Geophysical Research Abstracts
Vol. 18, EGU2016-12367, 2016
EGU General Assembly 2016

Metallic elements fractionation in municipal solid waste incineration residues

Piotr R. Kowalski, Monika Kasina, and Marek Michalik

Jagiellonian University, Institute of Geological Sciences, Oleandry 2a, 30-063 Krakow, Poland (p.kowalski@uj.edu.pl)

Municipal solid waste incineration (MSWI) residues are represented by three main materials: bottom ash, fly ash and air pollution control (APC) residues. Among them ∼80 wt% is bottom ash. All of that materials are products of high temperature (>1000˚C) treatment of waste. Incineration process allows to obtain significant reduction of waste mass (up to 70%) and volume (up to 90%) what is commonly used in waste management to reduce the amount need to be landfilled or managed in other way. Incineration promote accumulation non-combustible fraction of waste, which part are metallic elements. That type of concentration is object of concerns about the incineration residues impact on the environment and also gives the possibility of attempts to recover them. Metallic elements are not equally distributed among the materials. Several factors influence the process: melting points, volatility and place and forms of metallic occurrence in the incinerated waste.

To investigate metallic elements distribution in MSWI residues samples from one of the biggest MSW incineration plant in Poland were collected in 2015. Chemical analysis with emphasis on the metallic elements content were performed using inductively coupled plasma optical emission (ICP-OES) and mass spectrometry (ICP-MS).

The bottom ash was a SiO_2-CaO-Al_2O_3-Fe_2O_3-Na_2O rich material, whereas fly ash and APC residues were mostly composed of CaO and SiO_2. All of the materials were rich in amorphous phase occurring together with various, mostly silicate crystalline phases. In a mass of bottom ash 11 wt% were metallic elements but also in ashes 8.5 wt% (fly ash) and ∼4.5 wt% (APC residues) of them were present.

Among the metallic elements equal distribution between bottom and fly ash was observed for Al (∼3.85 wt%), Mn (770 ppm) and Ni (∼65 ppm). In bottom ash Fe (5.5 wt%), Cr (590 ppm) and Cu (1250 ppm) were concentrated. These values in comparison to fly ash were 5-fold higher for Fe, 3-fold for Cu and 1.5-fold for Cr. In comparison to bottom ash, in fly ash 10-fold more Zn was present (8070 ppm), 4-fold more Sn (540 ppm) and also 2-fold more Ti (1.1 wt%), Pb (460 ppm) and Sn (540 ppm). Although APC residue is the material produced in the smallest quantities, in its composition some high concentrations of metallic elements were also present. Contents of Zn (>1 wt%), Pb (2560 ppm) and Sn (875 ppm) were much higher than in bottom and fly ash.

Obtained results confirmed that fractionation of elements occurs during the municipal waste incineration and further detailed study of the residues may allow better understanding of the process.

Acknowledgment: Research was funded by Polish National Science Centre (NCN). Scientific grant No. UMO-2014/15/B/ST10/04171.