# Differential Behavior of Combustion and Gasification Fly Ash from Puertollano Power Plants (Spain) for Zeolite Synthesis and Silica Extraction

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ABSTRACT

Coal gasification and combustion fly ashes, obtained from two power plants fed with the carboniferous bituminous coal from Puertollano (Spain), are characterized and used as raw materials for zeolite synthesis and silica extraction at laboratory scale. The Puertollano fly ashes were selected because the high silica contents (55-60%) with respect to the Spanish coal fly ashes.

The results from synthesis and extraction yields obtained for the two types of fly ash are compared. High zeolite synthesis yields are obtained from both fly ashes by using conventional alkaline activation. However, the silica extraction yields are very different.

Thus, in the gasification fly ash the occurrence of Al only in the highly soluble glass matrix, limits drastically the silica extraction with respect to the very high extraction yields obtained for the combustion fly ash. In the combustion fly ash the occurrence of mullite (a highly insoluble Al-bearing phase) accounts for the trapping of Al and prevents the fast dissolution of Al when Si is extracted. If both Al and Si are extracted simultaneously, the extraction solution is saturated and the silica extraction is limited by the precipitation of zeolitic material in the extraction residue.

The results of the zeolite synthesis from the Si-bearing extracts from both fly ashes demonstrate that high purity Al ~~A~~ zeolites can be produced, but with a different synthesis yields. The results on the synthesis of zeolites by direct conversion allowed obtaining zeolitic material with a relatively high content (close to 50 %) of NaP1 zeolite for both fly ashes, with a cation exchange capacity (CEC) ranging from 1.6 to 2.3 meq/g. However, this zeolitic material contains residual fly ash particles that may contain significant amounts of metals that might limit the use of these zeolites as a cation exchanger for some environmental applications.

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