Observation of Pore Structure for Differently Compacted Landfill Final Cover Soils Using Microfocus X-ray CT

Arjun BANIYA1, Takuya KOIKE1, Kai WATANABE2, Shoichiro HAMAMOTO3, Ken KAWAMOTO1 (1. Graduate School of Science and Engineering, Saitama University, Japan, 2. Department of Civil and Environmental Engineering, Saitama University, Japan, 3. Graduate School of Agricultural and life Sciences, University of Tokyo, Japan)

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The final cover soil on a solid waste landfill consists of many layers of materials and is highly compacted. It is used to prevent rain/surface water infiltration into the waste layer. On the other hand, the landfill site has a significant emission source of greenhouse gases. Gas and mass transport in soils occurs through the soil pore network, which is highly affected by soil physical properties including compaction, particle size, moisture content and total porosity. However, there are a limited number of studies on visualization and quantification of soil pore network for highly compacted soil like final cover soil. The objectives of this study were setting of microfocus X-ray Computed tomography (CT) for scanning landfill final cover soils in conjunction with 3-D image analysis techniques and analyzing the soil pore structure parameters. In this study, soil samples were collected from landfill site in Saitama prefecture, Japan. Soil pore structure was analyzed using micro focus X-ray CT (Shimadzu inspeXio SMX-90CT, Shimadzu Corporation) for air dried final cover soil samples of particle size (d≤2mm) with different dry densities 1.4, 1.55 and 1.65 gcm⁻³ by a hand compaction. The tested soil texture was silty sand. The scanned images were taken by the micro focus X-ray CT. Then, by the use of software VGStudio MAX, they were reconstructed in 3-D images. Finally, using software of EXFact analysis they were analyzed to obtain pore structure parameters such as pore size distribution, coordination number, specific area and
pore-network tortuosity. For determining suitable scanned images for soil pore structure and network, several scanning conditions for the microfocus X-ray CT have been tested i.e. different combinations of voxel size (10, 30 and 50 μm), scan number, view number, field of view (FOV), region of interest (ROI), and percent of interior pore for pore structure analysis. Based on the results from the tested conditions, we will propose a suitable condition on the microfocus X-ray CT scanning for macropore network (typically, effective pore diameter > 100 μm) in differently compacted final cover soils.