Abstract

This research work investigated the effects of condensed silica fume (CSF) and iron furnace slag on the chemical and physical properties of cement-based solidified waste forms. Final setting and strength development of blended cements at different curing duration were used to decide the optimum proportions of the binders. In addition, the ability of the solidified wastes to contain the electroplating sludge from a zinc-cyanide process was evaluated. Compressive strength, leachability of heavy metals, durability of the solidified wastes against corrosion by 0.5 N acetic, nitric and sulfuric acid solution and durability to wet and dry cycle were determined.

Experimental results showed that the time to final setting of blended cements increased with increasing contents of CSF and iron furnace slag in the cement mixes. Final setting time of cements blended with CSF at 0, 5 and 10 wt.% increased from 4 to 4.25 and 4.5 hours, respectively whereas those blended with iron furnace slag at 0, 20 and 30 wt.% increased from 4 to 5 and 5.5 hours, respectively. In addition, compressive strength of cement paste and blended cements increased with increasing curing duration but at a decreasing rate. Lower rate of strength development was observed from blended cements of all mixes compared to that of cement paste, except cement blended with 5 wt.% CSF.

Compressive strength of all solidified wastes made with 20, 35 and 50 wt.% of plating sludge was dramatically decreased compared to those without. Despite curing duration was prolonged to 91 days, strength of all solidified wastes was hardly developed. This is believed to be resulted from cement hydration inhibition caused by zinc hydroxide, which was the main constituent present in the plating sludge. As a result, the quality of the solidified wastes made with blended cements as was assessed using dynamic leach testing, durability against acid deterioration and durability to wet-dry cycle were similar to that of the control.