Reducing Potential Groundwater Contamination From Coal Fly Ash: Developing a Unique Bentonite/Zeolite Matrix Barrier

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Coal ash is produced from burning coal and has accumulated for years in piles and landfill pits. Coal ash contains toxins like lead, arsenic, lithium, selenium and cadmium (Gopinathan, et al, 2022). Mixing fly ash with water may speed leaching of these toxins into groundwater and surface streams (Parzentny and Rog, 2021). Current cleanup of these coal ash storage sites could cost billions of dollars. Suggested cleanup could include collecting and storage, barrier construction and/or liners - all of which take time and can be very expensive. This research incorporates the capabilities of ionic retention in bentonite and zeolite to potentially serve as a barrier mechanism for coal fly ash storage. Filtrates from each material were analyzed using ICP-OES to establish existing concentrations of selected elements. Once these levels were established, 5 different bentonite/zeolite matrix barriers were used to evaluate the ability of the clay matrices to reduce toxic materials generated from coal fly ash. The bentonite/zeolite matrices all reduced the levels of hazardous materials in the coal fly ash by over 99%. All five matrix variations were highly effective with chromium testing indicating that the Group B matrix was slightly more capable of reducing the target elements. Natural barriers composed of a mixture of bentonite and zeolite have shown exceptional capability in reducing coal fly ash toxins while also providing a considerable savings in barrier cost, both which are positive outcomes in reducing contamination of groundwater near existing ash pits and storage locations.

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