

Fly ash as an alternative to limestone in active acid mine drainage treatment systems

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ABSTRACT

The current acid mine drainage (AMD) treatment system utilizing limestone has several drawbacks. AMD neutralization is achieved; however the pH is restricted to approximately pH 7.5 resulting in only moderate sulfate reduction and no toxic element removal. Additional sulfate reduction is achieved by a biological process at an additional cost. The residual sludge contains a low percentage of solids and has a high solubility and thus requires additional treatment with flocculants for water recovery.

Laboratory and larger scale studies have demonstrated that by mixing fly ash (FA) with AMD, the pH can be raised to 7 or higher, depending on process conditions, allowing maximum removal of toxic elements, iron, aluminum and sulfates simultaneously. AMD of varying composition was able to be treated in this manner by coal ash from various power utilities in South Africa. Solid residues recovered from the process were observed to settle faster than the limestone sludge thus eliminating the need for flocculation. Moreover, these were more dense allowing much higher water recovery. The quality of the remediated water was suitable for reuse and possible release and complied largely with regulatory standards.

A technical comparison and theoretical cost analysis based on the free alkalinity content will be presented. The cost estimate takes into account the volume of neutralizing agent added to AMD, the pH achieved, the degree of sulfate removal, the volume of sludge remaining, the cost of additives (flocculants), and purchase and transportation costs of the neutralizing agents.

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