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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

Technologies for Biochemical Conversion of Biomass introduces biomass biochemical conversion technology, including the pretreatment platform, enzyme platform, cell refining platform, sugar platform, fermentation platform, and post-treatment platform. Readers will find a systematic treatment, not only of the basics of biomass biochemical conversion and the introduction of each strategy, but also of the current advances of research in this area. Researchers will find the key problems in each technology platform for biomass biochemical conversion identified and solutions offered. This valuable reference book features new scientific research and the related industrial application of biomass biochemical conversion technology as the main content, and

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then systematically introduces the basic principles and applications of biomass biochemical conversion technology. Combines descriptions of these technologies to provide strategies and a platform for biochemical conversion in terms of basic knowledge, research advances, and key problems Summarizes models of biomass biochemical conversion for multiple products Presents products of biomass biochemical conversion from C1 to C10

With more than 40 contributions from expert authors, this is an extensive overview of all important research topics in the field of bioengineering, including metabolic engineering, biotransformations and biomedical applications. Alongside several chapters dealing with biotransformations and biocatalysis, a whole section is devoted to biofuels and the utilization of biomass. Current perspectives on synthetic biology and metabolic engineering approaches are presented, involving such example organisms as *Escherichia coli* and *Corynebacterium glutamicum*, while a further section covers topics in biomedical engineering including drug delivery systems and biopharmaceuticals. The book concludes with chapters on computer-aided bioprocess engineering and systems biology. This is a part of the Advanced Biotechnology book series, covering all pertinent aspects of the field with each volume prepared by eminent scientists who are experts on the topic in question. Invaluable reading for biotechnologists and bioengineers, as well as those working in the chemical and pharmaceutical industries. Compiled by a well-known expert in the field, *Liquid Biofuels* provides a profound knowledge to researchers about biofuel technologies, selection of raw materials, conversion of various biomass to biofuel pathways, selection of suitable methods of conversion, design of equipment, selection of operating parameters, determination of chemical kinetics, reaction mechanism, preparation of bio-catalyst: its

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application in bio-fuel industry and characterization techniques, use of nanotechnology in the production of biofuels from the root level to its application and many other exclusive topics for conducting research in this area. Written with the objective of offering both theoretical concepts and practical applications of those concepts, Liquid Biofuels can be both a first-time learning experience for the student facing these issues in a classroom and a valuable reference work for the veteran engineer or scientist. The description of the detailed characterization methodologies along with the precautions required during analysis are extremely important, as are the detailed description about the ultrasound assisted biodiesel production techniques, aviation biofuels and its characterization techniques, advance in algal biofuel techniques, pre-treatment of biomass for biofuel production, preparation and characterization of bio-catalyst, and various methods of optimization. The book offers a comparative study between the various liquid biofuels obtained from different methods of production and its engine performance and emission analysis so that one can get the utmost idea to find the better biofuel as an alternative fuel. Since the book covers almost all the field of liquid biofuel production techniques, it will provide advanced knowledge to the researcher for practical applications across the energy sector. A valuable reference for engineers, scientists, chemists, and students, this volume is applicable to many different fields, across many different industries, at all levels. It is a must-have for any library.

Technologies for Converting Biomass to Useful Energy Combustion, Gasification, Pyrolysis, Torrefaction and Fermentation CRC Press

This book reviews the recent advances in hydrothermal conversion of biomass into chemicals and fuels, and consists of 15 chapters. It introduces the properties of high-

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temperature water, the merits of hydrothermal conversion of biomass, and some novel hydrothermal conversion processes, mainly including hydrothermal production of value-added products, hydrothermal gasification, hydrothermal liquefaction and hydrothermal carbonization. This book introduces a new concept for counteracting the imbalance in the carbon cycle, which is caused by the rapid consumption of fossil fuels in anthropogenic activities in combination with the slow formation of fossil fuels. Accordingly, the book is useful in conveying a fundamental understanding of hydrothermal conversion of biomass in the carbon cycle so that a contribution can be made to achieving sustainable energy and environment. It is also interesting to a wide readership in various fields including chemical, geologic and environmental science and engineering. Fangming Jin is a Distinguished Professor at the School of Environmental Science & Engineering, Shanghai Jiao Tong University, China

Innovative Energy Conversion from Biomass Waste offers a new approach to optimizing energy recovery from waste using thermochemical conversion. Instead of conventional pinch technology, the book proposes integrated systems employing exergy recovery and process integration technologies to minimize exergy loss due to entropy generation. This innovative approach is demonstrated in three case studies using high-potential low-rank fuels from industrial waste products with high moisture content, high volatile matter, and high hemicellulose content. From these case studies, readers are provided with three different examples of biomass type, pre-treatment route, and conversion, from fruit bunch cofired within existing coal power plants, black liquor in a stand-alone system, and rice waste processing integrated into existing agricultural systems. *Innovative Energy Conversion from Biomass Waste* is a valuable resource for researchers and practitioners alike, and

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will be of interest to environmental scientists, biotechnologists, and chemical engineers working in waste-to-energy and renewable energy. Provides a new approach to developing systems based on exergy recovery and process integration technologies Discusses the possible routes of energy recovery in different scenarios from selected low-rank fuels from industrial waste biomass Includes a replicable and applicable efficiency improvement method for different process developments

Officially, the use of biomass for energy meets only 10-13% of the total global energy demand of 140 000 TWh per year. Still, thirty years ago the official figure was zero, as only traded biomass was included. While the actual production of biomass is in the range of 270 000 TWh per year, most of this is not used for energy purposes, and mostly it

Biofuel is a renewable energy source produced from natural materials. The benefits of biofuels over traditional petroleum fuels include greater energy security, reduced environmental impact, foreign exchange savings, and socioeconomic issues related to the rural sector. The most common biofuels are produced from classic food crops that require high-quality agricultural land for growth. However, bioethanol can be produced from plentiful, domestic, cellulosic biomass resources such as herbaceous and woody plants, agricultural and forestry residues, and a large portion of municipal and industrial solid waste streams. There is also a growing interest in the use of vegetable oils for making biodiesel.

“Biofuels: Securing the Planet’s Future Energy Needs” discusses the production of transportation fuels from biomass (such as wood, straw and even household waste) by Fischer-Tropsch synthesis. The book is an important text for students and researchers in energy engineering, as well as professional fuel engineers.

This book addresses the potential of the transformation of

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biomass into a wide range of marketable products, and examines the biological, biochemical, physical and thermal processing of biomass into products such as fuels, power, heat, feeds, chemicals and materials. Respective chapters explore various topics including biomass characterization, biomass pre-conditioning and sustainability analysis, aspects that are supplemented by a global overview of their implementation in current pilot bio-refineries. Providing a valuable resource to energy engineers, chemical engineers, biotechnologists and economists, this book will also be of great interest to students and policymakers.

This book investigates innovative solutions to increase the share of renewable energy in the global power mix, with a particular focus on improved and sustainable biomass conversion technologies. To this end, the book deals with an analysis of the generation mix of renewable energies (including biofuels, renewable waste and biogas) in the overall power balance of several countries. In addition, the possibilities of using bioenergy resources in the context of power generation are thoroughly analyzed. As one of the most important ways of converting biomass into energy, the combustion process is analyzed in detail, highlighting the vast potential for the use of innovative biofuels. In this context, a detailed classification of existing biofuels is established, reflecting the relationship between their energy properties and their potential use in industrial facilities. Additionally, the most efficient combustion technologies for the respective applications are discussed. Furthermore, the authors emphasize that the management of renewable waste, both from industry (tannery waste and oils from transport) and agriculture, requires an economic and environmental friendly approach. The challenges of burning various renewable waste fuels and upgrading industrial facilities are discussed, and the ideas and technologies presented in this book

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Gasification Pyrolysis Torrefaction And Fermentation Sustainable Energy Developments contribute to the UN Sustainable Development Goal (SDG) for "Affordable and Clean Energy". The book is a useful

resource for professionals dealing with current and upcoming activities related to renewable energy combustion, and a good starting point for young researchers.

A text to the advances and development of novel technologies in the production of high-value products from economically viable raw materials Lignocellulosic Biorefining Technologies is an essential guide to the most recent advances and developments of novel technologies in the production of various high-value products from economically viable raw materials. Written by a team of experts on the topic, the book covers important topics specifically on production of economical and sustainable products such as various biofuels, organic acids, enzymes, biopigments, biosurfactants, etc. The book highlights the important aspects of lignocellulosic biorefining including structure, function, and chemical composition of the plant cell wall and reviews the details about the various components present in the lignocellulosic biomass and their characterizations. The authors explore the various approaches available for processing lignocellulosic biomass into second generation sugars and focus on the possibilities of utilization of lignocellulosic feedstocks for the production of biofuels and biochemicals. Each chapter includes a range of clear, informative tables and figures, and contains relevant references of published articles. This important text: Provides cutting-edge information on the recent developments in lignocellulose biorefinery Reviews production of various economically important and sustainable products, such as biofuels, organic acids, biopigments, and biosurfactants Highlights several broad-ranging areas of recent advances in the utilization of a variety of lignocellulosic feedstocks Provides a valuable, authoritative reference for anyone

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Interested in the topic Written for post-graduate students and researchers in disciplines such as biotechnology, bioengineering, forestry, agriculture, and chemical industry, Lignocellulosic Biorefining Technologies is an authoritative and updated guide to the knowledge about various biorefining technologies.

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

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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.

Biomass is a key resource for meeting the energy and material demands of mankind in the future. As a result, businesses and technologies are developing around biomass processing and its applications. Transformation of Biomass:

Theory to Practice explores the modern applications of biomass and bio-based residues for the generation of energy, heat and chemical products. The first chapter presents readers with a broad overview of biomass and its

composition, conversion routes and products. The following chapters deal with specific technologies, including anaerobic digestion, pyrolysis and gasification, as well as hydrothermal and supercritical conversion. Each chapter details current

practises, recent developments, business case models and comprehensive analysis of the problems associated with each approach, and how to optimize them. Topics covered include:

Anaerobic digestion Reactor design Pyrolysis Catalysis in biomass transformation Engines for combined heat and power Influence of feedstocks on performance and products

Bio-hydrogen from biomass Analysis of bio-oils Numerical simulation and formal kinetic parameters evaluation Business

case development This textbook will provide students, researchers and industry professionals with a practical and accessible guide to the essential skills required to advance in the field of bioenergy.

Lignocellulosic Biomass to Value-Added Products:

Fundamental Strategies and Technological Advancements focuses on fundamental and advanced topics surrounding technologies for the conversion process of lignocellulosic biomass. Each and every concept related to the utilization of

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biomass in the process of conversion is elaborately explained, with importance given to minute details. Advanced level technologies involved in the conversion of biomass into biofuels, like bioethanol and biobutanol, are addressed, along with the process of pyrolysis. Readers of this book will become fully acquainted with the field of lignocellulosic conversion, from its basics to current research accomplishments. The uniqueness of the book lies in the fact that it covers each and every topic related to biomass and its conversion into value-added products. Technologies involved in the major areas of pretreatment, hydrolysis and fermentation are explained precisely. Additional emphasis is given to the analytical part, especially the established protocols for rapid and accurate quantification of total sugars obtained from lignocellulosic biomass. Includes chapters arranged in a flow-through manner Discusses mechanistic insights in different phenomena using colorful figures for quick understanding Provides the most up-to-date information on all aspects of the conversion of individual components of lignocellulosic biomass

This proceedings volume represents the culmination of nearly three years of planning, organizing and carrying out of a NATO Advanced Study Institute on Biomass Utilization. The effort was initiated by Dr. Harry Sobel, then Editor of Biosources Digest, and a steering committee representing the many disciplines that this field brings together. . When the fiscal and logistical details of the original plan could not be worked out, the idea was temporarily suspended. In the spring of 1982, the Renewable Materials Institute of the State University of New York at the College of Environmental Science and Forestry in Syracuse, New York revived the plan. A number of modifications had to be made, including the venue which was changed from the U.S.A. to Portugal. Additional funding beyond the basic support provided by the

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Scientific Affairs Division of NATO had to be obtained. Ultimately there were supplementary grants from the Foundation for Microbiology and the Anne S. Richardson Fund to assist student participants. The New York State College of Forestry Foundation, Inc. provided major support through the Renewable Materials Institute. The ASI was held in Alcabideche, Portugal from September 26 to October 9, 1982. Eighty participants including fifteen principal lecturers were assembled at the Hotel Sintra Estoril for the program that was organized as a comprehensive course on biomass utilization. The main lectures were supplemented by relevant short papers offered by the participants.

Separation and purification processes play a critical role in biorefineries and their optimal selection, design and operation to maximise product yields and improve overall process efficiency. Separations and purifications are necessary for upstream processes as well as in maximising and improving product recovery in downstream processes. These processes account for a significant fraction of the total capital and operating costs and also are highly energy intensive. Consequently, a better understanding of separation and purification processes, current and possible alternative and novel advanced methods is essential for achieving the overall techno-economic feasibility and commercial success of sustainable biorefineries. This book presents a comprehensive overview focused specifically on the present state, future challenges and opportunities for separation and

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purification methods and technologies in biorefineries. Topics covered include: Equilibrium Separations: Distillation, liquid-liquid extraction and supercritical fluid extraction. Affinity-Based Separations: Adsorption, ion exchange, and simulated moving bed technologies. Membrane Based Separations: Microfiltration, ultrafiltration and diafiltration, nanofiltration, membrane pervaporation, and membrane distillation. Solid-liquid Separations: Conventional filtration and solid-liquid extraction. Hybrid/Integrated Reaction-Separation Systems: Membrane bioreactors, extractive fermentation, reactive distillation and reactive absorption. For each of these processes, the fundamental principles and design aspects are presented, followed by a detailed discussion and specific examples of applications in biorefineries. Each chapter also considers the market needs, industrial challenges, future opportunities, and economic importance of the separation and purification methods. The book concludes with a series of detailed case studies including cellulosic bioethanol production, extraction of algae oil from microalgae, and production of biopolymers. Separation and Purification Technologies in Biorefineries is an essential resource for scientists and engineers, as well as researchers and academics working in the broader conventional and emerging bio-based products industry, including biomaterials, biochemicals,

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biofuels and bioenergy.

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 weed biomass as alternative feedstock. In the Recent Approaches for Increasing Fermentation Efficiency of Lignocellulosic Ethanol section, potential and research progress using thermophile 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. While energy is essential for development, standard fossil fuels are often in short supply in countries where it is needed most. However, alternative fuel

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resources abundant in the form of agricultural and municipal waste or "biomass." This report reviews the state of the art of biomass combustion and gasification systems, their advantages and disadvantages. It also encourages investment in use of these technologies to enable developing countries to better exploit their biomass resources and help close the gap between their energy needs and their energy supply.

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The utilisation of biomass is increasingly important for low- or zero-carbon power generation.

Developments in conventional power plant fuel flexibility allow for both direct biomass combustion and co-firing with fossil fuels, while the integration of advanced technologies facilitates conversion of a wide range of biomass feedstocks into more readily combustible fuel. Biomass combustion science, technology and engineering reviews the science and technology of biomass combustion, conversion and utilisation. Part one provides an introduction to biomass supply chains and feedstocks, and outlines the principles of biomass combustion for power generation. Chapters also describe the categorisation and preparation of biomass feedstocks for combustion and gasification. Part two goes on to explore biomass combustion and co-firing, including direct combustion of biomass, biomass co-firing and gasification, fast pyrolysis of biomass for the production of liquids and

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intermediate pyrolysis technologies. Large-scale biomass combustion and biorefineries are then the focus of part three. Following an overview of large-scale biomass combustion plants, key engineering issues and plant operation are discussed, before the book concludes with a chapter looking at the role of biorefineries in increasing the value of the end-products of biomass conversion. With its distinguished editor and international team of expert contributors, Biomass combustion science, technology and engineering provides a clear overview of this important area for all power plant operators, industrial engineers, biomass researchers, process chemists and academics working in this field. Reviews the science and technology of biomass combustion, conversion and utilisation Provides an introduction to biomass supply chains and feedstocks and outlines the principles of biomass combustion for power generation Describes the categorisation and preparation of biomass feedstocks for combustion and gasification Renewable energy (RE) is a subject of great interest today. It is one of the two main means for implementing climate change mitigation programmes, and presently the only perceived means for replacing the declining global fossil fuel reserves. It also helps fight poverty and assists in the global quest for gender equity by taking clean energy where it is needed most for development. It is

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perhaps not surprising therefore that there is so much coverage of RE in both the conventional media and the internet by media and tech writers, economists and bloggers, many of who only have a partial understanding of the technology itself. The end result is mostly promotional rhetoric that says little about the true value of the technology, and leads to a confused picture for the serious individual or decision-maker who wants to know what the technology is really capable of doing. This book provides a clear and factual picture of the status of RE and its capabilities today. The need for such a book was first realized by the author when he was engaged in a renewable energy capacity-building project encompassing countries from Europe, the Caribbean, Africa, and the Pacific. The book is largely non-technical in nature; it does however contain enough mention of the science and technology to enable readers to go further with their own investigations should they wish to. The book covers all areas of renewable energy (RE), starting from biomass energy and hydropower and proceeding to wind, solar and geothermal energy before ending with an overview of ocean energy. It begins with a simple introduction to the physical principles of the RE technologies, followed by an enumeration of the requirements for their successful implementation. The last two chapters consider how the technologies are actually being implemented

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today and their roles in climate change mitigation and poverty alleviation.

This book offers comprehensive coverage of the design, analysis, and operational aspects of biomass gasification, the key technology enabling the production of biofuels from all viable sources--some examples being sugar cane and switchgrass. This versatile resource not only explains the basic principles of energy conversion systems, but also provides valuable insight into the design of biomass gasifiers. The author provides many worked out design problems, step-by-step design procedures and real data on commercially operating systems. After fossil fuels, biomass is the most widely used fuel in the world. Biomass resources show a considerable potential in the long term if residues are properly handled and dedicated energy crops are grown. Includes step-by-step design procedures and case studies for Biomass Gasification Provides worked process flow diagrams for gasifier design. Covers integration with other technologies (e.g. gas turbine, engine, fuel cells)

The Role of Catalysis for the Sustainable Production of Bio-fuels and Bio-chemicals describes the importance of catalysis for the sustainable production of biofuels and biochemicals, focused primarily on the state-of-the-art catalysts and catalytic processes expected to play a decisive role in the "green" production of fuels and chemicals from

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biomass. In addition, the book includes general elements regarding the entire chain of biomass production, conversion, environment, economy, and life-cycle assessment. Very few books are available on catalysis in production schemes using biomass or its primary conversion products, such as bio-oil and lignin. This book fills that gap with detailed discussions of: Catalytic pyrolysis of lignocellulosic biomass Hybrid biogasoline by co-processing in FCC units Fischer-Tropsch synthesis to biofuels (biomass-to-liquid process) Steam reforming of bio-oils to hydrogen With energy prices rapidly rising, environmental concerns growing, and regulatory apparatus evolving, this book is a resource with tutorial, research, and technological value for chemists, chemical engineers, policymakers, and students. Includes catalytic reaction mechanism schemes and gives a clear understanding of catalytic processes Includes flow diagrams of bench-, pilot- and industrial-scale catalytic processing units and demonstrates the various process technologies involved, enabling easy selection of the best process Incorporates many tables, enabling easy comparison of data based on a critical review of the available literature

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,

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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.

Greenhouse Gases Balance of Bioenergy Systems covers every stage of a bioenergy system, from establishment to energy delivery, presenting a comprehensive, multidisciplinary overview of all the relevant issues and environmental risks. It also provides an understanding of how these can be practically managed to deliver sustainable greenhouse gas reductions. Its expert chapter authors present readers to the methods used to determine the greenhouse gas balance of bioenergy systems, the data required and the significance of the results obtained. It also provides in-depth discussion of key issues and uncertainties, such as soil, agriculture, forestry, fuel conversion and emissions formation. Finally, international case studies examine typical GHG reduction levels for different systems and highlight best practices for bioenergy GHG mitigation. For bringing together into one volume information from several different fields

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that was up until now scattered throughout many different sources, this book is ideal for researchers, graduate students and professionals coming into the bioenergy field, no matter their previous background. It will be particularly useful for bioenergy researchers seeking to calculate greenhouse gas balances for systems they are studying. I will also be an important resource for policy makers and energy analysts. Uses a multidisciplinary approach to synthesize the diverse information that is required to competently execute GHG balances for bioenergy systems Presents an in-depth understanding of the science underpinning key issues and uncertainty in GHG assessments of bioenergy systems Includes case studies that examine ways to maximize the GHG reductions delivered by different bioenergy systems Officially, the use of biomass for energy meets only 10-13% of the total global energy demand of 140 000 TWh per year. Still, thirty years ago the official figure was zero, as only traded biomass was included. While the actual production of biomass is in the range of 270 000 TWh per year, most of this is not used for energy purposes, and mostly it is not used very efficiently. Therefore, there is a need for new methods for converting biomass into refined products like chemicals, fuels, wood and paper products, heat, cooling and electric power. Obviously, some biomass is also used as food – our primary life necessity. The different types of

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conversion methods covered in this volume are biogas production, bio-ethanol production, torrefaction, pyrolysis, high temperature gasification and combustion. This book covers the suitability of different methods for conversion of different types of biomass. Different versions of the conversion methods are presented – both existing methods and those being developed for the future. System optimization using modeling methods and simulation are analyzed to determine advantages and disadvantages of different solutions. Many international experts have contributed to provide an up-to-date view of the situation all over the world. These global perspectives and the inclusion of so much expertise of distinguished international researchers and professionals make this book unique. This book will prove useful and inspiring to professionals, engineers, researchers and students as well as to those working for different authorities and organizations.

Biomass to Energy Conversion Technologies: The Road to Commercialization examines biomass production, biomass types, properties and characterization, and energy conversion technologies with an emphasis on the production of a gaseous fuel to supplement the gas derived from the landfilling of organic wastes (landfill gas) and used in gas engines to produce electricity. The book discusses the integration of both fermentation and

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anaerobic digestion in a biorefinery concept that allows the production of ethanol—along with biogas—to be used to produce heat and electricity, thus improving overall energy balance. Included case studies based on worldwide projects discuss both risks and challenges. The main studies on the combination of both bioethanol and biogas production processes are reviewed and the strength and weakness of the integrated treatment for industrial application are highlighted. The book also considers gasification technologies and their potential for biomass gasification and lists the advantages and disadvantages of using of biomass as a source of energy, the path of commercialization of the various processes, energy related environmental issues. Highlights commercialization and technological risks Discusses challenges, limitations and future prospects of third- and fourth generation biofuels Includes integration of both fermentation and anaerobic digestion in a biorefinery concept Discusses energy related environment issues (Greenhouse effect, acid rain, air pollution) Plant biomass is attracting increasing attention as asustainable resource for large-scale production of renewable fuelsand chemicals. However, in order to successfully compete withpetroleum, it is vital that biomass conversion processes aredesigned to minimize costs and maximize yields. Advances inpretreatment technology are critical in order to

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develop high-yielding, cost-competitive routes to renewable fuels and chemicals. Aqueous

Pretreatment of Plant Biomass for Biological and Chemical Conversion to Fuels and Chemicals presents a comprehensive overview of the currently available aqueous pretreatment technologies for cellulosic biomass, highlighting the fundamental chemistry and biology of each method, key attributes and limitations, and opportunities for future advances. Topics covered include:

- The importance of biomass conversion to fuels
- The role of pretreatment in biological and chemical conversion of biomass
- Composition and structure of biomass, and recalcitrance to conversion
- Fundamentals of biomass pretreatment at low, neutral and high pH
- Ionic liquid and organosolv pretreatments to fractionate biomass
- Comparative data for application of leading pretreatments and effect of enzyme formulations
- Physical and chemical features of pretreated biomass
- Economics of pretreatment for biological processing
- Methods of analysis and enzymatic conversion of biomass streams
- Experimental pretreatment systems from multiwell plates to pilot plant operations

This comprehensive reference book provides an authoritative source of information on the pretreatment of cellulosic biomass to aid those experienced in the field to access the most current information on the topic. It will also be

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invaluable to those entering the growing field of biomass conversion.

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

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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.

Thermochemical pathways for biomass conversion offer opportunities for rapid and efficient processing of diverse feedstocks into fuels, chemicals and power. Thermochemical processing has several advantages relative to biochemical processing, including greater feedstock flexibility, conversion of both carbohydrate and lignin into products, faster reaction rates, and the ability to produce a diverse selection of fuels. Thermochemical Processing of Biomass examines the large number of possible pathways for converting biomass into

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fuels, chemicals and power through the use of heat and catalysts. The book presents a practical overview of the latest research in this rapidly developing field, highlighting the fundamental chemistry, technical applications and operating costs associated with thermochemical conversion strategies. Bridging the gap between research and practical application, this book is written for engineering professionals in the biofuels industry, as well as academic researchers working in bioenergy, bioprocessing technology and chemical engineering. Topics covered include: Combustion Gasification Fast Pyrolysis Hydrothermal Processing Upgrading Syngas and Bio-oil Catalytic Conversion of Sugars to Fuels Hybrid

Thermochemical/Biochemical Processing Economics of Thermochemical Conversion For more information on the Wiley Series in Renewable Resources, visit a href="http://www.wiley.com/go/rrs"www.wiley.com/go/rrs/a

Most coveted energy forms nowadays are gas in nature and electricity due to their environmental cleanness and convenience. Recently, gasification market trend is starting to switch to low-grade feedstock such as biomass, wastes, and low-rank coal that are still not properly utilized. In this sense, the most promising area of development in gasification field lies in low-grade feedstock that should be converted to more user-friendly gas or

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electricity form in utilization. This book tried to shed light on the works on gasification from many parts of the world and thus can feel the technology status and the areas of interest regarding gasification for low-grade feedstock.

This book addresses a key innovative technology for decarbonization of the energy system: hydrothermal processing. It basically consists of treating biomass and wastes in a wet form, under pressure and temperature condition. This approach is becoming more and more attractive, as new feedstock and applications are appearing on the scene of bioeconomy and bioenergy. The hydrothermal processing of various type of biomass, waste, and residues, thus, raised the interest of many researchers and companies around the world, together with downstream upgrading processes and technologies: solid products as biochar, for instance, or liquid ones as crude bioliquids, are finding new market opportunities in circular economy schemes. The Special Issue collects recent innovative research works in the field, from basic to applied research, as well as pilot industrial applications/demo. It is a valuable set of references for those investing time and effort in research in the field.

Advances in Feedstock Conversion Technologies for Alternative Fuels and Bioproducts: New Technologies, Challenges and Opportunities highlights the novel

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applications of, and new methodologies for, the advancement of biological, biochemical, thermochemical and chemical conversion systems that are required for biofuels production. The book addresses the environmental impact of value added bio-products and agricultural modernization, along with the risk assessment of industrial scaling. The book also stresses the urgency in finding creative, efficient and sustainable solutions for environmentally conscious biofuels, while underlining pertinent technical, environmental, economic, regulatory and social issues. Users will find a basis for technology assessments, current research capability, progress, and advances, as well as the challenges associated with biofuels at an industrial scale, with insights towards forthcoming developments in the industry. Presents a thorough overview of new discoveries in biofuels research and the inherent challenges associated with scale-up Highlights the novel applications and advancements for biological, biochemical, thermochemical and chemical conversion systems that are required for biofuels production Evaluates risk management concerns, addressing the environmental impact of value added bio-products and agricultural modernization, and the risk assessment of industrial scaling

This book provides an introduction to the basic science and technologies for the conversion of biomass (terrestrial and aquatic) into chemicals and fuels, as well as an overview of innovations in the field. The entire value chain for converting raw materials into platform molecules and their transformation into final products are

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presented in detail. Both cellulosic and oleaginous biomass are considered. The book contains contributions by both academic scientists and industrial technologists so that each topic combines state-of-the-art scientific knowledge with innovative technologies relevant to chemical industries.

The aim of this book is to provide an integrated framework for the teaching, research, and application of science and engineering to the sustained production, transformation, utilisation, and impact of biomass energy. Coverage focuses on four main areas: biomass and bioenergy; bioenergy production and accounting; biomass conversion and end-use technologies; and an appraisal of the costs and benefits of biomass energy. In recent years carbon dioxide has played an increasingly important role in biomass processing. This book presents the state-of-the-art of a range of diverse approaches for the use of carbon dioxide in biomass valorisation. The book explores cutting-edge research and important advances in green high-pressure technologies. It gives an overview of the most relevant and promising applications of high-pressure CO₂-based technologies in biomass processing from the perspective of the biorefinery concept. Demonstrating the interdisciplinary aspects of high-pressure technologies from biology, chemistry and biochemical engineering areas, this book brings researchers and industrialists up to date with the latest advances in this field, including novel technologies for energy; biochemicals and materials production; and green chemical engineering processes.

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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 This book is the outcome of contributions by many experts in the field from different disciplines, various

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backgrounds, and diverse expertise. This book provides information on biomass volume calculation methods and biomass valorization for energy production. The chapters presented in this book include original research and review articles. I hope the research presented in this book will help to advance the use of biomass for bioenergy production and valorization. The key features of the book are: Providing information on biomass volume estimation using direct, nondestructive and remote sensing methods Biomass valorization for energy using thermochemical (gasification and pyrolysis) and biochemical (fermentation) conversion processes. This book presents a systems approach to bioenergy and provides a means to capture the complexity of bioenergy issues, including both direct and indirect impacts across the energy economy. The book addresses critical topics such as systems thinking; sustainability, biomass; feedstocks of importance and relevance (that are not competing with the food market); anaerobic digestion and biogas; biopower and bioheat; and policies, economy, and rights to access to clean energy. This is a contributed volume with each chapter written by relevant experts in the respective fields of research and teaching. Each chapter includes a review with highlights of the key points, critical-thinking questions, and a glossary. This book can be used as a primary or secondary textbook in courses related to bioenergy and bioproducts and sustainable biofuels. It is suitable for advanced undergraduate and graduate students. Researchers, professionals, and policy makers will also be able to use this book for current reference

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