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CLEAN UP OF ACIDIC LEACHATES USING FLY ASH BARRIERS: LABORATORY COLUMN STUDIES

K. KOMNITSAS[1], G. BARTZAS[2] and I. PASPALIARIS[2]

[1] Technical University of Crete, Department of Mineral Resources Engineering, 73 100 Chania, Hellas, [2] National Technical University of Athens, School of Mining and Metallurgical Engineering, Laboratory of Metallurgy, Zografos Campus 157 80, Athens, Greece
E-mail: komni@mred.tuc.gr

EXTENDED ABSTRACT

In situ permeable reactive barriers installed in the path of contaminated plume are emerging alternative technologies to traditional pump and treat systems for remediating groundwater and treating Acid Mine Drainage (AMD).

Laboratory column tests were conducted to examine the efficiency of lignite fly ash barriers to remove dissolved constituents, such as Fe, Zn, Mn, Ni, Cd, Co, Al and Cu, from AMD. Reactive mixtures consisted of lignite-based fly ash and silica sand. Two plexiglas columns (40 cm long each) were used in series to assess the potential of lignite fly ash as a reactive material; a synthetic solution spiked with high concentrations of contaminants was circulated in the columns from bottom to top in order to better simulate plume quality and field flow rates. Sampling ports fitted along the length of each column allowed sampling at predetermined time intervals and provided information on clean up progress and reactive materials efficiency.

The geochemical speciation/mass transfer computer code PHREEQC and the MINTEQ database, were used for geochemical modelling.

The experimental results prove the potential of lignite fly ash to treat efficiently acidic leachates generated at mine and coal sites, contaminated with a large number of inorganic contaminants. The removal of most contaminants over a relatively long period was almost complete. The main mechanisms involved in contaminants removal were adsorption at the surface of fly ash, precipitation as a separate phase and co-precipitation. The toxicity of the reactive material at the end of the runs regarding all heavy metals in concern is limited.

Therefore fly ash can be used as reactive material for the construction of PRBs. Careful design and control is required though to optimize their performance and avoid operational difficulties under real field conditions.

Key words: PRBs, leachates clean up, lignite fly ash, column studies, heavy metals