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Analysis of Vapor-Phase Diffusion of Benzene from Contaminated Soil

Authors : Asma A. Parlin, K. Nakamura, N. Watanabe, T. Komai

Abstract : Understanding the effective diffusion of benzene vapor in the soil-atmosphere interface is important as an intrusion of benzene into the atmosphere from the soil is largely driven by diffusion. To analyze the vertical one dimensional effective diffusion of benzene vapor in porous medium with high water content, diffusion experiments were conducted in soil columns using Andosol soil and Toyoura silica sand with different water content; for soil water content was from 0 to 30 wt.% and for sand it was from 0.06 to 10 wt.%. In soil, a linear relation was found between water content and effective diffusion coefficient while the effective diffusion coefficient didn't change in the sand with increasing water. A numerical transport model following unsteady-state approaches based on Fick's second law was used to match the required time for a steady state of the gas phase concentration profile of benzene to the experimentally measured concentration profile gas phase in the column. The result highlighted that both the water content and porosity might increase vertical diffusion of benzene vapor in soil.

Keywords : benzene vapor-phase, effective diffusion, subsurface soil medium, unsteady state
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