

Geochemical reaction and migration model of toxic heavy metals in contaminated soils

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The chemical composition of pore water in contaminated soils is controlled by leaching, speciation, absorption and precipitation under in-situ chemical condition. The toxic metals sorb on soil formation materials (quartz, plagioclase, clay, oxide and hydroxide of iron and aluminum, corrosion etc.) and precipitated minerals from dissolved elements. Some metals selectively precipitate as secondary minerals. These are actually competitive adsorption and accumulation among the ion species. The estimation of soil leaching test under aerobic condition are unconsidered these chemical transition of pore water from unsaturated zone to first saturated zone. We need to estimate not only concentration of toxic metals but in-situ chemical situation. In this research, metal migration model in contaminated subsurface soil above first aquifer was developed for the quality assessment of pore water and groundwater.

The sourced water was assumed only rain water in this model, and co-existing species eluted from soil-meteoric water interaction take account the mobility for targeted heavy metals. Erosion effect and absorption to the plant also included. The speciation of metals in solution is notably reflected on physicochemical condition of pore water. As an example, cadmium and lead mixed contaminated site was used for calculation. Initial contaminated level in the surface set to 500 times greater than environmental quality for leaching test of soils. The modeling results showed that lead retard in migration with respect to the cadmium at shallow level by the sorption on the precipitated hydrous oxides. The sorption and precipitation is most influential factor to evaluate the long-term migration of metals at shallow soil contaminated sites.