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Numerical simulation of fly-ash transport in sandy material using HYDRUS-1D

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Study is focused on the numerical modeling of fly-ash transport in three sandy materials, which was before experimentally studied in the laboratory. First, sands were packed in glass cylinders with diameters of 5.52 cm and heights of 18 cm. Secondly, sands were packed in plastic cylinders with diameters of 30 cm and heights of 40 cm. The fly-ash was applied on the top of all cylinders followed by pulse infiltrations. Visually observed and gravimetrically evaluated fly-ash migration on small cylinders corresponded to fly-ash mobility in large columns detected magnetically using the SM400 Kappameter that measured increasing magnetic susceptibility in depth with increasing amount of fly-ash, which contains ferrimagnetic particles. While the fly-ash migrated freely thought the course sand material, in the other two sand materials the fly-ash moved to the depths of 10-12 and 4-6 cm in the medium and fine sand, respectively, due to the pore-space blocking and water flow decrease.
The two kinetic sites model (attchment/dettachment concept) in HYDRUS-1D was used to simulate observed fly-ash transport. First, parameters of soil hydraulic functions were estimated using numerical inversion of transient water flow data (infiltration rates, pressure heads, and soil-water contents) measured during the experiments. Second, parameters characterizing colloid transport in soil were estimated from the final fly-ash distribution in sandy columns. The micro-morphological images of sands contaminated by fly-ash improved parameter estimation.

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