



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

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Thesis Title: A Study on the Effect of Heavy Metals and Leachates on Engineering Behaviour of Bentonite

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SHORT ABSTRACT

A rapid increase in industrialization is leading to the generation of high metal toxicity to the ecosystem. Landfilling has been carried out as the most preferred method of waste disposal around the globe. In the present study, two bentonites of different mineralogical composition were studied for their change in the index properties, swelling, swelling potential, swelling pressure, hydraulic conductivity, consolidation parameters, shear strength properties and sorption characteristics in the presence of different heavy metals of various concentrations and different leachates. Different isotherm models were used to determine the best-fit equilibrium isotherms. Kinetic models were fitted to investigate the kinetics and mechanisms of metal sorption on both the bentonites. FESEM and FTIR studies were conducted to analyze the change in surface morphology and alteration in FTIR pattern in both the bentonites before and after sorption of heavy metals.

The results showed that the liquid limit, free swelling, swelling potential and swelling pressure of the bentonites decreased with an increase in the heavy metal ion concentration and the presence of leachates. Results also indicated that compression index (C_c) and time required for the 90% of consolidation (t_{90}) decreased. In contrast, the coefficient of consolidation (c_v) and hydraulic conductivity (k) increased in the presence of heavy metals and leachates. Both the bentonites showed a reduction in the Unconfined Compression Strength in the presence of heavy metals and leachates, yet, lying within the recommended a minimum value of 200 kPa. The study showed that pH influenced the adsorption of heavy metals for both bentonites. Isotherms' investigation reveals that both the isotherm model fits well with equilibrium data. Kinetic studies followed the Pseudo-second order model. A comparison between the two bentonites showed that bentonite, which has a high liquid limit, swelling capacity, specific surface area (SSA), cation exchange capacity (CEC) and montmorillonite content, showed higher sorption capacity and undergoes a massive change in the liquid limit, free swelling, swelling pressure and hydraulic conductivity due to the presence of the various permeants.