

Stabilization of Medical Waste Incineration Fly Ash in Cement Mortar Matrix

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Abstract : We performed laboratory experiments to assess the suitability of using medical waste incineration fly ash in cement as a construction material based on the engineering properties of fly ash-cement matrix and the leaching potential of toxic heavy metals from the stabilized mix. Fly ash-cement samples were prepared with different proportions of fly ash (0%, 5%, 10%, 15% and 20% by weight) in the laboratory controlled conditions. The solidified matrix exhibited a compressive strength from 3950 to 4980 psi when fly ash is mixed in varying proportions. The 28-day compressive strength has been found to decrease with the increase in fly ash content, but it meets the minimum requirement of compressive strength for cement-mortar. Soundness test results for cement-mortar mixes having up to 15% fly ash. Final and initial setting times of cement have been found to generally increase with fly ash content. Water requirement (for normal consistency) also increased with the increase in fly ash content in cement. Based on physical properties of the cement-mortar matrix it is recommended that up to 10% (by weight) medical waste incineration fly ash can be incorporated for producing cement-mortar of optimum quality. Leaching behaviours of several targeted heavy metals (As, Cu, Ni, Cd, Pb, Hg and Zn) were analyzed using Toxicity Characteristics Leaching Procedure (TCLP) on fly ash and solidified fly ash-cement matrix. It was found that the leached concentrations of As, Cu, Cd, Pb and Zn were reduced by 80.13%, 89.47%, 33.33% and 23.9% respectively for 10% fly ash incorporated cement-mortar matrix compared to that of original fly ash. The leached concentrations of heavy metals were from the matrix were far below the EPA land disposal limits. These results suggest that the solidified fly ash incorporated cement-mortar matrix can effectively confine and immobilize the heavy metals contained in the fly ash.

Keywords : cement-mortar, fly ash, leaching, waste management

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