

# Determination of the Available Si and Al from Coal Fly Ashes under Alkaline Conditions with the Aim of Synthesising Zeolite Products

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## ABSTRACT

Pure zeolites can be synthesised from silica extracts obtained from fly ash by alkaline leaching. The extraction potential of various types of European fly ashes was investigated under realistic process conditions (2 M NaOH; 90°C; L/S=3; 4-10h.) and found to vary between 20 and 140 g of SiO<sub>2</sub> per kg ash, using a single step process. However, during extraction zeolites are formed within the ash and this limits the amount of SiO<sub>2</sub> liberated, and thus the yield of pure zeolites to be produced from the extracts. The Al content in the extracts is almost negligible, showing that the liberated Al in the process is all used for crystallising zeolites and consequently the consumption of Si. As zeolites form on the ash particles, this also makes the dissolution reactions to cease before completion.

In order to avoid zeolite formation at an early stage and to determine the availability of SiO<sub>2</sub>, experiments were done at 50°C, L/S=20 and reaction times up to 72h. In this way extraction increased up 250 g/kg but still were zeolites found in the residues, showing that the maximum available amount of SiO<sub>2</sub> could not be released yet. Although the amount of available SiO<sub>2</sub> is related to fly ash characteristics such as chemical and mineralogical composition and the composition of the glass phases, the formation of zeolites seems mainly be influenced by the presence of Al in the liquid phase. Therefore, complexants for Al that are normally used in the Al anodising industry (sorbitol, gluconic acid, etc.) were added to the solutions with the aim of suppressing the crystallisation of zeolites. In this way, the amount of liberated Si could be increased a bit further, and it is expected that this approach will show the availability of Si and Al as a function ash properties.