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Effect of PH Changes on the Geotechnical Properties of Clay Liners in Landfill

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ABSTRACT:
Nowadays the proper sanitary disposal of waste is considered as one of the main options in waste management. The chemicals produced from landfills' leachate affects the structure and characteristics of clay layers, so based on the acidity/basicity state of leachate, the study of the geotechnical properties of clay layers under the influence of these materials is very important. Therefore, in this research, the effect of PH variation on the geotechnical parameters of the soil was investigated by conducting a series of Atterberg limits, permeability and consolidation experiments on kaolinite clay and kaolinite mixture with different percentages of bentonite. In these experiments, acetic acid and sodium hydroxide were used as chemical agents representing leachate. Permeability parameters were measured via falling head method. The results of experiments show that the presence of acid and base in the kaolinite clay and the kaolinite mixture with different percentages of bentonite increases the liquid limit, plastic limit and permeability of the soil, as well as increasing the level of settling and accelerating the consolidating process. Addition of 10% bentonite also enhances the liquid limit from 36 to 41 (13%), and the addition of further 10% bentonite enhances the liquid limit from 36 to 46 (27%) at pH=7. Soil settling increases 6% when exposed to acetic acid and 17% in light of exposure to sodium hydroxide in kaolinite Permeability index is enhanced 14% with the addition of acid and 25% with the addition of base in kaolinite. increasing of 10% in bentonite to the same sample of kaolinite soil reduces the permeability index from 21% and an addition of further 10% of bentonite, decreases the original permeability index from 1.42×10^{-7} to 0.61×10^{-7} at PH=7.

Key words: Geotechnical parameters, Leachate, Atterberg limits, Permeability, Consolidation.

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1- Introduction

Leachate is a brown and smelly substance that leaks out of the waste material and includes soluble and floated materials. Most landfill sites are made through decomposition of organic and liquid matters, which may be related to external sources such as drainage of surface waters or rain and else, that is due to the underground resources involved. Leachates have a wide range of pH variations and also could have high concentrations of several contaminants simultaneously, which are hazardous even in low amounts and affect the geotechnical structure of the soil [1]. One of the most important contamination factors in the landfill site is the amount of leachate release, pH variations involved and the gas produced by the decomposition of organic waste [2]. Among soil, the presence of Special Surface Area (SSA), very low permeability and Cation Exchange Capacity (CEC) of clays altogether have caused these soils to be widely used in environmental geotechnical researches. Also, in the geo-environmental engineering, clay soils are considered as the best protective and absorbent layers of environmental pollutants [3].

The sanitary disposal of waste varies based on geographical location, groundwater level and the amount of available soil to cover the waste. In designing process of hygiene, engineered landfill, the separation of the contaminated environment from the leachate is carried out from the outside by the layers of seals. Usually the

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