Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

AGE003-05 会場:202 時間:5 月 27 日 15:30-15:45

Gas Transport Parameters for Landfill Cover Soil: Dry bulk density based models for gas diffusivity and air permeability

Gas Transport Parameters for Landfill Cover Soil: Dry bulk density based models for gas diffusivity and air permeability

Praneeth Wickramarachchi[1*], Ken Kawamoto[1], Shoichiro Hamamoto[1], Masanao Nagamori[2], Per Moldrup[3], Toshiko Komatsu[1]
Praneeth Wickramarachchi[1*], Ken Kawamoto[1], Shoichiro Hamamoto[1], Masanao Nagamori[2], Per Moldrup[3], Toshiko Komatsu[1]

[1]Saitama University, Japan, [2]Center for Environ. Science in Saitama, [3]Aalborg University, Denmark
[1]Saitama University, Japan, [2]Center for Environ. Science in Saitama, [3]Aalborg University, Denmark

Mitigation and emission of greenhouse gases such as carbon dioxide, methane as well as other environmental impact gases from terrestrial environments to the atmosphere gives increasing concerns for climatic, human and ecosystem health. Landfill sites, have been one of the largest sources of anthropogenic CH{sub}4{sub} emission over the last few decades. Gas exchange through compacted earthen final covers at landfill sites plays a vital role on emission of greenhouse gases, fate and transport of toxic landfill gases. Numerous studies have been dome for the hydraulic performance of landfill final cover soil but studies on gas transport parameters and their dependence have adequately not addressed.

The gas exchange through the final cover soils is controlled basically by advective and diffusive gas transport. Air permeability (k{sub}a{sub}) governs the advective gas transport while the soil-gas diffusion coefficient (D{sub}p{sub}) governs diffusive gas transport. In this study, the effects of compaction level (different dry bulk density) size fractions (finer and coarser) on k{sub}a{sub} and D{sub}p{sub} for landfill final cover soil were investigated. The disturbed soil samples were taken from landfill final covers at Saitama prefecture in Japan. Compaction tests were performed for the soil samples with two different size fractions (< 35.0 mm and < 2.0 mm). In the compaction tests at field water content , the soil samples were repacked into soil cores (i.d. 15-cm, height 12-cm) at two different compaction levels (2700 kN/m{sup}2{sup} and 600 kN/m{sup}2{sup}) correspondent to the modified and standard proctor compaction tests. Having completed the compaction tests, two 100-cm{sup}3{sup} intact core samples (i.d. 5.1 cm, height 4.1 cm) were taken each mold which 2 mm fraction soil were compacted at 9.0 and 10.0% moisture content. After the compaction tests, k{sub}a{sub} and D{sub}p{sub} were measured and then samples were saturated and subsequently drained at different soil-water matric potential of 1.5, 2.0, 3.0, 4.1, and with air-dried (pF 6.0) and oven-dried (pF 6.9) conditions. Further hand compaction was done at relatively low dry bulk densities (i.e., 1.40, 1.55 and 1.70 g cm{sup}-3{sup}) at different water contents ranging from 0.0 to 17.5 %.

Based on the normalized relationships between measured gas transport parameters [D{sub}p{sub}/D{sub}f{sub}, ratio of measured D{sub}p{sub} to D{sub}p{sub} at total porosity (f), and k{sub}a{sub}/k{sub}a,pF4.1{sub}, ratio of measured k{sub}a{sub} to k{sub}a{sub} at 1235 kPa suction (= pF 4.1)] and air-saturation, predictive D{sub}p{sub} and k{sub}a{sub} models in an exponential form with a single parameter (M for D{sub}p{sub} model and P for k{sub}a{sub} model) were developed. The model parameters, M and P, were correlated linearly to dry bulk density values, and the effects of compaction on D{sub}p{sub} and k{sub}a{sub} well-expressed graphically for both coarser and finer fractions.

キーワード: Gas transport, Dry bulk density, Landfill final cover
Keywords: Gas transport, Dry bulk density, Landfill final cover