Production Of Biodiesel From Waste Cooking Oil And Factors

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

The edited volume presents the progress of first and second generation biofuel production technology in selected countries. Possibility of producing alternative fuels containing biocomponents and selected research methods of biofuels exploitation characteristics (also aviation fuels) was characterized. The book shows also some aspects of the environmental impact of the production and biofuels using, and describes perspectives of biofuel production technology development. It provides the review of biorefinery processes with a particular focus on pretreatment methods of selected primary and secondary raw materials. The discussion includes also a possibility of sustainable development of presented advanced biorefinery processes.

Biodiesel Production: Technologies, Challenges, and Future Prospects provides in-depth information on fundamentals, approaches, technologies, source materials and associated socio-economic and political impacts of biodiesel production. This title includes a number of Open Access chapters. The world's interest in reducing petroleum use has led to the rapid development of the biofuel industry over the past decade or so. However, there is increasing concern over how current food-based biofuels affect both food security and the environment. Second-generation biofuels, however, use widely available sources such as non-food lignocellulosic-based biomass and fats, oils, and greases. They make practical consideration of how land use can simultaneously support both the world's food needs and some of its energy needs. This volume consolidates some of the most recent investigations into these issues. The chapters focus on these categories of research: The problems currently connected with biofuels relating to land use and the environment Investigations into the potential for land use to be managed more effectively and sustainably Research that focuses on new and developing options for second-generation biofuels This volume is recommended for all biofuel researchers, from the PhD student to the experienced scientist. It also offers an essential foundation to anyone interested in how biofuels relate to the future of our world.

According to the UN's Food & Agricultural Organization (FAO), one third of food produced globally for human consumption (nearly 1.3 billion tons) is lost annually. Food waste has often been incinerated with other combustible municipal wastes for possible recovery of heat or other forms of energy, however, incineration is not cost-effective, and can cause air pollution. Due to its organics- and nutrient-rich nature, food waste could be viewed as a useful resource for production of high-value platform chemicals through fermentation. This book examines the bioconversion of food wastes to energy and the recent developments in ethanol, hydrogen, methane, and biodiesel production from food wastes.

"Biofuels" provides state-of-the-art information on the status of biofuel production and related aspects. It includes a detailed overview of the alternative energy field and the role of biofuels as new energy sources, and gives a detailed account of the production of biodiesel from non-conventional bio-feedstocks such as algae and vegetable oils. Handbook of Biofuels Production, Second Edition, discusses advanced chemical, biochemical, and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage. Research and development in this field is aimed at improving the quality and environmental impact of biofuels production, as well as the overall efficiency and output of biofuels production plants. The book provides a comprehensive and systematic reference on the range of biomass conversion processes and technology. Key changes for this second edition include increased coverage of emerging feedstocks, including microalgae, more emphasis on by-product valorization for biofuels' production, additional chapters on emerging biofuel production methods, and discussion of the emissions associated with biofuel use in engines. The editorial team is strengthened by the addition of two extra members, and a number of new contributors have been invited to work with authors from the first edition to revise existing chapters, thus offering fresh perspectives. Provides systematic and detailed coverage of the processes and technologies being used for biofuel production Discusses advanced chemical, biochemical, and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage Reviews the production of both first and second generation biofuels Addresses integrated biofuel production in biorefineries and the use of waste materials as feedstocks.
Biodiesel is one of the main biofuels capable of substituting fossil fuel usage in compression ignition vehicles, and is used in a variety of fuel blends worldwide. First-generation biodiesel has been used in national markets for some time, with fuel quality standards in place for this purpose. There remain, however, several restrictions to sustainable and long term market development, which is influenced by many factors, including food vs. fuel pressures. The development of new generations of biodiesel, aimed at more sustainable and effective feedstock utilisation alongside improved production efficiency and fuel quality, is critical to the future both of this industry and of the continuing use of biodiesel fuels in transportation. This book provides a timely reference on the advances in the development of biodiesel fuels, production processes and technologies. Part one reviews the life cycle sustainability assessment and socio-economic and environmental policy issues associated with advanced biodiesel production, as well as feedstocks and fuel quality standards. This coverage is extended in Part two, with chapters focussing on the development of methods and catalysts essential to the improvement and optimisation of biodiesel production processes and technologies. With its distinguished editors and international team of contributors, Advances in biodiesel production a standard reference for chemical, biochemical and industrial process engineers, as well as scientists and researchers in this important field. Provides a timely reference on the advances in the development of biodiesel fuels, production processes and technologies Reviews the life cycle sustainability assessment and socio-economic and environmental policy issues associated with advanced biodiesel production, as well as feedstocks and fuel quality standards Discusses the development of methods and catalysts essential to the improvement and optimisation of biodiesel production processes and technologies This book aspires to be a comprehensive summary of current biofuels issues and thereby contribute to the understanding of this important topic. Readers will find themes including biofuels development efforts, their implications for the food industry, current and future biofuels crops, the successful Brazilian ethanol program, insights of the first, second, third and fourth biofuel generations, advanced biofuel production techniques, related waste treatment, emissions and environmental impacts, water consumption, produced allergens and toxins. Additionally, the biofuel policy discussion is expected to be continuing in the foreseeable future and the reading of the biofuels features dealt with in this book, are recommended for anyone interested in understanding this diverse and developing theme. Biodiesel: A Realistic Fuel Alternative for Diesel Engines describes current experimental research work in the field, including 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. Biodiesel Production from Waste Cooking Oil. This book presents the latest advances in and current research perspectives on the field of industrial solid waste recycling for bio-energy and bio-fuel recovery. It chiefly focuses on five main thematic areas, namely bioreactor landfills coupled with energy and nutrient recovery; microbial insights into anaerobic digestion; greenhouse emission assessment; pyrolysis techniques for special waste treatment; and industrial waste stabilization options. In addition, it compiles the results of case studies and solid waste management perspectives from different countries. Advanced Technology for the Conversion of Waste into Fuels and Chemicals: Volume 1: Biological Processes presents advanced and combined techniques that can be used to convert waste to energy, including combustion, gasification, paralyzing, anaerobic digestion and fermentation. The book focuses on solid waste conversion to fuel and energy and presents the latest advances in the design, manufacture, and application of conversion technologies. Contributors from the fields of physics, chemistry, metallurgy, engineering and manufacturing present a truly trans-disciplinary picture of the field. Chapters cover important aspects surrounding the conversion of solid waste into fuel and chemicals, describing how valuable energy can be recouped from various waste materials. As huge volumes of solid waste are produced globally while huge amounts of energy are produced from fossil fuels, the technologies described in this comprehensive book provide the information necessary to pursue clean, sustainable power from waste material. It presents the latest advances in waste to energy techniques for converting solid waste to valuable fuel and energy brings together contributors from physics, chemistry, metallurgy, engineering and the manufacturing industry includes advanced techniques such as combustion, gasification, paralyzing, anaerobic digestion and fermentation. goes far beyond municipal waste, including discussions on recouping valuable energy from a variety of industrial waste materials. Describes how waste to energy technologies present an enormous opportunity for clean, sustainable energy This book offers an insight into three promising and innovative pathways for the biological production of biodiesel, ethanol and methanol. This book explores a novel technique for processing biodiesel using lipase immobilization by encapsulation and its physical properties, stability characteristics, and application in stirred tank and re-circulated packed bed immobilized reactors for biodiesel production. The enzymatic processing of biodiesel addresses many of the problems associated with chemical processing. It requires only moderate operating conditions and yields a high-quality product with a high level of conversion and the life cycle assessment of enzymatic biodiesel production has more favourable environmental consequences. The chemical processing problems of waste water treatment are lessened and soap formation is not an issue, meaning that waste oil with higher FFA can be used as the feedstock. The by product glycerol does not require any purification and it can be sold at higher price. However, soluble enzymatic processing is not perfect. It is costly, the enzyme cannot be recycled and its removal from the product is difficult. For these
reasons, immobilized enzymatic process has been developed which retains the advantages of the soluble enzymatic process and reuse of the enzyme is possible which decreases the enzyme cost, the biodiesel produced does not contain any enzyme residue and the activity of the enzyme can be increased by immobilization. The drawbacks of the immobilized enzyme process are mass transfer limitation, enzyme leakage, the lack of a versatile commercial immobilized enzyme and some of immobilization methods involve toxic chemicals. To overcome the drawbacks of the immobilized enzyme, an attempt is made to use a degradable biopolymer (κ-carrageenan) as a carrier for lipase immobilization.

Reviews the latest advances in biofuel manufacturing technologies and discusses the deployment of other renewable energy sources for transportation. Aimed at providing an interface useful to business and scientific managers, this book focuses on the key challenges that still impede the realization of the billion-ton renewable fuels vision. It places great emphasis on a global view of the topic, reviewing deployment and green energy technology in different countries across Africa, Asia, South America, the EU, and the USA. It also integrates scientific, technological, and business development perspectives to highlight the key developments that are necessary for the global replacement of fossil fuels with green energy solutions. Green Energy to Sustainability: Strategies for Global Industries examines the most recent developments in biofuel manufacturing technologies in light of business, financial, value chain, and supply chain concerns. It also covers the use of other renewable energy sources like solar energy for transportation and proposes a view of the challenges over the next two to five decades, and how these will deeply modify the industrial world in the third millennium. The coming of age of electric vehicles is also looked at, as is the impact of their deployment on the biomass to biofuels value chain. Offers extensive updates on the field of green energy for global industries Covers the structure of the energy business; chemicals and diesel from biomass; ethanol and butanol; hydrogen and methane; and more Provides an expanded focus on the next generation of energy technologies Reviews the latest advances in biofuel manufacturing technologies Integrates scientific, technological and business perspectives Highlights important developments needed for replacing fossil fuels with green energy Green Energy to Sustainability: Strategies for Global Industries will appeal to academic researchers working on the production of fuels from renewable feedstocks and those working in green and sustainable chemistry, and chemical/process engineering. It is also an excellent textbook for courses in bioprocessing and environmental engineering.

A comprehensive overview of current developments and applications in biofuels production Process Systems Engineering for Biofuels Development brings together the latest and most cutting-edge research on the production of biofuels. As the first book specifically devoted to process systems engineering for the production of biofuels, Process Systems Engineering for Biofuels Development covers theoretical, computational and experimental issues in biofuels process engineering. Written for researchers and postgraduate students working on biomass conversion and sustainable process design, as well as industrial practitioners and engineers involved in process design, modeling and optimization, this book is an indispensable guide to the newest developments in areas including: Enzyme-catalyzed biodiesel production Process analysis of biodiesel production (including kinetic modeling, simulation and optimization) The use of ultrasonification in biodiesel production Thermochemical processes for biomass transformation to biofuels Production of alternative biofuels In addition to the comprehensive overview of the subject of biofuels found in the Introduction of the book, the authors of various chapters have provided extensive discussions of the production and separation of biofuels via novel applications and techniques.

Bioenergy and Biofuels provides an authoritative and comprehensive overview of the possibilities for production and use of bioenergy, biofuels, and coproducts. Issues related to environment, food, and energy present serious challenges to the success and stability of nations. The challenge to provide energy to a rapidly increasing global population has made it imperative to find new technological routes to increase production of energy while also considering the biosphere's ability to regenerate resources. The bioenergy and biofuels are resources that may provide solutions to these critical challenges. Divided into 25 discreet parts, the book covers topics on characterization, production, and uses of bioenergy, biofuels, and coproducts. Frontiers in Bioenergy and Biofuels provides an insight into future developments in each field and extensive bibliography. It will be an essential resource for researchers and academic and industry professionals in the energy field. The search for alternative sources of energy to offset diminishing resources of easy and cost-effective fossil fuels has become a global initiative, and fuel generated from biomass is a leading competitor in this arena. Large-scale introduction of biofuels into the energy mix could contribute to environmentally and economically sustainable development on a global scale. The processes and methodologies presented in this volume will offer a cutting-edge and comprehensive approach to the production of biofuels, for engineers, researchers, and students.

The second edition of this invaluable handbook covers converting vegetable oils, animal fats, and used oils into biodiesel fuel. The Biodiesel Handbook delivers solutions to issues associated with biodiesel feedstocks, production issues, quality control, viscosity, stability, applications, emissions, and other environmental impacts, as well as the status of the biodiesel industry worldwide. Incorporates the major research and other developments in the world of biodiesel in a comprehensive and practical format Includes reference materials and tables on biodiesel standards, unit conversions, and technical details in four appendices Presents details on other uses of biodiesel and other alternative diesel fuels from oils and fats.

The recent issue of peak oil and environmental concerns has prompted deeper research into the area of alternative fuels, particularly biofuel. Two types of feedstock for biodiesel production was researched in this project, namely waste cooking oil (WCO) and Refined-Bleached-Deodorized (RBD) palm oil. The performance of the alkaline catalyst potassium hydroxide was investigated towards the methyl ester purity of the product produced using ultrasonic transesterification. The methanol oil molar ratio used in this
research was 6:1. The best conditions for biodiesel production were determined in terms of reaction time and catalyst concentration. The range of catalyst concentration and reaction time studied were 0.75 to 1.75 weight percent and 20 to 50 minutes respectively. Catalyst concentration and reaction time played a significant role in the purity of the product produced. The results show that the best catalyst concentration to produce methyl ester of high purity is at 1.75 weight percent, while the best reaction time necessary is 50 minutes. The resulting conditions were then used to synthesize the final product that was then subjected to a combustion test to determine the quantity of carbon monoxide and carbon dioxide emitted. WCO biodiesel was found to have 19.1% lower carbon monoxide emissions than RBD palm oil biodiesel. In terms of the amount of carbon dioxide released, WCO biodiesel had emissions higher than that of RBD palm oil biodiesel by 2.3%. In conclusion, WCO biodiesel was found to be more environmentally friendly compared to RBD palm oil biodiesel upon combustion.

Biodiesel Basics and Beyond aims to separate fact from fiction and to educate potential home, farm, and cooperative manufacturers on the economic production of quality biodiesel from both waste and virgin oil feedstock. The book includes: detailed processes and equipment required to produce biodiesel fuel that meets North American standards how farmers can use excess oilseed as a feedstock for biodiesel production the use of the co-byproduct glycerin in the making of soap a guide to numerous reference materials and a list of supplier data. This is North America’s definitive guide to responsibly producing biodiesel from waste vegetable oil while minimizing your environmental footprint in the process.

Energy technologies have attracted great attention due to the fast development of sustainable energy. Biodiesel technologies have been identified as the sustainable route through which overdependence on fossil fuels can be reduced. Biodiesel has played a key role in handling the growing challenge of a global climate change policy. Biodiesel is defined as the monoalkyl esters of vegetable oils or animal fats. Biodiesel is a cost-effective, renewable, and sustainable fuel that can be made from vegetable oils and animal fats. Compared to petroleum-based diesel, biodiesel would offer a non-toxicity, biodegradability, improved air quality and positive impact on the environment, energy security, safe-to-handle, store and transport and so on. Biodiesels have been used as a replacement of petroleum diesel in transport vehicles, heavy-duty trucks, locomotives, heat oils, hydrogen production, electricity generators, agriculture, mining, construction, and forestry equipment. This book describes a comprehensive overview, covering a broad range of topics on biodiesel technologies and allied applications. Chapters cover history, properties, resources, fabrication methods, parameters, formulations, reactors, catalysis, transformations, analysis, in situ spectroscopies, key issues and applications of biodiesel technology. It also includes biodiesel methods, extraction strategies, biowaste utilization, oleochemical resources, non-edible feedstocks, heterogeneous catalysts, patents, and case-studies. Progress, challenges, future directions, and state-of-the-art biodiesel commercial technologies are discussed in detail. This book is an invaluable resource guide for professionals, faculty, students, chemical engineers, biotechnologists, and environmentalists in these research and development areas.

Energy from Toxic Organic Waste for Heat and Power Generation presents a detailed analysis on using scientific methods to recover and reuse energy from Toxic waste. Dr. Barik and his team of expert authors recognize that there has been a growing rise in the quantum and diversity of toxic waste materials produced by human activity, and as such there is an increasing need to adopt new methods for the safe regeneration and minimization of waste produce around the world. It is predominantly broken down into 5 sections: The first section provides an overview on the Toxic waste generation addressing the main components for the imbalance in ecosystem derived from human activity The second section sets out ways in which toxic waste can be managed through various methods such as chemical treatment, cracking and Electro-beam treatment The final 3 sections deliver an insight into how energy can be extracted and recycled into power from waste energy and the challenges that these may offer. This book is essential reference for engineering industry workers and students seeking to adopt new techniques for reducing toxic waste and in turn extracting energy from it whilst complying with pollution control standards from across the world. Presents techniques which can be adopted to reduce toxic organic waste while complying with regulations and extract useable energy it includes case studies of various global industries such as nuclear, medical and research laboratories to further enhance the readers understanding of efficient planning, toxic organic waste reduction methods and energy conversion techniques. Analyses methods of extracting and recycling energy from toxic organic waste products Reviews recent advances in catalytic biodiesel synthesis, highlighting various nanocatalysts and nano(bio)catalysts developed for effective biodiesel production.Nano- and Biocatalysts for Biodiesel Production delivers an essential reference for academic and industrial researchers in biomass valorization and biofuel industries. The book covers both nanocatalysts and biocatalysts, bridging the gap between homogenous and heterogenous catalysis. Readers will learn about the techno-economical and environmental aspects of biodiesel production using different feedstocks and catalysts. They will also discover how nano(bio)catalysts can be used as effective alternatives to conventional catalysts in biodiesel production due to their unique properties, including reusability, high activation energy and rate of reaction, easy recovery, and recyclability. Readers will benefit from the inclusion of: Introductions to CaO nanocatalysts, zeolite nanocatalysts, titanium dioxide-based nanocatalysts and zinc-based in biodiesel production. An exploration of carbon-based heterogeneous nanocatalysts for the production of biodiesel. Practical discussions of bio-based nano catalysts for biodiesel production and the application of nanoporous materials as heterogeneous catalysts for biodiesel production. An analysis of the techno-economical considerations of biodiesel production using different feedstocks. Nano- and Biocatalysts for Biodiesel Production focuses on recent advances in the field and offers a complete and informative guide for academic researchers and industrial scientists working in the fields of biofuels and bioenergy, catalysis, biotechnology, bioengineering, nanotechnology, and materials science.
A Thermo-Economic Approach to Energy From Waste provides readers with the tools to analyze the effectiveness of biomass waste conversion into value-added products and how thermochemical conversion methods can be commercialized with minimum environmental impact. The book provides a comprehensive overview of biomass conversion technologies through pyrolysis, including the types of reactors available, reactor mechanisms, and the upgradation of bio-oil. Case studies are provided on waste disposal in selected favelas (slums) of Rio de Janeiro, including data on subnormal clusters and analyses of solid waste in the 37 slums of Catumbi. Step-by-step guidance is provided on how to use a life cycle assessment (LCA) approach to analyze the potential impact of various waste-to-energy conversion technologies, and a brief overview of the common applications of LCA in other geographical locations is presented, including United States, Europe, China, and Brazil. Finally, waste-to-value-added functional catalysts for the transesterification process in biodiesel production are discussed alongside various other novel technologies for biodiesel production, process simulation, and techno-economic analysis of biodiesel production. Bringing together research and real-world case studies from an LCA perspective, the book provides an ideal reference for researchers and practitioners interested in waste-to-energy conversion, LCA, and the sustainable production of bioenergy. Presents an overview of the technologies for the production of biofuels from waste via pyrolysis and gasification Provides a guide to the utilization of LCA to assess the economic and environmental impact of value-added products Describes real-world case studies on the implementation of LCA in waste-to-energy scenarios This book offers the current state of knowledge in the field of biofuels, presented by selected research centers from around the world. Biogas from waste production process and areas of application of biomethane were characterized. Also, possibilities of applications of wastes from fruit bunch of oil palm tree and high biomass/bagasse from sorghum and Bermuda grass for second-generation bioethanol were presented. Processes and mechanisms of biodiesel production, including the overview of catalytic transesterification process, and careful analysis of kinetics, including bioreactor system for algae breeding, were widely analyzed. Problem of emissivity of NOx from engines fueled by B20 fuel was characterized. The closing chapters deal with the assessment of the potential of biofuels in Turkey, the components of refinery systems for production of biodegradable plastics from biomass. Also, a chapter concerning the environmental conditions of synthesis gas production as a universal raw material for the production of alternative fuels was also added. Food Waste to Valuable Resources: Applications and Management compiles current information pertaining to food waste, placing particular emphasis on the themes of food waste management, biorefineries, valuable specialty products and technoeconomic analysis. Following its introduction, this book explores new valuable resource technologies, the bioeconomy, the technoeconomical evaluation of food-waste-based biorefineries, and the policies and regulations related to a food-waste-based economy. It is an ideal reference for researchers and industry professionals working in the areas of food waste valorization, food science and technology, food producers, policymakers and NGOs, environmental technologists, environmental engineers, and students studying environmental engineering, food science, and more. Presents recent advances, trends and challenges related to food waste valorization Contains invaluable knowledge on of food waste management, biorefineries, valuable specialty products and technoeconomic analysis Highlights modern advances and applications of food waste bioresources in various products’ recovery In this study, the use of waste coffee grounds for biodiesel production, its solid by-product after oil extraction for bioethanol generation, and the second by-product after bioethanol generation for solid fuel generation is explored. For the study, waste coffee grounds samples were gathered from TOMOCA PLC, Addis Ababa, Ethiopia. The oil was then concentrated utilizing n-hexane and brought about an oil yield of 19.73 %w/w. The biodiesel was acquired by a two-stage process, i.e. acid catalyzed esterification followed by base catalyzed transesterification utilizing catalysts sulfuric acid and sodium hydroxide respectively. The change, after esterification of waste coffee grounds oil into biodiesel, was about 80.4%w/w. Different parameters that are fundamental for biodiesel quality were assessed utilizing the American Standard for Testing Material (ASTM D 6751-09) and revealed that all quality parameters are inside the extent pointed out aside from acid value. Also, the strong waste staying after oil extraction was researched for conceivable use as a feedstock for the generation of bioethanol and brought about a bioethanol yield of 8.3 %v/v. Moreover, the solid waste staying after bioethanol generation was assessed for solid fuel (20.8 MJ/Kg) applications. A vast amount has been written about petroleum fuels, including books and guidelines; hence, we thought it timely to produce a book Petroleum Fuels: Recent Updates, which covers the most important areas in the topic. In its pages, we tried to include advances toward green and sustainable viable products in terms of biodiesel production and chemical transformation. The book contains rich extracts from experts in the fuel field, including technical/environmental and econometric aspects.