

Carbonation for fixation of metals in MSWI fly ash

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Abstract

Waste management is in need of a reliable and economical treatment method for metals in fly ashes from municipal solid waste incineration (MSWI). However, no state-of-the-art technique has gained wide acceptance yet. This presentation aims to assess the possibilities and limitations of carbonation as a stabilization method. Factors that were studied are the partial pressure of carbon dioxide (CO₂), the addition of water, the temperature, and the reaction time. Laboratory experiments were performed applying methods such as factorial experimental design, thermal analysis, scanning electron microscopy (SEM), x-ray diffraction (XRD), and leaching assays including pH_{stat} titration and sequential extraction. Leaching data were verified and complemented using chemical equilibrium calculations. Data evaluation was performed by means of multivariate statistics such as multiple linear regression, principal component analysis (PCA), and partial least squares (PLS) modeling. It was found that carbonation is a good prospect for a stabilization technique especially with respect to the major pollutants lead (Pb) and zinc (Zn). Their mobility decreased with increasing factor levels. Dominating factors were the partial pressure of CO₂ and the reaction time, while temperature and the addition of water were of minor influence. However, the treatment caused a mobilization of cadmium (Cd), requiring further research on possible countermeasures such as metal demobilization through enhanced silicate formation.