

Current Developments in Biotechnology and Bioengineering



Advanced Membrane Separation Processes for
Sustainable Water and Wastewater Management –
Aerobic Membrane Bioreactor Processes and Technologies



Editors

How Yong Ng, Tze Chiang Albert Ng,
Huu Hao Ngo, Giorgio Mannina and Ashok Pandey



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Preface

The book titled *Advanced Membrane Separation Processes for Sustainable Water and Wastewater Management – Aerobic Membrane Bioreactor Processes and Technologies* is a part of the comprehensive series on *Current Developments in Biotechnology and Bioengineering* (Editor-in-Chief: Ashok Pandey), in which overall three books are included on Advanced Membrane Separation Processes for Sustainable Water and Wastewater Management. This book is one of these three books and it covers advances on aerobic membrane bioreactors (MBR) processes and technologies.

Buzzwords like “environmental sustainability” and “water-stressed areas” have been bandied recently by politicians and media outlets alike. Indeed, severity of countries facing water stress has been found to be increasing, particularly in Asia and Africa, because of climate change. And water, being an integral component for life and development, has been given its due attention. Water has always been a precious and strategic commodity and the fact that ancient civilizations flourished along banks of great rivers bears testament to its crucial role in our survival and societal development. It is precisely of this importance that environmental protection and the availability of portable water have driven development in treatment processes that can recover clean water from wastewater discharges.

Membrane bioreactors (MBRs) combine conventional activated sludge process to biologically treat wastewaters and filtration process to separate treated water from biomass. The concept of an MBR is surprisingly simple; find membrane filters of the right size (pore size smaller than the unwanted particles), apply a pressure on one end and *voila* (!), clean water from the other side of the membrane emerges. This concept has been successfully applied by sari-clan women in India to purify river water for household uses for generations. However, simple as it is in theory, scaling up the filtration process, managing the quality of water produced, and mitigating clogging of the membrane pores were significant issues that had to be resolved. Advances in MBRs were so rapid and successful in the last couple of decades that the number of full-scale installations increased exponentially, in part because of the increasing confidence in this technology and the decreasing start-up costs.

A decade ago, *The MBR Book* written by Simon Judd had provided useful information on design, assessment, and operation of MBRs for many budding researchers and practitioners. In the intervening years, much progress has been made and the field has branched to many sub-areas, including aerobic MBRs (AeMBRs), anaerobic MBRs, hybrid MBRs, and power generating MBRs. Numerous research articles have been published along the way and improved on the way we looked at and operated MBRs. It was necessary, then, to consolidate this information and systematically organize them. For these reasons, this MBR book focusing on advances in AeMBR technology has been mooted and

published. Providing the latest comprehensive review in various important aspects of AeMBR including hybrid processes and advanced fouling control strategies, we expect this book to be a useful resource for water professionals and students to understand the basics and the latest developments in AeMBRs.

Contributed by industry experts and academic scientists, this book is set out to provide information on the most currently relevant aspects in AeMBRs, challenges and opportunities to resolve in the most pressing issues particularly in nutrients removal and membrane fouling control. This book provides as much practical and theoretical information in the beginning ([Chapters 1–3](#)) before delving into greater detail on one of the main causes of membrane fouling and the techniques to understand membrane fouling mechanisms ([Chapters 4 and 5](#)). These preceding sections provide a comprehensive understanding of AeMBRs for readers to gain particular insights into recent advances in membrane materials, MBR designs, and fouling control strategies in subsequent chapters.

It is acknowledged that this book may not provide the most comprehensive listing of all AeMBR processes but hopes to provide major information required for a good understanding of state of AeMBRs in the market and research. At the same time, references for further readings are provided for readers to develop a greater and more in-depth understanding of each topic.

Grateful thanks are given to the contributing authors and reviewers, without whom we would not have been able to put together such a comprehensive review of AeMBRs and the challenges that still exist. We thank Elsevier team comprising Dr Kostas Marinakis, Senior Book Acquisition Editor; Ms Sara Valentino, Editorial Project Manager; Mr Omer Mukhtar Moosa, Production Manager; and the entire Elsevier production team for their consistent hard work in the publication of this book.

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