



Applications of Microorganisms in Wastewater Treatment

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Abstract

Wastewater treatment is essential for protecting public health, preserving aquatic ecosystems, and promoting sustainable water management. Microorganisms play a crucial role in wastewater treatment by naturally degrading organic matter and transforming or removing various pollutants. This paper examines the applications of microorganisms in wastewater treatment, with particular emphasis on bacteria, fungi, algae, and other microbial communities involved in biological treatment processes. Microbial processes such as activated sludge treatment, biofilm systems, anaerobic digestion, and biological nutrient removal are discussed as important approaches for reducing organic pollutants, nitrogen, phosphorus, and other contaminants from wastewater. The study also highlights the potential of microorganisms in treating industrial and domestic wastewater and in recovering useful resources such as biogas and nutrients. Compared with many conventional treatment approaches, microbial treatment can provide an efficient and environmentally sustainable method when properly designed and operated. However, factors such as pH, temperature, oxygen availability, toxic substances, microbial diversity, and wastewater composition can affect treatment efficiency. The paper concludes that advances in microbial biotechnology and sustainable treatment technologies can further improve wastewater treatment efficiency and contribute to environmental protection and water resource conservation.

Keywords: Microorganisms, Wastewater Treatment, Bioremediation, Microbial Biotechnology, Activated Sludge, Anaerobic Digestion, Biological Treatment, Environmental Sustainability

