UNIVERSITI TEKNOLOGI MARA

STUDY OF NANO KOALINITE AS ADDITIVES IN KAOLINITE CLAY TO DEVELOP NEW CLAY LINER DESIGN

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AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

Leachate virtually is one of the problems in landfill system. The landfill liner with different types has widely been used in modern landfill to overcome the problems. In this study, improvement was made by studies further properties of kaolinite at nano-scale of 1nm to 100nm for soil liner application. In this study the new design of nano-kaolinite is compared with current practice soil liner material to compare the effectiveness of nano-kaolinite properties. Various percentages of bentonite and sodium bentonite (2.0%, 5.0% 7.5% and 10.0%) are tested to evaluate the compaction parameters to choose the best percentage of both admixtures. This result will reflect for this admixture according to their properties pH value, shrinkage limit, Atterberg limits and compaction parameter. Based on the determination of the compaction test, we can determine the hydraulic conductivity of the kaolinite clay mixtures. The best and desired compaction parameter is the ones that can be compacted with little amount of water and gives the best compacted result. From this study, it can be concluded that the addition of 3% nano-kaolinite to the kaolinite gives the best compaction result which is 1.39 Mg/m3 for maximum dry density and 27.34% for optimum moisture content. It is because of when dry density is increased, it reduces the air voids, thereby reducing permeability. Furthermore, based on the Atterberg limit test, all of the samples are suitable to be used as a compacted kaolinite liner. Linear shrinkage result for K + 3% Nano was decreased the result of kaolinite itself and the lower shrinkage limit 7.17% compare to kaolinite, bentonite and sodium bentonite and is suitable to be used for a liner purpose. Ph value for the Kaolinite itself is 5.66 (Acidic) and also the other 2 samples which are K +3.0%Nano, K+5.0%B and K+2.5%SB resulting in the range of 5.66 to 6.37. This means that, the

present of the additives did not assist the kaolinite to reach the neutral value of pH as expected for soil liner but the value is closer to the neutral value. From the results, the addition of finer particles such as nano-kaolinite, even at low amount, could improve the properties of soils. In addition this compaction parameter is predicted by using hydraulic conductivity compaction plane which gives k value of 2.55×10^{-9} m/sec for 3.0% of nano-kaolinite compared with k value of blank kaolinite gives $4.31x\ 10^{-9}$ m/sec. Therefore, this can be conclude that by using nano-kaolinite as additives will develop new liner design and reduce groundwater contamination by leachate into ground and gives great benefits to the environment and also human health.

Keywords: soil liner, landfill, kaolinite, nano-kaolinite, bentonite, sodium bentonite, compaction

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