Preface

Mankind has transformed and contaminated the environment in parallel with the progression of civilization. Earth pollution, on a scale so large that it threatens wildlife and humans, has been noticeable from the mid-19th century. This pollution has been a consequence of the significant increase in the total number of living humans on Earth and of rapid industrial development, which has produced an increasing number of products for the expanding civilization and has contributed to the progressive degradation of the natural environment. The possibility of applying microorganisms to remove pollutants was fully appreciated in the late 19th century. Since that time, the first artificial waste water treatment plants were constructed and have been constantly improved.

Currently, the elimination of pollution of natural origin (domestic waste, waste from the agro-food industry, etc.) is generally not much of a problem, from the viewpoint of the effectiveness and efficiency of the technologies used. A major problem, both from technological and scientific standpoints, is the microbial degradation of deleterious xenobiotics, especially those (such as numerous pesticides, pharmaceuticals or synthetic dyes) that are very toxic and difficult to metabolize by microbes. The main reasons are combined with a relatively limited knowledge regarding the mechanisms and factors that have a crucial effect on the course and yield of biodegradation processes carried out by complex microbial populations in contaminated areas. New valuable prospects for better elucidating these intricate relationships are formulated by the advances in modern science, especially 'omics' sciences such as: genomics, proteomics, lipidomics, metabolomics and other related branches.

The presented book involves panels of selected subjects related to biodegradation processes, with an emphasis on the possibility of applying recent achievements in the field of 'omics' sciences for the microbial removal of deleterious contaminants.

The first set of units (chapters 1–3) provides an introduction to the burgeoning area of metagenomic and metatranscriptomic techniques used in the research on microbial organic pollutant degradation and heavy metal elimination, as well as the characteristics of housekeeping genes applied in microbial identification and functional genes exploited as molecular markers in biodegradation studies.

The next set of chapters (4–6) describes the usefulness of an analytical technique – mass spectrometry (MS) – in studies on microbial detoxification and degradation of contaminants, with special attention paid to MS-omic (metabolomics, proteomics and lipidomics) challenges in this area of knowledge.

The panel of chapters 7–11 reviews the latest advances in the investigations of the pathways and mechanisms of microbial detoxification and degradation of the most deleterious contaminants: EDCs (endocrine disrupting compounds), PAHs (polycyclic aromatic hydrocarbons), VOCs (volatile organic compounds), dyes covering also both the updates of 'omics' sciences and the aspects of practical application.

The last section (chapters 12 and 13) is focused on heavy metal elimination by microorganisms and the possibilities of applying surface-active agents in numerous bioremediation processes.

In summary, this book involves an overview of the current state-of-the-art in the field of microbial

biodegradation, and I believe that it will be useful to students, research scientists and consulting professionals in the spheres of environmental microbiology and biotechnology, as well as molecular biology.

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