Cement Based Solidification/Stabilization Leaching Performances of Selected Heavy Metal Ions under Different pH Extractions

Abstract: Liquid to solid partitioning as a function of pH leaching Procedure LSP EPA method 1313 was carried out to test the effectiveness, performance and efficiency of the cement-based solidification/stabilization (S/S) of heavy metals contaminated sand samples using Ordinary Portland Cement OPC type A. Two cement based mix designs (7 and 25%) have been applied to (S/S) sand contaminated samples with different heavy metal ions (Pb, Cu, Cr, and Cd) having the following concentrations (500, 1500 and 3000 mg/kg). Fixed water to cement ratio of 0.45 was maintained for all the experiments. Effective retention levels for the heavy metal ions was achieved using a 25% OPC mix ratio to (S/S) the contaminated samples even when the extraction solutions were of pH levels as low as 2. Leaching experiments showed that as the pH level of the extraction solution is reduced and as the OPC content in the (S/S) samples is reduced the more heavy metal ions that can leach out. Up to 80% of chromium, cadmium, lead, and copper ions leachability can be prevented when higher cement content is introduced to the solidification/stabilization process under the same pH extraction. Acidic extraction effects and solubilized the Calcium–Silica–Hydrate (C–S–H) gel that is created by the OPC binder, which holds, and contain the heavy metal ions and thus results in more release of those ions into the extraction solutions. The alkaline environments provided by the cement binder are believed to have participated in the precipitation of several metal ions such as cadmium and lead, leading to their less detection in the leaching extracts. Alkaline extraction experiments (pH 8-13) showed that the mobility of the metal ions under the same experimental conditions followed the order of Pb > Cr > Cu > Cd in samples of various cement contents.

Keywords: Solidification/Stabilization; Heavy Metals; LSP; Leaching.

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