7. Developing a New Toxic Substance Elution Model for Semi-dynamic Leaching Tests - Impact of Parameters in a Model Incorporating Solid-phase Diffusion -

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Understanding the leaching behavior of toxic substances is key to effectively evaluating the safety of soil or ground and its components. The DF-Kd model, which combines solid-phase diffusion and adsorption/desorption equilibrium to evaluate solute transport, was developed as a method for obtaining quantitative estimates of leaching behavior. Our study involves a new DKD toxic substances elution model, a model that links liquid phase diffusion in pore water to the DF-Kd model. Using the new DKD model, we investigated the impact of various parameters on the concentration of toxic substances in semi-dynamic leaching tests. The results show that the long-term impact of solid-phase diffusion cannot be disregarded. The results also show that solid-phase diffusion affects the gradient of the straight-line approximation used to determine the elution mechanism based on the relationship between elapsed time and elution flux. The DKD model is capable of accurately modeling the varying behaviors of diffusion elution phenomena and should prove useful in understanding the elution behavior of toxic substances attributable to diffusion, as well as in predicting long-term elution behavior from impermeable layers.

Keywords: solid-phase diffusion coefficient, distribution coefficient, semi-dynamic leaching test, poorly permeable material, numerical analysis