Unsaturated Hydraulic Conductivity Estimation from Multi-step Centrifuge Outflow

*Thanh Long Bui[1], Yasushi Mori[1]

1. Graduate School of Environmental and Life Science, Okayama University

In the age of blooming technologies, direct and indirect laboratory methods, which identified soil function, are developed to shorten experiment time. In developing countries of Asia area, research on soil physic is sometimes limited because it is not easy to bring samples from those countries. In addition, it is impossible to identify soil function from the soil sample without original structure. Therefore if we can measure soil hydraulic conductivity or water holding capacity with small volume of samples, it is very beneficial for the region where soil data is limited. In this study, centrifuge multi-step outflow method was examined to estimate drainage process, i.e., unsaturated hydraulic properties.

The experiment was conducted using 2-mL centrifuge tube with two pin-holes at the top and bottom of the tube. After saturated from the bottom, multi-step pressurized outflow was performed on four kinds of soil samples including standard soil, granite decomposed soil, rice paddy field soil and volcanic ash soil. Transient outflow volume was measured using small centrifuge machine within 5 and 15 minutes at room temperature (25oC). The centrifuge pressure step was 1000, 2000, 3000, 4000, and 5000rpm, which was approximately 90, 360, 810, 1400, and 2250cmH2O respectively. Based on the outflow volume and accumulated time as input data for inverse solution model (HYDRUS 1D v4.6), hydraulic conductivity was optimized.

We found out that the optimization was successful with clayey soils and volcanic ash soils, but not with granite decomposed soil and standard sandy soils. The more sand particles it contained, the less convergence for hydraulic conductivity optimization we had obtained.

Keywords: Unsaturated Hydraulic Conductivity, Multi-step outflow, Centrifuge

