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Prof. Dr. B. Mattiasson  
Department of Biotechnology  
Chemical Center, Lund University  
P.O. Box 124, 221 00 Lund, Sweden  
E-mail: bo.mattiasson@biotek.lu.se

Prof. Dr. K. Schügerl  
Institute of Technical Chemistry  
University of Hannover  
Callinstræde 3  
30167 Hannover, Germany  
E-mail: schuegerl@mbox.iftc.uni-hannover.de

Prof. Dr. U. von Stockar  
Laboratoire de Génie Chimique et Biologique (LGCB)  
Département de Chimie  
Swiss Federal Institute of Technology Lausanne  
1015 Lausanne, Switzerland  
E-mail: urs.stockar@epfl.ch

Prof. Dr. J. Villadsen  
Center for Process of Biotechnology  
Technical University of Denmark  
Building 223  
2800 Lyngby, Denmark  
E-mail: john.villadsen@biocentrum.dtu.dk

Prof. Dr. J.-J. Zhong  
State Key Laboratory of Bioreactor Engineering  
East China University of Science and Technology  
130 Meilong Road  
Shanghai 200237, China  
E-mail: jjzhong@ecust.edu.cn

Prof. Dr. H. Sahm  
Institute of Biotechnology  
Forschungszentrum Jülich GmbH  
52425 Jülich, Germany  
E-mail: h.sahm@fz-juelich.de

Prof. Dr. G. Stephanopoulos  
Department of Chemical Engineering  
Massachusetts Institute of Technology  
Cambridge, MA 02139-4307, USA  
E-mail: gregstep@mit.edu

Prof. Dr. G. T. Tsao  
Director  
Lab. of Renewable Resources Eng.  
A.A. Potter Eng. Center  
Purdue University  
West Lafayette, IN 47907, USA  
E-mail: tsao@ecn.purdue.edu

Prof. Dr. C. Wandrey  
Institute of Biotechnology  
Forschungszentrum Jülich GmbH  
52425 Jülich, Germany  
E-mail: c.wandrey@fz-juelich.de
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Preface

The environmental clean up industry has been estimated as having an annual turnover of $50 billion globally. With new regulations being written on additional chemicals that are just, now, becoming understood from a toxicological and environmental risk standpoint, this industry could expand even further. This is particularly true as more nations become industrialized. Typical contaminants that are of concern include agricultural byproducts, municipal wastes, industrial solvents, petroleum hydrocarbons, heavy metals, pesticides, radioactive wastes, munitions, and other man-made products.

In order to treat and remediate these contaminants, practitioners have several “tools” in the remediation “toolbox” including physical, chemical, and biological methods. One relatively new biological method that has been applied to address various environmental concerns is phytotechnologies. The method is defined as the use of vegetation to contain, sequester, remove, or degrade inorganic and organic contaminants in soils, sediments, surface waters, and groundwater. Although its roots were developed from other disciplines such as agronomy, agricultural engineering, chemical engineering, forestry, horticulture, hydrogeology, and microbiology, this set of technologies has grown substantially on its own in understanding of and application in the environmental clean-up industry around the world.

This broad-ranging set of technologies utilizes the complex processes occurring within the soil-plant-atmosphere continuum in order to clean up and restore environmentally impacted sites. Like all remediation technologies, the use of vegetation is appropriate under specific situations, but it can be utilized to address both organic and inorganic constituents as well as applied to remediating different impacted media. In some cases, it can address many of these situations simultaneously. This and its broad applicability are, perhaps, its biggest advantage in addition to some other ancillary benefits including aesthetics, waste minimization, low energy requirements, erosion control, greenhouse gas emissions reduction, and cost-effectiveness.

This edition of Advances in Biochemical Engineering and Biotechnology provides a general overview of phytotechnologies. Authors from private industry, academia, the consulting community and regulatory agencies have all contributed to this volume. Starting with the basic processes and mechanisms occurring in the soil-plant-atmosphere continuum, the typical applications of vegetation for cleaning up and remediating contaminated sites are described. Since the growth of vegetation is paramount to this technology, the factors with-
in the subsurface environment affecting growth are discussed in detail as well. These include the processes and factors in the soil environment that affect the plant and the subsurface microbial community. After these two “introductory” chapters, the most prevalent applications of phytotechnologies are reviewed. These include vegetated systems for treating organic and inorganic contaminants in solid media, hydraulic systems for controlling and treating contaminant groundwater plumes, and vegetative covers for surface water protection and landfill leachate management. Finally, this monograph concludes with a discussion of the regulatory implications of applying this technology towards the clean up and remediation of contaminated sites worldwide.

Naperville, August 2002

David T. Tsao
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