

Improvement of Environmental Quality of Coal Fly Ash by Applying Forced Leaching

Henk W. Nugteren¹, Maria Janssen-Jurkovicová² and Brian Scarlett¹

¹Delft University of Technology, Delft Department of Chemical Technology, Julianalaan 136, 2628BL Delft, The Netherlands

²KEMA, KEMA Sustainable, Utrechtseweg 310, 6812 AR Arnhem, The Netherlands

KEYWORDS: Fly ash, leaching, extraction, heavy metals

ABSTRACT

A coal fly ash containing leachable trace elements in amounts higher than allowed by Dutch law for its free application as granular building material, was subjected to forced leaching using water, citrate-, oxalate-, EDTA- and carbonate-solutions. With water only, the free lime and substantial amounts of Mo (30%), Se (20-40%) and SO_4^{2-} (40-50%) are removed. Using the extraction agents, these percentages increase to 60-90% and in addition 15-20% Cr, V and Sb are removed.

The environmental quality of the washed fly ash was checked with the Dutch standard leaching test (NEN7343). The leachability of the most critical elements Mo, Se and S decreased by a factor of 2-4 after washing with water and when using extracting agents by a factor between 2 and 18 (including Cr), depending on the concentrations used, the liquid/solid ratio and the reaction time. This was a substantial achievement since for all elements individual leaching values complying with Dutch standards were met, however up to now none of the conditions have been suitable to produce a residue compliant with the law for all elements simultaneously.

Since the extraction agents form stable precipitates and complexes with Ca, it is suggested to pretreat the ash with water. This step removes free lime prior to applying extraction agents, which will then be used more efficiently in the subsequent step. It is expected that in this way an environmentally sound residue can be produced at a relatively low consumption of chemicals.