

Mineralogical characteristic and comparison between slags from the incineration of municipal and industrial waste in Poland – preliminary results.

P. Kowalski and M. Michalik

Jagiellonian University, Institute of Geological Sciences, Krakow, Poland (p.kowalski@uj.edu.pl)

Incineration of waste is a response to the growing need to reduce the volume of wastes generated in urban and industrialized areas. It is closely related to the recycling of secondary raw materials and it should be an integral part of the modern municipal waste management system. The usage of advanced combustion systems allows to recover the energy during the process of waste utilization and enables the use of incinerator as a local producer of electricity or district heating.

Due to planned construction of 9 incinerators in Poland with the assumed production of slag around 2 million Mg/y studies of slag and ash in terms of environmental risk and potential impact on human health are significant. This is especially important because the solid waste residues, which are the final products of the combustion process, will be mostly landfilled until possibilities of using slags are developed.

Slag from two biggest incineration plants in Poland was studied (slag from the municipal solid waste incinerator “ZSUOK” in Warsaw and slag from industrial waste incinerator plant from “SARPI” in Dabrowa Gornicza). The aim of the study is to characterize mineralogical and chemical composition of slags including the stability of crystalline and amorphous mineral phases to determine the concentrations of heavy metals and possible negative environmental impact.

Mineralogical characteristic of slags was based on X-ray diffraction. Chemical analysis were performed using ICP-MS/ICP-AES methods. They allowed to follow variability within each type of slag as well as differences between studied slags samples. Characteristic of structures and forms of occurrence of mineral phases was based on the optical microscopy and SEM imaging coupled with EDS analysis.

All slag samples are rich in amorphous phase. Municipal slags are rich in Si, Ca and Al whereas Na and Fe are minor component. In industrial slags higher amounts of Fe, Na and Cl than in municipal slags were detected.

The main mineral phases present in industrial waste slags are quartz, halite and iron oxides, and in smaller quantities calcite, gehlenite and apatite. In vitreous parts of industrial slag there is a large amount of apatite and srebrodolskite. In the industrial slag samples small aggregates (about 1 cm size) rich in calcite, portlandite and periclase or apatite and srebrodolskite can be found. They are dispersed within sample and represent about 10% of the total.

The main components of municipal slags are quartz, gehlenite, calcite and feldspar, and in smaller quantities wollastonite, apatite, meionite and iron oxides. In municipal slags variations in the mineral composition between samples are observed. In addition to quartz and gehlenite which are present in each sample, three groups of associated minerals can be identified. In the first group feldspar, calcite apatite and iron oxides were found. In the second feldspar, calcite, meionite and iron oxides were detected, whereas in the third group meionite, wollastonite, iron oxides or feldspar are present. This diversity may be a consequence of differences in the material supplied to the furnace or in combustion characteristics of a blast furnace.