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Heavy Metals in the Environment: Origin, Interaction and Remediation

This text presents contemporary analytical techniques for the determination of heavy metals in air particles, water, soil and biological samples. It details experimental studies to reduce the occurrence of disease, remediate contaminated sites and establish acceptable range of oral intakes (AROI) guidelines.

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This book details the plant-assisted remediation method, "phytoremediation", which involves the interaction of plant roots and associated rhizospheric microorganisms for the remediation of soil contaminated with high levels of metals, pesticides, solvents, radionuclides, explosives, crude oil, organic compounds and various other contaminants. Each chapter highlights and compares the beneficial and economical alternatives of phytoremediation to currently practiced soil removal and burial practices. This book covers state of the art approaches in Phytoremediation written by leading and eminent scientists from around the globe. Phytoremediation: Management of Environmental Contaminants, Volume 1 supplies its readers with a multidisciplinary understanding in the principal and practical approaches of phytoremediation from laboratory research to field application.

Advances in Bioremediation and Phytoremediation for Sustainable Soil Management

While most books examine only the classical aspects of hydrology, this three-volume set covers multiple aspects of hydrology, and includes contributions from experts from more than 30 countries. It examines new approaches, addresses growing concerns about hydrological and ecological connectivity, and considers the worldwide impact of climate change.

Phytoremediation: Role of Aquatic Plants in Environmental Clean-Up

Removal of Emerging Contaminants from Wastewater through Bio-nanotechnology showcases profiles of the nonregulated contaminants termed as "emerging contaminants, which comprise industrial and household persistent toxic chemicals, pharmaceuticals and personal care products (PPCPs), pesticides, surfactants and surfactant residues, plasticizers and industrial additives, manufactured nanomaterials and nanoparticles, microplastics, etc. that are used extensively in everyday life. The occurrence of "emerging contaminants in wastewater, and their behavior during wastewater treatment and production of drinking water are key issues in the reuse and recycling of water resources. This book focuses on the exploitation of Nano-biotechnology inclusive of the state-of-the-art remediate strategies to degrade/detoxify/stabilize toxic and hazardous contaminants and restore contaminated sites, which is not as comprehensively discussed in the existing titles on similar topics available in the global market. In addition, it discusses the potential environmental and health hazards and ecotoxicity associated with the widespread distribution of emerging contaminants in the water bodies. It also considers the life cycle assessment (LCA) of emerging (micro)-pollutants with suitable case studies from various industrial sources. Provides natural and ecofriendly solutions to deal with the problem of pollution Details underlying mechanisms of nanotechnology-associated microbes for the removal of emerging contaminants Describes numerous successful field studies on the application of bio-nanotechnology for eco-restoration of contaminated sites Presents recent advances and challenges in bio-nanotechnology research and applications for sustainable development Provides authoritative
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To facilitate the acquisition of valuable insights into phytoremediation techniques in wastewater treatment, this document compiles contributions from leading experts on diverse aspects of bio-nanotechnology. It synthesizes methods, case studies, and analyses of various state-of-the-art techniques for removing contaminants from wastewater, solid waste, or sewage and converting or reusing the waste with minimal environmental impact. Focusing on innovative treatment strategies, as well as recent modifications to conventional processes, the book covers methods for a complex variety of emerging pollutants, including organic matter, chemicals, and micropollutants resulting from developmental and industrial activities. Serving as a practical guide to state-of-the-art methods, "Cost-Effective Technologies for Solid Waste and Wastewater Treatment" also delivers foundational information on the practical design of treatment and reuse systems and explains the treatments in terms of scale, efficiency, and effectiveness. It focuses on cost-effective technologies that are particularly applicable to environmental clean-up, such as bioaugmentation and biostimulation of plastics, activated carbon, phytoremediation, crude oil pollution stress, adsorbents, contaminants of emerging concern, anaerobic digestion, in situ chemical oxidation (ISCO), biosorption, bioremediation, radioactive contaminants, constructed wetlands, nanoremediation, and rainwater. As such, it is a valuable and practical resource for researchers, students, and managers in the fields of environmental science and engineering, as well as wastewater management, chemical engineering, and biotechnology.

- Presents low-cost treatment technologies for both solid waste and wastewater
- Analyzes the efficiency and effectiveness of state-of-the-art technologies
- Includes methods and case studies for practical application

Bioremediation: Applications for Environmental Protection and Management

This book details the plant-assisted remediation method, "phytoremediation," which involves the interaction of plant roots and associated rhizospheric microorganisms for the remediation of soil contaminated with high levels of metals, pesticides, solvents, radionuclides, explosives, crude oil, organic compounds and various other contaminants. Each chapter highlights and compares the beneficial and economical alternatives of phytoremediation to currently practiced soil removal and burial practices.

Heavy Metals In The Environment

This book provides useful information about bioremediation, phytoremediation, and mycoremediation of wastewater and some aspects of the chemical wastewater treatment processes, including ion exchange, neutralization, adsorption, and disinfection. Additionally, this book elucidates and illustrates the wastewater treatment plants in terms of plant sizing, plant layout, plant design, and plant location. Cutting-edge topics include wet air oxidation of aqueous wastes, biodegradation of nitroaromatic compounds, biological treatment of sanitary landfill leachate, bacterial strains for the bioremediation of...
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Methods for Bioremediation of Water and Wastewater Pollution This book reviews health hazards associated with wastewater use and water pollutants. Chapters present applications of green materials made of agricultural waste, activated carbon and magnetic materials for wastewater treatment. The removal of toxic metals using algal biomass and the removal of toxic dyes using chitosan composite materials are also discussed. The book includes reviews on the removal of phenols, pesticides, and on the use of ionic liquid-modified activated carbon for the treatment of textile wastewater.

Environmental Risk Assessment of Soil Contamination Excessive levels of heavy metals can be introduced into the environment, for example, by industrial waste or fertilizers. Soil represents a major sink for heavy metals ions, which can then enter the food chain via plants or leaching into groundwater. In Heavy Metal Ions in the Environment, the author looks at where heavy metals ions come from, how they interact with the environment and how they can be removed from the environment – by a process known as remediation. This book serves as a valuable addition to an increasingly important field of study, which is, at present, served by a limited number of archival texts. Includes comprehensive coverage of heavy metal ions in the environment Is practical and easy to read Is suitable for students and researchers in environmental science and environmental or chemical engineering

Removal of Refractory Pollutants from Wastewater Treatment Plants A heavy backlog of gaseous, liquid, and solid pollution has resulted from a lack of development in pollution control. Because of this, a need for a collection of original research in water and wastewater treatment, industrial waste management, and soil and ground water pollution exists. Advanced Treatment Techniques for Industrial Wastewater is an innovative collection of research that covers the different aspects of environmental engineering in water and wastewater treatment processes as well as the different techniques and systems for pollution management. Highlighting a range of topics such as agriculture pollution, hazardous waste management, and sewage farming, this book is an important reference for environmental engineers, waste authorities, solid waste management companies, landfill operators, legislators, environmentalists, and academicians seeking research on waste management.

Physico-Chemical Wastewater Treatment and Resource Recovery 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...
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Continuous studies on gene and protein expression for biodegradation techniques have been conducted. 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.

Synergistic Application of a Municipal Waste Material and Phytoremediation Technique for Remediating Acid Mine Drainage and Impacted Soil Contamination

The different components of the environment have guided new eras of research. This has led to the development of strategies/methodologies to curtail/minimize environmental contamination. Research studies conducted around the world established that bioremediation plays a promising role in minimizing environmental contamination. In the last decade, phytoremediation studies have been conducted on a vast scale. Initial research in this scenario focused on screening terrestrial plant species that remove contaminants from soil and air. Later, the scientific community realized that water is a basic necessity for sustaining life on earth and the quality of which is getting deteriorated day by day. This initiated studies on phytoremediation using aquatic plants. Role of aquatic plant species in cleaning water bodies was also explored. Many of the aquatic plant species showed potential to treat domestic, municipal, and industrial wastewaters and hence their use in constructed wetlands for treating wastewaters was emphasized.

The present book contains five chapters. The first two chapters provide information about types of contaminants commonly reported in wastewaters and enlist some important and well-studied aquatic plant species known for their potential to remove various contaminants from wastewater. Subsequent chapters deal with mechanisms involved in contaminant removal by aquatic plant species, and also provide detailed information about the role of aquatic plant species in wetlands. Potential of constructed wetlands in cleaning domestic and industrial wastewaters has also been discussed in detail. The strategy for enhancing phytoremediation capacity of plants by different means and the effectiveness of phytoremediation technology in terms of monetary benefits has been discussed in the last chapter. The last chapter also emphasizes the future aspects of this technology.

Plant Ecophysiology and Adaptation under Climate Change: Mechanisms and Perspectives II Scientific Essay from the year 2016 in the subject Geography / Earth Science - Physical Geography, Geomorphology, Environmental Studies, language: English, abstract: This text summarizes the role of phytoremediation in the remediation of industrial waste water since this waste water has become a threat to water quality. Several technologies are available to remediate water that is contaminated by industrial pollutants. However, many of these technologies are costly (e.g. excavation of contaminated material and chemical/physical treatment) or do not achieve a long-term and aesthetic solution. Phytoremediation can provide a cost-effective, long-lasting, and aesthetic solution for remediation of contaminated sites. In many cases, especially in tropical or subtropical areas,
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Invasive plants such as the water hyacinth (Eichhornia crassipes) and water lettuce (P. stratiotes L.) are used in these phytoremediation water systems. This is because, compared to native plants, these invasive plants show a much higher nutrient removal efficiency with their high nutrient uptake capacity, fast growth rate, and big biomass production. In the active growth season, for instance, water hyacinth plants can double in number and biomass in 6 to 15 days. This study shows the importance of phytoremediation in the phytoremediation of industrial waste.

Major impacts of current and pre-regulatory mining activities on the environment include the generation of acid mine drainage (AMD) and metal(loid)-laden acid sulfate soils. Current remediation techniques are mostly cost prohibitive due to high energy, material, and labor requirement. This study investigated two complementary low-cost methods that harnessed the metal(loid)-removing and acid-neutralizing properties of drinking water treatment residuals (WTRs) and the uptake (phytoremediation) potential of vetiver (Vetiviera zizanioides L.) and pokeweed (Phytolacca americana L.) to attenuate and immobilize metal(loid)s from natural AMD and metal(loid)-contaminated soil. Metals were removed from AMD by using a reverse flow fluidized column filter and hydroponic phytoremediation with vetiver and pokeweed. Metals were immobilized in soil through the amendment with Fe and Ca-WTR complimented by the uptake and translocation of metals by vetiver and pokeweed. Experiments were performed under controlled greenhouse conditions as well as under natural Illinois environment in simulated field conditions.

Physicochemical analysis of AMD and soil samples from the Tab-Simco abandoned mine in the Illinois Coal Basin, U.S.A, showed significant concentrations of major metals and metalloids such as Fe, Al, Mn, Zn, Ni, Cu and As at acidic pH levels. The degree of soil contamination at the site was spatially variable with respect to the location of the main AMD seep.

Physical, chemical, agronomic and mineralogical characterization of locally acquired water treatment residuals (WTR) showed that the silty and alkaline (pH ≈ 7.0-9.1) materials also contained significant amounts of plant required micronutrients. The presence of amorphous phases of mostly metal (oxy)hydroxides, alkalinity, and porosity of the WTRs suggested the potential to neutralize acidity and capability to remove metal(loid)s in contaminated soils and AMD. Recorded metal removal (%MR) rate by WTR was rapid in the first 80 min in a batch agitation study, except for Mn. Thus, high metal removal ranging from 99.8% to 84.9% at selectivity sequence of Al>Fe>Cu>Zn and Mn (9.6%) was obtained at equilibrium. The pH of the AMD was also increased from 2.6 to 6.7. Analysis of leachate samples from gravity-drained columns following simulated rain events in a greenhouse study showed reduced concentrations of Al, Fe, Mn, Zn, Cu, As and Pb at sustained neutral pH compared with unamended control columns during the 12 weeks study period. Metal immobilization in soil by the lower amendment rates of WTR was comparable to the higher application rates.
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Removal of Refractory Pollutants from Wastewater Treatment Plants

Phytoremediation is an exciting, new technology that utilizes metal-accumulating plants to rid soil of heavy metal and radionuclides. Hyperaccumulation plants are an appealing and economical alternative to current methods of soil recovery. Phytoremediation of Contaminated Soil and Water is the most thorough literary examination of the subject available today. The successful implementation of phytoremediation depends on identifying plant material that is well adapted to specific toxic sites. Gentle remediation is then applied in situ, or at the contamination site. No soil excavation or transport is necessary. This severely contains the potential risk of the pollutants entering the food chain. And it's cost effective. The progress of modern man has created many sites contaminated with heavy metals. The effected land is toxic to plants and animals, which creates considerable public interest in remediation. But the commonly used remedies are ex situ, which poses an expensive dilemma and an even greater threat. Phytoremediation offers the prospect of a cheaper and healthier way to deal with this problem. Read Phytoremediation of Contaminated Soil and Water to learn just how far this burgeoning technology has developed.

Soil Bioremediation Phytoremediation Technology for the Removal of Heavy Metals and Other Contaminants from Soil and Water focuses on the exploitation of plants and their associated microbes as a tool to degrade/detoxify/stabilize toxic and hazardous contaminants and restore the contaminated site. The book introduces various phytoremediation technologies using an array of plants and their associated microbes for environmental cleanup and sustainable development. The book mainly focuses on the remediation of toxic and hazardous...
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Environmental contaminants, their phytoremediation mechanisms and strategies, advances and challenges in the current scenario. This book is intended to appeal to students, researchers, scientists and a wide range of professionals responsible for regulating, monitoring and designing industrial waste facilities. Engineering consultants, industrial waste managers and purchasing department managers, government regulators, and graduate students will also find this book invaluable.

Provides natural and eco-friendly solutions to deal with the problem of pollution
Details underlying mechanisms of phytoremediation of organic and inorganic contaminants with enzymatic roles
Describes numerous, successful field studies on the application of phytoremediation for eco-restoration of contaminated sites
Presents recent advances and challenges in phytoremediation research and applications for sustainable development
Provides authoritative contributions on the diverse aspects of phytoremediation by world leading experts

Cost Effective Technologies for Solid Waste and Wastewater Treatment

This text details the plant-assisted remediation method, “phytoremediation”, which involves the interaction of plant roots and associated rhizospheric microorganisms for the remediation of soil contaminated with high levels of metals, pesticides, solvents, radionuclides, explosives, crude oil, organic compounds and various other contaminants. Many chapters highlight and compare the efficiency and economic advantages of phytoremediation to currently practiced soil and water treatment practices. Volume 5 of Phytoremediation: Management of Environmental Contaminants provides the capstone of the series. Taken together, the five volumes provide a broad-based global synopsis of the current applications of phytoremediation using plants and the microbial communities associated with their roots to decontaminate terrestrial and aquatic ecosystems.

Handbook of Engineering Hydrology (Three-Volume Set)

Wastewater Treatment: Cutting-Edge Molecular Tools, Techniques and Applied Aspects reports new findings in existing molecular biology strategies, including their limitations, challenges and potential application to remove environmental pollutants through advancements made in cutting edge tools. In addition, the book introduces new trends and advances in environmental bioremediation with thorough discussions on recent developments in this field.

Describes the application of different omics tools in wastewater treatment plants (WWTPs)
Describes the role of microorganisms in WWTPs
Points out the reuse of treated wastewater through emerging technologies
Includes the recovery of resources from wastewater
Emphasizes the need for the use of cutting-edge molecular tools
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The shortage of fresh water is already a major concern for the welfare of nations. Clearly, in today's world the competition for water resources coupled with the unfortunate commingling of wastewater discharges with freshwater supplies creates additional pressure on treatment systems. Recently, researchers focus on wastewater treatment by difference methods with minimal cost and maximum efficiency. This volume of the Wastewater Engineering: Advanced Wastewater Treatment Systems is a selection of topics related to physical-chemical and biological processes with an emphasis on their industrial applications. It gives an overview of various aspects in wastewater treatments methods including topics such as biological, bioremediation, electrochemical, membrane and physical-chemical applications. Experts in the area of environmental sciences from diverse institutions worldwide have contributed to this book, which should prove to be useful to students, teachers, and researchers in the disciplines of wastewater engineering, chemical engineering, environmental engineering, and biotechnology. We gratefully acknowledge the cooperation and support of all the contributing authors.

Phytoremediation

This book discusses new and innovative trends and techniques in the removal of toxic and or refractory pollutants through various environmental biotechnological processes from wastewater, both at the laboratory and industrial scale. It focuses primarily on environmentally-friendly technologies which respect the principles of sustainable development, including the advanced trends in remediation through an approach of environmental biotechnological processes from either industrial or sewage wastewater. Features:
- Examines the fate and occurrence of refractory pollutants in wastewater treatment plants (WWTPs) and the potential approaches for their removal.
- Highlights advanced remediation procedures involving various microbiological and biochemical processes.
- Assesses and compares the potential application of numerous existing treatment techniques and introduces new, emerging technologies.

Removal of Refractory Pollutants from Wastewater Treatment Plants is suitable for practicing engineers, researchers, water utility managers, and students who seek an excellent introduction and basic knowledge in the principles of environmental bioremediation technologies.

Handbook of Research on Microbial Tools for Environmental Waste Management

This book discusses new and innovative trends and techniques in the removal of toxic and or refractory pollutants through various environmental biotechnological processes from wastewater, both at the laboratory and industrial scale. It focuses primarily on environmentally-friendly technologies which respect the principles of sustainable development, including the advanced trends in remediation through an approach of environmental biotechnological processes from either industrial or sewage wastewater. Features:
- Examines the fate and occurrence of refractory pollutants in wastewater treatment plants (WWTPs) and the potential approaches for their removal.
- Highlights advanced remediation procedures involving various microbiological and biochemical processes.
- Assesses and compares the potential application of numerous existing treatment techniques and introduces new, emerging technologies.
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Recent Advancements in Bioremediation of Metal Contaminants

Rapid industrialization is a serious concern in the context of a healthy environment. With the growth in the number of industries, the waste generated is also growing exponentially. The various chemical processes operating in the manufacturing industry generate a large number of by-products, which are largely harmful and toxic pollutants and are generally discharged into the natural water bodies. Once the pollutants enter the environment, they are taken up by different life forms, and because of bio-magnification, they affect the entire food chain and have severe adverse effects on all life forms, including on human health. Although, various physico-chemical and biological approaches are available for the removal of toxic pollutants, unfortunately these are often ineffective and traditional clean up practices are inefficient. Biological approaches utilizing microorganisms (bacterial/fungi/algae), green plants or their enzymes to degrade or detoxify environmental pollutants such as endocrine disruptors, toxic metals, pesticides, dyes, petroleum hydrocarbons and phenolic compounds, offer eco-friendly approaches. Such eco-friendly approaches are often more effective than traditional practices, and are safe for both industry workers as well as environment. This book provides a comprehensive overview of various toxic environmental pollutants from a variety natural and anthropogenic sources, their toxicological effects on the environment, humans, animals and plants as well as their biodegradation and bioremediation using emerging and eco-friendly approaches (e.g. Anammox technology, advanced oxidation processes, membrane bioreactors, membrane processes, GMOs), microbial degradation (e.g. bacteria, fungi, algae), phytoremediation, biotechnology and nanobiotechnology. Offering fundamental and advanced information on environmental problems, challenges and bioremediation approaches used for the remediation of contaminated sites, it is a valuable resource for students, scientists and researchers engaged in microbiology, biotechnology and environmental sciences.

Emerging and Eco-Friendly Approaches for Waste Management

New Trends in Removal of Heavy Metals from Industrial Wastewater covers the applicable technologies relating to the removal of heavy metals from wastewater and new and emerging trends in the field, both at the laboratory and industrial scale. Sections explore new environmentally friendly technologies, the principles of sustainable development, the main factors contributing to heavy metal removal from wastewater, methods and procedures, materials (especially low-cost materials originated from industrial and agricultural waste), management of wastewater containing heavy metals and wastewater valorization, recycling, environmental impact, and wastewater policies for post heavy metal removal.
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This book is an advanced and updated vision of existing heavy metal removal technologies with their limitations and challenges and their potential application to remove heavy metals/environmental pollutants through advancements in bioremediation. Finally, sections also cover new trends and advances in environmental bioremediation with recent developments in this field by an application of chemical/biochemical and environmental biotechnology. Outlines the fate and occurrence of heavy metals in Wastewater Treatment Plants (WWTPs) and potential approaches for their removal Describes the techniques currently available for removing heavy metals from wastewater Discusses the emerging technologies in heavy metal removal Covers biological treatments to remove heavy metals Includes the valorization of heavy metal containing wastewater

The Role of Phytoremediation in Remediation of Industrial Waste

Phytoremediation Technology for the Removal of Heavy Metals and Other Contaminants from Soil and Water

The book on Physico-Chemical Treatment of Wastewater and Resource Recovery provides an efficient and low-cost solution for remediation of wastewater. This book focuses on physico-chemical treatment via advanced oxidation process, adsorption, its management and recovery of valuable chemicals. It discusses treatment and recovery process for the range of pollutants including BTX, PCB, PCDDs, proteins, phenols, antibiotics, complex organic compounds and metals. The occurrence of persistent pollutants poses deleterious effects on human and environmental health. Simple solutions for recovery of valuable chemicals and water during physico-chemical treatment of wastewater are discussed extensively. This book provides necessary knowledge and experimental studies on emerging physico-chemical processes for reducing water pollution and resource recovery.

Phytoremediation 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,
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Phytoremediation techniques are becoming increasingly important in the field of wastewater treatment. This is due to the need for sustainable and eco-friendly solutions to environmental problems. Academicians, researchers, and students in the fields of microbiology, toxicology, environmental chemistry, and soil and water science are currently utilizing phytoremediation techniques to address issues with wastewater.

Ecological Assessment of Wastewater Treatment Technologies
This book examines bioremediation technologies as a tool for environmental protection and management. It provides global perspectives on recent advances in the bioremediation of various environmental pollutants. Topics covered include comparative analysis of bio-gas electrification from anaerobic digesters, mathematical modeling in bioremediation, the evaluation of next-generation sequencing technologies for environmental monitoring in wastewater abatement; and the impact of diverse wastewater remediation techniques such as the use of nanofibers, microbes and genetically modified organisms; bioelectrochemical treatment; phytoremediation; and biosorption strategies. The book is targeted at scientists and researchers working in the field of bioremediation.

SOUVENIR of 4th International Science Congress
This two-volume work presents comprehensive, accurate information on the present status and contemporary development in phycoremediation of various types of domestic and industrial wastewaters. The volume covers a mechanistic understanding of microalgae based treatment of wastewaters, including current challenges in the treatment of various organic and inorganic pollutants, and future opportunities of bioremediation of wastewater and industrial effluents on an algal platform. The editors compile the work of authors from around the globe, providing insight on key issues and state-of-the-art developments in algal bioremediation that is missing from the currently available body of literature. The volume hopes to serve as a much needed resource for professors, researchers and scientists interested in microalgae applications for wastewater treatment. Volume 1 focuses on the different aspects of domestic and industrial wastewater treatment by microalgae. The case studies include examples such as genetic technologies as well as the development and efficient use of designer consortia for enhanced utilization of microalgae. This volume provides thorough and comprehensive information on removal of persistent and highly toxic contaminants such as heavy metals, organic pesticides, polyaromatic hydrocarbons, endocrine disruptors, pharmaceutical compounds, and dyes from wastewater by microalgae, diatoms, and blue-green algae. Design considerations for algal ponds and efficient use of photobioreactors and HRAPs for wastewater treatment are some other highlights. This volume addresses the applications, potentials, and future opportunities for these various considerations in water pollution mitigation using algal technologies.

Green Materials for Wastewater Treatment
Phytoremediation: Methods and Reviews presents the most innovative recent methodological developments in phytoremediation research, and outlines a variety of the contexts in which phytoremediation has begun to be applied. A significant portion of this volume is devoted to groundbreaking methods for the production of plants that are able to
Phytoremediation techniques in wastewater treatment degrade, take up, or tolerate the effects of pollutants. Phytoremediation: Methods and Reviews adopts a multidisciplinary approach to the examination of principles and practices of phytoremediation, from molecular manipulation to field application. Parts I and II discuss detailed protocols for achieving several different goals of phytoremediation, including enhancing contaminant degradation, uptake, and tolerance by plants; exploiting plant diversity for phytoremediation; modifying contaminant availability; and experimentally analyzing phytoremediation potential. Parts III and IV examine a variety of progressive techniques for phytoremediation and explore their implementation and success on a global scale. This cutting-edge volume highlights the myriad of contexts in which phytoremediation can be applied, and energizes new research by describing ways in which barriers to success have been recently overcome.

Bioremediation and Green Technologies This book offers insights into the recent research focusing on green solutions to address environmental pollution and its impacts. Bioremediation is a vast area that encompasses numerous innovative and cost-effective experimental and research methods involving numerous technologies, such as biotechnological, biochemical, microbial, marine, chemical and engineering approaches. Featuring original research and review articles by leading experts, the book explores potential solutions to the growing issues of waste management and environmental pollution and their impacts, and suggests future research directions. As such, it is a valuable resource for professionals and general readers alike.

Wastewater Treatment Engineering Soil is an irreplaceable resource that sustains life on the planet, challenged by food and energy demands of an increasing population. Therefore, soil contamination constitutes a critical issue to be addressed if we are to secure the life quality of present and future generations. Integrated efforts from researchers and policy makers are required to develop sound risk assessment procedures, remediation strategies and sustainable soil management policies. Environmental Risk Assessment of Soil Contamination provides a wide depiction of current research in soil contamination and risk assessment, encompassing reviews and case studies on soil pollution by heavy metals and organic pollutants. The book introduces several innovative approaches for soil remediation and risk assessment, including advances in phytoremediation and implementation of metabolomics in soil sciences.

Phytoremediation of Contaminated Soil and Water Water is 'elixir of life' and one of the most integral components of the environment. However, in recent years the quality of natural water has been altered seriously, mainly due to human interferences in natural processes. Recycling and reuse of wastewater is promising technique to reduce the pollution load on surface water bodies. Phytoremediation is a cost effective, environment friendly, aesthetically pleasing and most suitable approach for the appropriate treatment of wastewater. This book demonstrated a reduction in heavy metals and organic contents by using...
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Ozonation technique with this enhances the treatment capacity of existing sewage treatment plants due to its strong oxidant nature. On the basis of present findings and experimental designing, it is recommended that addition of phytoremediation and ozonation techniques with the existing sewage treatment plants shall further improve the efficiency of STPs and solve the problems of wastewater treatment.

Contamination of Water

As we know, rapid industrialization is a serious concern in the context of a healthy environment and public health due to the generation of huge volumes of toxic wastewater. Although various physico-chemical and biological approaches are available for the treatment of this wastewater, many of them are not effective. Now, there are a number of emerging eco-friendly, cost-effective approaches utilizing microorganisms (bacterial/fungi/algae), green plants or their enzymes, and constructed wetland treatment systems in the treatment of wastewaters containing pollutants such as endocrine-disrupting chemicals, toxic metals, pesticides, dyes, petroleum hydrocarbons, and phenolic compounds. This book provides a much-needed, comprehensive overview of the various types of wastewater and their ecotoxicological effects on the environment, humans, animals, and plants as well as various emerging and eco-friendly approaches for their treatment. It provides insights into the ecological problems and challenges in the treatment and management of wastewaters generated by various sources.

Application of Microalgae in Wastewater Treatment

New Trends in Removal of Heavy Metals from Industrial Wastewater

This book presents the state-of-the-art in plant ecophysiology. With a particular focus on adaptation to a changing environment, it discusses ecophysiology and adaptive mechanisms of plants under climate change. Over the centuries, the incidence of various abiotic stresses such as salinity, drought, extreme temperatures, atmospheric pollution, and metal toxicity due to climate change have regularly affected plants, and some estimates suggest that environmental stresses may reduce the crop yield by up to 70%. This in turn adversely affects the food security. As sessile organisms, plants are frequently exposed to various environmental adversities. As such, both plant physiology and plant ecophysiology begin with the study of responses to the environment. Provides essential insights, this book can be used for courses such as Plant Physiology, Environmental Science, Crop Production, and Agricultural Botany. Volume 2 provides up-to-date information on the impact of climate change on plants, the general consequences, and plant responses to various environmental stresses.

Wastewater Treatment

An Integration of Phycoremediation Processes in Wastewater Treatment reviews the potential of microalgae to treat wastewater containing highly recalcitrant compounds whose degradation is not achieved by

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The Handbook of Research on Microbial Tools for Environmental Waste Management is a critical scholarly resource that explores the advanced biological approaches used as remediation for pollution cleanup processes. It features coverage on topics such as biodegradation, microbial dehalogenation, and pollution controlling treatments, and is geared towards environmental scientists, biologists, policy makers, graduate students, and scholars seeking current research on environmental engineering and green technologies.

Introduction to Phytoremediation Contamination of Water: Health Risk Assessment and Treatment Strategies takes an interconnected look at various pollutants, sources of contamination, the effects of contamination on aquatic ecosystems and human health, and potential mitigation strategies. The book begins by examining the sources of potential contamination, including the current scenario of dyes, heavy metals, pesticides and oils contamination as well as regions impacted due to industrialization, mining or urbanization. It then analyzes various methods of water contamination, assesses health risk and adverse effects on those impacted, and concludes with an exploration of efficient, low-cost treatment technologies that remove toxic pollutants from the water. This book incorporates both theoretical and practical information that will be useful for researchers, professors, graduate students and professionals working on water contamination, environmental and health impacts, and the management and treatment of water resources.

Provides practical case studies of various types of contamination and sources in different regions Offers an overview of inorganic and organic contaminants and their impact on human health Evaluates several low-cost, efficient and effective water treatment technologies to remove toxins from water and minimize risk
Where To Download Phytoremediation Techniques In Wastewater Treatment

This book presents advanced techniques for wastewater treatment and the chapters review the environmental impact of water pollution, the analysis of water quality, and technologies for the preservation of water resources. Also outlined in this volume is the bioremediation of heavy metals, dyes, bisphenols, phthalates, cyanobacteria in contaminated water and wastewater. Another focus of this book is the use of natural remediation techniques such as bacterial biofilms and enzymes.