INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Hydro-Chemical Evaluation of Bentonite-Fly ash Mix as Liners in Near Surface Waste Disposal Facility**

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SHORT ABSTRACT

Hazardous industrial wastes are contained in engineered shallow near-surface disposal facilities or landfills. To minimize the migration of waste from landfills and protection ofgeoenvironment and groundwater, low permeable compacted liners are provided, which act as hydraulic and contaminant barriers. In normal practice, bentonite-sand (B-S) mixtures are recommended as liner material. Due to shortage, there is a need to explore the possibility of using alternate waste materials like fly ash (FA) as a substitute for sand (S). To ensure its application in compacted liner, the B-FA mixes should qualify hydro-chemical requirements laid out by different regulatory bodies like Environmental Protection Agency (EPA). The detailed hydro-chemical evaluation includes hydraulic conductivity determination, contaminant retention properties, adequate strength and volumetric shrinkage characteristics. Additionally, when two reactive materials (B and FA) are mixed together, it is important to ensure its compatibility over a period of time. A detailed study is needed to make sure that there are no undesirable interactions between B and FA leading to poor performance of liner. This necessitate long-term interaction studies of B-FA mixes for vital properties such as hydraulic conductivity and contaminant retention. This study investigated in detail the hydraulic conductivity of B-FA mixes under constant volume (swelling completely restricted) and free swelling conditions at time (t) varying from 0 days (immediately after compaction) to four years of interaction. Every measurement was carried out for extended duration of 90 days to ensure steady state condition. Since the

hydraulic conductivity determination of low permeable liner materials is highly time intensive, this study demonstrated the use of geotechnical centrifuge for determining flow properties in short duration of time. A detailed study was performed to evaluate contaminant retention characteristics of B-FA mixes for t varying from 0 days to four years. Additionally, the strength and volumetric shrinkage characteristics of B-FA mixes was determined. The results of B-FA mixes were compared with conventional B-S mixes, wherever applicable. Based on the results, this study demonstrated the utility of B-FA mixes and also identified an optimal mix that ensures maximum utility of FA.