Measurements of gas phase convection and dispersion parameters in soil

Shoichiro Hamamoto[1]; Ken Kawamoto[2]

[1] none; [2] Science and Engineering, Saitama Univ.

There are many sites contaminated by volatile organic chemicals (VOCs), such as trichloroethylene and hydrocarbon fuels. Once a VOCs enter the subsurface soils, they vaporize easily and move as a component of the gaseous phase as well as a component of the aqueous phase.

The transport of contaminants in the gas phase occurs by advective, diffusive, and dispersive fluxes.

The transport of gaseous chemicals in soils is mainly caused by gas diffusion, advection and dispersion. In many fluid flows and transport models, however, the gas phase pressures are assumed to be atmospheric, and diffusion is the only mechanism by which chemicals in the gaseous phase migrate. To date, the effect of gas advection and dispersion on gas transport phenomena in soils is not fully understood.

In this study, the objective is to investigate gas advection and dispersion phenomena with differently textured soils based on gas transport column experiments. Sandy soils with different average particle size and aggregate soils (Kuroboku soil) were used as soil samples. The soil sample was repacked into the three different soil columns (i.d. 5 cm length 30 cm, i.d. 5 cm length 60 cm, i.d. 14 cm length 100 cm) with given bulk density. The soil gas in repacked soil column was filled fully with nitrogen gas initially, and then the air was injected into the column. The oxygen (21%) in the air was used as a tracer gas. The air pressure fluctuation and the oxygen concentration in soil column and oxygen gas flux from soil column were measured. In addition, the gas transport parameters (i.e. gas diffusivity, air permeability and gas dispersion coefficient) for each soil were calculated from gas transport experiments. The effects of soil physical properties and scale on gas transport parameters were also investigated.

Author:
Hamamoto Shoichiro,Kawamoto Ken,Komatsu Toshiko