Effect of lime on permeability and microstructure of soil

[1]Baba Musta, [1]Khairul Anuar Kassim & [2]Mohd. Razman Salim

[1]Department of Geotechnic, Faculty of Civil Engineering
UTM 81310 Skudai, Johor, Malaysia

[2]Department of Environment, Faculty of Civil Engineering
UTM 81310 Skudai, Johor, Malaysia

Unstabilised and stabilised clayey sand soil with 6% of lime were cured in 190 mm and 100 mm diameter of cylindrical plexy-glass mould for 4 weeks to study the effect of lime on permeability and microstructure of the soil. The permeability of soils were measured for every 1 pore volume (PV)

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 28, No. 3, May-June 2002

solution by falling the head method during the leaching test. The leaching test was conducted until 7 PV solutions. Scanning Electron Microscopic (SEM) was used to study the microstructures of both soils before and after leaching tests. The initial permeability of stabilized soil is typically lower compared to the unstabilised soil after curing for 4 weeks. The permeability of unstabilised soil samples was 7.02×10^{-9} m/s and the stabilised soil was 2.40×10^{-9} m/s. The unstabilised samples show the immediate decrease of permeability to 1.85×10^{-9} m/s with leaching 2 PV leaching solutions, whereas the stabilized samples show the immediate decrease of permeability to 1.86×10^{-10} m/s after 1 PV leaching solution. Further increase in PV values almost maintained the permeability of stabilized and unstabilised soils with average values of 1.42×10^{-10} m/s and 2.33×10^{-9} m/s respectively. The phenomenon of decrease of permeability is due to the clogging of fine particles in pore space and formation of cementitious minerals. The scanning electron micrographs showed the structure of layered kaolinite, angular shape of quartz and high pore space in the unstabilised soil. After leaching at 7 PV solutions, the unstabilised soil at the top layer indicated packed microstructure and good reorientation of clay particles. Whereas, the structures at the bottom layer showed a more packed structure, flocculated and with low pore space. The scanning electron micrographs showed the formation of cementitious mineral in stabilized soil. After leaching with 7 PV solutions, the dissolution of cementitious minerals occurred and formed new channel. However, the dense cementitious minerals at the bottom layer were flocculated, link with one another and clogged up the fine particles in pore spaces. The test result indicates that addition of lime could modify the microstructure and reduce the permeability of the soil.