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The Electrokinetic Impact on Heavy Metals Remediation of Tasik Chini Iron Ore Mine Tailings at Pahang State, Peninsular Malaysia

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Abstract

The improper disposal of mining tailings is a severe threat to the surrounding environment because it comprises high concentrations of heavy metals contamination. Any precious metal extraction (mining) produces millions of tons of waste; iron ore extraction is common globally, unlike other metals extraction. The iron ore tailings contain heavy metals such as Arsenic (As), Cobalt (Co), Manganese (Mn), Lead (Pb), Copper (Cu), and Zinc (Zn). This study focuses on extracting hazardous metals such as As, V, and Zn from the disposed waste and improving its geotechnical properties. Nine samples were collected from Tasik Chini Iron ore mine, Pekan district, Pahang State, Malaysia. The initial data were prepared for elemental analysis by following ICP-OES analysis. The results showed that As, Co, Mn, Pb, Cu, and Zn concentrations exceeded the standard guidelines. In recent years, sustainable remediations techniques (EKR) have attracted extensive attention, including the electrokinetic remediation technique. The (EKR) method was applied to extract these metals from iron ore tailings specimens. A comprehensive approach of EKR shows an outstanding result where the highest removal efficiency of As was 68.4 %, Co 64.5%, Mn 67.8%, Pb 67.1%, and Cu was 64.1% and Zn 64.9% with the voltage gradient of 100 and 150 V for 4 and 8 hours constantly. Increasing the voltage gradient could be a cost-effective long-term solution for the remediation of iron ore tailings. The existing method was experienced as an effective and green technique for extracting heavy metals and recycling the mining waste materials.

Keywords: Heavy metals; Contamination; Environment; Toxicity; Electrokinetic remediation.