Overview Of Biogas Technology And Legislative Framework

The global demand for energy is met mainly by fossil fuels. Their excessive and indiscriminate use, coupled with increasing demand for energy, will soon deplete their existing reserves. Therefore, it is extremely important to find alternative, environment-friendly, and ecologically sound sources of energy for meeting the present and future energy requirements. Biogas Technology: Towards Sustainable Development makes an attempt to explore the potential of utilizing biodegradable biomass as fuel and manure. Anaerobic digestion is a biochemical degradation process that converts complex organic material, such as animal manure, into methane and other byproducts. Part of the author's Wastewater Microbiology series, Microbiology of Anaerobic Digesters eschews technical jargon to deliver a practical, how-to guide for wastewater plant operators. In Chapter One, Antonio Colmenar-Santos, Enrique Rosales-Asensio, David Borge-Diez, and Manuel Castro-Gil present an overview of recent research on equitable alternatives for recently constructed concentrated solar power plants in Spain. Next, Chapter Two by Dian Andriani, Arini Wresta, Ariffin Santosa, and Kusnadi discusses the idea that various raw materials can be used for biogas production. Additionally, the authors discuss modern biogas production technologies. In Chapter Three, Caroline Borges Agustini and Mariliz Gutterres provide a review on the significance of biogas production in conjunction with its characteristics and handling problems. Following this, the authors go on to review current microorganism identification techniques as well as crop optimisation techniques. In Chapter Five, Sina Gilassi, Seyed Mohammad Taghavi, Serge Kaliaguine, and Denis Rodrigue suggest commercial polymer hollow fibre could be used to improve separation efficiency and CH4 purity in biogas production. Vladimir I. Shcherbakov, Nadezhda V. Kuznetsova, and Tatiana V. Shchuyukina present research with the goal of determining favourable conditions for methane forming bacteria vital functions, fermentation processes intensification methods, and developing advance capacity reactors in Chapter Six. Afterwards, Chapter Seven by Spyridon Achina and Vasileios Achinas deliberates on the physicochemical properties of biogas and the need for further research on the subject. In Chapter Eight, Kevin N. Nwaigwe, Uchenna C. Egbulor, Sambas N. Asoegwu, and Christopher C. Enwereomadu propose water hyacinth as a substrate for biogas production. Chapter Nine by Preseela Satpathy, PhD examines recent trends in biogas technology advancements. Next, Chapter Ten by Caroline Borges Agustini and Mariliz Gutterres explores the anaerobic process characteristics of anaerobic digestion, as well as its efficiency. In Chapter Eleven, Mohamed Habib Sellami exhibits a modelling approach designed to hypothesise the performance, impact, and profitability of systems cogenerating energy from released biogas. In conclusion, Chapter Twelve by K. N. Nwaigwe, E. E. Anyanwu and C. C. Enwereomadu presents a synopsis on bioreactor technology development trends. Anaerobic digestion (AD) is by far the most important technology for providing clean renewable energy to millions in rural areas of many developing countries. AD of biowastes produces both biogas and anaerobic digestate as a byproduct that can be used further as a biofertilizer. Biowastes containing sewage, food processing wastes, animal wastes, and lignocellulosic wastes typically produce biogas containing 55%–70% biomethane. In the context of energy consumption, more than 85% of the total energy consumed currently comes from non-renewable fossil resources. Biogas technology can provide sustainable, affordable, and eco-friendly energy through waste recycling. This book provides basic knowledge and recent research on biogas production, focusing on the enhancement of biomethane and production routes integrated with microalgae cultivation or agriculture. 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. Biogas being a renewable, sustainable and alternative source of energy obtained from the anaerobic digestion of cow dung or other animal/plant wastes under appropriate conditions can be burnt and used as a cooking fuel after it has been properly purified or scrubbed. Biogas technology involves the construction of digester/ biogas plant in which the organic materials are charged into, and allowed to digest for production of the gas (a mixture of methane, carbon dioxide, hydrogen sulphide, water vapor etc) and a set of purifying chambers for cleaning or scrubbing the gas, before compressing it into the combustion chamber for domestic use. These are what you will learn: *Introduction to Biogas Technology *Properties of Biogas *Operating Parameters Affecting Biogas Production. *Biochemical Processes of Biogas Production. *Gas Flow Mechanism *Design of Digester and Purifying Chambers. *Gas Production *Gas Purification *Testing *Maintenance of a Biogas Plant *Safety of Biogas

This Book Is Written With Special Focus On Issues Relating To Policies And Strategies For Planning And Implementation Of Biogas Programme. The Book Provides A Detailed Overview Of Biogas Technology Covering All The Facets. It Provides Comprehensive History And Progress Of Biomethanation In Select Countries And Regions Where It Has Made Special Mark. It Provides A Detailed Overview Of Developments In India Covering Historical Perspectives, Biogas Potential, Chronological Progress Of Biomethanation, And Enumerates References Made To Biogas At Important Seminars And Conferences By Eminent Personalities From India And Abroad. It Comprehensively Spells Out Various Implementation Strategies Particularly The Turnkey Approach Which Is Largely Responsible For Bringing Biogas Revolution In India Judging By The Unprecedented Spurt In The Number Of Biogas Plants Installed In Recent Years. It Consolidates The Findings And Recommendations Of Several Socio-Economic Surveys On Biomethanation Undertaken In Past In India From Time To Time. It Presents Case-Studies Of Several Community Biogas Plants Which Have Greatly Helped In Improving The Rural Economy. It Also Provides An Overview Of Energy Needs Of Developing Countries, Reviews Integrated Rural Energy Programme (Irep) And The Ujjayanthi Programmes Of The Union Government As Supportive Programmes For Biomethanation, And Views Biogas Programme As An Instrument Of Sustainable Development. It Discusses At Length The Economics And Cost-Effectiveness Of Biogas Systems. The Book Also Identifies Areas For Further Studies And Looks Forward That Biomethanation Will Scale New Heights Even When The Subsidies Are Completely Withdrawn And Market-Driven Approach Under The New Economic Policy Governs The Biogas Programme. In Short, The Book Covers All Related Aspects Involving Policies, Progress And Prospects Of Biomethanation In India And Abroad. The leading book on the market just got better: With its unique approach covering all aspects of setting up and running a biogas plant, this new edition has been expanded to include recent advances in biomass processing. The author is a key player in the field, who has designed numerous small- and industrial-scale biogas plants, and who is also a long-time lecturer on biogas production, thus combining didactical skill with real-life expertise. As such, he covers both the biological and technical aspects of biogas generation. The full range of biogas substrates and processing modes is explained, from agricultural and industrial waste to marine algae and sediment. On-site use of biogas for conversion into electricity, fuel and heat is also discussed, as are safety and regulatory issues. Many real-life examples of European biogas plants already in operation illustrate the contents, as do numerous schemes, diagrams and summary tables. For this new edition, biogas analytics and quality control required for feeding biogas into natural gas networks are included, as is a completely new chapter on the microbiology of biogas-producing bacterial communities. Master's Thesis from the year 2018 in the subject Engineering - Civil Engineering, grade: 3.6, Addis Ababa University (Center for Development Studies), course: Environment and Sustainable Development, language: English, abstract: Access to modern energy is a key element in rural development. This thesis identified the Impact of Small Scale Biogas Technology on Household Income and Health in Ada’a Woreda, Oromia Region, Ethiopia. 9 kebeles were purposively selected where there are high number of biogas users. The descriptive statistical significances and the association of the dummy and continuous variables with the dependent variable were tested using chi-square and t-test. Propensity score matching was used to assess the impact small scale biogas technology has on health and income of household. The study found out small scale biogas technology is favorable among users due to; subsidy form the government; relatively cheap comparing to other fuel sources; as it considers the health economic and environmental benefits; as it saves fuel; it being smokeless; its durability; the fact that it cooks quickly; as it effectively uses waste from farm and produces compost for farm use. The result from Propensity score matching indicated that small scale biogas technology has a significant and positive impact on health. So, the impact of small scale biogas technology has an average treatment effect of 8249.2, 5968.5, 9961.5, 8652.3 ETB per annum to household income using nearest neighbor, radius, kernel and stratification methods. The impact of small scale biogas technology on health, the study looked at three outcome variables; cost of the treatment for the victims in the households; the number of days spent for fuel collection per week and; total members of the household affected by indoor air pollution (IAP). The impact of biogas on cost of treatment has an average treatment effect of 320.2, 392.5, 339.2, and 332.8 ETB using nearest neighbor, radius, kernel and stratification methods respectively. The impact of biogas on number days spent for fuel collection has an average treatment effect of -1.5, -1.4, -1.3,
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Bioenergy: Principles and Technologies introduces biomass energy resources and then elaborates on bioenergy technologies including biomass combustion, biogas production, biomass briquettes and biomass gasification. With a combination of theories, experiments and case studies, the book is an essential reference for bioenergy researchers, industrial chemists and chemical engineers. Current Developments in Biotechnology and Bioengineering: Waste Treatment Processes for Energy Generation provides extensive research on the role of waste management processes/technologies for energy generation. The enormous increase of waste materials generated by human activity and its potentially harmful effects on the environment and public health have led to an increasing awareness of an urgent need to adopt scientific methods for the safe disposal of wastes. This book outlines the basic knowledge, processes and technologies for the generation of energy from waste and functions as an important reference for academics and practitioners at varying levels of interest and knowledge. The book’s content encompasses all issues for energy recovery from waste in a very clear and simple manner, acting as a comprehensive resource for anyone seeking an understanding on the topic. Outlines the latest technologies used for waste conversion into energy and facilitates project evaluation based on these technologies Summarizes the pros and cons of various processes Includes case studies and economic analysis The International Conference on the State of the Art on Biogas Technology, Transfer and Diffusion was held in Cairo, Egypt, from 17 to 24 November 1984. The Conference was organized by the Egyptian Academy of Scientific Research and Technology (ASR T), the Egyptian National Research Centre (NRC), the Bioenergy Systems and Technology project (BST) of the US Agency for International Development (US/AID) Office of Energy, and the National Academy of Sciences (NAS). A number of international organizations and agencies co-sponsored the Conference. More than 100 participants from 40 countries attended. The purpose of the Conference was to assess the viability of biogas technology (BGT) and propose future courses of action for exploiting BGT prospects to the fullest extent. The Conference emphasized a balanced coverage of technical, environmental, social, economic and organizational aspects relevant to biogas systems design, operation and diffusion. It was organized to incorporate experiences that are pertinent for the most part, to developing countries. In addition to the wide spectrum of presentations and country programs, structured and non-structured discussions among the participants were strongly encouraged in thematic sessions at round-table discussions, and through personal contacts during poster sessions and field trips. It was clear from the enthusiastic response of most participants that the Conference, in large measure, succeeded in fulfilling its mission. Although draft papers were distributed to all participants, it was felt that the results obtained were worthy of organized and refined documentation. And this is precisely what this book intends to do. Recent advances in technology to recover bioenergy from various feedstocks make them suitable alternatives to fossil fuel. This book contains several scientific discussions regarding microbes involved in biogas production, the anaerobic digestion process, their operation, and application for sustainable development. The book provides in-depth information about anaerobic digestion for researchers and graduate students. The editor sincerely thanks all the contributors, whose efforts have brought this book to fruition. The Distinguishing Feature Of The Book Is Its Exhaustive Coverage Encompassing Theory And Practical Aspects On Items Like The Status Of Biogas Technology, Different Types Of Biogas Plants And Their Suitability For A Given Situation, Their Design Aspects, Sizing And Scaling Of Biogas Plants Which Are Illustrated With Calculations And Working Drawings. In Addition, Constructional Aspects, Cost Aspects, Diagnosis And Cure Of Faults During Operation And Details Of Utilisation Devices Are Detailed. Introduction to biogas, including its technology as well as principles, has been provided in this well-structured and descriptive book. It encompasses numerous research reports demonstrating sequential production of biogas and also discusses the principles and mechanisms involved in its operation. The efficacy of technologies adopted for the production of biogas, specifically anaerobic digestion of waste and gas production systems, its structure, mechanism and other
aspects of the process, applications and purification of biogas, architecture of pipes and plants, evaluation of environmental facets, economic issues and a few other topics which hold importance in any aspect of biogas generation have been examined in the book. Design and Optimization of Biogas Energy Systems presents an overview on planning, implementing, assessing and optimizing biogas systems, from fuel conversion to power generation. The book introduces the fundamental elements of bioenergy systems, highlighting the specificities of biogas systems. It discusses the current state of their adoption at a global level and the challenges faced by designers and operators. Methods for sizing, simulating and modeling are discussed, including prefeasibility analysis, available production processes, integration into hybrid energy systems, and the application of Big Data analysis and game theory concepts. All chapters include real-life examples and exercises to illustrate the topics being covered. The book goes beyond theory to offer practical knowledge of methods to reach solutions to key challenges in the field. This is a valuable resource for researchers, practitioners and graduate students interested in developing smart, reliable and sustainable biogas technologies. Provides an applied approach to biogas systems, from technology fundamentals, to economic and environmental assessment. Explores control methods and reliability prediction of each system component, including modeling and simulation with HOMER and MATLAB. Discusses the use of Big Data analysis, numerical methods, and Game Theory for plant assessment. Written as a practical introduction to biogas plant design and operation, this book fills a huge gap by presenting a systematic guide to this emerging technology -- information otherwise only available in poorly intelligible reports by US governmental and other official agencies. The author draws on teaching material from a university course as well as a wide variety of industrial biogas projects he has been involved with, thus combining didactical skill with real-life examples. Alongside biological and technical aspects of biogas generation, this timely work also looks at safety and legal aspects as well as environmental considerations. With pressure increasing to utilise wastes and residues effectively and sustainably, the production of biogas represents one of the most important routes towards reaching national and international renewable energy targets. The biogas handbook: Science, production and applications provides a comprehensive and systematic guide to the development and deployment of biogas supply chains and technology. Following a concise overview of biogas as an energy option, part one explores biomass resources and fundamental science and engineering of biogas production, including feedstock characterisation, storage and pre-treatment, and yield optimisation. Plant design, engineering, process optimisation and digestate utilisation are the focus of part two. Topics considered include the engineering and process control of biogas plants, methane emissions in biogas production, and biogas digestate quality, utilisation and land application. Finally, part three discusses international experience and best practice in biogas utilisation. Biogas cleaning and upgrading to biomethane, biomethane use as transport fuel and the generation of heat and power from biogas for stationery applications are all discussed. The book concludes with a review of market development and biomethane certification schemes. With its distinguished editors and international team of expert contributors, The biogas handbook: Science, production and applications is a practical reference to biogas technology for process engineers, manufacturers, industrial chemists and biochemists, scientists, researchers and academics working in this field. Provides a concise overview of biogas as an energy option. Explores biomass resources for production. Examines plant design and engineering and process optimisation. This book focuses on biogas production by anaerobic digestion, which is the most popular bioenergy technology of today. Using anaerobic digestion for the production of biogas is a sustainable approach that simultaneously also allows the treatment of organic waste. The energy contained in the substrate is released in the form of biogas, which can be employed as a renewable fuel in diverse industrial sectors. Although biogas generation is considered an established process, it continues to evolve, e.g. by incorporating modifications and improvements to increase its efficiency and its downstream applications. The chapters of this book review the progress made related to feedstock, system configuration and operational conditions. It also addresses microbial pathways utilized, as well as storage, transportation and usage of biogas. This book is an up-to-date resource for scientists and students working on improving biogas production. Introduces basic principles and mechanisms, covers new developments, and provides a different view of the main facets of bioelectrosynthesis. Bioelectrosynthesis represents a promising approach for storing renewable energy or producing target chemicals in an energy-sustainable and low-cost way. This timely and important book systematically introduces the hot issues surrounding bioelectrosynthesis, including potential value-added products via bioelectrochemical system, reactor development of bioelectrosynthesis, and microbial biology on biofilm communities and metabolism pathways. It presents readers with unique viewpoints on basic principles and mechanisms along with new developments on reactor and microbial ecology. Beginning with a principle and products overview of bioelectrosynthesis, Bioelectrosynthesis: Principles and Technologies for Value-Added Products goes on to offer in-depth sections on: biogas production and upgrading technology via bioelectrolysis; organic synthesis on cathodes; chemical products and nitrogen recovery; external electron transfer and electrode material promotion; and the microbiology of bioelectrosynthesis. Topics covered include: hydrogen production from waste stream with microbial electrolysis cell; microbial electrolysis cell; inorganic compound synthesis in bioelectrochemical system; microbial growth, ecological, and metabolic characteristics in bioelectrosynthesis systems; microbial metabolism kinetics and interactions in bioelectrosynthesis system; and more. *Comprehensively covers all of the key issues of bioelectrosynthesis * Features contributions from top
experts in the field * Examines the conversion of organic wastes to methane via electromethanogenesis; methane production at biocathodes; extracellular electron transport of electroactive biofilm; and more Bioelectrosynthesis: Principles and Technologies for Value-Added Products will appeal to chemists, electrochemists, environmental chemists, water chemists, microbiologists, biochemists, and graduate students involved in the field. This book provides comprehensive and simplified coverage of fundamentals of biogas such as production, purification, storage, methods of improving yield and utilization, types, construction, design and operation of biogas plants. It covers stepwise design and a manual for construction of biogas plants including a planning guide, profitability analysis and evaluation of biogas plants. The biogas energy profile in Nigeria is exclusively covered. Features: Explores planning for biogas plants as a pre-requisite to develop a functional plant balancing energy production and consumption. Gives out detailed provision of the types of substances that are and can be used for biogas production covering animal, municipal, and industrial wastes. Provides knowledge for aspiring biogas producers as well as decision makers, specifically in the context of Nigeria. Covers use of digestate for anaerobic digestion as a waste treatment method and on the input (feedstock) to the biogas plant. Compares carbon dioxide emissions from biogas plants with fossil fuel plants. This book aims at Graduate Students and Researchers in Agricultural, Environmental, Chemical, Civil and Energy engineering and related professional audience. This book focuses on agricultural waste treatment and renewable energy production from the perspective of anaerobic digestion. It covers topics on anaerobic digestion processes and practices in various types of biogas plant construction and management and systematically addresses the principle and main features of three kinds of anaerobic digestion systems: household digesters, biogas septic tanks, and biogas plants. Instructive, informative and easy to understand, the book offers a valuable asset for researchers, technicians, graduate students and managerial personnel working in the areas of renewable energy, agricultural ecological engineering and the treatment and utilization of agricultural wastes. Seminar paper from the year 2017 in the subject Energy Sciences, grade: 3.55, , course: Environmental biology, language: English, abstract: This report is based on a literature review to analyze various aspects of biogas technology and address resource requirements and multiple values of biogas technology for rural household in developing countries. Biogas technology has been developed and widely used to produce a renewable, high-quality fuel, biogas. However, the development of biogas technology significantly differs over the world, particularly between developing countries and developed countries. In rural areas of developing countries, biogas is normally used for cooking, lighting, heating, etc, and feedstock for biogas production derives from agricultural resources, such as manure and harvest remains. In addition, biogas technology also contributes to GHGs emission reduction and produces a valuable and improved fertilizer. Biogas is a renewable energy resource that can be an alternative solution for the world's insatiable energy demands while helping in managing waste and reducing the greenhouse gas (GHG) emissions. It is also regarded as carbon neutral as the carbon in biogas comes from organic matter (feedstock) that captured this carbon from atmospheric CO2 over a relatively short timescale. This book has been written and compiled to collate latest information on biogas technology to help readers to understand the fruitful exploitation of the process. Note: T&F does not sell or distribute the Hardback in India, Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka. This title is co-published with New India Publishing Agency. Michael Lebuhn, Stefan Weiß, Bernhard Munk, Georg M. Guebitz Microbiology and Molecular Biology Tools for Biogas Process Analysis, Diagnosis and Control Veronika Dollhofer, Sabine Marie Podmirseg, Tony Martin Callaghan, Gareth Wyn Griffith & Katerina Fliegerová Anaerobic Fungi and their Potential for Biogas Production Bianca Fröschle, Monika Heiermann, Michael Lebuhn, Ute Messelhäusser, Matthias Plöchl Hygiene and Sanitation in Biogas Plants Charles-David Dubé and Serge R. Guiot Direct Interspecies Electron Transfer in Anaerobic Digestion: A Review Simon K.-M. R. Rittmann A Critical Assessment of Microbiological Biogas to Biomethane Upgrading Systems Manfred Lübken, Pascal Kosse, Konrad Koch, Tito Gehring, Marc Wichern Influent Fractionation for Modeling Continuous Anaerobic Digestion Processes Fermo, F. G, van Hullebusch, E. D, Guibaud, G, Collins, G, Svensson, B. H, Carliell-Marquet, C, Vink, J.P.M, Esposito, G, Frunzo, L Fate of Trace Metals in Anaerobic Digestion: Lignocellulosic wastes has been widely discussed as a promising natural chemical source and alternative feedstock for second-generation biofuels. However, there are still many technical and economic challenges facing its utilization. Lignin is one of the components of lignocellulosic biomass, and is the most rigid constituent and can be considered as a glue providing the cell wall with stiffness and the plant tissue with compressive strength. In addition, it provides resistance to chemical and physical damage. Resistance of lignocelluloses to hydrolysis is mainly from the protection of cellulose by lignin and cellulose binding to hemicellulose. The present book provides basic knowledge and recent research on different applications of biomass, focusing on the bioenergy and different pretreatment methods that overcome the aforementioned hurdles. Emerging Technologies and Biological Systems for Biogas Upgrading systematically summarizes the fundamental principles and the state-of-the-art of biogas cleaning and upgrading technologies, with special emphasis on biological processes for carbon dioxide (CO2), hydrogen sulfide (H2S), siloxane, and hydrocarbon removal. After analyzing the global scenario of biogas production, upgrading and utilization, this book discusses the integration of methanation processes to power-to-gas systems for methane (CH4) production and physiochemical upgrading technologies, such as chemical absorption, water scrubbing, pressure swing adsorption and the use of membranes. It then explores more recent and sustainable upgrading technologies, such
as photosynthetic processes using algae, hydrogen-mediated microbial techniques, electrochemical, bioelectrochemical, and cryogenic approaches. H2S removal with biofilters is also covered, as well as removal of siloxanes through polymerization, peroxidation, biological degradation and gas-liquid absorption. The authors also thoroughly consider issues of mass transfer limitation in biomethanation from waste gas, biogas upgrading and life cycle assessment of upgrading technologies, techno-economic aspects, challenges for upscaling, and future trends. Providing specific information on biogas upgrading technology, and focusing on the most recent developments, Emerging Technologies and Biological Systems for Biogas Upgrading is a unique resource for researchers, engineers, and graduate students in the field of biogas production and utilization, including waste-to-energy and power-to-gas. It is also useful for entrepreneurs, consultants, and decision-makers in governmental agencies in the fields of sustainable energy, environmental protection, greenhouse gas emissions and climate change, and strategic planning. Explores all major technologies for biogas upgrading through physiochemical, biological, and electrochemical processes Discusses CO2, H2S, and siloxane removal techniques Provides a systematical approach to discuss technologies, including challenges to gas–liquid mass transfer, life cycle assessment, technoeconomic implications, upscaling and systems integrationHundreds of million tonnes of agricultural and food waste are produced each year around the world, most of which is just that, waste. Anaerobic digestion, biogas and the heat and electricity that can be produced from it is still a nascent industry in many countries, yet the benefits of AD spread throughout the community: Gives good financial returns to farmers and eco-entrepreneurs. Helps community leaders meet various policies and legislative targets. Offers an environmentally sensitive waste disposal option. Provides a local heat and power supply, & creates employment opportunities Reduces greenhouse gas emissions, as well as providing an organic fertilizer. Although the process of AD itself is relatively simple there are several system options available to meet the demands of different feedstocks. This book describes, in simple, easy to read language the five common systems of AD; how they work, the impact of scale, the basic requirements, the costs and financial implications, and how to get involved in this rapidly growing green industry.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 first part of the book presents the fundamentals of the biorefinery concept. The second part describes the biorefinery approach for production of several industrially important chemicals from waste biomass and agro residues. These chemicals include industrially important C4, C5 and C6 chemicals, propylene glycol, glycerol byproducts, dyes and inks etc. Each and every chemical has its own industrial value and the book describes the production processes and strategies at the industrial level. The final part of the book describes the various biorefinery approaches and economic analysis for the different types of biofuel production. Copyright code : cb3b1e0e8f56f5f03e14ed17c3cd02a0