

## Slag and ash as a final product of municipal waste management system

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The waste management system (WMS) is a modern way for secure disposal of waste produced in every household. Its primary aim is to protect natural environment and human health against harmful effects of waste generation and storage. Its aims are also the reduction of the amount of waste destined for storage and making maximum use of secondary materials from wastes (Sabbas *et al.*, 2003).

In the past wastes were collected and the most of them were landfilled. Increasing amount of produced wastes, limited capacity of landfill site, people concern about the environment condition and, what is also important, economic issues has forced the introduction of methods of waste managing. Waste storage is the worst solution for waste disposal. It is space consuming and do not solve the problem in general, only move it in time. Building and exploitation of landfill site is connected with the need to comply with strict regulations about environmental safety and parameters of waste possible to storage. It is difficult to predict the behaviour of the large amount of waste in a long time period and its possible influence on surrounding areas in terms of ground water and land contamination. Therefore even after closing of landfill site, it must be monitored for many years.

Nowadays wastes are source of valuable secondary materials, organic fraction and energy from combustible fraction which can be used in district heating production or electricity generation.

Building a complex waste management system is a long-term process and requires the cooperation of the government, local authorities and inhabitants of the area covered by it. In Europe, the WMS should be based on legislation in accordance with the laws of the European Community. In Poland, waste management system has been consistently formed since 1998 and some internal parts of it are still under construction.

WMS starts in every house when people are sorting their garbage which are later collected divided into several fractions. Later all of the processes connected with raw wastes processing take place. Collected fractions of wastes are resorted to separate every valuable material like paper, plastic, glass, various types of metals and organic fraction. All of these materials can be used in industry and their value has influence on lowering of the costs of waste managing. Later, residues which could not be used in different way can be landfilled or used as a fuel in incineration power plant. This facility can fulfil several tasks. Using proper technological solution it is possible to separate secondary materials from wastes (before or after incineration). Also usage of energy generated in time of incineration for district heating or electricity production is possible. Incineration plants are final elements of waste management system and their usage allow obtaining significant reduction of wastes volume (up to 70%) and mass (up to 50%).

Incineration plant produces slag and ash as final products of incineration. Raw wastes are incinerated in temperatures around 1000°C in controlled conditions in the furnace which is equipped with an exhaust gas cleaning system. Its usage reduces the amount of toxic components in exhaust gas and enables capturing of fine particles suspended in the flue gas, called fly ash.

The main product of incineration plant is heavy, incombustible fraction of raw wastes called, due to the obtained fraction, slag or bottom ash.

Composition of materials produced in waste incineration power plants varies in broad range depending on many factors specific for waste generation areas such as level of urbanization and industrialization of the area. This causes that for every incineration plant in every country obtained results are unique and cannot be comparable.

In order to characterize the final products of waste management system in Poland slag and ash samples were collected. Material was produced in municipal solid waste incineration power plant in one of the largest city in Poland. Samples were collected in 2012. The aim of this study is mineralogical and chemical characterisation of slag and ash samples with emphasis on their composition as a result of functioning waste management system in Poland.

Municipal slags are grainy materials with high silica and calcium content. They are in form of multi-element assemblages of slag material and residual fraction of wastes which were not changed during incineration processes such as glass and ceramic fragments, pieces of metals and stone fragments.

Ashes from incineration of municipal wastes are fine grained materials with similar chemical composition to slags, are also rich in silica and calcium, but more uniform in terms of fraction and general composition.

In an ideal situation, all the produced waste should be used or reprocessed. Work on the practical application of slags and ashes from the incineration of municipal waste are carried out successfully and probably in the coming years their usage will increase significantly. Slags and ashes can be used in cement and concrete production, glasses and ceramics industry and also as an adsorbent, stabilizing agent or raw material in zeolite production (Lam *et al.*, 2010, Rambaldi *et al.*, 2010, Lin *et al.*, 2003).

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