
Preface

Marine bioenergy is one of the most important components to mitigate greenhouse gas (GHG) emissions and for the substitution of fossil fuels. The study of marine algae for fuel has become a hot topic in recent years with energy prices fluctuating widely and GHG emissions increasingly becoming a cause for concern. Marine microalgae are emerging as one of the most promising resources of biodiesel, with a projected yield of 58,700–136,900 L ha⁻¹ year⁻¹. Bioethanol, as a clean and renewable combustible, is considered as a good alternative to oil. Although the energy equivalent of ethanol is 68% lower than that of petroleum fuel, the combustion of ethanol is cleaner (because it contains oxygen). Hydrogen gas is thought to be the ideal fuel for a world in which air pollution has been alleviated, global warming has been arrested, and the environment has been protected in an economically sustainable manner. Marine microbial fuel cell (MFC) is a promising new technology for generating electricity directly from biodegradable compounds. More recently, generation of electricity using MFC is gaining important attention in the research fraternity. MFC is a type of fuel cell that converts the chemical energy contained in organic matter to electricity using microorganisms as a biocatalyst.

Marine biodiesel is a renewable, nontoxic, biodegradable, and CO₂-neutral energy source. Therefore, in recent years it has become a hot topic for the exploitation of renewable and environment-friendly energy forms. Compared to conventional oil crops, microalgae are more attractive as feedstock for biodiesel production due to their high photosynthesis efficiency and lipid content. The marine microalgal lipid productivity/biomass (dry weight) is about 15–300 times that of conventional crops. Besides that, marine microalgae have the function of removing nitrogen and phosphorus and fixing CO₂, making the coupling of bioenergy production and wastewater treatment based on microalgae a promising technology in the future. Therefore, marine microalgae-based biodiesel has attracted increasing attention worldwide. However, the high cost of biodiesel production is the main bottleneck in its commercial application. Increasing the lipid content per microalgal biomass is one of the efficient methods to reduce the total cost of biodiesel production.

Marine Bioenergy: Trends and Developments covers the key aspects of marine bioenergy, namely, marine biomass, techniques, bioethanol, biomethane, biomethanol, biohydrogen, biodiesel, bioelectricity, marine waste, commercialization, and the global market. Section I provides an introduction to marine bioenergy; Section II describes marine algae as a source of bioenergy; Section III describes the biotechnological techniques for biofuel production; Section IV deals with the production of bioenergy particularly bioethanol, biomethane, biomethanol, biohydrogen, and biodiesel; Section V discusses bioelectricity and MFCs by marine algae and microbes; Section VI covers marine waste for bioenergy; and Section VII deals with commercialization and the global market. The chapters in each section are a good collection of comprehensive research on these bioenergies carried out by proficient scientists from around the world. In addition, the preparation methodologies for these bioenergies have also been well depicted in their respective chapters. We are quite certain that the findings and latest information presented in this book will be helpful for upcoming researchers to establish phenomenal research from an intersection of multiple research areas.

We are grateful to all the chapter authors who have provided state-of-the-art contributions in the field of marine bioenergy; their relentless effort was the result of scientific attitude, drawn from the past history in this field. I also thank the staff of Taylor & Francis Group and CRC Press for the continual support, which was essential for the successful completion of this book. We hope that the fundamental ideas presented in this book serve as potential research and development options for marine bioenergy for the benefit of humankind.

We strongly recommend this book to marine bioenergy researchers/students and hope that it helps to enhance their understanding in this field.

Se-Kwon Kim
Choul-Gyun Lee

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The MathWorks, Inc.
3 Apple Hill Drive
Natick, MA 01760-2098 USA
Tel: 508-647-7000
Fax: 508-647-7001
E-mail: info@mathworks.com
Web: www.mathworks.com