Biotechnology for Biofuels: A Sustainable Green Energy Solution

Nitish Kumar
Editor

Biotechnology for Biofuels: A Sustainable Green Energy Solution

Springer

Editor
Nitish Kumar
Department of Biotechnology
Central University of South Bihar
Gaya, Bihar, India

ISBN 978-981-15-3760-8 ISBN 978-981-15-3761-5 (eBook)
https://doi.org/10.1007/978-981-15-3761-5

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

The depletion of petroleum-derived fuel and environmental concerns have prompted many millennials to consider biofuels as alternative fuel sources. But completely replacing petroleum-derived fuels with biofuels is currently impossible in terms of production capacity and engine compatibility. Nevertheless, the marginal replacement of diesel with biofuel could delay the depletion of petroleum resources and abate the radical climate change caused by automotive pollutants. Energy security and climate change are the two major driving forces for worldwide biofuel development and also have the potential to stimulate the agro-industry. The development of biofuels as alternative and renewable sources of energy has become critical in national efforts towards maximum self-reliance, the cornerstone of our energy security strategy. At the same time, the production of biofuels from various types of biomass such as plants, microbes, algae, and fungi is now an ecologically viable and sustainable option. This book describes the biotechnological advances in biofuel production from various sources while also providing essential information on the genetic improvement of biofuel sources at both the conventional and genomic level. These innovations and the corresponding methodologies are explained in detail.

Biotechnology for Biofuels: A Sustainable Green Energy Solution contains 11 chapters which covers the latest developments in the research on a promising biofuel crop Jatropha, discusses the application of nanotechnology and computational biology in biofuel production, addresses the role of microorganisms in biofuel production, catalytic approach for production of hydrocarbon-rich bio-oil from a red seaweed species, seaweed biomass and microbial lipids as a source of biofuel, and biomass of bamboo and sugarcane as a source of bioenergy.

Gaya, Bihar, India — Nitish Kumar

Acknowledgment

Thanks to all the authors of the various chapters for their contributions. It had been a bit long process from the initial outlines to developing the full chapters and then revising them in the light of reviewers' comments. We sincerely acknowledge the authors' willingness to go through this process. I also acknowledge the work and knowledge of the members of our review panels, many of which had to be done at short notice. Thanks to all the people at Springer Nature, India especially Ms. Aakanksha Tyagi and Mr. Selvakumar Rajendran with whom we corresponded for their advice and facilitation in the production of this book. I am grateful to my family member Mrs. Kiran (Wife), Miss Kartika Sharma (Daughter) and parent for their incredible and selfless support all the time.

Gaya, Bihar, India Nitish Kumar

Contents

About the Editor

Nitish Kumar is a Senior Assistant Professor at the Department of Biotechnology, Central University of South Bihar, Gaya, Bihar, India. He received his Master's Degree in Agricultural Biotechnology from Himachal Pradesh Agricultural University, Palampur in 2003 and his PhD in Botany from Bhavnagar University in 2009. Dr. Kumar is currently a plant biologist with a focus on Plant Tissue Culture, Molecular Marker Development, Transgenic Technology, and Microbial Biotechnology. He has published a number of research papers in peer-reviewed journals of national and international repute. In addition, he has received many awards \fellowships from various organizations, e.g. the CSIR, DBT, ICAR, and DST. He is an associate editor of the journal *GENE*.

(64)

5 Catalytic Approach for Production of Hydrocarbon Rich Bio-Oil from a Red Seaweed Species

Sanjay Kumar, Priyanka Roat, Sonal Hada, Bhawna Chechani, Neetu Kumari, Praveen Ghodke, and Devendra S. Rawat

Abstract

Macro algae represent a diverse group of multicellular marine organisms capable of performing the photosynthetic process and classified into three main categories due to the presence of specific photosynthetic pigment into their body: (1) Phaeophyceae (2) Rhodophyceae, and (3) Chlorophyceae, which in general term known as brown, red, and green seaweeds, respectively. There are more than 1000 species belonging to these groups of plants, having uses in food, pharma, textile, agriculture, and microbiology based industries, as they are the main sources of the key products. Due to different growth rate, hybrid nature of the products, higher contents of other cellular components, and poor quality of the obtained products, etc., only few species had occupied the industrial applications among which *Gracilaria, Eucheuma, Sargassum, Ulva, Laminaria* species are the key players. Nature has offered unique features to each species with respect to their possible application in the selective domain. The absence of lignin, higher rates of growth, no use of lands for cultivation as well as their higher CO_2 mitigation capabilities, seaweed biomass can find application in the energy sector as suitable energy resources. As compared to micro algal biomass, which has considered as alternative energy source of the third-generation biofuels macroalgal biomass has not been explored that much.

In this work, a red macroalgal biomass *Champia indica* was used for study towards its bioenergy prospective in terms of pyrolysis. Based on proximate,

S. Kumar (✉) · D. S. Rawat
Department of Chemistry, University of Petroleum and Energy Studies, Dehradun, India
e-mail: sanjay.kumar@ddn.upes.ac.in

P. Roat · S. Hada · B. Chechani · N. Kumari
Department of Chemistry, Mohanlal Sukhadia University, Udaipur, India

P. Ghodke
Department of Chemical Engineering, University of Petroleum and Energy Studies, Dehradun, India

N. Kumar (ed.), *Biotechnology for Biofuels: A Sustainable Green Energy Solution*,
https://doi.org/10.1007/978-981-15-3761-5_5