

GEOTECHNICAL PROPERTIES OF OIL CONTAMINATED SOIL

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Abstract

This research investigated the effect of oil contamination on grading modulus, Atterberg limits, compaction, and hydraulic conductivity of bentonite-kaolinite-sand mixtures. An area that lacked experimental data was chosen for the research. Data on oil contaminated soil containing montmorillonite were scarce; hence, bentonite-kaolinite-sand mixtures at oil contents of 0.0, 1.8, 3.5, 5.3 and 7.1% by dry mass of the soil were used for the study.

The first aspect of the study was the use of grading modulus to confirm reduction of fine aggregate in the contaminated soils. Atterberg limits tests were performed to determine the liquid and plastic limits of uncontaminated and contaminated soils. Proctor compaction tests were performed to determine the compaction characteristics of the oil contaminated soils. Hydraulic conductivity tests were performed using a Rowe cell. Aggregate size distribution analysis of the oil contaminated soil mixtures showed that the aggregate size distribution curves shifted from finer to coarser as the oil content increased, indicating that oil contamination caused reduction of fine aggregate in the soil while forming soil clods. The Atterberg limits tests showed that the liquid limit and plastic limit increased as oil contamination increased in the soil mixtures. The plasticity index of the soils also increased as oil contamination increased. It was deduced from the research that soils 1 and 2 had plasticity index below 65%, those of soils 3, 4 and 5 were above 65%. However, soil 3 had plasticity index close to 65. The results of the compaction tests with respect to maximum dry density and optimum water content showed that oil contamination resulted in decreased maximum dry density and optimum water content in the five soils. The hydraulic conductivity of soil mixtures decreased as oil contamination increased. Generally, soils 3, 4 and 5 had hydraulic conductivities that were close to 1×10^{-9} m/s. Soil 3 had plasticity index close to 65% and hydraulic conductivity less than 1×10^{-9} m/s, hence, it is suitable as soil liner for landfill. However, soils with plasticity index above 65% are difficult to handle.

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