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LEACHING BEHAVIOR OF HEAVY METALS AND ANIONS ON STABILIZED/SOLIDIFIED ASH FROM INCINERATION OF REFINERY OILY SLUDGE

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EXTENDED ABSTRACT

The objective of this work was to investigate the leaching behavior of heavy metals and anions from stabilized/solidified (S/S) ash, produced by incineration of refinery oily sludge. The ash and the initial oily sludge are classified as hazardous wastes, according to the European Waste Catalogue. Incineration followed by stabilization/solidification is identified as the best demonstrated available treatment technology in the USA, according to Resource Conservation and Recovery Act.
The S/S process was applied using two different types of Portland cement (I-45 and II-45). The leaching behavior of these cement-based waste materials was studied using the standard Toxicity Characteristic Leaching Procedure (TCLP) test. Sequential TCLP tests were used to simulate the acidic environment in a sanitary landfill. The heavy metals of interest in the initial sludge were Pb, Ni, Cr, Zn, Cd, Cu and Fe. From these, only Ni, Cr, Zn, Fe and Cu remained in the ash after the incineration. The anions, which were determined, using High Performance Liquid Chromatography (HPLC) with suppressed conductivity detection, were SO_4^{2-}, NO_3^-, and CrO_4^{2-}.
The results showed that the S/S waste did not exceed TCLP limitis for Pb and Ni. Cr exceeded TCLP limits only when II-45 Portland cement was used as binder. Remarkably low levels of Zn (maximum leached concentration 0.43 mg/L) and Fe and Ni (below detection limit; 0.006 mg/L and 0.01 mg/L, respectively) were traced during the leaching tests. The leaching behavior of either heavy metals or anions was pH-depended.
The concentration of SO_4^{2-}, which was leached from the solidified specimens, increased as the pH decreased. A very interesting observation was that the leached amount of sulfate from the non-stabilized/solidified incinerated oily sludge or the cement alone was, in every TCLP extraction, lower than the amount of sulfate leached from the solidified specimens. This increased amount of leached sulfate is due to reactions occurring in the cement matrix. Several cement-based structures formed, during the hydration of cement or reactions between the waste constituents and cement, utilize sulfate as a principal reagent. For the time being, the exact mechanism, which explains the leaching behavior of the sulfate, is obscure.

Key words: Solidification, stabilization, leaching, anions, ash, heavy metals, oily refinery sludge, sequential toxicity characteristic leaching procedure (TCLP).