Hamid Sarabadani

Title

Hydration and Shrinkage of Geosynthetic Clay Liners under Simulated Landfills Conditions

Abstract

Geosynthetic Clay Liners (GCLs) are used as part of composite liner systems in municipal solid waste landfills to prevent the escape of contaminants into the surrounding environment. The performance of the GCL is primarily dependent on the degree of the hydration from the underlying subsoil. The level of the normal stress applied to the GCL by the overlying layers (e.g. Leachate Collection System (LCS), and waste materials) affects the rate of hydration as well as the equilibrium moisture content of the GCL. In order to investigate this phenomenon, the hydration behavior of two GCL products from different subsoil conditions while subjected to various normal stresses (0-8 kPa) was investigated. The normal stress of 2 to 5 kPa, which could be easily provided by a typical LCS, was shown to induce the maximum equilibrium moisture content and an adequately high rate of hydration.

In addition, previous studies have shown that the GCL panels are prone to significant shrinkage (up to 30%) and separation while the geomembrane is exposed to solar radiation. Hence, extensive experimental models were initiated to evaluate the effect of daily thermal cycles on shrinkage of different GCL products subjected to simulated landfill conditions. The manufacturing techniques, the initial degree of saturation and the aspect ratio of the GCL as well as the subsoil grain size distribution were found to considerably affect the maximum shrinkage of GCLs. The derived results of this study highlight the importance of employing cover soil or construction of LCS shortly after the liner installation.

Degree

M.A.Sc. Civil Engineering

Completion Date

2013

Supervisor

Mohammad Tofigh Rayhani