



Krzysztof J. Ptasinski

EFFICIENCY OF BIOMASS ENERGY

An Exergy Approach to Biofuels, Power, and Biorefineries

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Efficiency Biomass Energy Approach Biorefineries

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Efficiency Biomass Energy Approach Biorefineries:

Efficiency of Biomass Energy Krzysztof J. Ptasinski, 2016-05-11 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

Efficiency of Biomass Energy Krzysztof J. Ptasinski, 2016-08-30 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

A Biorefinery Approach to Algal Biomass Conversion for Biofuels and Bioproducts Kaustubha Mohanty, Satya Sundar Mohanty, 2025-03-03 A Biorefinery Approach to Algal Biomass Conversion for Biofuels and Bioproducts presents a detailed overview of the processes and products of algal biomass within the concept of the circular economy With a particular emphasis on biofuels the book addresses the fundamentals and underlying concepts of biomass conversion processes the equipment and their advanced application for algal feedstocks This includes the principles of biomass conversion processes a complete profile of the generated biofuels feed food and chemicals the concept of integrated biorefinery based on micro and microalgae and sustainability evaluations through technoeconomic analysis and life cycle analysis Readers are supported by step by step guidance on methods and protocols and decision making diagrams and flowcharts and examples of commercial successes Offering a clear and comprehensive overview of algal biomass conversion to biofuels and related products this book is an ideal reference for researches and faculty members looking to develop a deeper understanding of algal biofuels and related conversion processes or seeking a consistent and structured approach to the topic Presents a complete view of the concepts underpinning algal biofuels with decision making processes supported by detailed illustrations and flow charts

Offers detailed step by step guidance on methods from fundamental processes to the latest techniques Provides examples of commercial success through detailed case studies highlighting the challenges and potential solutions to key problems of commercialization

Algal Biorefinery: An Integrated Approach Debabrata Das,2015-11-30 This book critically discusses different aspects of algal production systems and several of the drawbacks related to microalgal biomass production namely low biomass yield and energy consuming harvesting dewatering drying and extraction processes These provide a background to the state of the art technologies for algal cultivation CO₂ sequestration and large scale application of these systems In order to tap the commercial potential of algae a biorefinery concept has been proposed that could help to extract maximum benefits from algal biomass This refinery concept promotes the harvesting of multiple products from the feedstock so as to make the process economically attractive For the last few decades algal biomass has been explored for use in various products such as fuel agricultural crops pigments and pharmaceuticals as well as in bioremediation To meet the huge demand there has been a focus on large scale production of algal biomass in closed or open photobioreactors Different nutritional conditions for algal growth have been explored such as photoautotrophic heterotrophic mixotrophic and oleaginous This book is aimed at a wide audience including undergraduates postgraduates academics energy researchers scientists in industry energy specialists policy makers and others who wish to understand algal biorefineries and also keep abreast of the latest developments

Biomass, Biorefineries and Bioeconomy Mohamed Samer,2022-09-28 This book comprehensively reviews biomass and bioeconomy biomass production and treatment biomass utilization biomass biorefineries and bioenergy generation from biomass It discusses topics focusing on the concept of circular and sustainable bioeconomy economic assessment of biomass utilization biomass valorization biomass pretreatment bioprocessing of biomass using integrated bioindustrial systems and production of value added biochemicals and bioenergy from biomass

Biorefineries Carlos Ariel Cardona Alzate,Jonathan Moncada Botero,Valentina Aristizábal Marulanda,2018-09-03 Aimed at presenting a systematic design of biorefineries the book initiates with an overview about relevance and applications explained through origin of raw materials transformation routes and products Then concepts as hierarchy sequencing and integration are considered which helps in generating a sustainable and strategic design of biorefineries Further framework for biorefineries based on techno economic environmental and social aspects is analyzed with examples to show the applications Finally some mass energy and economic indices are considered to assess the biorefinery sustainability and key challenges for future development of biorefineries Key Features Presents current state of the art of the biorefineries design and analyses for in depth understanding of biofuels and biomaterials Explores conceptual design of processes Concepts discussed with strong engineering approach including design strategies and techno economic analyses Includes bio based materials natural products and food products in the biorefinery concept Presentation of structured method to calculate indices of performance of biorefineries

Integrated Waste Biorefineries: Achieving Sustainable Development

Goals, 2nd edition Mohammad Rehan, Muhammad Amjad, Ala'A Al-Muhtaseb, Muhammad Abdul Qyyum, Konstantinos Moustakas, Su Shiung Lam, Abdul-Sattar Nizami, Meisam Tabatabaei, Imtiaz Ali, Arshid Mahmood Ali, Muhammad Farooq, 2024-01-11 The United Nations Sustainable Development Goals SDGs are designed to revolutionize societies to prepare for the future challenges However the practical implementation of such goals in many domains is are yet to be achieved despite of unique essence Sustainable energy production aligned with SDG 7 clean water and sanitation aligned with SDG 6 sustainable waste services aligned with SDG 11 and mitigating climate change impacts aligned with SDG 13 have been the prime focus of SDGs Moreover much attention is being paid to research and development activities on waste prevention reduction recycling and reuse to achieve responsible consumption and production aligned with SDG 12 Waste biorefineries have emerged as a sustainable environmental management solution to achieve not only the aforementioned SDGs but also to accomplish no poverty aligned with SDG 1 and zero hunger aligned with SDG 2 and to maintain well being and good health aligned with SDG 3 and decent work and economic growth aligned with SDG 8 worldwide This is true because integrated waste biorefineries can efficiently and sustainably produce fuels heat energy power and multiple value added products and chemicals It can further facilitate the transition from linear to circular economies and mitigate the major challenges faced including environmental pollution climate change and adverse effects on public health This Research Topic will focus on different types of waste biorefineries current status practical implications optimization of waste to energy technologies detailed life assessment studies and future opportunities with a vision to achieve SDGs in the areas of sustainable energy generation waste management circular economies and climate change mitigation The editorial team of this special issue consisting of world renowned scientists including Highly Cited Researchers welcomes submissions of original research articles review articles short communications industrial and or country region case studies that covers the following enlisted topics Waste biorefineries e g organic waste biorefinery agricultural and forestry waste biorefinery etc Integration of different types of biorefineries Sustainable development goals Waste to energy technologies Energy and resource recovery from biomass and other waste Renewable and sustainable energy systems Biomass and waste supply chain Sustainable waste management systems Mitigation of environmental pollution and climate change Life cycle assessment Sustainable circular and bio based economies

Biorefineries: A Step Towards Renewable and Clean Energy Pradeep Verma, 2021-01-04 This book provides a comprehensive account of past present and future of the biomass based biorefineries It is an all inclusive and insightful compilation of recent advancements in the technology and methods used for conversion of biomass to bioenergy and other useful biochemicals The book also focuses on the limitations of existing technologies and provides the future prospects as well as discusses socio economic impact of biomass based biorefineries This book assists researchers in the area of lignocellulosic biorefineries and can be used by the students scientist and academician as an advanced reference textbook

Biorefinery Production Technologies for Chemicals and Energy Arindam

Kuila, Mainak Mukhopadhyay, 2020-09-22 This book covers almost all of the diverse aspects of utilizing lignocellulosic biomass for valuable biorefinery product development of chemicals alternative fuels and energy The world has shifted towards sustainable development for the generation of energy and industrially valuable chemicals Biorefinery plays an important role in the integration of conversion process with high end equipment facilities for the generation of energy fuels and chemicals The book is divided into four parts The first part Basic Principles of Biorefinery covers the concept of biorefinery its application in industrial bioprocessing the utilization of biomass for biorefinery application and its future prospects and economic performance The second part Biorefinery for Production of Chemicals covers the production of bioactive compounds gallic acid C4 C5 and C6 compounds etc from a variety of substrates The third part Biorefinery for Production of Alternative Fuel and Energy covers sustainable production of bioethanol biodiesel and biogas from different types of substrates The last part of this book discusses sequential utilization of wheat straw material balance and biorefinery approach The approaches presented in this book will help readers users from different areas like process engineering and biochemistry to plan integrated and inventive methods to trim down the expenditure of the industrial manufacture process to accomplish cost effective feasible products in biorefinery

Localized Energy Transition in the 4th Industrial Revolution Opeyeolu Timothy Laseinde, Andrew C. Eloka-Eboka, 2024-10-24 This book presents a holistic view on localized energy transition while addressing current challenges associated with the production of biofuels introducing new materials to produce solar photovoltaic PV panels and digital systems for sustainable energy monitoring on a small scale carbon capture and sequestration Also each chapter of the book addresses specific aspects of the renewable and sustainable energy space while focusing more on energy improvement and storage technologies that are practical focused Features Offers useful information on new forms of renewable energy generation with reference to Industry 4.0 Illustrates practical approaches to energy transition Provides guidance on renewable energy sources and energy storage systems Discusses the application of the Fourth Industrial Revolution 4IR related approaches to emerging energy storage technologies Includes studies that reveal approaches to realizing productivity profitability and increased return on investment ROI This book is aimed at graduate students and researchers in mechanical chemical and mechatronics engineering and renewable energy systems

Integrated Biorefineries Paul R. Stuart, Mahmoud M. El-Halwagi, 2012-12-10 Integrated Biorefineries Design Analysis and Optimization examines how to create a competitive edge in biorefinery innovation through integration into existing processes and infrastructure Leading experts from around the world working in design synthesis and optimization of integrated biorefineries present the various aspects of this complex process capturing the state of the art in the advancing bioeconomy The book defines an integrated biorefinery as a processing facility that transforms biomass into value added products from biofuels and biochemicals to food and pharmaceuticals The chapters cover biorefinery product and process design supply chains process analysis feedstocks technologies and policy and environmental analysis They focus on second

generation feedstocks including forestry resources energy crops agricultural residues oils and various waste materials With the growing interest in sustainability in general and in renewable resources in industrial facilities biorefineries are likely to play increasingly significant roles and have greater economic environmental and societal impact This book fills an information gap by presenting cutting edge advances that can effectively guide engineers and decision makers in the synthesis selection design analysis and optimization of biorefineries

Biorefinery of Industrial Effluents for a Sustainable Circular Economy Mu. Naushad, Shamsul Rahman Mohamed Kutty, Sohrab Hossain, Abdullahi Haruna Birniwa, Ahmad Hussaini Jagaba, 2024-11-28 Bio Refinery of Industrial Effluents for a Sustainable Circular Economy provides a combined approach between environmental engineering which involves the improvement of the natural environment or remediation of polluted sites In addition it discusses bioprocess engineering involving the development of processes for the manufacture of products from biological materials to produce a valuable bioproduct This book covers knowledge on sources impacts and applications of industrial effluents that could potentially be used as feedstock for the IEB with examples of applied research that demonstrates the relationship between the effluents biorefinery treatment and bioproduct recovery Materials that can be produced from IEB and the treatment processes for such are considered Provides industrial effluents source characteristics and treatment Assists in designing an optimization strategy for maximizing efficiency of waste treatment and of bioresource utilization in terms of economic environmental and social impact Explains bio based product recovery for a bio based economy Discusses advanced processes for simultaneous industrial effluents treatment and the generation of bio based products of sufficient value

Sustainable Clean Energy Production Using Waste Biomass Dan Bahadur Pal, Ashutosh Kumar Rai, Samra Siddiqui, 2024-04-15 This edited volume covers sustainable biomass valorization and its application in various sectors Bioenergy has concerned enormous attention as a promising alternative to conventional energy resources Abundance of bioresources and their renewable nature provides a distinct advantage to biofuels from sustainability perspective Biofuels have found increasing applications in the energy and transportation sector in recent years Blended fuels are being used worldwide However several challenges remain to be addressed due to the diverse nature of biomasses and inherent recalcitrant nature of biological materials used as feedstock This book aims to provide an overview of recent developments in the production of bioenergy and its applications in various areas Specific emphasis is given to production of biofuels from modern biomass such as agro forest waste and dedicated non edible energy crops that do not interfere with food production The scope of the book covers synthesis and characterization of biologically derived fuels advances in microbiological methods and enzyme engineering approaches The book covers techno economic analysis to identify challenges and prospects for commercialization of biofuels The directions for future research should pave way for net zero scenario for a sustainable world The book will cater to a wide range of readers interested in learning the fundamentals as well as advances in the field of biofuels

Biorefineries Michele Aresta, Angela Dibenedetto, Franck Dumeignil, 2015-08-31

Biorefineries compiles the basic science and technologies used to convert terrestrial and aquatic biomass into essential molecular compounds and polymeric materials. The book provides in depth insights into this fairly recent concept of industrial chemistry that aims to achieve optimal economic profits while minimizing the environmental impact. Chapters written by renowned experts cover amongst others the application of catalysis downstream processing biomass sourced olefins lignin biorefinery techniques and biogas. The authors thoroughly examine and explain the value chain for biomass conversion into platform molecules and their transformation into final products. A comprehensive thematic overview on the topic giving beginners access to fundamental concepts is presented. Supplemented by numerous full color figures and tables the contents impart knowledge about the involved techniques. Advanced students and experts in the field will find the summary of state of the art research and current literature of valuable interest. Explores the enormous potential of biomass conversion as a future source for fuels and chemicals. Focuses on both general scientific background and current innovations in the field of biorefinery. Targets students and researchers in Chemistry Chemical Engineering Biotechnology and Materials Science. About the Editors: Prof Michele Aresta, Chair of the Scientific Committee of CIRCC in Italy and holds the IMM Chair at the Department of Chemical and Biomolecular Engineering at NUS Singapore. He is author of over 200 papers and Author or Editor of nine books. Prof Angela Dibenedetto, Associate Professor at the Department of Chemistry of the University of Bari Italy, focused on carbon dioxide utilization by applying biorefinery concepts and Director of the Interuniversity Consortium on Chemical Reactivity and Catalysis CIRCC. Prof Franck Dumeignil, Deputy Director of the CNRS joint Unit of Catalysis and Chemistry of Solid UCCS of Lille University France, project coordinator of several projects on chemistry including the EuroBioRef Project for designing next generation biorefineries.

Biorefinery Olatunde Samuel Dahunsi, 2024-10-15

Biorefinery: A Sustainable Waste Management Solution for the Developing World presents a comprehensive introduction to the new field of biorefinery as a sustainable waste management solution. With an emphasis on developing economies, the book explains how to develop sustainable methods for the collection, sorting, storage, and processing of waste streams for the production of fuels and platform chemicals. The first four chapters introduce the theoretical framework for the analysis of the various waste streams for bioenergy production with an emphasis in developing countries. These introductory chapters are followed by a thorough examination of specific waste streams for bioenergy production, addressing every known waste feedstock in detail. Subsequent chapters explain biorefinery concepts for these waste feedstocks, addressing different biorefinery approaches as well as considering important topics like pretreatment, microorganisms, and value added products in dedicated chapters. Finally, the book discusses the policies, economics, and strategies for waste management and waste valorization. Analyzes the extent of adoption and the prospects of biorefinery in developing countries and emerging economies. Bridges the gap between theoretical concepts of biorefinery and end users working in developing countries. Integrates the principles of sustainable development and the circular economy.

Energy Footprints of the Bio-refinery.

Hotel, and Building Sectors Subramanian Senthilkannan Muthu, 2018-08-29 This book deals with the energy footprints of biorefineries and the hotel and buildings sector. It presents footprint case studies which include background information, methodological frameworks, assessment checklists, calculation tools and techniques, applications, challenges and limitations. It also discusses the application of each indicator framework in various industrial sectors and the associated challenges along with outlooks for the future. Consumption and conservation of energy are key elements in any industry's sustainability strategy.

Waste-to-Energy Pooja Sharma, Yen Wah Tong, Sanjeeb Mohapatra, Diane Purchase, Himanshu Kumar Khuntia, Surendra Pratap Singh, 2024-11-13 Waste to Energy Sustainable Approaches for Emerging Economies presents the latest developments and applications for the conversion of waste into biofuels and other energy products. Divided into two parts, Section I reviews the major sources of solid waste and their management strategies in developing countries and includes the collection, composition, segregation and dispersal of various waste streams as well as the generation of biogas and other value added products. Section II examines the transformation of waste into biofuels and the management strategies required to efficiently implement waste to energy processes. Methods for the production of hydrogen, biomethane, biofuels and bioenergy as well as resource recovery are discussed in depth and mathematical models are provided for anaerobic digestion techniques. The benefits and challenges of waste to energy as a waste management strategy are explored through dedicated chapters on the techno-economics, environmental and social regulation and the operation of WtE plants. The final chapter of the book presents a lifecycle assessment and environmental impact analysis of the technologies and strategies discussed. Critically reviews technologies and procedures for integrating waste management with energy production. Evaluates and compares various waste to energy technologies for their utility in producing biofuels. Explores the use of waste to energy techniques for mass biotechnological processing of waste.

Microbial Niche Nexus Sustaining Environmental Biological Wastewater and Water-Energy-Environment Nexus Senthilkumar Kandasamy, Maulin P Shah, Kavitha Subbiah, Naveenkumar Manickam, 2025-01-15 In most of the industries, industrial effluent treatment plants are playing vital roles to ensure the efficient management of industrial effluent for supporting sustainable development of our society. Due to the technological development, new concepts about future wastewater management are being incorporated by process industries in the whole world, including recyclable resources and energy/nutrient recovery from industrial effluent etc. However, conventional treatment methods, including biotechnological methods used in treatment plants, are facing a lot of difficulties due to the strict discharging norms and coming out of new-fangled pollutants. Recently, a novel concept, microbial niche nexus sustaining biological wastewater treatment, was introduced, which can accomplish the significant removal of toxic emerging pollutants by different microbial communities with the concern of other components like integrated and healthy ecosystem. The book focuses on research related to future potential and progress of microbial niche-based environmental biotechnology such as microbial enrichment, microbial function, system design, new technological developments and its applications. Besides the book

reviews important interconnections between water energy and the environment as security in water and energy and the environment is associated with human beings natural resources economic and environmental sustainability In addition the book describes innovative green technologies with the aim of enhancing the present state of the art technologies in the various fields like water energy the environment and the related potential fields of industrial wastewater treatment

Biotechnological Advances in Biorefinery Komal Agrawal,Pradeep Verma,2024-10-03 This book is unique as it will cover the latest technological advancements in the field of biorefinery and how it is a major futuristic component of global biofuel research Initially the role of bio based waste materials microorganisms and their bioactive metabolites in biorefinery will be focused Further recent advances and emerging topics that are related to industrially important products such as biofuels hydrogen production will also be elaborated The book addresses the lack of understanding of recent technological advancement such as life cycle assessment LCA and techno economic assessment TEA as well The systems for biorefineries demand a methodical approach to identifying effects and evaluating their long term viability Thus a futuristic paradigm focusing on in silico studies will also be incorporated enabling us to understand the developments and impacts of bio based materials towards a circular and sustainable economy Additionally the proposed book will also discuss various strategies such as the analysis of cost effectiveness nanotechnology value sensitive design VSD and also emphasize the economic technical and environmental aspects that affect their production as well as the future perspective in terms of the market scenario Thus the book will provide cumulative information on various dimensions of biorefinery and its role as a major bio economic industry of the future for researchers industrialists entrepreneurs career starters and policymakers The shift towards a bioeconomy not only promises innovative solutions to pressing global challenges but also opens up new avenues for various industries and policymakers Thus biorefinery is regarded as a crucial aspect of biobased economy ultimately leading the path towards sustainability

Climate Change Impact on Livestock: Adaptation and Mitigation

Veerasamy Sejian,John Gaughan,Lance Baumgard,Cadaba Prasad,2015-03-31 This volume addresses in detail both livestock s role in climate change and the impacts of climate change on livestock production and reproduction Apart from these cardinal principles of climate change and livestock production this volume also examines the various strategies used to mitigate livestock related GHG emissions and those which can reduce the impacts of climate change on livestock production and reproduction Presenting information and case studies collected and analyzed by professionals working in diversified ecological zones the book explores the influence of climate change on livestock production across the globe The most significant feature of this book is that it addresses in detail the different adaptation strategies and identifies targets for different stakeholders in connection with climate change and livestock production Further it puts forward development plans that will allow the livestock industries to cope with current climate changes and strategies that will mitigate the effects by 2025 Lastly it provides researchers and policymakers several researchable priorities to help develop economically viable

solutions for livestock production with less GHG emissions promoting a cleaner environment in which human beings and livestock can live in harmony without adverse effects on productivity Given that livestock production systems are sensitive to climate change and at the same are themselves a contributor to the phenomenon climate change has the potential to pose an increasingly formidable challenge to the development of the livestock sector However there is a dearth of scientific information on adapting livestock production to the changing climate as such well founded reference material on sustaining livestock production systems under the changing climate scenarios in different agro ecological zones of the world is essential By methodically and extensively addressing all aspects of climate change and livestock production this volume offers a valuable tool for understanding the hidden intricacies of climatic stress and its influence on livestock production

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Efficiency Biomass Energy Approach Biorefineries Introduction

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