A Review On Bioremediation Of Petroleum Hydrocarbon

The pollution of soil and groundwater by heavy metals and other chemicals is becoming a serious issue in many countries. However, the current bioremediation processes do not often achieve sufficient remediation, and more effective processes are desired. This book deals with advances in the bioremediation of polluted soil and groundwater. In the former chapters of this book, respected researchers in this field describe how the optimization of microorganisms, enzymes, absorbents, additives and injection procedures can help to realize excellent bioremediation. In the latter chapters, other researchers introduce bioremediation processes that have been performed in the field and novel bioremediation processes. Thus, the readers will be able to obtain new ideas about effective bioremediation as well as important information about recent advances in bioremediation.

This authoritative text addresses the latest in bioremediation technologies for three difficult-to-treat contaminant groups: chlorinated solvents, PCBs, and PAHs - one of the most complex and expensive areas of applied remediation engineering. Bioremediation of Recalcitrant Compounds assesses innovative R&D projects developed for each contaminant group by a specially funded consortium of experts. Considering factors such as availability, toxicity, and treatability, world-class experts chronicle the development of field-ready biotechnologies, reflecting on the science and engineering challenges encountered as the research team progressed from bench-scale testing to the field. This book features the experimental work involved in enzymatic reactions for the biodegradation of co-solvent extraction of chlorinated solvents, bioaugmentation enhanced PAH degradation, and genetically engineered microorganisms (GEMs) for enhanced PCB degradation. Comparisons to traditional methods of remediation also provide new insight on how to optimize biotreatment. Concluding with future directions of research and development in this area, Bioremediation of Recalcitrant Compounds is a must-have for professionals seeking cutting-edge, innovative biotreatment technologies for these hazardous organic compounds.

This book is a compilation of detailed and latest knowledge on the various types of environmental pollutants released from various natural as well as anthropogenic sources, their toxicological effects in environments, humans, animals and plants as well as various bioremediation approaches for their safe disposal into the environments. In this book, an extensive focus has been made on the various types of environmental pollutants discharged from various sources, their toxicological effects in environments, humans, animals and plants as well as their biodegradation and bioremediation approaches for environmental cleanup.

Bioremediation is an eco-friendly, cost-effective and natural technology targeted to remove heavy metals, radionuclides, xenobiotic compounds, organic waste, pesticides etc. from contaminated sites or industrial discharges through biological means. Since this technology is used in in-situ conditions, it does not physically disturb the site unlike conventional methods i.e. chemical or mechanical methods.

The introduction of contaminants, due to rapid urbanization and anthropogenic activities into the environment, causes distress to the physio-chemical systems including living organisms, which possibly is threatening the dynamics of nature as well as the soil biology by producing certain xenobiotics. Hence, there is an immediate global demand for the diminution of such contaminants and xenobiotics that can otherwise adversely affect the living organisms. Some toxic xenobiotics include synthetic organochlorides such as PAHs and some fractions of crude oil and coal. Over time, microbial remediation processes have been accelerated to produce better, more eco-friendly, and more biodegradable solutions for complete dissemination of these xenobiotic compounds. The advancements in microbiology and biotechnology led to the launch of microbial biotechnology as a separate area of research and contributed dramatically to the development of areas like agriculture, environment, biopharmaceutics, fermented foods, and more. The Handbook of Research on Microbial Remediation and Microbial Biotechnology for Sustainable Soil provides a detailed comprehensive account for microbial treatment technologies, bioremediation strategies, biotechnology, and the important microbial species involved in remediation. The chapters focus on recent developments in microbial biotechnology in the areas of agriculture and environment and the physiology, biochemistry, and the mechanisms of remediation along with a future outlook. This book is ideal for scientists, biologists, academicians, students, and researchers in the fields of life sciences, microbiology, environmental science, environmental engineering, biotechnology, agriculture, and health sciences.

Addresses a Global Challenge to Sustainable Development Advances in Biodegradation and Bioremediation of Industrial Waste examines and compiles the latest information on the industrial waste biodegradation process and provides a comprehensive review. Dedicated to reducing pollutants generated by agriculturally contaminated soil, and plastic waste from various industries, this text is a book that begs the question: Is a pollution-free environment possible? The book combines with current available data with the expert knowledge of specialists from around the world to evaluate various aspects of environmental microbiology and biotechnology. It emphasizes the role of different bioreactors for the treatment of complex industrial waste and provides specific chapters on bioreactors and membrane process integrated with biodegradation process. It also places special emphasis on phytoremediation and the role of wetland plant rhizosphere bacterial ecology and the bioremediation of complex industrial wastewater. The authors address the microbiological, biochemical, and molecular aspects of biodegradation and bioremediation which cover numerous topics, including microbial genomics and proteomics for the bioremediation of industrial waste. This text contains 14 chapters and covers: Bioprocess engineering and mathematical modelling with a focus on environmental engineering The roles of siderophores and the rhizosphere bacterial community for phytoremediation of heavy metals Current advances in phytoremediation, especially as it relates to the mechanism of phytoremediation of soil polluted with heavy metals Microbial degradation of aromatic compounds and pesticides: Challenges and solution Bioremediation of hydrocarbon contaminated wastewater of refinery plants The role of biosurfactants for bioremediation and biodegradation of various pollutants discharged from industrial waste as they are tools of biotechnology The role of potential microbial enzymatic processes for bioremediation of industrial waste The latest knowledge regarding the biodegradation of tannery and textile waste A resource for students interested in the field of environment, microbiology, industrial engineering, biotechnology, botany, and agricultural sciences, Advances in Biodegradation and Bioremediation of Industrial Waste provides recent knowledge and approaches on the bioremediation of complex industrial waste.

Handbook of Bioremediation: Physiological, Molecular and Biotechnological Interventions discusses the mechanisms of responding to inorganic and organic pollutants in the environment using different approaches of phytoremediation and bioremediation. Part One focuses specifically on inorganic pollutants and the use of techniques such as metallothionein-assisted remediation, phytoextraction and genetic manipulation. Part Two covers organic pollutants and consider topics such as plant enzymes, antioxidant defense systems and the remediation mechanisms of different plant species. This comprehensive volume is a must-read for researchers interested in plant science, agriculture, soil science and environmental science. The techniques covered in this book will ensure scientists have the knowledge to practice effective bioremediation techniques themselves. Provides a comprehensive review of the latest advances in bioremediation of organic and inorganic pollutants Discusses a range of different phytoremediation techniques Evaluates the role of genomics and bioinformatics within bioremediation

This critical review of the status of in situ bioremediation, which is used to clean up contaminated groundwater aquifers and surface soils, has been organized according to possibilities and restrictions. Possibilities are based on present knowledge and indicate that in situ bioremediation can achieve decontamination of aquifers and soils. Restrictions encompass the scientific, engineering, legal, and other questions that stand in the way of successful development and application of in situ bioremediation. Although much has been written about bioremediation, this

critical review is unique because it is comprehensive, critical, and integrated. This situation was no accident; the organization of the authorship team and the report's contents were designed to achieve each of the three attributes. Combining a good plan, outstanding individuals contributing, and an incredible amount of work, they created a critical review that defines the technical and non-technical issues that will determine how much of an impact in situ bioremediation makes on solving the world's challenges for cleanup of our legacy of improperly disposed of materials. Readers of this review will find the issues identified and connected. They will have a solid foundation for research, application, or evaluation of in situ bioremediation in the future.

With oil spills occurring worldwide, much media and practical attention has been given in recent years to the rapidly maturing field of hydrocarbon bioremediation, particularly with application to marine spills. Hydrocarbon contamination of soil and groundwater, although less visible, is even more widespread and has provided the background for the numerous studies presented in this book, in addition to those devoted to shoreline spills. Chapters address a wide variety of theory and practice and cover important subjects such as biofiltration, natural attenuation, surfactants, and the use of in situ bioventing compared to soil venting. This unique book represents the collective global experience of practitioners and researchers in North America, Europe, Africa, and Asia. It describes experiences in tying laboratory studies to field applications. Nowhere else can anyone involved in hydrocarbon bioremediation find more up-to-date, relevant information on field experience using the various techniques and combinations of techniques in remediating hydrocarbons by biological means.

The quality of agricultural soils are always under threat from chemical contaminants, which ultimately affect the productivity and safety of crops. Besides agrochemicals, a new generation of substances invades the soil through irrigation with reclaimed wastewater and pollutants of organic origin such as sewage sludge or cattle manure. Emerging pollutants such as pharmaceuticals, nanomaterials and microplastics are now present in agricultural soils, but the understanding of their impact on soil quality is still limited. With focus on in situ bioremediation, this book provides an exhaustive analysis of the current biological methodologies for recovering polluted agricultural soils as well as monitoring the effectiveness of bioremediation.

Microbial Biodegradation and Bioremediation brings together experts in relevant fields to describe the successful application of microbes and their derivatives for bioremediation of potentially toxic and relatively novel compounds. This single-source reference encompasses all categories of pollutants and their applications in a convenient, comprehensive package. Our natural biodiversity and environment is in danger due to the release of continuously emerging potential pollutants by anthropogenic activities. Though many attempts have been made to eradicate and remediate these noxious elements, every day thousands of xenobiotics of relatively new entities emerge, thus worsening the situation. Primitive microorganisms are highly adaptable to toxic environments, and can reduce the load of toxic elements by their successful transformation and remediation. Describes many novel approaches of microbial bioremediation including genetic engineering, metagenomics, microbial fuel cell technology, biosurfactants and biofilm-based bioremediation Introduces relatively new hazardous elements and their bioremediation practices including oil spills, military waste water, greenhouse gases, polythene wastes, and more Provides the most advanced techniques in the field of bioremediation, including insilico approach, microbes as pollution indicators, use of bioreactors, techniques of pollution monitoring, and more

Pollution and ways to combat it have become topics of great concern for researchers. One of the most important dimensions of this global crisis is wastewater, which can often become contaminated with heavy metals such as lead, mercury, and arsenic, which are released from different industrial wastes, mines, and agricultural runoff. Bioremediation of such heavy metals has been extensively studied using different groups of bacteria, fungi, and algae, and has been considered as a safer, eco-friendly, and cost-effective option for mitigation of contaminated wasteland. The toxicity of water impacts all of society, and so it is of great importance that we understand the better, cleaner, and more efficient ways of treating water. Recent Advancements in Bioremediation of Metal Contaminants is a pivotal reference source that explores bioremediation of pollutants from industrial wastes and examines the role of diverse forms of microbes in bioremediation of wastewater. Covering a broad range of topics including microorganism tolerance, phytoremediation, and fungi, the role of different extremophiles and biofilms in bioremediation are also discussed. This book is ideally designed for environmentalists, engineers, policymakers, academicians, researchers, and students in the fields of microbiology, toxicology, environmental chemistry, and soil and water science.

This book provides an example of the successful and rapid expansion of bioengineering within the world of the science. It includes a core of studies on bioengineering technology applications so important that their progress is expected to improve both human health and ecosystem. These studies provide an important update on technology and achievements in molecular and cellular engineering as well as in the relatively new field of environmental bioengineering. The book will hopefully attract the interest of not only the bioengineers, researchers or professionals, but also of everyone who appreciates life and environmental sciences.

Bioremediation for Environmental Sustainability: Toxicity, Mechanisms of Contaminants Degradation, Detoxification and Challenges introduces pollution and toxicity profiles of various organic and inorganic contaminants, including mechanisms of toxicity, degradation, and detoxification by microbes and plants, and their bioremediation approaches for environmental sustainability. The book also covers many advanced technologies in the field of bioremediation and phytoremediation, including electro-bioremediation, microbial fuel cells, nano-bioremediation, constructed wetlands, phytotechnologies, and many more, which are lacking in other competitive titles existing in the market. The book includes updated information, as well as future directions for research, in the field of bioremediation of industrial wastes. This book is a reference for students, researchers, scientists, and professionals in the fields of microbiology, biotechnology, environmental sciences, eco-toxicology, environmental remediation, and waste management, especially those who aspire to work on the biodegradation and bioremediation of industrial wastes and environmental pollutants for environmental sustainability. Environmental safety and sustainability with rapid industrialization is one of the major challenges worldwide. Industries are the key drivers in the world economy, but these are also the major polluters due to discharge of potentially toxic and hazardous wastes containing various organic and inorganic pollutants, which cause environmental pollution and severe toxic effects in living beings. Introduces pollution and toxicity profiles of environmental contaminants and industrial wastes, including oil refinery wastewater, distillery wastewater, tannery wastewater, textile wastewater, mine tailing wastes, plastic wastes, and more Describes underlying mechanisms of degradation and detoxification of emerging organic and inorganic contaminants with enzymatic roles Focuses on recent advances and challenges in bioremediation and phytoremediation, including microbial enzymes, biosurfactants, microalgae, biofilm, archaea, genetically engineered organisms, and more Describes how microbes and plants can be successfully applied for the remediation of potentially

toxic industrial wastes and chemical pollutants to protect the environment and public health

The book discusses ways to overcome the side effects of using hydrocarbon-based products as energy sources. Hydrocarbons produce raw crude oil waste of around 600,000 metric tons per annum, with a range of uncertainty of 200,000 metric tons per year. The various chapters in this book focus on approaches to reduce these wastes through the application of potential microbes, in a process called bioremediation. The book is a one-stop reference resource on the methods, mechanisms and application of the bio-composites, in the laboratory and field. Focusing on resolving a very pressing environmental issue, it not only provides details of existing challenges, but also offers deeper insights into the possibility of solving problems using hydrocarbon bioremediation.

This book discusses the bioremediation of both solid and liquid waste, including regional solutions for India as well as globally relevant applications. The topics covered include pollutant reduction through composting, solutions for petroleum refinery waste, use of microorganisms in the bioremediation of industrial waste and toxicity reduction, microbial fuel cells, and microbial depolymerisation. The book also explores the biosorption of metals and the bioremediation of leachates, especially with regard to soil and groundwater remediation. It is a valuable resource for researchers, professionals, and policy makers alike.

A report on progress in the development of materials used in or on the human body, ranging from biopolymers used in controlled-release drug delivery systems and prosthetic devices to metals used in bone repair and plastics used in absorbable mechanisms such as sutures.

Bioremediation is an emerging field of environmental research. The objective of a bioremediation process is to immobilize contaminants (reactants) or to transform them into chemical products that do not pose a risk to human health and the environment. Toxicity and Waste Management Using Bioremediation provides relevant theoretical and practical frameworks and the latest empircal research findings on the remediation of contaminated soil and groundwater using bioorganisms. Focusing on effective waste treatment methodologies and management strategies that lead to improved human and environmental health, this timely publication is ideal for use by environmenal scientists, biologists, policy makers, graduate students, and scholars in the fields of environmental science, chemistry, and biology.

The remediation of environmental pollutants has become a relevant topic within the field of waste management. Advances in biological approaches are a potential tool for contamination and pollution control. The Handbook of Research on Microbial Tools for Environmental Waste Management is a critical scholarly resource that explores the advanced biological approaches that are used as remediation for pollution cleanup processes. Featuring coverage on a broad range of topics such as biodegradation, microbial dehalogenation, and pollution controlling treatments, this book is geared towards environmental scientists, biologists, policy makers, graduate students, and scholars seeking current research on environmental engineering and green technologies.

Bioremediation for Environmental Sustainability: Approaches to Tackle Pollution for Cleaner and Greener Society discusses many recently developed and successfully applied bio/phytoremediation technologies for pollution control and minimization, which are lacking more comprehensive coverage in previous books. This book describes the scope and applications of bio/phytoremediation technologies and especially focuses on the associated eco-environmental concerns, field studies, sustainability issues, and future prospects. The book also examines the feasibility of environmentally friendly and sustainable bio/phytoremediation technologies to remediate contaminated sites, as well as future directions in the field of bioremediation for environmental sustainability. Illustrates the importance of microbes and plants in bio/phytoremediation and wastewater treatment Includes chapters on original research outcomes pertaining to pollution, pollution abatement, and associated bioremediation technologies Covers emerging bioremediation technologies, including electro-bioremediation, microbial fuel cell, nano-bioremediation, constructed wetlands, and more Highlights key developments and challenges in bioremediation and phytoremediation technologies Describes the roles of relatively new approaches in bio/phytoremediation, including molecular engineering and omics technologies, microbial enzymes, biosurfactants, plant-microbe interactions, genetically engineered organisms, and more

The microbial bioremediation of contaminants is cost effective and reliable and a number of approaches are in widespread commercial use. Microbial bioremediation makes use of the metabolic activities of biofilm-dwelling microorganisms which are responsible for the majority of pollutant degradation in natural environments. In this book, renowned scientists from around the world provide up-to-date and authoritative reviews of the latest scientific research that has contributed to our understanding of the vital importance of microbial biofilms for the biological remediation of contaminated environments. The results of a variety of key case studies are presented to highlight the broad range of treatment approaches and applications at our disposal. In addition, the authors discuss the future trends and likely growth areas in biofilm-related research. This comprehensive volume is indispensable for anyone involved in bioremediation, biofilm research or environmental microbiology. It is also recommended as a reference work for all microbiology libraries.

This book will discuss the effective and sustainable technological approaches for remediation of contaminates via eco-friendly usage of microbes. The primary focus will be on the role of microbes, particularly bacteria and fungi, for the degradation and removal of various xenobiotic substances in the environment. The book will also emphasize molecular approaches and biosynthetic pathways of microbes, and present gene and protein expression studies for bio-deterioration techniques. New innovative and sophisticated green technologies for waste minimization and waste control will be presented, as well as the potential of microbes for various techniques of bioremediation, including bio-sorption, bio-augmentation, bio-stimulation, to clean contaminated environments.

Provides a detailed background of the technologies available for the bioremediation of contaminated soil & ground water. Prepared for scientists, consultants, regulatory personnel, & others who are associated in some way with the restoration of soil & ground water at hazardous waste sites. Also provides insights to emerging technologies which are at the research level of formation, ranging from theoretical concepts, through bench scale inquiries, to limited field-scale investigations. 95 tables & figures.

The huge expansion of the chemical and petroleum industries in the twentieth century has resulted in the production of a vast array of chem ical compounds and materials that have transformed our lives. The associated large-scale manufacturing, processing and handling activi ties have caused a serious deterioration in environmental quality and created threats to human health. These negative impacts have led to responses and regulations requiring remedial action in support of envi ronmental sustainability. of biotechnological methods through bioremediation, Application has gained prominence as an option for soil remediation methods. Bioremediation is a multidisciplinary approach where biologists, chem ists, soil scientists and engineers work as team to develop and imple ment remediation processes. Bioremediation has now been used successfully to remediate many petroleum-contaminated sites. However, there are as yet no commercial technologies commonly used to reme diate the most recalcitrant contaminants. Nevertheless, bioremediation is a rapidly advancing field and new bio-based remedial technologies are continuing to emerge.

Bioremediation--one of the hottest technologies of the decade--is the use of microorganisms in reducing, controlling, and rectifying the effects of chemical pollutants. Written by two leaders at the Environmental Microbiology Association, this book offers an overview of the major classes of pollutants, and the bioremediation of various environments. Also relates this scientific information to real problems using case studies. Includes illustrations and an index.

Green Sustainable Process for Chemical and Environmental Engineering and Science: Biosurfactants for the Bioremediation of Polluted Environments explores the use of biosurfactants in remediation initiatives, reviewing knowledge surrounding the creation and application of biosurfactants for addressing issues related to the release of toxic substances in ecosystems. Sections cover their production, assessment and optimization for bioremediation, varied pollutant degradation applications, and a range of contaminants and ecological sites. As awareness and efforts to develop greener products and processes continues to grow, biosurfactants are garnering more attention for the potential roles they can play in reducing the use and production of more toxic products. Drawing on the knowledge of its expert team of global contributors, this book provides useful insights for all those currently or potentially interested in developing or applying biosurfactants in their own work. Provides an accessible introduction to biosurfactant chemistry Highlights the optimization, modeling, prediction and kinetics of key factors supporting biosurfactant-enhanced biodegradation processes Explores a wide range of biosurfactant applications for remediation and degradation of pollutants

In this volume, experts from universities, government labs and industry share their findings on the microbiological, biochemical and molecular aspects of biodegradation and bioremediation. The text covers numerous topics, including: bioavailability, biodegradation of various pollutants, microbial community dynamics, properties and engineering of important biocatalysts, and methods for monitoring bioremediation processes. Microbial processes are environmentally compatible and can be integrated with non-biological processes to detoxify, degrade and immobilize environmental contaminants. Alexander presents the basic principles of biodegradation and how these principles relate to bioremediation. All the subject's microbiological, chemical, toxicological, environmental, engineering and technological aspects are covered.

The rapid progression of technology has significantly impacted population growth, urbanization, and industrialization in modern society. These developments, while positive on the surface, have created critical environmental problems in recent years. The Handbook of Research on Inventive Bioremediation Techniques is a comprehensive reference source for the latest scholarly information on optimizing bioremediation technologies and methods to control pollution and enhance sustainability and conservation initiatives for the environment. Highlighting pivotal research perspectives on topics such as biodegradation, microbial tools, and green technology, this publication is ideally designed for academics, professionals, graduate students, and practitioners interested in emerging techniques for environmental decontamination.

The U.S. Environmental Protection Agency (EPA) was introduced on December 2, 1970 by President Richard Nixon. The agency is charged with protecting human health and the environment, by writing and enforcing regulations based on laws passed by Congress. The EPA's struggle to protect health and the environment is seen through each of its official publications. These publications outline new policies, detail problems with enforcing laws, document the need for new legislation, and describe new tactics to use to solve these issues. This collection of publications ranges from historic documents to reports released in the new millennium, and features works like: Bicycle for a Better Environment, Health Effects of Increasing Sulfur Oxides Emissions Draft, and Women and Environmental Health.

This volume provides a clear understanding of how microbes, following their degradative processes, contribute maximally to the benefit of mankind through biotransformations of waste materials as well as a wide variety of health-risk compounds. The book contains twenty four chapters contributed by leading scientists from different parts of the world, covering various aspects of bioremediation of xenobiotics such as toxic, carcinogenic, teratogenic, and mutagenic compounds, which include halogenated aromatics, derivatives of heavy metals, microbial toxins, tannins, dyes, sulfur compounds of coal and petroleum and pesticides. The bioremediation of agricultural residue, industrial as well as municipal wastes, fuel oils, lubricants, natural rubber products, and other synthetic polymers, which pollute the environment substantially, also constitutes an important component of the book. All biotechnological aspects of microbial transformations pertaining to biodegradation/bioremediation of hazardous wastes, ranging from screening methods for microbes with degradative potential, processes of degradation, strain improvement for enhanced biodegradation and elimination of xenobiotics of health and environmental concern have been dealt with. The book intends to widen the scope of Applied Microbiology and Biotechnology in general and biotransformations in particular. It will provide an opportunity for scientists in the areas of biochemistry, food industry, environmental science and engineering and their implications in technologically feasible, environment friendly and economically viable bioremediation options. Also, it forms an interface between agro-industrial establishments and the academic world and will generate new thought provoking ideas for scientists of future generations for the safeguard of both human and animal health as well as the environment.