

Temperature Dependency on Solute Transport Parameters in Porous Media at Saturated Condition

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Widespread use of ground source heat pump systems may disturb thermal condition of soils, and potentially causes changes in subsurface mass transport. Therefore, understanding temperature dependency of the solute transport characteristics is essential to accurately assess environmental risks due to perturbation of subsurface temperature. In this study, one-dimensional solute transport experiments were conducted in repacked columns under temperature control (10 °C to 40 °C) to investigate effects of temperature on solute transport parameters. Toyoura sand and glass beads were used in the experiments. In the transport experiments, 0.01M KCl solution was injected to the core sample with 5-cm diameter and 5-cm height from the bottom end. The concentrations of the electrolyte at the effluent were measured using electrical conductivity, and used for calculating solute dispersion coefficient. The solute diffusion experiments were also performed under different temperature conditions to obtain temperature effect of solute diffusion coefficient. The results showed hydraulic conductivity and solute diffusion coefficient for both materials increased with increasing temperature due to lower viscosity of water at higher temperature. Toyoura sand showed that solute dispersion coefficient at 25 °C was highest followed by 40 °C, and 10 °C, indicating effects of temperature on solute diffusivity and viscosity of water affected solute dispersion characteristics. For glass beads with larger size fraction, temperature dependency on solute dispersion coefficient was insignificant.

Keywords: solute dispersion coefficient, solute diffusion coefficient, hydraulic conductivity, thermal dependency