow biofuel commodities. The book's main findings are derived by an original and unique dataset collecting information on the investors acquiring land in Africa and on the voluntary standard, certification and labelling schemes adopted by them as Corporate Social Responsibility (CSR) strategy. The analysis links together in an original way public and private initiatives to make biofuel sustainable. Therefore, this book represents an improvement in the understanding of biofuel production and policy's sustainability. This book is of interest to those who study environmental economics, agricultural economics and sustainable development. It is also suitable for those in the renewable energy sector, with a particular focus on biofuel sustainability.

This book offers an insight into three promising and innovative pathways for the biological production of biodiesel, ethanol and methane.

Biofuels and Bioenergy Processes and Technologies CRC Press

Bioenergy: Biomass to Biofuels and Waste to Energy, 2nd Edition presents a complete overview of the bioenergy value chain, from feedstock to end products. It examines current and emerging feedstocks and advanced processes and technologies enabling the development of all possible alternative energy sources. Divided into seven parts, bioenergy gives thorough consideration to topics such as feedstocks, biomass production and utilization, life-cycle analysis, energy return on invested, integrated sustainability assessments, conversions technologies, biofuels economics, business, and policy. In addition, contributions from leading industry professionals and academics, augmented by related service-learning case studies and quizzes, provide readers with a comprehensive resource that connect theory to real-world implementation. **Bioenergy: Biomass to Biofuels and Waste to Energy, 2nd Edition** provides engineers, researchers, undergraduate and graduate students, and business professionals in the bioenergy field with valuable, practical information that can be applied to implementing renewable energy projects, choosing among competing feedstocks, technologies, and products. It also serves as a basic resource for civic leaders, economic development professionals, farmers, investors, fleet managers, and reporters interested in an organized introduction to the language, feedstocks, technologies, and products in the biobased renewable energy world. • Includes current and renewed subject matter, project case studies from real world, and topic-specific sections on the impacts of biomass use for energy production from all sorts of biomass feedstocks including organic waste of all kinds. • Provides a comprehensive overview and in-depth technical information of all possible bioenergy resources: solid (wood energy, grass energy, waste, and other biomass), liquid (biodiesel, algae biofuel, ethanol, waste to oils, etc.), and gaseous/electric (biogas, syngas, biopower, RNG), and cutting-edge topics such as advanced fuels. • Integrates current state of art coverage on feedstocks, cost-effective conversion processes, biofuels economic analysis, environmental policy, and triple bottom line. • Features quizzes for each section derived from the implementation of actual hands-on biofuel projects as part of service learning.

Biofuels and Bioenergy: A Techno-Economic Approach provides an in-depth analysis of the economic aspects of biofuels production from renewable feedstock. Taking a biorefinery approach, the book analyses a wide range of feedstocks, processes, and products including; 1) common biofuels such as bioethanol, biobutanol, biooil, and biodiesel, 2) feedstocks such as lignocellulosic biomass, non-edible feedstocks like vegetable oils, algae and microbial lipids, and solid and liquid wastes, 3) performance assessments of biodiesel in diesel engine, and 4) the latest developments in catalytic conversion and microbial electrosynthesis technologies. Moreover, several chapters address the environmental aspects of different technologies and provide a broader perspective on the balance between environmental and economic performance. **Biofuels and Bioenergy: A Techno-Economic Approach** offers valuable insights into the commercial feasibility of biofuels products for researchers and students working in the area of bioenergy and renewable energy, as well as practicing engineers in the biorefinery and biofuel industry looking to develop commercial products. Focuses on the in-depth techno-economic analysis of biofuel and bioenergy products, including all important feedstocks, processes, and products, and supported by industry case studies Includes environmental impact and life-cycle assessments of biofuels production alongside techno-economic analyses Provides a critical guide to assessing the commercial viability and feasibility of bioenergy production from renewable sources

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