

Preface

As a renewable resource and substitute of traditional fossil resources, conversion of biomass into chemicals, materials, biofuels and energy is one of the most important research topics today. The application of process intensification techniques such as ultrasound irradiation in biorefineries has been proved to be able to increase energy efficiency, shorten reaction time and improve product yields. The present text provides up-to-date fundamentals, state-of-the-art reviews, current assessments and prospects in this area that includes aspects of reactors design, ultrasound assisted pretreatment, extraction and transformation of lignocellulose, microalgae and the other wastes to materials, chemicals and biofuels. The techno-economic analysis of the processes and some other auxiliary methods such as catalysis and mechanochemical techniques used in the pretreatment and transformations are also covered.

This book is the fourth book of the series entitled, *Biofuels and Biorefineries*, and it consists of 12 chapters contributed by leading experts in the field around the world. The chapters are categorized into three parts:

Part I: Fundamentals and Reactors (Chaps. 1–3)

Part II: Biodiesel: Extraction and Production (Chaps. 4–6)

Part III: Lignocellulose and Industrial Waste: Pretreatment and Conversions (Chaps. 7–12).

Chapter 1 provides an overview of the dynamics, mechanisms and theories of acoustic cavitation in sonochemistry. Chapter 2 illustrates physical and chemical mechanisms of ultrasound-assisted processes involved in the synthesis of biofuels. Chapter 3 describes reactor configurations for both transesterification and esterification for the production of methyl esters from vegetable oils. Chapter 4 reviews ultrasound applications in lipid extractions from algal biomass and challenges associated with the processes. Chapter 5 covers microalgae lipid extraction by the ultrasound-assisted method accompanied with solvents and the characteristics of the obtained fuel. Chapter 6 describes the synthesis of biodiesel and bioethanol by employing microwave and sonochemistry. Chapter 7 gives an overview of the technology associated with the conversion of biomass into biofuels. Chapter 8 focuses

on the production of biogas through ultrasound pretreatment of lignocellulosic materials, manures, sludges and microalgae. Chapter 9 shows methods for the ultrasonic vibration-assisted pelleting of cellulosic biomass for biofuel production and includes topics on pellet quality, pellet sugar yield, pelleting energy consumption and pelleting conditions. Chapter 10 focuses on the treatment of biomass with mechanical and combined chemical and mechanical techniques. Chapter 11 deals with the valorization of starch-based industrial waste into sugars employing ultrasound and microwave technologies. Chapter 12 provides a methodology for performing a techno-economic assessment during the development process and a framework for its application for the ultrasonic production of biofuels and chemicals.

This book covers a wide range of scientific and technical aspects of ultrasound that are used in conversion of biomass to bioenergy, biofuels, bio-based chemicals and materials. The reactor design techniques and techno-economic assessment necessary for the process are also included. The text will be of interest to students, researchers, academicians and industrialists in the areas of biomass processing, sonochemistry technique, and bioenergy and bioproduct development.

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Fang, Z.; Smith, Jr., R.L.; Qi, X. (Eds.)

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