

Preface

Life is energy. A sustainable supply of energy is required for the overall human development. The Sun is the primary source of energy on Earth. Fossil energy, the major source of energy (80 % of current world power consumption), is the result of energy entrapped by plants through photosynthesis in past eras. Fossil energy is a finite source and is likely to be exhausted sooner rather than later due to the fast pace of urbanization and increased use worldwide. Regular price hikes and environmental damage caused by excessive use of fossil fuels are the major alarming concerns. Owing to these geopolitical factors, the time is now to look out intensively for alternatives to fossil fuels. Renewable or bioenergy is the suitable answer as it can be produced directly from natural resources.

Bioenergy sources are diverse and broad in range. It can be categorized mainly as solar, wind, hydrothermal, and biomass-derived. Amongst all the renewable resources, biomass is one of the most promising answers, particularly for transportation fuels. Brazil is the fourth largest country in the world and is largely blessed by nature for appropriate fertile land, rain, light, and water. Brazil is representative of renewable energy program in the world and ranks second in ethanol production. The government of Brazil has taken appreciable initiatives in order to make the bioenergy program successful. Sugarcane-juice-derived ethanol, so-called first-generation ethanol, is the principle component of bioenergy in Brazil. However, cellulosic ethanol or second-generation ethanol is a prospective energy source in the near future. There are numerous research programs nationwide to make cellulosic ethanol a reality in the near future with financial help from the Ministry of Science and Technology, Government of Brazil. Many countries, particularly the developing world, can learn from the success stories of the Brazilian Bioenergy program and implement the policies for their energy security and betterment of socioeconomic status.

This book aims to disseminate the current advances in the bioenergy program of Brazil starting from feedstock analysis, availability, chemical composition, technical aspects, technoeconomic analysis, and government policies. This book is a fine and unique collection of 19 book chapters written by specialists in the related research area, who afford critical insights into several topics, review of current research, and discuss future progress in this area. Broadly, this book intends to

provide critical insight and background research analysis on raw materials, processing, synthesis, recovery, and application as energy sources, comparative account on major alternative energy producing countries in addition to feedstock variation and analysis. In regard to technical updates, this book highlights the system biology-based approaches for the development of new energy feedstocks, microorganisms, and enzyme titers. Furthermore, recent technical progress made toward pretreatment, enzymatic hydrolysis of biomass, and the fermentation of sugars into ethanol is also mentioned. Similarly, these aspects have also been discussed for the production of other biofuels such as biohydrogen, biodiesel, or bio oil. An assessment on technological development for capturing, regeneration, and storage of solar energy, wind energy, and turbines is also made along with future directions. Comparative technoeconomic and life cycle analysis of various biofuels have been discussed in the last section along with the commercialization of cellulosic ethanol and other by-products. Additionally, initiatives taken by the Brazil Government for implementing effective bioenergy policy for the promotion of biofuels through research, commercialization, and private investment support have been apprised to the readers. Apart from researchers and graduate students of microbial biotechnology, and chemical and industrial engineers, this book will assist the business community and policy analysts who deal with geopolitical analysis of bio-based products, bioenergy, and their marketing.

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