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Enhanced Electrokinetic Remediation of Cadmium-Contaminated Natural Clay using Organophosphonates in Comparison with EDTA*

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Abstract Soil contamination by metals is a worldwide environmental problem. Electrokinetic extraction is a promising technology for in-situ remediation of contaminated soils of low hydraulic permeability. However, the extraction of metals is usually hindered by the high buffer capacity of natural soils. Organophosphonates are strong metal chelates as ethylenediaminetetraacetic acid (EDTA) which has been widely studied in the enhancement of electrokinetic remediation. In this study, batch desorption experiments and bench-scale electrokinetic extraction experiments were carried out to study the effect of two organophosphonates, *i.e.*, (nitrilotrimethylene)triphosphonate (NTMP) & (ethylenedinitrilo)-tetramethylenephosphonate (EDTMP), on the extraction of cadmium from a natural clay in comparison with EDTA. Results of the batch desorption experiments showed that more than 75% of the sorbed cadmium could be dissolved into solution using 0.1 $mol \cdot L^{-1}$ organophosphonates or EDTA in the wide pH range of 1-11. Results of the electrokinetic extraction experiments showed that the cadmium spiked in the specimen migrated towards the anode with the enhancement of NTMP, EDTMP, and EDTA under a constant voltage gradient of approximately 1.0 $V \cdot cm^{-1}$. Although cadmium mobilization enhanced by EDTA was more efficient than that by the organophosphonates, accumulation of

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