World Academy of Science, Engineering and Technology
International Journal of Geotechnical and Geological Engineering
Vol:11, No:02, 2017

Activated Carbon Content Influence in Mineral Barrier Performance

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Abstract : Soil and aquifer pollution, caused by hydrocarbon liquid spilling, is induced by misguided operational practices and inefficient safety guidelines. According to the Environmental Brazilian Institute (IBAMA), during 2013 alone, over 472.13 m3 of diesel oil leaked into the environment nationwide for those reported cases only. Regarding the aforementioned information, there's an indisputable need to adopt appropriate environmental safeguards specially in those areas intended for the production, treatment, transportation and storage of hydrocarbon fluids. According to Brazilian norm, ABNT-NBR 7505-1:2000, compacted soil or mineral barriers used in structural contingency levees, such as storage tanks, are required to present a maximum water permeability coefficient, k, of 1x10-6 cm/s. However, as discussed by several authors, water can not be adopted as the reference fluid to determine the site's containment performance against organic fluids. Mainly, due to the great discrepancy observed in polarity values (dielectric constant) between water and most organic fluids. Previous studies, within this same research group, proposed an optimal range of values for the soil's index properties for mineral barrier composition focused on organic fluid containment. Unfortunately, in some circumstances, it is not possible to encounter a type of soil with the required geotechnical characteristics near the containment site, increasing prevention and construction costs, as well as environmental risks. For these specific cases, the use of an organic product or material as an additive to enhance mineral-barrier containment performance may be an attractive geotechnical solution. This paper evaluates the effect of activated carbon (AC) content additions into a clayey soil towards hydrocarbon fluid permeability. Variables such as compaction energy, carbon texture and addition content (0%, 10% and 20%) were analyzed through laboratory falling-head permeability tests using distilled water and commercial diesel as percolating fluids. The obtained results showed that the AC with smaller particle-size reduced k values significantly against diesel, indicating a direct relationship between particle-size reduction (surface area increase) of the organic product and organic fluid containment.

Keywords : activated carbon, clayey soils, permeability, surface area
Conference Title : ICSMGE 2017 : International Conference on Soil Mechanics and Geotechnical Engineering
Conference Location : Paris, France
Conference Dates : February 23-24, 2017