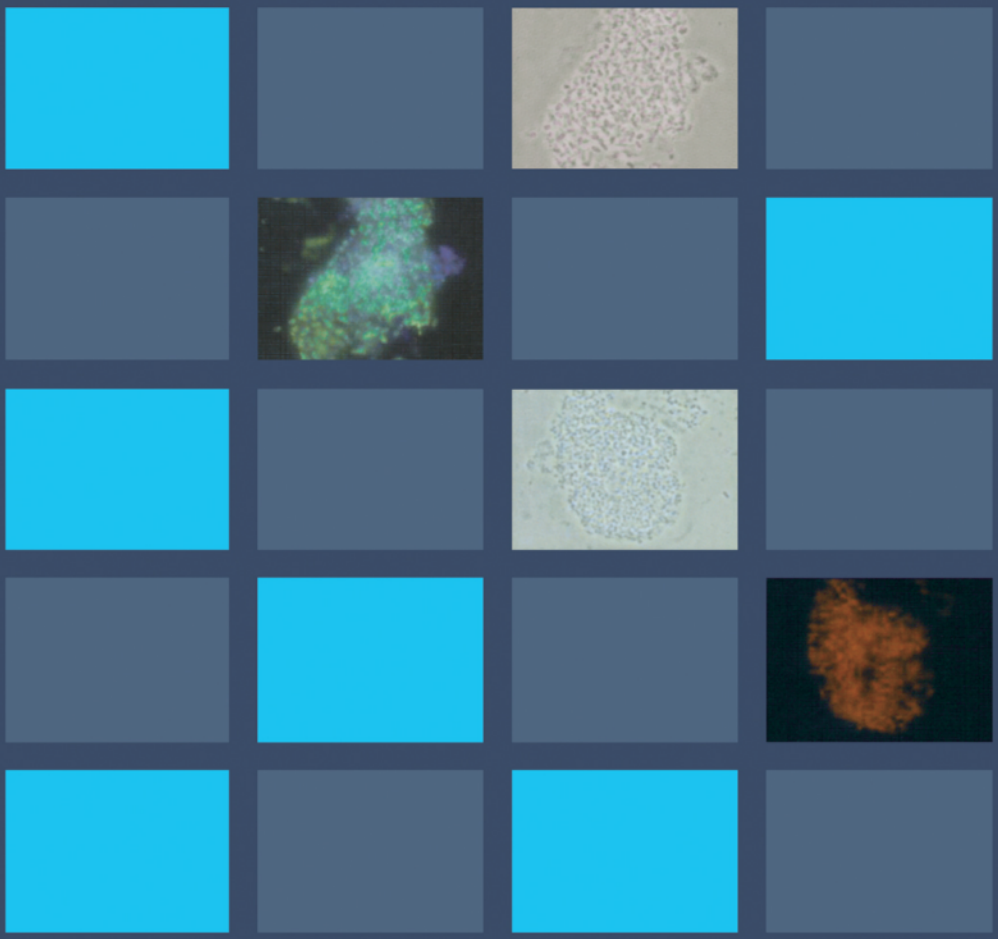
ADVANCES IN WATER AND WASTEWATER TREATMENT TECHNOLOGY

MOLECULAR TECHNOLOGY, NUTRIENT REMOVAL, SLUDGE REDUCTION AND ENVIRONMENTAL HEALTH

EDITED BY T. MATSUO, K. HANAKI, S. TAKIZAWA AND H. SATOH



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Molecular Technology, Nutrient Removal, Sludge Reduction and Environmental Health

Edited by

TOMONORI MATSUO
Graduate School of Regional Development Studies, Toyo University
1-1-1 Izumino, Itakura-machi, Ora-gun, Gunma 374-0193, Japan

KEISUKE HANAKI
Department of Urban Engineering, School of Engineering, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

SATOSHI TAKIZAWA
Department of Urban Engineering, School of Engineering, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

HIROYASU SATOH
Department of Urban Engineering, School of Engineering, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

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PREFACE

Environmental issues have become more and more critical aspects for sustainability of the earth on which we live. Global warming issue is attracting attention for global sustainability, but water environmental issues are also very critical ones and more urgent. More than one billion of people do not have good access to safe drinking water, and numerous people suffer from poor quality of water. Availability of water with enough quantity and good quality is indispensable condition for human settlement.

There is long history of engineering for improving water quality, namely water and wastewater treatment. There exist microbiological, physical and chemical processes. Among them microbiological process is one of the most reasonable processes that employs and enhances the function of bacteria in natural environment.

However, operation of biological treatment process has long been very empirical. Design and operation of process are based on the past experiences. Such experience-based technology has been satisfactory as long as conventional pollutant removal is aimed at. However, removal of wider varieties of pollutant with high efficiency and with low energy or resource consumption is nowadays required. We need to explore into details of microbial communities to satisfy such requirements. Empirical way of design and operation should be reviewed and improved under the light of advanced knowledge on complex microorganisms.

Traditional microbiology uses the approach of pure culture study. On the other hand, microorganisms work as consortium in microbiological community in the actual wastewater treatment. There exists great gap between pure culture approach and the actual process. Isolation and cultivation are basic tools in the pure culture study. However, such methods are very difficult and not always relevant in the wastewater treatment. A typical example is phosphorus removing organisms of which pure culture is hardly obtained. The second problem is that the simple summation of function of each group of the isolated microorganisms does not necessarily show the function of bacterial community in treatment process.

The appropriate approach in wastewater treatment is to examine the complex microbial community as it is. However, such research often becomes very empirical and microbial community is treated as an unknown black box. We have not had satisfactory tool to open and elucidate this box.

The rapid progress of the molecular biological techniques for analyzing microorganisms has been changing and enhancing our understanding of the complex microbial communities. This technological progress provides us new possibility of disclosing this black box. Our exploring journey is still at initial stage, but many new findings are expected in the near future.

The other important aspect of microbiology in water and wastewater treatment is the control of health-related microorganisms. Water-borne diseases are common problem in developing countries, and also critical issue in developed countries. The outbreak of new type of infectious organisms such as *Cryptospordium* since late 80's has challenged our view such that water-borne disease is the past issue in the developed countries. Molecular biological methods have enabled the detection and identification of trace amount of infectious microorganisms. Discussion in molecular level and that from the viewpoint of risk

management is being required to protect our health.

Under these background the University of Tokyo started in 1996 "Center of Excellence (COE)" project of Ministry of Education, Culture and Sports, Japan. The project is named as "Establishment and Evaluation of Advanced Water Treatment Technology Systems Using Functions of Complex Microbial Community." This project is being conducted at Department of Urban Engineering and other departments or research institutes in the University of Tokyo. This COE project is aiming at crossing the bridge between science of microbiology and practical water and wastewater treatment.

This book is based on one of the periodical symposia held under this project on March 6 – 8, 2000.

On behalf of the editors and as the former COE project leader, I wish that this book would contribute to the progress of water and wastewater treatment both from scientific and practical aspects.

Tomonori Matsuo
Professor, Toyo University
Professor Emeritus, The University of Tokyo

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