

# **Biofuel and Biorefinery Technologies**

Volume 10

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Ali Asghar Rastegari · Ajar Nath Yadav ·  
Arti Gupta  
Editors

# Prospects of Renewable Bioprocessing in Future Energy Systems

 Springer

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# Foreword

Biofuels are the potential and sustainable alternative sources of fossil fuels. Over the past few decades of years, there has been a substantial increase in research and development in the area of biofuels. Many researchers around the world have dealt with environmental, economic, policy and technical subjects aspects relating to these studies. Worldwide, there is a great interest from researchers and industries to increase the percent of biofuel use on the total energy consumption. The production of bioethanol from biomass is well reported, but, more recently, the production of biobutanol and biohydrogen, which are more energetic than bioethanol, have aroused interest. The present book volume on *Prospects of Renewable Bioprocessing in Future Energy Systems* is a very timely publication, which provides state-of-the-art information in the area of Biofuel and Biorefinery Technologies, broadly involving microbial-based innovations and applications.

The book volume comprises 18 chapters. Chapter 1 by Kour et al. describes different technologies for biofuel production. The biofuels production is still challenging at commercial scale and new strains with commercial potential are still to be explored more. The combination of multiple genetic engineering strategies for optimizing the biofuels production will surely be useful. Chapter 2 presented by Lugani et al. highlights techniques for enhanced biofuel production using biochemical strategies. Chapter 3 by Sharma, and Arya describes photobiological production of biohydrogen: recent advances and strategy. Chapter 4 by Yusoff et al. highlights strategy and development in bioreactor for microalgal cultivation systems for future energy needs. In Chap. 5, Mozghan Ghiasian explains the potential of cyanobacteria to produce biohydrogen and focuses on biophotolysis-based hydrogen production by cyanobacteria. Chapter 6, by Naghavi, and Sameipour gives an overview of the studies aimed at the technology for enhanced biofuel production using phototrophic microbial consortium. Chapter 7 authored by Asif et al. deals with chemical conversion in biodiesel refinery. Biodiesel is produced generally from a wide range of edible and non-edible vegetable oil, animal fats and frying and waste cooking oils. Use of edible oil for biodiesel production has recently been of great concern because they compete with food security. In Chap. 8, Kumar and Kumar emphasize on production bioethanol, acetone and

butanol through fermentation of oil extraction techniques. Guruviah et al. describe thermo-conversion process for the production of bio-oil and syngas using biomass additionally it presents a brief description of types of thermoconversion process employed in current research in Chap. 9.

Kumar et al. explain the replacement of fossil oil with biofuel derived from plant biomass has the potential to greatly reduce greenhouse gas emissions in Chap. 10. The use of sweet sorghum as a feed-stalk for renewable fuel production is being seen as instrumental in a shift to low-carbon fuels, which would bring sustainability in the transport sector have been described by Prasad et al. in Chap. 11. Chapter 12 by Yadav et al. describes different types of bioenergy crops, their characteristics and biofuel production. Panpatte and Jhala describes the overview of the available and accessible technologies for bioethanol production using these major lignocellulosic agro waste in Chap. 13. Kumar et al. discuss the bioethanol production through microbes from lignocellulosic biomass in Chap. 14. Possibility of complete replacement of fossil fuel is being emphasized worldwide and also for utilizing alternate low-cost feedstocks and biocatalysts, developing economically better technology, application of genetic engineering, implementing new laws and government policies and improving public awareness have been discussed by Sirajunnisa et al. in Chap. 15. Chapter 16, by De Farias Silva et al. highlights the biological treatment process of wastewater, biomass disposal and biogas production from agro-industrial wastewater, food waste and biomass. In Chap. 17, Chigullapalli, and Rao describes different technologies and policies for biofuel production in India. Finally, the overall status of biofuel production has been described in Chap. 18 by Banerjee et al. as Global Scenario of Biofuel Production: Past, Present and Future.

Overall, great efforts have been carried out by Dr. Ali Asghar Rastegari, Dr. Ajar Nath Yadav and Dr. Arti Gupta, the editorial team and scientists from different countries to compile this book as a highly unique, up-to-date source on 'Biofuel and Biorefinery Technologies' for the students, researchers, scientists and academicians. I hope that the readers will find this book highly useful and interesting during their pursuit on Biofuel and Biorefinery Technologies.



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basmati and developed elite wheat lines biofortified for grain rich in iron and zinc through wide hybridization with related non-progenitor wild wheat species and molecular breeding. Dr. Dhaliwal had the membership of several task forces and committees of Department of Biotechnology, Ministry of Science and Technology, Govt. of India, New Delhi; Chairman, Project Monitoring committee for Wheat Quality Breeding, Department of Biotechnology, Ministry of Science & Technology, Government of India (2007–2010); Chairman of the Project Monitoring Committee in ‘Agri-biotechnology’ of Department of Biotechnology, Govt. of India, New Delhi (2014–2016) and presently, Member of newly constituted Expert Committee for DBT-UDSC Partnership Centre on Genetic Manipulation of Crop Plants at UDSC, New Delhi (2016 onwards).



# Preface

The ability of renewable energy sources to supply global energy needs if not completely then to a significant degree has been amply demonstrated. What needs to happen now in order to make large-scale implementation possible? Special consideration is given to chances of commercialization of biofuels that provides a reasonable assessment of various techno-economical aspects of pilot-scale future energy production. The future for renewable energy examines each of the major renewable energy technologies. It provides a qualitative evaluation of achievements to date, which proposes for each chapter of this book detailed, realistic goals for a strong and coherent research, development and demonstration (R&D) policy, and maps out a path to a stronger market and more widespread deployment of renewable energy sources. The future for renewable energy will be regarded as a critical and authoritative source for strategic planning of renewable energy development worldwide. The current status and future directions of the biological processes for the production of energy by a biofuel provides a unique perspective to the industry about the scientific problems and their possible solutions in making a bioprocess work for the commercial production of commodity bioproducts. The commercial production of some of these commodity bioproducts in the near future will have a far-reaching effect in realizing our goal of sustainable conversion of these renewable resources and realizing the concept of the biorefinery. The processing of renewable resources, such as plant biomass, for mass production of commodity chemicals and liquid fuels to meet our ever-increasing demands is discussed. The use of sustainable green technologies for the utilization of renewable resources is encouraged, which offers timely solutions to help address the energy problem as non-renewable fossil oil will soon be unavailable. This book enables the perspective of a successful renewable bioprocessing. The different biomass needs to be effective in bioenergy, comprising mainly of crops such as lignocellulosic biomass and agricultural wastes as feedstock are addressed, and also biomass conversion into biofuels, such as bioethanol, biodiesel, bio-methane and bio-gasoline. They also include a comparison between the most recent conversion technologies and conventional approaches for hydrogen production. Accordingly, the book deals with aspects crucial for the pretreatment and hydrolysis of biomass to give energy at

high yield, as well as the general aspects of bioprocessing technologies which will enable the development of biorefineries through inputs of bioengineering, downstream processing and formulation.

The present book on *Prospects of Renewable Bioprocessing in Future Energy Systems* covers all aspects of biofuels productions. The book volume comprises 18 chapters contributed by different authors from different countries. All the chapters were selected logically and arranged to provide comprehensive state-of-the-art information on practical aspects of cultivation, harvesting, biomass processing and biofuel production from algae and microorganisms. Each chapter discusses topics with simplicity and clarity. All the chapters and their contents are supported by extensive citations of available literature, calculations and assumptions based on real facts and figures on the current status of research and development in this field. In a summation, this edited volume provides a wealth of information based on realistic evaluations of contemporary developments in biofuel research with an emphasis on pilot-scale studies. Prospects for the commercialization of algal biofuels are another highlight of the book. Essential reading for energy policy makers and planners, and for all those involved in renewables whether as researchers, manufacturers and utilities. Therefore, this collection suitable perspective for graduate students and consultants in bioenergy/bioprocess engineering, researchers, industrial microbiology, bioprocess technology, environmental science and energy.

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