THE EFFECT OF MSWI BOTTOM ASH TREATMENT ON THE QUALITY OF SECONDARY RAW MATERIALS

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MSWI bottom ash represents the largest solid residue from MSWI (municipal solid waste incineration) and amounts to about 20-25 % of the MSW input into the incinerator. This bottom ash consists generally of about 10 % metals and about 90 % mineral material (including glass). MSWI bottom ash is treated in order to separate the metals for recycling and prepare a mineral material suitable for disposal on landfills or for utilisation as a construction material. Bottom ash treatment plants can apply either only dry processes or they can add water to wash fine particles and soluble components from the bottom ash. Such treatment plants often comprise different arrangements of sieves, crushers, magnet separators, eddy current separators, jigs and inductive sorting systems in order to generate metal and mineral products. The quantity and quality of these products depends on the one hand on the treatment processes used and on the other hand on the bottom ash used. Until now, the quality of products from a particular MSWI bottom ash can only be determined by effortful experiments and subsequent analysis of the products generated thereby. The aim of the present study is, however, to determine the quality of products from MSWI bottom ash treatment based on data about composition and transfer coefficients for the single treatment operations.

MFA (material flow analysis) was used to track the flows in different bottom ash treatment plants. The MFA was conducted on goods level and on elemental level for Ag, Al, As, Au, Ba, Ca, Cd, Cl, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Nb, Ni, P, Pb, S, Sb, Se, Si, Sn, Ta, Ti, Tl, V, W and Zn. Detailed data on the composition of differently sized material fractions present in MSWI bottom ash from Vienna published in a recent study were used as the basis for an MFA. Said previous study also gives necessary information about the material composition of agglomerates from molten mineral materials with enclosed metal pieces and composites consisting of different metals. The transfer coefficients used for the MFA models were retrieved from literature data and the software STAN was used to describe and analyse the systems.

The MFA showed that about 12 % of the metallic Cu present in MSWI bottom ash is transferred to the iron scrap as part of metallic composites like transformers, electric motors, cooking pots with copper bottom, which are magnetic due to the presence of iron. The iron scrap (0-16 mm) also contains 25 % of the total Cd present in bottom ash. This can be explained by batteries rich in Cd that are magnetic and therefore separated from the bulk material by magnetic separators. The chemical composition of the mineral material could also be determined depending on the screen sizes used in bottom ash processing for both, wet and dry processing systems. As in wet processing systems, small particles and easily soluble substances rich in elements like Na, Cl and S are removed, the remaining mineral material is more suitable for utilisation (e.g. in road construction or clinker production). Furthermore, an increased separation of metallic pieces from MSWI bottom ash decreases the total content of certain heavy metals in the mineral products. This is relevant, as some countries have legal limits for the total content of heavy metals in mineral products derived from bottom ash. For example, the removal of stainless steel from bottom ash by inductive sorting systems decreases the total content of Cr and Ni.

The use of detailed data on MSWI bottom ash composition for the establishment of MFA models for different treatment plants was demonstrated. The significant transfer of Cu to the iron scrap is not only a loss of valuable copper, but also decreases the quality of the steel generated during the recycling of the steel scrap recovered from bottom ash. The transfer of Cd from batteries to the steel industry can clearly not be seen as a suitable final sink for this heavy metal. The findings from this study show that source separation of waste electric and electronic equipment and batteries has to be improved even further in order to increase the quality of recycled products and to provide safe final sinks for toxic heavy metals like Cd.