Paper 98

Selection and Enhancement of Deep-Sea Oil-Degrading Microorganisms in Marine Environmental Engineering

Oil pollution in marine environments poses a significant threat to ecosystems, particularly in deep-sea regions where natural degradation processes are slow due to extreme conditions such as high pressure, low temperature, and limited nutrient availability. Bioremediation, which utilizes microorganisms to degrade oil contaminants, has emerged as an effective and environmentally friendly approach for mitigating oil spills. However, the efficiency of bioremediation in deep-sea environments depends on the selection of highly efficient oil-degrading microorganisms and the optimization of their metabolic activity under extreme conditions.

The screening of deep-sea oil-degrading microorganisms involves isolating and characterizing microbial strains capable of utilizing hydrocarbons as their primary energy source. Advanced metagenomic and microbial cultivation techniques enable the identification of key bacterial and fungal species with strong hydrocarbon degradation potential. Moreover, genetic and metabolic engineering approaches can be employed to enhance the adaptability and efficiency of these microorganisms in deep-sea environments. Strategies such as gene editing, nutrient supplementation, and biofilm formation enhancement can significantly improve oil degradation rates.

This study explores the screening, characterization, and enhancement of deep-sea oil-degrading microorganisms, focusing on their application in marine environmental engineering. By integrating microbiology, biotechnology, and environmental science, this research aims to develop advanced bioremediation strategies for deep-sea oil spill mitigation, ultimately contributing to the protection and restoration of marine ecosystems.