# Biological Wastewater Treatment

## Principles, Modelling and Design

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# Preface

Over the past twenty years, the knowledge and understanding of wastewater treatment has advanced extensively and moved away from empirically-based approaches to a fundamentally-based 'first principles' approach embracing chemistry, microbiology, physical and bioprocess engineering, and mathematics. Many of these advances have matured to the degree that they have been codified into mathematical models for simulation by computers. For a new generation of young scientists and engineers entering the wastewater treatment profession, the quantity, complexity and diversity of these new developments can be overwhelming, particularly in developing countries where access is not readily available to advanced level courses in wastewater treatment. This book seeks to address that deficiency. It assembles and integrates the postgraduate course material of a dozen or so professors from research groups around the world that have made significant contributions to the advances in wastewater treatment.

The book forms part of an internet-based curriculum in wastewater treatment and, as such, may also be used together with lecture handouts, filmed lectures by the author professors and tutorial exercises for students' self-study. Upon completion of this curriculum, the modern approach of modelling and simulation to wastewater treatment plant design and operation - be it activated sludge, biological nitrogen and phosphorus removal, secondary settling tanks or biofilm systems - can be embraced with deeper insight, advanced knowledge and greater confidence.

This book and innovative learning materials were produced under the framework of the UNESCO-IHE Partnership for Water Education and Research (PoWER). PoWER develops and provides demand-responsive and duly accredited postgraduate education, joint research and capacity building services to individuals and organizations throughout the developing world.

The book was made possible through the generous sponsorship of UNESCO-IHE Institute for Water Education and Korea Water Resources Corporation – Kwater.

A number of individuals deserve to be singled out as their contribution is highly appreciated: Jetze Heun, Atem Ramsundersingh, Caroline Figueres, Jan Herman Koster, Kyul Ho Kwak, Nahm-Chung Jung, Byung-goon Kim, Peter Stroo, Hans Emeis, Vincent Becker, Angela Lorena Pinzón Pardo, Loreen Ople Villacorte, Assiyeh A. Tabatabai, Claire Taylor, Michael Dunn, Michelle Jones, David Burns, and of course, all the authors.

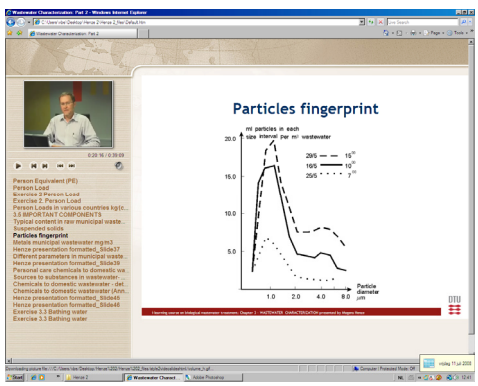
Further, we acknowledge the contributors who allowed their data, images and photographs to be used in this book.

Finally, the editors wish you a beneficial study of biological wastewater treatment and its successful use in improving sanitation worldwide.

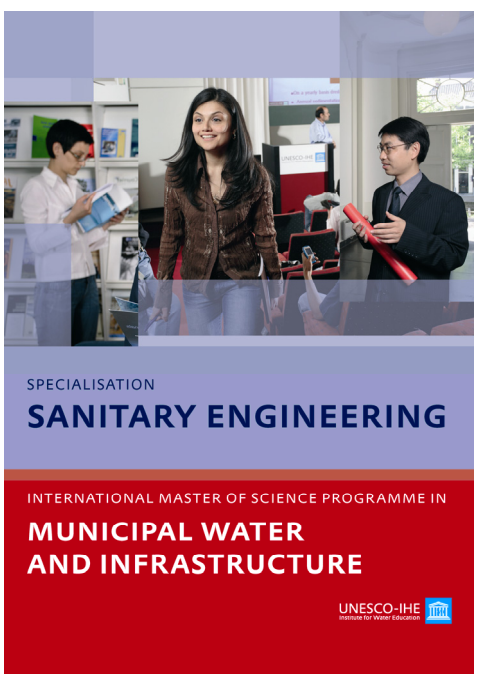
*Editors*

# About the book and online course

The idea of making this online learning course on Biological Wastewater Treatment was conceived in 2003 when UNESCO-IHE obtained a grant from the Dutch government to develop innovative learning methods and products which resulted in the Partnership for Water Education and Research (PoWER). Under the framework of PoWER, state-of-the-art video conferencing facility was constructed at the premises of UNESCO-IHE in Delft. These soon became part of the World Bank Global Development Learning Network which is a partnership of over 120 recognized global institutions, collaborating in the design of customized learning solutions for people working in development. The PoWER regulations required that at least two partners beside UNESCO-IHE were actively involved in the preparation of online learning courses (in this particular case Monterrey University, Mexico, and Birzeit University, Palestine). However, the original idea of the coordinator of this online learning course, D. Brdjanovic, was also to involve professors from around the world that have made significant contributions to advances in wastewater treatment. It took three years and the sponsorship of the Korean Water Resources Corporation (K-water) to secure supplementary financial resources and to start working on the preparation of materials. The conceptual framework for the book and the online course that it is part of was agreed upon in Beijing during the IWA World Water Congress and Exhibition in September 2006. Besides providing chapters in the book, authors were requested to prepare presentation slides, tutorial exercises and to deliver video-recorded lectures at the UNESCO-IHE studio in Delft, all compiled into a DVD package available to those registered for the online course. IWA Publishing agreed to publish the book and market both the book and online learning course.




Exactly two years later in September 2008 the book Biological Wastewater Treatment: Principles, Modelling and Design was presented to the public at the IWA World Water Congress and Exhibition in Vienna. In the context of the International Year of Sanitation, the very first copy of the book was presented to HRH the Prince of Orange, the Chairman of the United Nations Secretary-General's Advisory Board on Water and Sanitation.




The online course is delivered twice a year starting in spring and autumn. The book is also used for teaching as part of a lecture series in the Sanitary Engineering specialization of the UNESCO-IHE's Masters Program in Municipal Water and Infrastructure. It is conceptualized in such a way that it can be used as a self-contained textbook or as an integral part of the online learning course.

Further information on this online learning course and UNESCO-IHE's Sanitary Engineering specialization can be obtained from D. Brdjanovic (d.brdjanovic@unesco-ihe.org) or by visiting the respective web pages: http://www.unesco-ihe.org/education/short_courses/online_courses and http://www.unesco-ihe.org/education/msc_programmes/msc_in_municipal_water_and_infrastructure/sanitary_engineering

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