

Leaching Properties of Naturally Occurring Heavy Metals from the Soils around Abandoned Metal Mines

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The major threats to human health from heavy metals are associated with exposure to lead, cadmium, mercury, chromium, arsenic, as well as selenium, fluorine and boron. The effects of such heavy metals on human health have been extensively studied and officially reviewed by international organizations such as the WHO and heavy metal pollutions have been regulated by national environmental standards and/or laws such as the Soil Contamination Countermeasures Act in Japan.

Leaching of naturally occurring heavy metals from the soils around abandoned metal mines into surrounding water systems, either groundwater or surface water systems, is one of the major pathways of exposure. Therefore, understanding the leaching properties of toxic heavy metals from naturally polluted soils is of fundamental importance for managing abandoned metal mines, excavated rocks discharged from tunneling and/or selecting a pertinent countermeasure against pollution when it is necessary.

In this study, soil samples taken from the surroundings of abandoned metal mines in Tochigi, Miyagi, Yamagata, Akita and Iwate prefectures in Kanto and Tohoku regions were collected and analyzed. The samples contained multiple heavy metals such as lead, arsenic and chromium. Standard leaching test and sequential leaching test considering different forms of contaminants, such as trivalent and pentavalent arsenics, and trivalent and hexavalent chromiums, together with X-ray Fluorescence Analysis (XRF), X-ray diffraction analysis (XRD) and Cation Exchange Capacity (CEC) tests were performed. This presentation illustrates the details of the above experimental study, discusses the relationships among leaching properties, and chemical and mineral compositions, indicates the difficulties associated with remediation of naturally polluted sites, and emphasizes the importance of risk-based countermeasures against naturally occurring heavy metals.

Keywords: Naturally occurring, Heavy metals, Leaching properties, Mineral composition, Bulk concentration