Electrokinetic Remediation of Cadmium (Cd), Copper (Cu) and Nickel (Ni) Co-contaminated Soil with Oxalic Acid, Acetic Acid or Citric Acid as the Catholyte

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Electrokinetic remediation (EKR) of Cd, Cu, and Ni co-contaminated soil was investigated using three organic acids (oxalic acid, acetic acid, or citric acid) as promising catholytes. Four experiments were performed to explore the effects of the three organic acids on pH and TDS (total dissolved solids) values, removal performance, content, distribution, and changes in speciation of heavy metal ions (exchangeable, reducible, oxidizable and residual fractions). Application of organic acids (oxalic acid, acetic acid, or citric acid) as catholyte coupled with EKR alleviated significant pH jumps and improved the efficiency of heavy metal removal. The application of the three organic acids and CK improved the remediation performance for Cd, Cu, and Ni, with citric acid being the most effective, followed by acetic acid, oxalic acid, and finally, CK. The Cd, Cu, and Ni removal efficiencies (average of five sections) for the citric acid treatment reached 61±1.6% (from 300 mg/kg to 182 mg/kg), 41±0.5% (from 845 mg/kg to 345 mg/kg), and 52±1.3% (from 436 mg/kg to 225 mg/kg), respectively. Heavy metal speciation analysis showed that the contents of the exchangeable and reducible fractions decreased near the cathode for all three organic acid treatments compared with the CK treatment only.

Keywords: Electrokinetic remediation, cadmium, copper, nickel, organic acid.

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