Soil-Water Characteristic Curves of Clays

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ABSTRACT

The drying suction – water content soil-water characteristic curves (SWCCs) of three clays (MX80 bentonite, yellow bentonite, and Speswhite kaolin) were experimentally determined using axis-translation, vapour equilibrium, and osmotic techniques. The shrinkage paths of the clays were established from Clod tests. The suction – water content SWCCs in conjunction with the Clod test results enabled establishing the suction – degree of saturation SWCCs and further determination of the air-entry values (AEVs) of the clays. Chemical analyses of the polyethylene glycol (PEG) solutions in the osmotic tests revealed an imbalance of the osmotic suctions between the expelled and the retained salts on either side of semi-permeable membranes. A decrease in the water content due to an applied suction for clays with significant osmotic efficiencies was explained by two mechanisms. In mechanism 1, the water content decrease prior to the air entry is controlled by the interparticle repulsive pressure, and in mechanism 2, a decrease in the degree of saturation following the air entry is primarily due to the matric suction. The agreements between the AEVs of the clays determined based on the osmotic suctions corresponding to various applied suctions and that determined from the suction – degree of saturation SWCCs were found to be very good.

KEYWORDS: soil-water characteristic curve (SWCC); unsaturated soils; volume measurement; shrinkage; Clod test; clays

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