Preface

At the United Nations Climate Conference (COP21) that took place in Paris in December 2015, 195 governments agreed to adopt a global action plan aimed a long-term maintainence of the global average temperature increase to be well below 2 °C above preindustrial levels.

Improving the global policy for the stimulation of the research and the consumption of green fuels can contribute to a quick reduction of CO_2 emission of fossil fuels in next decades.

This book comprises 22 chapters, providing an extensive overview about the state of the art regarding to the current technological developments in green biofuels. Chapter "History and Global Policy of Biofuels" provides a generalized overview of the history of biofuels production and the global policies related to their development and brings to the fore the problem of emissions greenhouse gas (GHG) and the sense that energy is an essential input for global economic growth. In Chapter "Feedstocks for Biofuels" the most important vegetal feedstock and agroindustrial wastes utilized in the production of green biofuels are presented. Chapters "Oil Crops in the Context of Global Biodiesel Production" and "An Overview of Production, Properties and Uses of Biodiesel from Vegetable Oil" present the global market of the main vegetal oils used in the biodiesel production and an overview about their production, properties, uses of biodiesel from vegetable oil, and various technical and economic aspects that require to be made for increasing the production and consumption of this biofuel.

The pretreatment technologies of lignocellulose biomass available to date, with emphasis on those that are already closed to or have eventually reached precommercial scale such as steam explosion and/or dilute acid hydrolysis are presented and discussed in Chapter "Pretreatment Processes for Cellulosic Ethanol Production: Processes Integration and Modeling for the Utilization of Lignocellulosics Such as Sugarcane Straw".

The main enzymes involved in cellulose degradation include the classical glycoside hydrolases, namely endoglucanases, cellobiohydrolases, and β-glucosidases, as well as oxidative enzymes, among which cellobiodehydrogenases and the newly

discovered lytic polysaccharide monooxygenases are introduced and explored in Chapter "Fungal Enzymatic Degradation of Cellulose". In Chapter "Principles and Challenges Involved in the Enzymatic Hydrolysis of Cellulosic Materials at High Total Solids" the new challenges involved in the production of enzymatic hydrolysates with high sugar concentrations (180–200 g L^{-1}), signaled as the most important factor to economically produce second generation ethanol, are argued.

In Chapters "First Generation Bioethanol" and "Second Generation Bioethanol" the currently technology developed for the production of first- and second generation bioethanol is presented. Chapter "Bioethanol from Soybean Molasses" focuses on the production of bioethanol from soybean molasses at laboratory, pilot, and Industrial scales. Soybean molasses is the main by-product generated during the industrial processing of soybean to produce the soy protein concentrate. It is a rich source of carbohydrates, proteins, and lipids and demonstrated to be a suitable fermentation medium to produce bioethanol, either with *Saccharomyces cerevisiae* or *Zymomonas mobilis*.

Chapter "Bioethanol Wastes: Economic Valorization" describes the most promising technology for the reuse and valorization of the solid, liquid, and gaseous wastes generated during the production of ethanol through the fermentation of sugarcane.

Chapters "General Assessment of the Currently Available Biodiesel Production Technologies"–"Biodiesel and Bioethanol from Microalgae" present a general discussion about available technologies, with a special focus on hydroesterification and biodiesel production from algae. Chapter "Microbial Oil for Biodiesel Production" is a description of biodiesel production (at bench and pilot scale) from oleaginous microorganisms cultivation in alternative substrates for microbial oil production and extraction of lipids. Also, a promising example of microbial oil production from sugarcane juice by yeasts and microalgae and its use as raw material for biodiesel production is presented as a case study.

The research development in biohydrogen is presented in a chronological order in Chapter "Biohydrogen", and anaerobic digestion for biogas production as an evolutionary perspective in the Indian context are discussed in Chapter "Biogas: An Evolutionary Perspective in the Indian Context".

Chapter "Bio-butanol—"A Renewable Green Alternative of Liquid Fuel" from Algae" describes briefly, biobutanol as a fuel and its biochemical production and challenges and a particular emphasis is given on their production from algae as potential substrate.

Pyrolysis process is the thermal degradation of biomass under an inert atmosphere leading to three different products: solid char, liquid biofuel, and fuel gas. This thermochemical process involves complex and multiple reactions. In Chapter "Pyrolysis of Biomass for Biofuel Production", the biomass pyrolysis is studied using the thermogravimetric analysis (TGA) coupled with mass spectrometry (MS), one of the main analytical tools to evaluate the potential of a feedstock.

Life cycle assessment is a powerful tool to analyze the economic efficiency and the environmental impacts of a product, processes, or human activity on the

environment. In Chapter "Life-Cycle Assessment of Biofuels", the theory of life cycle assessment, scope and objectives, besides some of the commonly used parameters to evaluate and compare efficiency of different processes are briefly discussed. Then some specificities of biofuel's life cycle are focused, and finally some case studies concerning the most important biofuels such as biodiesel, bioethanol, and biohydrogen, among others, are presented.

The statistics of patent applications is used as indicator for evaluating the technological development in different knowledge areas. Chapter "Patents on Biofuels" covers every aspect of the production process of biofuels, focusing on biotechnological aspects and its most recent trends.

Finally, Chapter "Economic and Environmental Aspects of Biofuels" inspects the economic and environmental impacts of the first generation biofuel, which is the only largely available fuel in the market today. Based on this experience, the process of continuous improvement for the future generations of biofuels is evaluated.

The book would be of special interest for academic, researchers, graduate students, and industry scientists that are working in the area of biofuels.

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Curitiba, Brazil — Carlos Ricardo Soccol
Québec, Canada — Satinder Kaur Brar
Marseille, France — Craig Faulds
Curitiba, Brazil — Luiz Pereira Ramos

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