Comparison on Leaching of Metals from Lime Stabilized Subgrade Containing Tannery Sludge Ash Using USEPA and NEN Methods

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Abstract

Tannery sludge (TS) ash, rich in heavy metals such as chromium, zinc, and lead, poses significant environmental hazards if improperly disposed. To address this, the present study incorporated TS ash into subgrade soil and stabilized the blend with lime, aiming to enhance both geotechnical performance and environmental safety. Initially, the optimal lime proportion by weight of soil to enhance the properties of soil was determined and was termed the "hybrid mix". Subsequently, TS ash was introduced into this hybrid mix in increasing weight percentages. Metal leaching from each blend was assessed using two established protocols: the USEPA Method 1311 (TCLP) and the Dutch NEN 7345 tank leaching test. In both assessments, metal leaching intensified in direct proportion to the TS ash content. Notably, the TCLP method consistently registered marginally higher metal release than the Dutch method, a discrepancy attributed to particle crushing during sample preparation, which increased reactive surface area. Moreover, TCLP conditions more closely simulate aggressive environmental scenarios, rendering its results especially representative of real-world field conditions over the material's service life. Overall, the study demonstrates that lime was successful in improving the properties of subgrade and stabilizes the metals of TS. These findings conclude that controlled use of TS ash–lime blends in subgrade applications can reduce the landfilling of TS ash and suggests a sustainable solution.

Keywords

Metals, NEN 7345, subgrade, USEPA 1311.