Preface

The utilization of naturally occurring and mainly prokaryotic organisms in soil for detoxifying and rehabilitating polluted soils provides an effective, economical, versatile and eco-compatible means of reclaiming polluted land. Soil microbial communities are relatively evenly distributed in unpolluted environments. In the soil, microorganisms may develop various mechanisms to access sorbed compounds on soil particles and sediments, as well as to utilize water-insoluble pollutants, facilitating the development of new equilibrium states. These mechanisms may create concentration gradients, bring about micro-environmental pH shifts, and cause secretion of extracellular enzymes and production of surfactants, emulsifiers, solvents or chelators in order to partition chemicals from the non-aqueous phase liquid to the water phase, and to promote degradation of exposed substituents. The purpose of soil remediation is not only to enhance the degradation, transformation, or detoxification of pollutants, but also to protect the quality and capacity of the soil to function within ecosystem boundaries, to maintain environmental quality and sustain biological productivity.

It is difficult to evaluate this market with any specificity, but the international market for remediation is estimated to be around US $25–30 billion. It is challenging to establish such estimates, as many countries have not undertaken comprehensive identification of contaminated sites. Remediation markets usually develop after a country has considered and addressed its air, water and waste management priorities. The US, Canada, Western Europe, Japan and Australia are considered to be the dominant international markets for remediation, with an established presence of a large number of environmental companies, products and services. Emerging economies of some more developed Asian, Eastern European and Latin American countries will represent significant medium-term remedial market opportunities.

Soil remediation processes may be implemented using a variety of different engineered configurations applicable in situ, at the surface or subsurface, and to the excavated soils. Biological remediation technologies require knowledge of interdisciplinary sciences, involving microbiology, chemistry, hydrogeology, engineering, soil and plant sciences, geology and ecology. Biological processes are typically implemented at a relatively low cost, and biological remediation methods have been successfully used to treat polluted soils, oily sludges, and groundwater contaminated by petroleum hydrocarbons, solvents, pesticides and other chemicals.

This volume, “Advances in Applied Bioremediation”, of the series Soil Biology is a selection of topics related to biological processes, with an emphasis on their use in remediation of soil pollutants. Topics include an overview of the global soil remediation market and available biotechnology solutions, the bioavailability of contaminants in soil, the role of biosurfactants in bioremediation, metabolism of nitroaromatics, bioremediation of explosive- contaminated soils, biodegradation of petroleum hydrocarbons, bioremediation of benzene-contaminated aquifers, microbial remediation of metals in soil, biotransformation of toxic metals and metalloids, biomining microorganisms and phytoremediation technologies, application of bacterial soluble di-iron monooxygenases and fungal enzymes, and advanced molecular tools for monitoring biological processes in soil remediation.

Experts in the area of environmental microbiology, biotechnology and bioremediation, from diverse institutions worldwide have contributed to this book. This book should prove to be useful to students, teachers and consulting professionals in the disciplines of biotechnology, microbiology, biochemistry, molecular biology, and soil and environmental sciences.

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Canada Ajay Singh
Canada Owen P. Ward
India Ramesh C. Kuhad
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