

Preface

Microalgae cultivation has an advancing role in solving some of the future limitations of traditional biomass production and markets (i.e., food, feed, energy, emission mitigation, chemicals, materials, etc.). In conjunction with conventional growth systems, new biomass industries such as microalgae must be developed in order to produce large-scale sustainable products cost-effectively. This book presents some of the most promising existing microalgal biomass growth technologies and summarizes some of the novel methodologies for sustainable and commercial microalgae production.

There are many different and unrelated microalgae taxonomic groups that directly or indirectly utilize solar energy to produce organic compounds. At present only a little over a dozen species are medium-term candidates for large-scale cultivation. However, even an ideal microalga must sustain high productivity under varying environmental and production conditions, and produce commercially sought services and products.

To enable such an industry, both advancements in microalgae biological sciences and biomass production and processing engineering systems are a major parallel focus of this book. We are very pleased to have 17 excellent chapters detailing some of the latest research and developments in microalgae cultivation and processing techniques, heterotrophic production methods, introduction of wastewaters, the effect of CO₂ injection, flocculation and auto-flocculation, in addition to species-specific extraction methods and bioproduct optimization. The chapters also include the production of a range of fuels, including anaerobically digested microalgae for biogas, and biodiesel, bioethanol, and also hybrid chemical and electric production systems. Furthermore, innovations in production via genetic engineering for microalgae strain improvement, synthetic biology approaches, genomic, and metabolic modeling approaches are analyzed and discussed in detail. In terms of large-scale production, selected chapters discuss the economics of harvesting and downstream processing, energy and economic modeling for large-scale facilities, and research on life-cycle environmental impact of microalgae biofuel and co-products.

As the book developed we were amazed at the breadth and detail of the ongoing advances in both the biological and engineering elements that surround modern microalgae production. We trust the reader will enjoy the book as much as we enjoyed writing and editing it.

The editors would like to thank all of the authors for their excellent and timely contributions. Considering the professionalism and the experience of the contributing researchers, the editing of this book was a relative pleasure. We also thank the many people directly and indirectly involved in the production of this book, including the publisher, and also our families who supported us through our various endeavors.

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