
The single most important task of food scientists and the food industry as a whole is to ensure the safety of foods supplied to consumers. Recent trends in global food production, distribution and preparation call for increased emphasis on hygienic practices at all levels and for increased research in food safety in order to ensure a safer global food supply. The ISEKI-Food book series is a collection of books where various aspects of food safety and environmental issues are introduced and reviewed by scientists specializing in the field. In all of the books a special emphasis was placed on including case studies applicable to each specific topic. The books are intended for graduate students and senior level undergraduate students as well as professionals and researchers interested in food safety and environmental issues applicable to food safety. The idea and planning of the books originates from two working groups in the European thematic network “ISEKI-Food” an acronym for “Integrating Safety and Environmental Knowledge In to Food Studies”. Participants in the ISEKI-Food network come from 29 countries in Europe and most of the institutes and universities involved with Food Science education at the university level are represented. Some international companies and non teaching institutions have also participated in the program. The ISEKI-Food network is coordinated by Professor Cristina Silva at The Catholic University of Portugal, College of Biotecnology (Escola) in Porto. The program has a web site at: http://www.esb.ucp.pt/iseki/Heavy Metals in the Environment: Impact, Assessment, and Remediation synthesizes both fundamental concepts of heavy metal pollutants and state-of-the-art techniques and technologies for assessment and remediation. The book discusses the sources, origin and health risk assessment of heavy metals as well as the application of GIS, remote sensing and multivariate techniques in the assessment of heavy metals. The various contamination indices like contamination factor, geoaccumulation index, enrichment factor, and pollution index ecological risk index are also included to provide further context on the state of heavy metals in the environment. Covering a variety of approaches, techniques, and scenarios, this book is a key resource for environmental scientists and policymakers working to address environmental pollutants. Covers state-of-the-art techniques for the assessment and remediation of heavy metals Presents the interdisciplinary impacts of heavy metals, including human health, ecosystems and water quality Includes various contamination indices, such as contamination factor, geoaccumulation index, enrichment factor, pollution index and ecological risk indexSoil 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.Fundamental societal changes resulted from the necessity of people to get organized in mining, transporting, processing, and circulating the heavy metals and their follow-up products, which in consequence resulted in a differentiation of society into diversified professions and even societal strata. Heavy metals are highly demanded technological materials, which drive welfare and progress of the human society, and often play essential metabolic roles. However, their eminent toxicity challenges the field of chemistry, physics, engineering, cleaner production, electronics, metabolomics, botany, biotechnology, and microbiology in an interdisciplinary and cross-sectoral manner. Today, all these scientific disciplines are called to dedicate their efforts in a synergistic way to avoid exposure of heavy metals into the eco- and
biosphere, to reliably monitor and quantify heavy metal contamination, and to foster the development of novel strategies to remediate damage caused by heavy metals. This chapter summarizes the results of heavy metal's human health and ecological risk assessment of multipurpose ecogeochemical studies performed by the Center for Ecological-Noosphere Studies of the National Academy of Sciences of the Republic of Armenia in the young industrial cities of Yerevan and Gyumri and in an old mining region of the city of Kajaran. According to the results, children non-carcinogenic risk values were greater than permissible limit of 1 indicating the possibility of an adverse health effect in the whole area of all studied cities. Among all studied elements, the riskiest were those previously identified as primary pollutants. It has also been shown that in biogeochemical provinces, where mining activities and agricultural land of rural communities are spatially juxtaposed, health risk assessment should include all possible exposure pathways. Otherwise, underestimation of possible health risk will take place. Heavy metals in soils of Yerevan and Gyumri are also an ecological risk factor and the riskiest elements having significant contribution to the overall risk and are those (Hg, Cd, and Pb) with the high level of toxicity. This book highlights the latest research on dissolved heavy metals in drinking water and their removal. Heavy metals, individually & their compounds can affect human health. These are all naturally occurring substances which are often present in the environment at low levels. In high levels, these can be dangerous. Toxic heavy metals entering the ecosystem may lead to geo-accumulation, bio-accumulation and bio-magnifications. Due to their widespread use in human activities such as industry, agriculture and even as medicine numerous health risks may be associated with exposure to these substances. Their toxicity depends on several factors including the dose, route of exposure, and chemical species, as well as the age, gender, genetics, and nutritional status of exposed individuals. These metallic elements are considered systemic toxicants that are known to induce multiple organ damage, even at lower levels of exposure. Considering the importance of this subject, the present book "Metallic contamination and its Toxicity" gives an overview of the main features of heavy metal and their health consequences. The present book provides sufficient information on toxicology and risk assessment & remedial measures. This book will be useful to Environmentalist, Scientists, Researchers, Industrialists, Social workers and Toxicologists providing useful data. This will help to setup standards/guideline to protect human health & environmental hazard from heavy metal. In a review of the present book, the authors point out that the book is highly relevant for those involved in environmental science, soil science, geochemistry, agronomy, environmental health, and environmental engineering, including specialists responsible for the management and clean-up of contaminated land. Most publications on heavy metals and the environment have focused on environmental pathways and risks. The present book establishes a link between the environmental risks of heavy metals and the societal causes of the risks. Economic models, substance flow models and environmental fate and risk assessment models have been integrated into a single analytical framework that has been used to trace and understand the routes by which heavy metals enter the economy, through to their final destination in the environment. The long-term impacts of the current metals management regime in the Netherlands have been used as a case study by which to assess the effectiveness of certain policy measures. Readership: Environmental scientists, especially those practising in the areas of ecological economics, industrial ecology, materials flow accounting and integrated environmental assessment. Environmental policy makers will also find the book an invaluable aid in their deliberations. Peer reviewed literature was searched to identify research pertaining to the uptake of heavy metals (As, Cd, Pb and Zn) by vegetables (cabbage, carrot, lettuce, and radish). The objectives of this research were to 1) determine the relationship between heavy metal concentrations in the soil and heavy metal concentrations in vegetables, and 2) determine the level of risk associated with exposure to heavy metals through ingestion of contaminated vegetables. Highly variable estimates and biologically implausible regression equations resulted from this meta-analysis. Exposure to arsenic from the ingestion of lettuce grown on contaminated soil significantly increases cancer risk, especially in children. Highly variable hazard quotients prevent strong statements concerning toxic effects from exposure to Pb, Cd, or Zn. A more in-depth meta-analysis (multiple-regression and nonlinear curve-fitting) and an upgrade in data reporting standards are recommended. In the USA, Western and Central Europe, there are many large-scale polluted sites that are too large to be cleaned up economically with available technologies. The pollution is caused by heavy industries to soils and sediments in waterways and reservoirs. Since these
areas are expected to remain polluted for many years, it is necessary to take a long-term view to insure that the capacity to retain the contaminants is not diminished and to understand the potential for large-scale contaminant mobilization at these sites triggered by changing environmental conditions. This book provides information for predicting long-term changes and making risk assessments and describes the approach of geochemical engineering to handling large-scale polluted sites. This chapter is aimed at evaluating learner's health risk based on the concentration of toxic metals (Pb, Cr, Cd and Mn) in soil/dust from playgrounds/classrooms in selected primary schools in Lagos State. Samples were divided into four groups based on the density of the locations. Concentration of toxic metals in samples were determined by Graphite Furnace Atomic Absorption Spectrophotometer (GFA-EX7) technique after microwave digestion. The result showed that some of the heavy metals in the soil were higher than permissible limits set by DPR, FEPA and WHO. The soil/dust were contaminated with Cr, Cd and Pb but Mn was within permissible limit. Due to exposure to playground soil and classroom dust, hazardous index (HI) for non-carcinogenic/carcinogenic risk in children was estimated. HI value indicated that the heavy metal pollution may pose no obvious non-cancer health risk to children learning in such schools. However, children via ingestion pathway are exposed to the greatest carcinogenic risk followed by the inhalation pathway. The cancer risk for learners was found to be 3.2 × 10⁻⁷ (1 in 31 individuals). Hence, there is need for local environmental authorities to be warned about the potential health risks caused by heavy metals in playground/classroom. This book demonstrates the measurement, monitoring and mapping of environmental contaminants in soil & sediment, surface & groundwater and atmosphere. This book explores state-of-art techniques based on methodological and modeling in modern geospatial techniques specifically focusing on the recent trends in data mining techniques and robust modeling. It also presents modifications of and improvements to existing control technologies for remediation of environmental contaminants. In addition, it includes three separate sections on contaminants, risk assessment and remediation of different existing and emerging pollutants. It covers major topics such as: Radioactive Wastes, Solid and Hazardous Wastes, Heavy Metal Contaminants, Arsenic Contaminants, Microplastic Pollution, Microbiology of Soil and Sediments, Soil Salinity and Sodicity, Aquatic Ecotoxicity Assessment, Fluoride Contamination, Hydrochemistry, Geochemistry, Indoor Pollution and Human Health aspects. The content of this book will be of interest to researchers, professionals, and policymakers whose work involves environmental contaminants and related solutions. Master's Thesis from the year 2012 in the subject Geography / Earth Science - Physical Geography, Geomorphology, Environmental Studies, , language: English, abstract: The effect of leachate seepage from a landfill site on the quality of an urban river, Densu, that is the one of the main sources of water abstracted for treatment for most residents in the Accra Metropolitan area was determined by measuring the levels of heavy metals (As, Pb, Hg, and Cd) in the seepage and in the river itself using Atomic Absorption Spectrometry methods. Heavy metal concentration upstream before leachate contamination was low and within WHO limits. The mean concentrations of arsenic, lead, mercury and cadmium were 0.026mg/l, 0.957mg/l, 0.025mg/l and 0.005mg/l, respectively in the leachate. Mean heavy metal concentration, two hundred metres downstream from the leachate discharge point (where water is drawn for domestic and drinking purpose) was 0.008mg/l for arsenic, 0.393mg/l for lead, 0.001mg/l for mercury while cadmium was not detected. Lead exceeded the WHO acceptable limit of 0.01mg/l for drinking water. Mean levels in the corresponding sediment samples were 0.015mg/kg for arsenic. This book provides a unique overview of research methods over the past 25 years assessing critical loads and temporal effects of the deposition of air pollutants. It includes critical load methods and applications addressing acidification, eutrophication and heavy metal pollution of terrestrial and aquatic ecosystems. Applications include examples for each air pollution threat, both at local and regional scale, including Europe, Asia, Canada and the US. The book starts with background information on the effects of the deposition of sulphur, nitrogen and heavy metals and geochemical and biological indicators for risk assessments. The use of those indicators is then illustrated in the assessment of critical loads and their exceedances and in the temporal assessment of air pollution risks. It also includes the most recent developments of assessing critical loads and current and future risks of soil and water chemistry and biodiversity under climate change, with a special focus on nitrogen. The book thus provides a complete overview of the knowledge that is currently used for the scientific support of policies in the field of air pollution control to protect ecosystem services. Peer-reviewed literature was searched to identify research pertaining to the uptake of heavy metals (As, Cd, Pb and Zn) by vegetables (cabbage, carrot, lettuce, and radish). The objectives of this research were to 1) determine the relationship between heavy metal concentrations in the soil and heavy metal concentrations in vegetables, and 2) determine the level of risk associated with exposure to heavy metals through ingestion of contaminated vegetables. Highly variable estimates and biologically implausible regression equations resulted from this meta-analysis. Exposure to arsenic through the ingestion of lettuce grown on contaminated soil significantly increases cancer risk, especially in children. Highly variable hazard quotients prevent strong statements concerning toxic effects from exposure to Pb, Cd, or Zn. A more in-depth meta-analysis (multiple-regression and nonlinear curve-fitting) and an upgrade in data reporting standards are recommended. Currently, it is a serious concern to manage waste in the environment. Therefore, detailed knowledge of heavy metals, their eco-toxicological and health effects and ecofriendly approaches for their immobilization and detoxification is urgently required to control and minimize the environmental pollution. Composting is one of the popular methods in waste management and there are a lot of issues pertaining to composting. One of it is the leaching of heavy metals. This book discusses thoroughly, the availability, leachability and the speciation of heavy metals in the entire process of composting. Risk assessment is one of the main parts of complex systematic research of natural and man-made hazards and risks together with the concepts of risk analysis, risk management, acceptable risk, and risk reduction. It is considered as the process of making a recommendation on whether existing risks are acceptable and present risk control measures are adequate, and if they are not, whether alternative risk control measures are justified or will be implemented. Risk assessment incorporates the risk analysis and risk evaluation phases. Risk management is considered as the complete process of risk assessment, risk control, and risk reduction. The book reflects on the state-of-the-art problems and addresses the risk assessment to establish the criteria for ranking risk posed by different natural or man-made hazards and disasters, to quantify the impact that hazardous event or process has on population and structures, and to enhance the strategies for risk reduction and avoiding. Heavy metal and metalloid contamination of groundwater and surface water ecosystems involves important policy-related and ethical issues besides its more well-known scientific aspects. Heavy Metal and Metalloid Contamination of Surface and Underground Water: Environmental, Policy, and Ethical Issues has brought these three dimensions under a single volume. The book presents an updated status of the nature and extent of heavy metal and metalloid...
contamination of water and discuss its future implications. In Section I, the book provides a state-of-the-art review of research findings on entry, storage, and release, human health risks, and the uptake and accumulation by freshwater biota and the toxic effects experienced by them. The book also provides information on the bioremediation of heavy metals and metalloids, and the possible effects of climate change on their distribution and toxicity. Section II of the book throws light on the policies and legislations adopted in several countries to deal with the vexed issue of metal contamination of waters in both historical and current perspectives. Special emphasis has been given to the contamination of drinking water and its attendant implications for human health. The book also treats the relevance and applications of Integrated Water Resources Management (IWRM), which forms the backbone of the water policies of several countries. In Section III, discussions focus on ethical issues rising out of heavy metal and metalloid contamination of water, and on the different ethical approaches and principles in both indigenous and other societies. Features: A systematic overview of the major facets of heavy metal and metalloid contamination of water Compilation and analysis of the latest research in the subject area Ample case studies in all chapters that highlight specific problems Review of policy and legislation for the control of heavy metal pollution of water Water ethics in indigenous societies This book will be a vital resource for students and research scholars in the field of environmental science, ecotoxicology, and pollution studies.It is an old wisdom that metals are indispensable for life. Indeed, several of them, like sodium, potassium, and calcium, are easily discovered in living matter. However, the role of metals and their impact on life remained largely hidden until inorganic chemistry and coordination chemistry experienced a pronounced revival in the 1950s. The experimental and theoretical tools created in this period and their application to biochemical problems led to the development of the field of discipline now known as Bioinorganic Chemistry, Inorganic Biochemistry, or more recently also often addressed as Biological Inorganic Chemistry. By 1970 Bioinorganic Chemistry was established and further promoted by the book series Metal ions in Biological Systems founded in 1973 (edited by H.S., who was soon joined by A.S.) and published by Marcel Dekker, Inc., New York, for more than 30 years. After this company ceased to be a family endeavor and its acquisition by another company, we decided, after having edited 44 volumes of the MIBS series (the last two together with R.K.O.S.) to launch a new and broader minded series to cover today’s needs in the Life Sciences. Therefore, the Sigel’s new series is entitled Metal Ions in Life Sciences. After publication of the first four volumes (2006-2008) with John Wiley & Sons, Ltd., Chichester, UK, we are happy to join forces now in this still new endeavor with the Royal Society of Chemistry, Cambridge, UK; a most experienced Publisher in the Sciences. This title includes a number of Open Access chapters. Although adverse health effects of heavy metals have been known for a long time, exposure to heavy metals continues and is even increasing in some areas. Remediation of heavy metal contaminated soils and water is necessary to reduce the associated health and ecological risks, make the land resource available for agricultural production, enhance food security, and scale down land tenure problems. This book discusses the causes and the environmental impact of heavy metal contamination. It then explores many exciting new methods of analysis and decontamination currently studied and applied in the field today. The purpose of this book is to provide the latest, if not complete amount of updated information regarding the use of sediments for the estimation of chemical pollution in the aquatic environment from three main perspectives, namely, monitoring, ecological risk assessment and environmental management. The intended readers of this book include academicians, policy-makers, university students and researchers. This book contains eleven chapters. Chapters Three, Four, Six, Seven, Eight, Nine, Ten and Eleven mainly contain monitoring studies of pollutants (especially heavy metals) and sedimentary characteristics. Chapters Two, Five, Six, Eight, Nine and Ten have the portions largely consist of the monitoring data for the ecological risk assessments. Chapters One, Two, Four, Seven, Eight and Ten include recommendations for possible environmental management. Chapters One, Three, Four, Nine and Ten are reviews based on published data and findings, but with new insights and perspectives from researchers points of view. Chapter One reviews thirty publications, published between 2015 and August 2017, the management of coastal environments focusing on the pollutants investigated in the sedimentary components of the resourceful area in the coasts. Chapter Three reviews and compares scientific papers related to sedimentary characteristics of the tsunami sediments and deposits after the 2004 Indian Ocean and 2011 Tohoku-oki Tsunamis. Chapter Four reviews fourteen ISI published papers on the metal contamination in sediments of the Persian Gulf that were impacted by anthropogenic activities. Chapter Nine investigates geographical spatial distribution, and the ecological and children’s health risk assessments of Copper (Cu) aquatic ecosystems ranging from rivers, mangroves, estuaries and offshore areas were investigated using cited Cu data in the sediments from 100 randomly selected published papers in the literature. Chapter Ten presents the geochemical speciation and risk assessment of heavy metals in southwestern Taiwan coastal sediments. The study was based on a review of more than eleven studies and the heavy metal data were re-analyzed for the enrichment factor and potential ecological risk index. Other chapters (namely Chapters Two, Five, Six, Seven, Eight and Eleven) investigated metal pollution by using sediment watch, reporting metal data for the first time. Chapter Two presents the geochemical fractions of six heavy metals on surface sediments collected from drainages of Malacca’s industrial area and the Malacca River. Chapter Five presents the ecological risk assessment of heavy metals in the sediments collected in 2007, from the Sepang Besar River and the Sepang Kecil River, that were previously a pig farming area in the early 1990s. Chapter Six investigates the distribution and enrichment of heavy metals in the surface marine sediments of coastal Sabah, Malaysia. Chapter Seven reports the concentrations of Cr, Co, Mn and Sc in the mangrove snail in association with the above four metals with their habitat surface sediments. Chapter Eight presents the ecological risk assessments of heavy metals in surface sediments collected from a rocky shore in Tanjung Harapan. Chapter Eleven reports the Nd isotopic signature in sedimentary Mn/Fe oxides, which can be used as a tracer of the variations of west Pacific oceanographic exchange during the last 27 ka. Prominent scientists from Japan such as Prof. Hideo Okamura (Kobe University, Japan), Prof Hiroya Harino (Kobe College, Japan), Prof. Minoru Saito (Nihon University, Japan) and Prof. Kazuhiro Toyoda (Hokkaido University, Japan), Dr. Gen Kanaya and Dr. Tomohiko Isobe (both from National Institute of Environmental Sciences, Tsukuba, Japan), who co-authored some of the chapters have helped to improve the quality of the chapters in this book. Chapters from Prof Chen-Feng You from the National Cheng Kung University (Taiwan), and Dr. Moslem Sharifiinia from the Iranian National Institute for Oceanography and Atmospheric Science (Iran) are also important elements concerning the construction of international readership for this book.

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