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Mechanism of delayed leaching of heavy metals from naturally contaminated soils

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Existing models for sorption kinetics of contaminants such as heavy metals (e.g., pseudo-second-order model introduced in [1]) mainly focused on describing artificial adsorption/desorption for a relatively short duration, where contaminants absorb onto the surface of the adsorbent. However, ground formed by metamorphism or sedimentation usually contains heavy metals during their natural formation process, and heavy metals are distributed throughout the ground in such cases. In fact, several research (e.g. [2]) has implied the significance of the effect of intra-particle adsorption/desorption kinetics of heavy metal leaching. From this perspective, naturally contaminated soils that contain contaminants deep within the particles may show delayed leaching. Therefore, a novel approach for predicting the distribution of contaminants, both in the soil particle and surrounding liquid, is achieved using the finite difference method. The approach is named the "intraparticle pore-diffusion model" and is applied to simulate the batch leaching test of heavy metal contaminated soils. Intraparticle diffusion and sorption equilibrium are considered. The desorption phenomena of heavy metal from soil particles are considered as a one-dimensional, polar-symmetric problem in the spherical coordinate system by supposing soil particles to be porous, perfect spheres. The results indicate that soil constituted of larger particles leach more contaminants at a certain time and faster for a certain leaching amount.

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