

Simultaneous Removal of Arsenic and Toxic Metals from Contaminated Soil: a Pilot-Scale Demonstration

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Abstract : Contaminated soils are recognized as one of the most pressing global environmental problems. As is one of the most hazardous elements: chronic exposure to arsenic has devastating effects on health, cardiovascular diseases, cancer, and eventually death. Pb, Zn and Cd are very highly toxic metals that affect almost every organ in the body. With this in mind, new technologies for soil remediation processes are urgently needed. Calcareous artificially contaminated soil containing 231 mg kg⁻¹ As and historically contaminated with Pb, Zn and Cd was washed with a 1:1.5 solid-liquid ratio of 90 mM EDTA, 100 mM oxalic acid, and 50 mM sodium dithionite to remove 59, 75, 29, and 53% of As, Pb, Zn, and Cd, respectively. To reduce emissions of residual EDTA and chelated metals from the remediated soil, zero valent iron (ZVI) was added (1% w/w) to the slurry of the washed soil immediately prior to rinsing. Experimental controls were conducted without the addition of ZVI after remediation. The use of ZVI reduced metal leachability and minimized toxic emissions 21 days after remediation. After this time, NH₄NO₃ extraction was performed to determine the mobility of toxic elements in the soil. In addition, Unified Human Bioaccessibility Method (UBM) was performed to quantify the bioaccessibility levels of metals in stimulated human gastric and gastrointestinal phases.

Keywords : soil remediation, soil science, soil washing, toxic metals removal

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