Bioremediation And Natural Attenuation Process Fundamentals And Mathematical Models

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Encyclopedia of Soils in the Environment John Wiley & Sons
Environmental Inorganic Chemistry for Engineers explains the principles of inorganic contaminant behavior, also applying these principles to explore available remediation technologies, and providing the design, operation, and advantages or disadvantages of the various remediation technologies. Written for environmental engineers and researchers, this reference provides the tools and methods that are imperative to protect and improve the environment. The book's three-part treatment starts with a clear and rigorous exposition of metals, including topics such as preparations, structures and bonding, reactions and properties, and complex formation and sequestering. This coverage is followed by a self-contained section concerning complex formation, sequestering, and organometallics, including hydrides and carbonyls. Part Two, Non-Metals, provides an overview of chemical periodicity and the fundamentals of their structure and properties. Clearly explains the principles of inorganic contaminant behavior in order to explore available remediation technologies Provides the design, operation, and advantages or disadvantages of the various remediation technologies Presents a clear exposition of metals, including topics such as preparations, structures, and bonding, reaction and properties, and complex formation and sequestering
Biostimulation Remediation Technologies for Groundwater Contaminants Butterworth-Heinemann
"Little is known about natural attenuation of chlorinated solvents in subarctic ground water. This study aimed to better understand the biogeochemistry and microbiology associated with naturally occurring processes of contaminent removal at two hydrologically diverse sites near Fairbanks, Alaska. Six Mile Village, located several km north of the Tanana River, is hydrologically stable, experiencing minor fluctuations in ground-water levels. Fort Wainwright is located adjacent to the Chena River and is hydrologically dynamic, experiencing seasonal flow reversals and substantial fluctuations in water-table elevations. By comparing data collected seasonally and with data collected at the two sites, I determined how ground-water/surface-water interactions affected in situ redox conditions and, hence, natural attenuation processes. A portion of the aquifer at Fort Wainwright was undergoing active treatment so I was also able to compare differences in chlorinated solvent transformations in treated and untreated ground water. Although ground water at Fort Wainwright was generally more oxidized than ground water at Six Mile Village, hydrogen concentrations at both sites were almost uniformly within ranges suggestive of iron or manganese reduction. However, aquifer sediments in the Tanana/Chena Alluvium are composed of mafic (containing reduced iron and manganese) minerals; suspended ferric iron appeared to result from oxidation of ferrous iron as ground water rose through the unsaturated zone. Sulfate concentrations were substantial and dissolved sulfide in most samples suggested that sulfate reduction might have been an important process. Calculated in situ Gibbs free energies for iron and sulfate reduction were energetically favorable at both sites; given other geochemical data, it seems likely these two processes co-occurred. Although methane was present in most samples, methanogenesis from H_2/CO_2 was generally not energetically feasible at either site. Methane likely diffused from underlying permafrost or peat. The presence of less chlorinated intermediates of solvent degradation suggested that biological reductive dechlorination occurred, providing further support that sulfate-reducing conditions existed. However, low rates of microbial activity, incomplete degradation and persistence of contaminants imply that biologically mediated mechanisms did not likely represent an important contribution to natural attenuation of contaminants at either site where dilution appeared to be a major attenuation mechanism"--Leaves iii-iv.
Current Developments in Biotechnology and Bioengineering CRC Press
Increased awareness surrounding environmental protection has prompted the development of more ecofriendly technologies. This book provides useful information on technologies based upon the use of biological agents for environmental clean-up, including bacteria, yeast, fungi, algae, and plants. Some chapters refer to the direct application of products derived from plants and microorganisms for designing strategies of environmental remediation. The combination of strategies helps in efficient removal of pollutants generated from anthropogenic activities with minimal environmental impact. This book is meant for professionals involved in environmental technology and waste management.
Groundwater 2000 Springer Science & Business Media

As the global population grows and many developing countries modernize, the importance of water supply and wastewater treatment becomes a much greater factor in 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.

Advances in Bioremediation of Wastewater and Polluted Soil Butterworth-Heinemann

Bioremediation and Sustainability is an up-to-date and comprehensive treatment of research and applications for some of the most important low-cost, "green," emerging technologies in chemical and environmental engineering.

Consequences of Microbial Interactions with Hydrocarbons, Oils, and Lipids: Biodegradation and Bioremediation John Wiley & Sons

In this book international experts discuss the state-of-the-art in the biological degradation of hydrocarbons to meet remedial or disposal goals. The work focuses on practical applications, often on globally important scales including the remediation of some of the world’s largest crude oil spills. Other related chapters discuss important implications of microbial transformation of hydrocarbons, including treatment of high fat processing wastes, impacts of microbial biodegradation activity on industrial processes, and the implications of microbial oil degradation in relation to modern oil extraction processes like hydraulic fracturing of shales and extraction of oil sands.

Biological Processing of Solid Waste ASCE Publications

The pollution of soil and groundwater by harmful chemical compounds and heavy metals is becoming very serious in many countries. Although remediation is necessary as soon as possible, the performance of conventional bioremediation processes is not sufficient. This book deals with advances in bioremediation and phytoremediation processes by using excellent strains and a combination of processes. In the chapters of this book, the researchers have introduced the overall status of contamination; the characteristics of bioremediation using halobacteria, Candida yeast, and autochthonous bacteria; and phytoremediation using macrophytes. Moreover, other researchers introduced a process using biochar and electric currents, and this combination of processes and phytoremediation enhances the overall process.

Installation Restoration Research Program. Review of the Utility of Natural Attenuation for Remediating Contaminated Army Sites CRC Press

This book outlines the strategies used in the investigation, characterization, management, and restoration and remediation for various contaminated sites. It draws on real-world examples from across the globe to illustrate remediation techniques and discusses their applicability. It provides guidance for the successful corrective action assessment and response programs for any type of contaminated land problem, and at any location. The systematic protocols presented will aid environmental professionals in managing contaminated land and associated problems more efficiently. This new edition adds twelve new chapters, and is fully updated and expanded throughout.

Natural Attenuation of Chlorinated Solvents in Subarctic Ground Water CRC Press

Across the United States, thousands of hazardous waste sites are contaminated with chemicals that prevent the underlying groundwater from meeting drinking water standards. These include Superfund sites and other facilities that handle and dispose of hazardous waste, active and inactive dry cleaners, and leaking underground storage tanks; many are at federal facilities such as military installations. While many sites have been closed over the past 30 years through cleanup programs run by the U.S. Department of Defense, the U.S. EPA, and other state and federal agencies, the remaining caseload is much more difficult to address because the nature of the contamination and subsurface conditions make it difficult to achieve drinking water standards in the affected groundwater. Alternatives for Managing the Nation's Complex Contaminated Groundwater Sites estimates that at least 126,000 sites across the U.S. still have contaminated groundwater, and their closure is expected to cost at least $110 billion to $127 billion. About 10 percent of these sites are considered "complex," meaning restoration is unlikely to be achieved in the next 50 to 100 years due to technological limitations. At sites where contaminant concentrations have plateaued at levels above cleanup goals despite active efforts, the report recommends evaluating whether the sites should transition to long-term management, where risks would be monitored and harmful exposures prevented, but at reduced costs.

Environmental Inorganic Chemistry for Engineers IGI Global

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. Biostimulation Remediation Technologies for Groundwater Contaminants is a critical scholarly publication that examines the release of heavy metals into the environment as a result of human activities and the use of nanoparticles and other technologies to manage and treat the effects of the pollution. Featuring coverage on a broad range of topics such as toxicity of heavy metals, bioremediation, and acclimated bacterial strains, this book is geared toward environmentalists, engineers, academics, researchers, and graduate-level students seeking current research on bioremediation as an alternate way to manage or degrade heavy metal waste.

The Utilization of Bioremediation to Reduce Soil Contamination: Problems and Solutions Springer Nature

Over the past 4 billion years, microorganisms have contributed to shaping the earth and making it more habitable for higher forms of life. They are remarkable in their metabolic diversity and their ability to harvest energy from oxidation and reduction reactions. Research on these microbiological processes has led to the newly evolving fields of geomicrobiology and biogeochemistry, linking the geosphere and the biosphere. This volume of the Soil Biology series provides an overview of the

biogeochemical processes and the microorganisms involved, with an emphasis on the industrial applications. Topics treated include aspects such as bioremediation of contaminated environments, biomining, biotechnological applications of extremophiles, subsurface petroleum microbiology, enhanced oil recovery using microbes and their products, metal extraction from soil, soil elemental cycling and plant nutrition.

Wastewater Engineering: Advanced Wastewater Treatment Systems CRC Press

Advances in Remediation Techniques for Polluted Soils and Groundwater focuses on the thematic areas for assessment, mitigation, and management of polluted sites. This book covers advances in modelling approaches, including Machine Learning (ML)/ Artificial Intelligence (AI) applications; GIS and remote sensing; sensors; impacts of climate change on geogenic contaminants; and socio-economic impacts in the poor rural and urban areas, which are lacking in a more comprehensive manner in the previous titles. This book encompasses updated information as well as future directions for researchers working in the field of management and remediation of polluted sites. Introduces fate and transport of multi-pollutants under varying subsurface conditions Details underlying mechanisms of biodegradation and biodetoxification of geogenic, industrial and emerging pollutants Presents recent advances and challenges in assessment, water quality modeling, uncertainty, and water supply management Provides authoritative contributions on the diverse aspects of management and remediation from leading experts around the world

Green Sustainable Process for Chemical and Environmental Engineering and Science CRC Press

Traditional reliance on chemical analysis to understand the direction and extent of treatment in a bioremediation process has been found to be inadequate. Whereas the goal of bioremediation is toxicity reduction, few direct, reliable measures of this process are as yet available. Another area of intense discussion is the assessment of market forces contributing to the acceptability of bioremediation. Finally, another important component is a series of lectures and lively exchanges devoted to practical applications of different bioremediation technologies. The range of subjects covers a wide spectrum, encompassing emerging technologies as well as actual, full-scale operations. Examples discussed include landfarming, biopiling, composting, phytoremediation and mycoremediation. Each technology is explored for its utility and capability to provide desired treatment goals. Advantages and limitations of each technology are discussed. The concept of natural attenuation is also critically evaluated since in some cases where time to remediation is not a significant factor, it may be an alternative to active bioremediation operations.

In Situ and On-site Bioremediation: Natural attenuation of petroleum hydrocarbons, air sparging and related technologies, process monitoring of petroleum biodegradation in soil, bioslurping, cold region applications, bioventing applications and extensions, integrated approaches to bioremediation, biopiles CRC Press

Offering a comprehensive approach, this title covers fundamentals, technologies, and management of biological processing of solid waste. It discusses kinetic modeling and synergistic impact evolution during bioprocessing of solid waste, environmental impacts such as greenhouse gas emission from biological processing of solid waste, energy recovery from solid waste, and biodrying of solid waste. It also presents cases and challenges from different countries, successful business models, and economic analyses of various processing options. Aimed at researchers and industry professionals in solid and hazardous waste management, this title offers a wealth of knowledge to help readers understand this increasingly important area.

Emerging Technologies in Environmental Bioremediation DIANE Publishing

Emerging Technologies in Environmental Bioremediation introduces emerging bioremediation technologies for the treatment and management of industrial wastes and other environmental pollutants for the sake of environmental sustainability. Emerging bioremediation approaches such as nano-bioremediation technology, electro-bioremediation technology, microbial fuel cell technology, Modified Ludzack-Ettinger Process, Modified Activated Sludge Process, and phytotechnologies for the remediation of industrial wastes/pollutants are discussed in a comprehensive manner not found in other books. Furthermore, the book includes updated information as well as future directions for research in the field of bioremediation of industrial wastes. This book will be extremely useful to students, researchers, scientists and professionals in the field of microbiology and biotechnology, Bio (chemical) engineers, environmental researchers, eco-toxicology, and many more. Includes the recovery of resources from wastewater Describes the importance of microorganisms in environmental bioremediation technologies Points out the reuse of treated wastewater through emerging technologies Pays attention to the occurrence of novel micro-pollutants Emphasizes the role of nanotechnology in pollutant bioremediation

Management of Contaminated Site Problems, Second Edition Elsevier

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.

Bioremediation and Natural Attenuation Academic Press

In the past decade, officials responsible for clean-up of contaminated groundwater have increasingly turned to natural attenuation-essentially allowing naturally occurring processes to reduce the toxic potential of contaminants-versus engineered solutions. This saves both money and headaches. To the people in surrounding communities, though, it can appear that clean-up officials are simply walking away from contaminated sites. When is natural attenuation the appropriate approach to a clean-up? This book presents the consensus of a diverse committee, informed by the views of researchers, regulators, and community activists. The committee reviews the likely effectiveness of natural attenuation with different classes of contaminants-and describes how to evaluate the "footprints" of natural attenuation at a site to determine whether natural processes will provide adequate clean-up. Included are recommendations for regulatory change. The committee emphasizes the importance of the public's belief and attitudes toward remediation and provides guidance on involving community stakeholders throughout the clean-up process. The book explores how contamination occurs, explaining concepts and terms, and includes case studies from the Hanford nuclear site, military bases, as well as other sites. It provides historical background and

important data on clean-up processes and goes on to offer critical reviews of 14 published protocols for evaluating natural attenuation.

Natural Attenuation of Hazardous Wastes Springer Science & Business Media

Test Area North (TAN) at the Idaho National Engineering and Environmental Laboratory (INEEL) is the site of a large trichloroethene (TCE) plume resulting from the historical injection of wastewater into the Snake River Plain Aquifer. The TAN Record of Decision (ROD) selected pump and treat as the final remedy and included a contingency for post-ROD treatability studies of alternative technologies. The technologies still under consideration are in situ bioremediation, in situ chemical oxidation, and natural attenuation. Both anaerobic and aerobic laboratory microcosm studies indicate the presence of microorganisms capable of chloroethene degradation. Field data indicate that TCE concentrations decrease relative to tritium and tetrachloroethene indicating an as yet unknown process is contributing to natural attenuation of TCE. Several methods for analyzing the field data have been evaluated and important limitations identified. Early results from the continued evaluation of the three alternative technologies suggest the combined approach of active remediation of the source area (in situ bioremediation and/or chemical oxidation replacing or augmenting pump and treat) and natural attenuation within the dissolved phase plume may be more cost and schedule effective than the base case pump and treat.

Engineered approaches to in situ bioremediation of chlorinated solvents fundamentals and field applications. National Academies Press

It is crucial to consider the impact of abiotic and biological remediation technologies on the microbial ecology to predict the success of short-term active treatments and long-term passive attenuation processes. In this research, three bioremediation strategies were tested individually or coupled with chemical remedies in bench- and pilot-scale studies for removing 1,4-dioxane and chlorinated volatile organic compounds (CVOCs), which are widespread co-occurring contaminants in soils and water resources across the U.S., attracting attention because of their potential carcinogenicities. In each project, amplification of taxonomic and functional genes by qPCR as well as metagenomics including high-throughput sequencing were applied to provide reliable information about microbial communities in the ecological matrices as they transitioned from 1,4-dioxane and CVOC contaminations to exposures from treatment technologies and degradation products. A comprehensive multiple lines of evidence approach provided evidence of natural attenuation by microorganisms capable of metabolic or co-metabolic degradation of 1,4-dioxane within a large, diffuse plume. A pilot study of bioaugmentation with Pseudonocardia dioxanivorans CB1190 through direct injection as well as in-situ bioreactor was successfully conducted at a site impacted by 1,4-dioxane and CVOCs. Bench-scale microcosms were established to inform pilot-scale ex-situ bioreactors and in-situ propane biosparging at an industrial site. 1,4-Dioxane co-metabolism by indigenous microbes was accelerated by biostimulation with propane and nutrients. Inoculations with CB1190 or propanotroph, Rhodococcus ruber ENV425, were eventually outcompeted by native microbes, but gene allocations for xenobiotics and lipid metabolism were enhanced and accompanied rapid 1,4-dioxane degradation rates. Three synergistic treatment trains: oxidation & catalysis, oxidation & biodegradation, and catalysis & biodegradation, were applied to achieve nearly complete 1,4-dioxane removals even in the presence of inhibitory CVOCs. While oxidant- or nanocatalyst-tolerant microbes were dominant immediately after chemical processes, the microbial community thrived during the biodegradation in a deterministic process over time, presenting higher biodiversity that indicated a more stable community. The post-treatment community carried various functional potentials, such as degradation of CVOCs and aromatic hydrocarbons, as well as nitrogen fixation. These mechanistic and quantitative data will be valuable for developing synergistic treatments that lead to savings in cost, energy, and substrate amendments for the remediation of contaminant mixtures.

Bioremediation of Chlorinated Solvents Springer

These proceedings, with cd-rom, present a comprehensive overview of advances in groundwater research. The five main topics covered are: aquifers and contaminant distribution; groundwater quality; natural attenuation; remediation technologies and groundwater protection. Groundwater 2000 is a useful resource to both scientists and to those working in the field.