

Preface

Current energy scenario clearly suggests that oil and gas reserves are finite and will last only few more decades. Therefore, massive research efforts are underway globally for developing energy from resources with lower carbon footprint for sustainable development and environmental protection. In order to ensure energy security and to reduce impact of global and local pollution from fossil fuels, utilization of biofuels has been adopted as an immediate solution. Biofuels play an important role in the future scientific research portfolio, which will affect energy independence and energy security, revitalize rural infrastructure and shift energy landscape of the twenty-first century towards greater sustainability and towards low carbon-intensity. Discussing multidisciplinary research dimensions of bioenergy and its potential for replacing fossil fuels in coming decades, this monograph provides a roadmap for understanding broad sweep of technological, sociological, and energy policy issues that intermingle and intertwine. Biotechnology and especially synthetic biology can play a key role in promoting sustainable production and use of bioenergy through development of next-generation biofuels from locally available biomass feedstocks using advanced sunlight-to-biomass-to-bioenergy conversion processes. Socio-economic and environmental challenges need to be duly considered while designing these technological solutions. This monograph covers such advanced techniques for efficient production of biofuels from locally available raw biomaterials and their utilization in IC engines and power generating equipment.

An international workshop, 3rd ISEES Workshop on “Sustainable Energy, Environment & Safety with Railway Centric Theme”, was held at Research Designs and Standards Organisation (RDSO), Lucknow, India from December 21 to 23, 2015 under the aegis of International Society for Energy, Environment and Sustainability (ISEES). This workshop provided a platform for discussions between eminent scientists and engineers from various countries including India, USA, South Korea, Thailand, and Austria. In this workshop, eminent speakers presented their views related to different aspects of biofuels, and alternative energy resource for sustainable development and cleaner environment. This research monograph is based on the topics covered at the workshop, and brings together a wealth

of knowledge from renowned experts on the latest developments in selected technology domains with a focus on fundamentals, applications, and advanced teaching pedagogy. Main areas covered in this monograph are biofuels and their advantages, advanced biofuel production techniques and their utilization in various sectors such as transportation and power generation. This monograph also includes methodologies of increasing biofuel yield from different resources. Research on using biofuel blended with conventional fossil fuels for power generation is also presented. In addition, novel technology developments in biofuel production from microalgae are also discussed.

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This monograph is intended for researchers, practitioners of engineering and technology, and we hope that the monograph would be of great interest to the professionals involved in biofuels as well as students, government officials, decision makers, policy makers, and civil society organizations interested in renewable energy and more specifically to those working in biofuel production, optimization, and their utilization in IC engines. Its objective is to promote a better and more accurate understanding of the nature, production, challenges, technological status, and usage of biofuels from vegetable oils and algae and to provide an updated and reliable reference and guidebook on biofuels.

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