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# Contaminant Transport Modeling in a Soil with Variable Charge Properties under Different pH Conditions using HP1

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The fate and transport of contaminants in soils is a function of not only the fluid flow rate, but also of a range of possible geochemical reactions, including changes in pH. A good example is the transport of solutes in volcanic-ash soils. These soils typically possess a high buffering capacity (i.e., an ability to resist changes in the pH of the soil solution). In particular pH ranges, this capacity is reflected by an increase in negatively charged sites during infiltration of relatively alkaline solutions, and an increase in positively charge sites in case of acid solutions. Hence, values of the cation exchange capacity (CEC) and anion exchange capacity (AEC) can also change, which in turn leads to different sorption behavior. In this study, the soil buffering capacity and adsorption properties were evaluated using a variable charge model describing the pH-dependent charges. Simulations were carried out of two transport scenarios involving cation and anion exchange following the infiltration of alkaline and acid solutions into an initially pH neutral environment. Cation and anion concentrations and changes in the soil solution pH were evaluated using the HP1 simulator. Although the transport scenarios were mostly hypothetical, results showed correct modeling representations of the adsorption dynamics under different pH conditions. The applied approach provides considerable potential for simulating chemical transport in variable-charge soils.

Keywords: pH dependent charge, solute trasport, buffering capacity, HP1, Andisol