Effect of Different Pretreatment Solutions on Electrokinetic Remediation of Heavy Metals from Municipal Solid Waste Incineration Fly Ash

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The presence of carbonate and alkaline oxides leads to the strong acid buffering capacity and high pH of municipal solid waste incineration (MSWI) fly ash, hindering the removal of heavy metals (HMs) during electrokinetic remediation (EKR). Acid pretreatment offers the possibility to solve this problem. In this study, four pretreatment solutions (deionized water, HNO₃, HCl and HAc) were investigated with the aim of lowering the high acid buffering capacity of MSWI fly ash. A series of laboratory scale EKR experiments were conducted with different pretreatment conditions and operating parameters. The experiment with HCl pretreatment showed the best removal of HMs. Then, an orthogonal experiment was designed to explore the optimum EKR conditions based on acid pretreatment. The results showed that the best leaching efficiencies of Pb (94.23%), Zn (89.09%), Cu (88.21%) and Cd (84.97%) were obtained after 15 d, at a voltage gradient of 2 V/cm and with the addition of 0.05 mol/L citric acid to the catholyte every day. The carbonate and alkaline oxides in fly ash were significantly reduced after the EKR treatment, as confirmed by XRD analysis. Sequential extraction of Pb, Zn, Cu and Cd indicated that the oxidizable and reducible states were converted to a more stable compound after treatment.

Keywords: Electrokinetic remediation; Acid pretreatment; MSWI fly ashes; Heavy metals; Removal efficiency; Buffering capacity

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