

The application of zeolites synthesized from solid waste residues recovered from the neutralization of acid mine drainage with fly ash for toxic element removal

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ABSTRACT

Fly ash (FA) derived from coal burning energy utilities in South Africa has proven to work as an effective and cheap neutralizing agent for acid mine drainage (AMD) treatment. The objective of this study was to use the solid residues recovered after neutralization to synthesize high capacity adsorbents, such as zeolites, which may be further used for secondary effluent treatment by toxic element removal. V.Somerset et al successfully synthesized zeolite Y-(Faujasite) from solid residues using a high temperature (600°C) method. In this study a mild synthesis temperature (100°C), which is low energy consuming, was applied to prepare zeolites in a manner more applicable at industrial scale. XRD analysis showed that the crystallography of the product synthesized at 100°C was a combination of zeolite P and mullite.

Zeolitic material synthesized was successfully used to decontaminate municipal liquid waste, acid mine waters and post-neutralization water from the treatment of AMD with FA. The capacity of the zeolite synthesized at low temperature was also compared with that of a commercial faujasite, CBV 400. Despite a low surface area, the removal efficiency of the synthesized material was good and sometimes better than the removal efficiency of the commercial zeolite CBV 400 for the treatment of post-neutralization effluent.

Toxicity characteristic leaching procedure (TCLP) tests indicated that minimum leaching occurred from the above zeolites and were safe for landfill disposal. This is an important finding underlining the value of these zeolite materials for long term entrapment and disposal of toxic elements.

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