

Toxicity immobilization of refinery sludge containing heavy metals via vitrification process

ABSTRACT

Heavy metals are known to be toxic to human and the environment. Despite the growing of petrochemical and refinery industries, the world is facing problems with the heavy metals contamination from the sludge by the industries. Many methods have been applied to address these issues from the refinery sludge. In this study, stabilization and solidification of refinery sludge containing heavy metals using vitrification method was utilized to solve this problem. The ashing temperature of 550oC was selected in preparing the ash of the dried sludge prior to the vitrification process at 1110oC to 1400oC. After vitrification, all samples were morphologically, thermally and toxically analyzed using Scanning Electron Microscopy, Thermogravimetric Analysis and Toxicity Characteristic Leaching Procedure. The sludge contained high amount of iron and aluminum, followed by some amount of magnesium, gold, arsenic and zinc with some traces of nickel and lead. Results showed that at maximum vitrified temperature of 1400oC, no magnesium, nickel and lead were detected in the sludge and only some traces of other heavy metals with less than 1 ppm. The vitrification method exhibits excellent output in immobilizing the transition metals leading to a reduction in environmental pollution caused by petrochemical and refinery sludge containing heavy metals.

Keyword: Vitrification; Heavy metals contamination; Refinery sludge; Toxicity; Leaching analysis