World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:8, No:05, 2014

Modeling the Performance of Natural Sand-Bentonite Barriers after Infiltration with Polar and Non-Polar Hydrocarbon Leachates

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Abstract : The complexity of the sand-bentonite liner barrier system calls for an adequate model that reflects the conditions depending on the barrier materials and the characteristics of the permeates which lead to hydraulic conductivity changes when liners infiltrated with polar, no-polar, miscible and immiscible liquids. This paper is dedicated to developing a model for evaluating the hydraulic conductivity in the form of a simple indicator for the compatibility of the liner versus leachate. Based on two liner compositions (95% sand: 5% bentonite; and 90% sand: 10% bentonite), two pressures (40 kPa and 100 kPa), and three leachates: water, ethanol and biofuel. Two characteristics of the leacahtes were used: viscosity of permeate and its octanol-water partitioning coefficient (Kow). Three characteristics of the liners mixtures were evaluated which had impact on the hydraulic conductivity of the liner system: the initial content of bentonite (%), the free swelling index, and the shrinkage limit of the initial liner's mixture. Engineers can use this modest tool to predict a potential liner failure in sand-bentonite barriers.

Keywords : liner performance, sand-bentonite barriers, viscosity, free swelling index, shrinkage limit, octanol-water partitioning coefficient, hydraulic conductivity, theoretical modeling
Conference Title : ICCBE 2014 : International Conference on Civil and Building Engineering
Conference Location : Montreal, Canada
Conference Dates : May 12-13, 2014