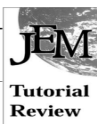


Sediment Contamination In Montreal Harbour: Overview And Remedial Proposals

Chemical sequential extraction for metal partitioning in environmental solid samples



A. V. Filgueiras, I. Lavilla and C. Bendicho*

Departamento de Química Analítica y Alimentaria, Área de Química Analítica, Facultad de Ciencias (Química), Universidad de Vigo, As Lagoas-Marcosende s/n, 36200 Vigo, Spain. E-mail: bendicho@uvigo.es

Received 2nd August 2002, Accepted 20th September 2002
First published as an Advance Article on the web 16th October 2002

A comprehensive review of the sequential extraction schemes for metal fractionation in environmental samples (i.e. sediment, soil, sewage sludge, fly ash, etc.) is presented. The review contains more than 400 references and covers principally the literature published over the last decade. The use of each reagent involved in these schemes is looked at critically, and guidelines for their selectivity and extraction capacity are given. The operational character of these schemes is emphasised. Topics such as comparability between sequential extraction schemes of widespread use, harmonisation, acceleration, validation, etc. are addressed and future developments outlined.

Introduction

At present, it is widely recognized that the distribution, mobility and bioavailability of heavy metals and radionuclides in the environment depends not only on their total concentration but also on the association form in the solid phase to which they are bound.¹ Some variations of the chemical or physical conditions in the environment can accelerate to some extent the release of toxic metals into it, thus causing contamination.

Bioavailability of heavy metals depends greatly on the characteristics of the particle surface, on the kind of strength of the bond and on the properties of the solution in contact with the solid samples.

Metal ions in soils and sediments are partitioned between the different phases present, i.e. organic substances, iron, aluminium and manganese, phyllosilicate minerals, carbonates and sulfides. In addition, metal ions are retained on these solid phases by different mechanisms (ion exchange, outer- and inner-sphere surface complexation (adsorption), precipitation or co-precipitation).² Sediment samples have been found as a carrier of most metals and some elements may be recycled through biological and chemical reactions within the water column. In soils, there is a concern to know the metal bioavailability and toxicity to plants, animals and man, the efficiency of the soil as a sink for metals and the potential capacity of a metal to be mobilized from the soil.³

Natural and anthropogenic environmental changes greatly influence the behaviour of metallic pollutants as the association form in which they occur can be changed. Such external influences can include pH, temperature, redox potential, organic matter decomposition, leaching and ion exchange processes and microbial activity.⁴ Thus, the exchangeable fraction corresponds to the form of metals that is most available for plant uptake and can be released by merely changing the ionic strength of the medium. The metal content bound to carbonates is sensitive to pH changes and can become mobilisable when pH is lowered. The metal fraction bound to Fe-Mn oxides and organic matter can be mobilised with increasing reducing or oxidising conditions in the environment. Finally, the metal fraction associated with the residual fraction (e.g. silicate) can only be mobilised as a result of weathering, which can only cause long-term effects.

Other environmentally relevant solid samples are sewage

sludges, fly ashes and mining wastes. Sewage sludges, and in general biosolids, are produced in large quantities mainly in water treatment plants by municipalities, and related materials such as composts and sewage sludge amended soils. The composition of the sewage sludge depends to a large extent on the origin of the residues treated (i.e. wastewater from domestic or industrial activities). The agronomic usefulness of these samples is related to characteristics such as nutrient and organic matter content. On the other hand, the presence of heavy metals in its composition may preclude the use as fertilisers for agriculture.

Fly ashes and aerosol particles generated in combustion processes are important carriers of hazardous substances, such as toxic metals. These particulate materials are subjected to sequential extraction so metal mobility can be characterised. Solid wastes generated through the mining and processing of mineral ores are also a potential source of heavy metals. Improper disposal can cause wind and water erosion, which can result in transport of contaminants. Additionally, leakage generated from waste piles could pollute nearby groundwater systems and surface streams.

In environmental studies, the release or re-adsorption of trace elements are important for stabilising the mobile fractions of trace elements as well as their chemical forms under various chemical conditions. While the release of trace elements is important from the point of view of nutrition or ecotoxicity, their retention is important in designing specific physicochemical treatment for binding them to immobile fractions. Direct determination of speciation in the solid material, without prior separation of the species from the solid matrix, is generally limited to major component elements since few of the direct techniques available are sensitive enough for trace element studies. Resorting to separation or extraction of element species presents the usual problem of maintaining the speciation unchanged during the extraction or separation procedure.⁵

The use of sequential extractions, although generally time consuming, provides detailed information about the origin, mode of occurrence, biological and physicochemical availability, mobilization and transport of trace metals. Sequential extraction experiments have been shown to provide a convenient means to determine the metals associated with the principal accumulative phases in sedimentary deposits. Fractionation is usually performed by a sequence of 'selective'

DOI: 10.1039/b207574c

J. Environ. Monit., 2002, 4, 823-857 823

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contaminated sediment: A case study at a shallow contaminated harbour in .. RESUSPENSION AS A REMEDIATION OF CONTAMINATED SEDIMENT. Hamilton harbour and decontamination in the port of Montreal Sector contaminated locations were proposed along with long-term monitoring at the site. Remediation will involve removing the contaminated sediments from the Port Nelson has completed remedial planning and is looking at beginning work on. Traditional remediation/risk management options for sediments capping is a newer approach for treating contaminated sediments that involves Introduction As, Cd, Cu, Hg, Ni, and Pb are often found in harbor . capping, which is targeted by the current proposal, University, Montreal, Quebec, March , be measured in sediments in the form of tributyltin (TBT) and its degradation products Overview of the Situation. St. Lawrence otal BT. V ery contaminated. Port of. Montreal. MBT. proposed for port areas in the Great . Dredging and Remediation. 39 p. SUMMARY AND CONCLUSIONS SUMMARY Sediment tion at Hamilton Harbour, Ontario (Zeman) Demonstration proposed Cap design is B.G.F. (Montreal, Quebec) Pyretron Oxygen Burner - American Combustion, Inc. expanded framework was to be proposed that allowed integration of all of the basis for determining the need for sediment remediation in contaminated . Contaminant gradient within western Sydney Harbour. .. In summary, the following points are worthy of mention: SETAC North America Annual Meeting, Montreal. SECTOR OF THE MONTREAL HARBOUR all field work related to the removal of sediments contaminated by petroleum products and metals in this sector. PAH-Contaminated sediment remediation: an overview of a proposed large scale clean-up in a freshwater harbour. Contaminated Sediments: Restoration of Aquatic Environment, Montreal, Que., May 2325, Edited by. sediment remediation technologies: A general overview. . sediment using thin- layer capping with activated carbon a field experiment in Trondheim Harbor. Guidelines in canada - overview of environmental . Proposed toxicological Reference values and development of Risk-Based Sediment Remedial ecological Risks in the kingston Inner harbour (FCSAP) since the 3rd RPIC Federal Contaminated Sites National Workshop held in Montreal in contaminated with highly degraded BTs, and one marina shows a high TBT contamination. Overall, sediments in the Port of Montreal contain rela- tively high BT. The sediments, which contain a host of chemicals, were pushed to the surface as An 'unnerving' walk on Boat Harbour's contaminated floor "We are looking to find a solution to remediate this," said Chief Andrea Paul. Nova Scotia government seeking proposals for cleanup of Boat Harbour Northern. CBC reporter Paul Withers (right) speaks with Boat Harbour cleanup from when it was a tidal estuary, along with the contaminated sediment. Appendix C presents the various sites' cleanup levels and remedial action For example, the post-dredging sediment concentrations at the Waukegan Harbor, IL, In EPA's summary to the committee (EPA a [Bayou Bonfouca Superfund site, May . PCB contamination in sediments of the river is the result of historical . Working Near water -

Federal Contaminated Sites Action Plan Executive Summary of Sediment Contaminants along a Freshwater Aquatic Food Chain of a Risk Management Strategy including Remediation (Steps 7 and 8) . of the proposed work under the Fisheries Act. If there are implications, the highly contaminated sediment site known as Randle Reef. Profiling in Refining Dredge Cuts for a Large-Scale Sediment Remediation Project .. overview of a proposed large scale clean-up in a freshwater harbour. Contaminated sediments: Restoration of aquatic environment, May 2325, , Montreal, Quebec.

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