

Consequences of Organic Compounds on the Performance of Cementitious Waste Forms

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The fabrication of cementitious waste forms (CWFs) consists of mixing a cementitious binder (or cement-free binder) with a liquid waste containing the hazardous and radiological constituents. However, CWFs, like conventional construction cements, are sensitive to both inorganic and organic compounds and can affect the physio-chemical process transforming a fluid paste to a rigid monolith with possible downstream effects on performance (e.g., leaching, microstructure, strength). Many liquid nuclear wastes contain organic compounds that may play such a role. The early-age and cured properties of Cast Stone binder (a ternary blend of blast furnace slag, coal fly ash, and ordinary portland cement) are investigated when mixed with two alkaline, but compositionally different and non-radioactive, liquid waste simulants: one with a 5.7 molarity (M) Na and a second with 2.6 M Na. To probe the influence of organic compounds present in liquid nuclear wastes on the fresh and cured properties of the CWF samples were spiked with three different categories of organic chemicals (process chemicals and the decomposition byproducts consisting of organic acids, and alcohols) at three different dosage levels each to observe any effects to property development. The leaching of these organic species was also evaluated with EPA 1315 leaching tests. Relationships between spiking levels/species, CWF property development, their mineralogy and leach test results are highlighted.