INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Influence of Ionic Characteristics of Inorganic Salt Solutions a**nd M**echanical Loading on Attenuation and Self-sealing Ability of Compacted Bentonites**

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SHORT ABSTRACT

In the present work an extensive study on the diffusion characteristics of both compacted powdered and granular bentonite under the aggressive salt environment was carried out for the first time. The influence of the sorption potential on the diffusion rates of various salt cations was also studied. Further, the sealing and swelling ability of compacted granular bentonite in the presence of high ionic strength salt solutions and under the overburden stresses induced by the landfill waste was studied for the first time. It was shown in this present study that the design parameters viz., D_e, and R_d were significantly influenced by the type of permeating fluid. In the presence of high ionic strength salt solutions, the diffusion rates were significantly higher through both powder and granular bentonite. Further, the present study reveals for the first time that the sealing ability of the GB was completely lost upon permeation with high salt concentrations and under low overburden stresses. Therefore, the applicability of the granular bentonites in the form of geosynthetic clay liners as a bottom liner facility in a higher saline environment remains a serious concern.

A protective layer consisting of kaolin was proposed in this work for the first time to address the problems associated with the granular bentonite under the extreme saline environment. The proposed barrier system comprising of kaolin-bentonite layer was found to perform satisfactorily even in the presence of high ionic strength salt-leachate in terms of the diffusion rates of the salts. Further, the microstructural and the elemental compositional analysis further revealed that the addition of kaolin allowed the underlying granular bentonite layer to disintegrate into smaller particles and seal the inter-aggregate voids. The study also provides a qualitative assessment of the applicability of the clay-based barrier systems in attenuating various viral pathogens. Therefore, the present work brings out the problems associated with the existing bentonite-based liner materials in MSW landfills and also provides a natural solution based on kaolin which can be adapted in the field to safeguard the environment.