

The composition of the bottom ash from professional and individual heat production systems - the Polish case

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The combustion process of solid fuels, both in the power industry and households generate the a large quantities of ash, which composition depends on the type of material being burned and the combustion technology used. The obtaining ash is a waste, which creates a problem in the storage and disposal. Determination of the physicochemical properties of the bottom ash enables possibility of their economic use as well as monitoring of materials used for combustion.

Nearly half of the Polish households still use solid fuels heating devices. The most popular are boilers for domestic water and rooms heating. Many households use stoves, and in rural areas also steamers. Commonly used fuel is coal and firewood, although combustion in domestic boilers different types of waste is also very frequent.

Physicochemical analyses were performed using a spectrometer with energy dispersive MINIPALA PW 4025/00 PANalytical and XRD.

The study of the elemental composition of a variety of ashes were conducted. Samples were divided into three groups:

- fly ash - a samples from the biomass combustion in the fluidized bed boiler and the biomass co-firing with coal in pulverized coal fired boiler,
- bottom ash - samples from the combustion units in households: boilers for central heating, tiled stove and steamers,
- residues after combustion of biomass in an experimental reactor (technical scale).

On the basis of conducted analyzes it was found that:

- The type of unit in which the combustion process is carried out affects the quality of obtained ash. In boilers used in the power industry high combustion temperatures are achieved, enabling optimum fuel combustion. In domestic households boilers with the function of airflow allows for a minimal amount of unburned fuel.
- The type of burned fuel affects chemical composition of ash. This was confirmed by the result obtained for boilers used in three different households, using a different material for combustion (wastes: wood and paper (boiler A: wood, paper, cardboard; boiler B: walnuts shale; boiler C: wood, coal and paper).
- The ash obtained from the combustion of biomass is characterized by a high content of calcium and potassium.
- The largest amount of iron was determined in the ash after co-firing of coal and biomass, but much less sulfur was detected, relatively to the other ashes.
- In each of the samples presence of manganese, titanium, silicon and phosphorous in varying amounts was revealed.
- The ash containing significant amounts of phosphorus, calcium and potassium, that is those produced from the combustion of biomass are particularly interesting from the point of view of energy production and recovery of the raw materials.
- An interesting issue is also a result of the distribution of elements in the post-processing molten slag fractions with respect to the flue dust, illustrated in the results obtained for biomass combustion in the experimental reactor.
- XRF method can be used as an effective way to study qualitative composition of ash samples. The obtained spectra are simple and characterized by low backgrounds and well resolved signals.

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