Distribution and chemical association of trace elements in incinerator residues and mining waste from a leaching perspective

av

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Abstract

Incineration is a mainstream strategy for solid waste management in Sweden and all over the world. Improved knowledge and understanding about the distribution of trace elements (in ashes) during incineration, and how trace element partitioning respond to the changes in waste composition, are important in terms of combustion process optimization and plant efficiency. Moreover, determination of chemical association of trace elements in ashes are vital for avoiding environmental concerns and to promote possible reuse. In this study, partitioning of trace elements in ashes during incineration as function of input waste fuel and incineration technology was investigated. Further, chemical association of trace elements in resulting ashes was studied. An evaluation was also performed about feasibility of metal extraction from sulfidic mining waste and flotation tailings. Moreover, green liquor dreg (GLD) was tested with respect to stabilization of metals within the sulfidic mining waste.

Findings showed that the total input of trace elements and chlorine affects the partitioning and increasing chlorine in the input waste caused increase in transfer of trace elements to fly ash especially for lead and zinc. Vaporization, condensation on fly ash particles and adsorption mechanisms play an important role for metal distribution. Firing mixed waste, especially biofuel mix, in grate or fluidized (CFB) boilers caused increased transfer into fly ash for almost all trace elements particularly lead and zinc. Possible reasons might be either an increased input concentration of respective element in the waste fuel, or a change in volatilization behavior due to the addition of certain waste fractions. Chemical association study for fly ashes indicated that overall, Cd, Pb, Zn, Cu and Sb are presenting major risk in most of the fly ashes, while in bottom ashes, most of elements are associated with stable fraction. Further, fuel type affects the association of elements in ashes. Chemical leaching of mining waste materials showed that sulfuric acid (under different conditions) is the best reagent to recover zinc and copper from sulfidic mining waste and also copper from flotation tailings. GLD indicates potential for metal stabilization in mining waste by reducing the metal mobility. Extraction methods could be applied to treat mining waste in order to meet the regulatory level at a specific mining site. Similarly stabilization/solidification methods might be applied after leaching for recovery of metals.

Keywords: trace elements, partitioning, fly ash, bottom ash, speciation, association, risk assessment, wood waste, incineration, mining waste

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