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LOCALLY AVAILABLE SOILS AS LINER MATERIALS FOR DEVELOPING COUNTRIES: A COMPARISON WITH GEOSYNTHETIC CLAY LINER

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Solid waste management has become a major issue for the urban areas of developing countries. Due to rapid increase in urbanization coupled with the rise in community living standards the generation of municipal solid waste is highly accelerated in past few decades. At present most of the landfill practice in developing countries is open dumping without proper measures to mitigate the migration of contaminants to surrounding environment. It is the need of hour to construct engineering landfills with impermeable liners to avoid groundwater and surface water pollution. Most of the engineered landfills in developed countries are equipped with commercially available liner material known as Geosynthetic Clay Liner (GCL). GCLs are popular due to their extremely low hydraulic conductivity which is primarily due to the presence of a thin layer of bentonite. However, due to economic constraints, developing countries cannot afford engineered landfills equipped with such commercially available liners. In contrast, Locally Available Clayey Soils (LACs) are less expensive and can be used as bottom liners under the provision that they meet the recommended criteria for base liner. A detailed comparison between GCL and LAC with respect to both geotechnical and hydraulic performance can therefore provide the basis for using appropriate LACs as landfill liner material.

This study employed locally available soils obtained from Moragahakanda area of Srilanka(hereafter referred to as Soil M). Swell index, plasticity index and Hydraulic conductivity tests were carried out on Soil M and its mixtures with bentonite component of GCL. Soil-bentonite mixtures were prepared by mixing Soil M with 5 % and 10 % bentonite. Experimental Investigations were carried out using de-aerated water and 1M $CaCl_2$ as hydrating liquids. The hydraulic conductivity tests were carried out on non consolidated and pre-consolidated samples to investigate the effect of consolidation on hydraulic conductivity of candidate soils. Data on pure bentonite was used to examine the performance of Soil M and mixture soils compared to GCL. Results showed that the nature of hydrating liquid has an insignificant effect on swell Index and plasticity index of the candidate soils when compared to pure bentonite. Hydraulic conductivity was found to decrease with an increase in bentonite content when permeated with de-aerated water. However, the effect was found insignificant for $CaCl_2$ permeation. An increase in consolidation pressure caused a decrease in hydraulic conductivity irrespective of permeating liquid and bentonite content. At very high consolidation pressure, all the candidate soils were found to exhibit much lower values of hydraulic conductivities than the maximum recommended value for base liners.

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