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Sulfate Transport and Release in Technogenic Soil Substrates: Experiments and Numerical Modeling

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In Berlin and many other cities technogenic soil substrates from World War II and building and construction debris in general play an important role for soil formation and solute transport in the vadose zone. The largest debris landfill in Berlin is the Teufelsberg. Sulfate release from the landfill poses threats for groundwater quality. The scope of this study is to determine the processes controlling sulfate release from soils containing rubble.
Column leaching experiments were conducted to analyze sulfate mobilization from Teufelsberg topsoil material. Flow interruptions of one and seven days were introduced. Sulfate release was modeled using a geochemical simulation tool (HP1). The model considered water flux, solute transport and precipitation/dissolution with first order kinetics.
Sulfate release increased after flow interruptions, although bromide breakthrough indicated physical equilibrium of transport processes. The model was applicable for qualitative description of our experimental results. The estimated equilibrium concentrations of sulfate were one to two orders of magnitude smaller than expected according to the equilibrium constant of gypsum.
It is assumed that the mobilization of sulfate from calcite/gypsum co-precipitates determines the sulfate concentrations in the soil solution of the studied soils. If Sulfate release and transport from soils containing debris is modeled with literature values, sulfate concentrations will be overestimated by one to two orders of magnitude.