

Environmental Contamination Remediation and Management

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Bioremediation of Petroleum Contaminated Soil and Sediment

 Springer

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Chapter 17

Eco-Savvy Solutions: A Deep Dive into Modern Bioremediation Techniques for Soil and Sediment Cleanup



Suranajana Sarkar, Tina Basu, Subhamoy Banerjee, and Ruchira Mukherjee

Abstract Remediating contaminated sediment and soil is a pressing environmental concern that requires effective strategies. This comprehensive review delves into various bioremediation techniques, highlighting six pivotal approaches: biostimulation, nanoremediation, phytoremediation, rhizoremediation, soil microorganisms, and vermiremediation. Biostimulation involves augmenting the growth of indigenous microorganisms to metabolize contaminants effectively, whereas phytoremediation is a predominantly green strategy that harnesses the unique capabilities of plants to carry out three operations: to absorb, accumulate, and detoxify pollutants, thus offering economically viable and sustainable solutions. Rhizoremediation capitalizes on the symbiotic relationship between soil microbes and plant roots to increase contaminant degradation. Microorganisms in the soil play a vital role in pollutant degradation through enzymatic processes, rendering them indispensable in bioremediation endeavors. Vermiremediation employs earthworms to enhance soil structure and microbial activity, thereby facilitating contaminant attenuation. Each technique is meticulously examined in terms of its underlying principles, practical applications, and ecological ramifications. These diverse bioremediation strategies provide invaluable insights for addressing soil and sediment contamination challenges sustainably and efficiently. By leveraging natural processes and organisms, bioremediation offers promising avenues for remediating polluted sites and rejuvenating environmental health.

Keywords Contaminated · Nanoremediation · Soil · Phytoremediation · Microbial

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