LABORATORY MODELLING OF FRACTURED CLAY FOR HAZARDOUS WASTE STUDIES

C. VIPULANANDAN, O.I. GHAZZALY, M.W. O'NEILL and M. LEUNG

Department of Civil and Environmental Engineering, University of Houston, Houston, TX 77204-4791 (U.S.A.)

Abstract

The integrity and permeability of a clay mass that acts as a waste confining layer will be controlled by local defects such as desiccation cracks, fissures and fractures. In the Gulf Coast region, growth faults associated with natural geological processes and fluid withdrawal accelerate the production of local defects. Laboratory permeability tests conducted on recompacted samples or small undisturbed samples are unlikely to contain representative pattern of cracks and fissures and significantly under-predict the hydraulic conductivity of clay (natural deposits or liners) by several orders of magnitude. Although large-scale *in-situ* permeability tests may provide correct permeability information in accessible soils (near-surface), the time period required to conduct tests makes them impractical and hence it is essential to develop laboratory tests procedures to model closely the field conditions.

Several methods of simulating cracks in the laboratory clay samples were investigated by using double ring-rigid wall permeameters. By inserting syringe needles of various sizes (gage numbers) and lengths defects were introduced into the compacted clay samples (simulating cracks) and the preliminary results indicate that the permeability of clay could be increased in a controlled manner. Using this technique, several tests are underway to investigate the effect of crack length, size and density on the permeability of Kaolinite clay. Relationship between permeability and crack length have been developed and the concept of effective clay thickness and effective permeability is introduced based on crack length. Numerical simulations based on a finite element model are being used to verify the experimental results.

POLYMER CONCRETE IN HAZARDOUS WASTE MANAGEMENT: APPLICATIONS

C. VIPULANANDAN and O.I. GHAZZALY

Department of Civil and Environmental Engineering, University of Houston, Houston, TX 77204-4791 (U.S.A.)

Abstract

There is no universal waste treatment or immobilization process that will handle all the variation of waste produced, which is estimated to be between

27 to 60 million tons per year nation wide and 7 million in the gulf coast region. The key preventive measures for minimizing the hazardous waste problem are waste control, reduction, reuse, stabilization, solidification and encapsulation. In this regard developing and/or modifying additives for solidification and materials for encapsulation to meet the current demands in hazardous waste disposal has drawn tremendous interest. Polymer concrete (PC) with its rapid-setting, high-strength, low permeability and high corrosive resistance appears to be a potential material for use in hazardous waste management and recent applications have shown promising results. PC is a composite material formed by combining mineral aggregates such as sand and gravel with a polymerizing monomer. Compared to polymers, PC systems will be cost effective, since only 20 to 25% (by volume) of polymer is used in the PC composite.

The objectives of this study are to select and characterize PC systems in solidification and encapsulation processes by bench-scale process development. Several polymers will be selected but special consideration will be given to polybutadiene, polyvinyl chloride and polyester. Optimum PC systems based on low permeability, high mechanical strength and high corrosive resistance will be developed. Two hazardous waste materials will be selected for the preliminary study with one inorganic waste and the other organic waste that are not easily treatable by other methods. The selected PC systems will be used for solidification and/or encapsulation of the inorganic and organic wastes. The treated waste will be investigated for leachate and mechanical properties.

LIQUID DIFFUSION COEFFICIENTS IN SHALE

MARVIN D. McKINLEY and I. ATLY JEFCOAT

Department of Chemical Engineering, University of Alabama, College of Engineering, Tuscaloosa, AL 35487-6373 (U.S.A.)

Abstract

The safety and acceptability of deep well injection as a means of disposal of chemical hazardous wastes relies upon containment of the waste for a long time. Containment for 10,000 years is the current criterion for safety. Many of the strata into which chemical wastes are injected in the U.S. are bounded by shale, which serves as a containment barrier to transport of the injected waste. Thus, the effectiveness of containment depends upon transport of the waste in the shale. Modeling of the penetration of liquids into the shale requires sorption and diffusion data. While the diffusion coefficients of liquids in shale are low, no experimental values are available. The purpose of this research is to experimentally determine diffusion coefficients of liquids in shales typical