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Environmentally friendly bioenergy; 1.4 Conclusions; References; Chapter 2 Biodegradation and Bioconversion of Volatile Pollutants; 2.1 Introduction; 2.2 Biodegradation of volatile compounds; 2.2.1 Inorganic compounds; 2.2.1.1 Hydrogen sulphide (H<sub>2</sub>S); 2.2.1.2 Ammonia; 2.2.2 Organic compounds; 2.2.2.1 C<sub>x</sub>H<sub>y</sub> pollutants; 2.2.2.2 C<sub>x</sub>H<sub>y</sub>O<sub>z</sub> pollutants; 2.2.2.3 Organic sulphur compounds; 2.2.2.4 Halogenated organic compounds; 2.3 Mass balance calculations; 2.4 Bioconversion of volatile compounds; 2.4.1 Carbon monoxide and carbon dioxide; 2.4.2 Volatile organic compounds (VOCs); 2.5 Conclusions; References; Chapter 3 Identification and Characterization of Microbial Communities in Bioreactors; 3.1 Introduction; 3.2 Molecular techniques to characterize the microbial communities in bioreactors; 3.2.1 Quantification of the community members; 3.2.1.1 Microscopic direct counts; 3.2.1.2 Quantitative PCR; 3.2.2 Assessment of microbial community diversity and structure; 3.2.2.1 Biochemical methods; 3.2.2.2 Genetic fingerprinting methods; 3.2.2.3 Analysis of fingerprint data by multivariate statistical tools and diversity indices; 3.2.3 Determination of the microbial community composition; 3.2.3.1 Construction of small sub-unit (SSU) rRNA clone libraries followed by phylogenetic identification by randomly sequencing the clones; 3.2.3.2 Fluorescent in situ hybridization (FISH); 3.2.4 Techniques linking microbial identity to ecological function; 3.2.4.1 Stable isotope probing (SIP); 3.2.4.2 Microautoradiography combined with FISH (FISH-MAR); 3.2.5 Microarray techniques; 3.2.6 Synthesis; 3.3 The link of microbial community structure with ecological function in engineered ecosystems; 3.3.1 Introduction; 3.3.2 Temporal and spatial dynamics of the microbial community structure under stationary conditions in bioreactors; 3.3.2.1 Temporal stability and dynamics of the total bacterial community structure in the steady state; 3.3.2.2 Microbial and functional stratification along the biofilter height; 3.3.2.3 The microbial community structure-ecosystem function relationship; 3.3.3 Impact of environmental disturbances on the microbial community structure within bioreactors; 3.4 Conclusions; References; Part II Bioreactors for Air Pollution Control; Chapter 4 Biofilters; 4.1 Introduction; 4.2 Historical perspective of biofilters

## Sommario/riassunto

In recent years, air pollution has become a major worldwide concern. Air pollutants can affect metabolic activity, impede healthy development, and exhibit carcinogenic and toxic properties in humans. Over the past two decades, the use of microbes to remove pollutants from contaminated air streams has become a widely accepted and efficient alternative to the classical physical and chemical treatment technologies. Air Pollution Prevention and Control: Bioreactors and Bioenergy focusses on these biotechnological alternatives looking at both the optimization of bioreactors and the development o