Dissolved-Solid Filtering Efficacy of Varied Landfill Liners

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To prevent the leaching of contaminated water (leachate) into the surrounding environment, current landfills utilize a liner system containing Bentonite powder, a material intended to filter leachate's dissolved solids and release clean water. This research aimed to test different powders' filtration abilities to detect a better alternative to Bentonite. It was hypothesized that if the basic powders Kaolin (KL), Diatomaceous Earth (DE), Activated Charcoal (AC), and Zeolite (ZL) are used to filter concentrated salt solutions against Bentonite (BT), then DE will decrease the concentration of the salt by the largest amount. This was tested through gravitational filtration by placing each clay into holed cups and running them through with NaCl, $MgSO_4$, $CuSO_4$, $ZnSO_4$, and $CaCl_2$. The filtrates were collected, and the concentration decrease from each powder was recorded. From the chloride and sulfate tests, DE displayed the closest concentration decrease to Bentonite (27% to 65%). KL, AC, and ZL showed similar adsorption data for all the chloride and sulfate salts (concentration decreases between 8% to 23%). Similar results were found from the heavy metal salt tests, where DE performed substantially better than BT. Only ZL improved in filtration for the heavy metal salts, although never surpassing BT. One-tailed directional t-tests and ANOVA tests gave sufficient evidence to conclude that DE powder is a better filtering alternative to BT for both common salts (chlorides, sulfates) and heavy metal salts (copper, zinc). Future research will investigate other factors contributing to the finest landfill powder, such as absorption.

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