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Algal Research, Special Issue Editorial: Wastewater and Algae; Risk, biofuels MARK and long-term sustainability

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The application of microalgae in wastewater treatment for management of biological oxygen demand (BOD), nutrient removal and microbial risk mitigation has been a significant focus of international research effort for several decades. Recent interest in alternative sources of fuels and the potential advantages and sustainability of bioprocess based energy and bio-production systems has also increased interest in the integration of microalgae both for the bioremediation of wastewaters and the concomitant production of biofuels and added value bio-products. Wastewater can provide most if not all the nutrients required for algal cultivation as well as the necessary water substrate, saving significant production costs compared to industrial process systems. The ability of algae to effectively remove nutrients from wastewater also provides an alternative, and potentially more cost effective, means of treatment for regulated water discharge, compared to conventional wastewater management. Combining these two aspects has the potential to make both wastewater treatment and algal biomass production more economically viable and cost effective.

The expanding research output integrating algae within wastewater treatment and for biofuel production was the impetus for the current Special Issue which aims to present the current state of the technology application and development as well as new and emerging research issues. We selected 15 manuscripts for publication to represent the widest geographical interest and that either summarize the state of the art of the science or consider new areas yet to be extensively researched. These were authored by researchers from 29 institutions in 14 countries worldwide including: Australia, Belgium, Brazil, Canada, China, France, Greece, India, Mexico, New Zealand, Portugal, Spain, United Kingdom, and the United States of America. This indicates the global scope and application of the research into algae and wastewater and also the international collaborative capacity supporting much of this research.

The evidence presented in this selected collection of papers demonstrates that cultivation of algae in wastewaters to produce biofuels or other bio-products offers a significant potential for advancing the sustainability of global energy systems and supporting associated economic stability. However, though it is possible to generalize the potential of these systems, the research emphasizes that specific solutions must be tailored to local circumstances.

The Special Issue identifies the many facets of this significant technological challenge and offers insight into the diversity of approaches and the wide scope, and associated challenges, of the algae and wastewater research needs. Specific topics address: saline and fresh water algae, including micro- and macroalgae, mesophiles and extremophiles; technical tools and scenarios for spatially explicit life cycle analyses; planktonic and fixed substrate algal production systems; and issues related to wastewaters with extreme properties, such as geochemically complex wastewaters from the oil and gas industries or desalination residual waters. The final paper addresses the need for a

more consistent approach to defining and describing experimental conditions and the development of protocols to allow the replication and comparison of research results to facilitate the coherent development of the supporting science and engineering.

We initiate the issue with a “Note to the Editor” that assesses the bibliographic output in this field. This note analyzes the growing number of manuscripts in the peer-reviewed literature since 1970 and the various areas of research emphasized and undertaken by the global community of researchers.

Finally, we wish to acknowledge the invaluable support of the many reviewers who also contributed to this Special Issue through their expert and critical input.