The use of Stop-flow leaching experiments for the detection of physical and chemical non-equilibrium

Lian Zhou (1), Laurent Lassabatere (2), and Khalil Hanna (1)
(1) Institut des Sciences Chimiques de Rennes UMR 6226, Ecole Nationale Supérieure de Chimie de Rennes, Rennes, France,
(2) ENTPE, University of Lyon LEHNA UMR 5023 CNRS ENTPE UCBL, Vaulx en Velin, France

The fate of pollutants is closely linked to water pathways and flow homogeneity. Homogeneous flow in the vadose zone is less the rule than heterogeneous flow. Indeed, preferential flow limits the access of pollutant to sorbent sites. In addition to non-equilibrium flow, kinetical limitations of sorption processes can also reduce the efficiency of pollutant removal (chemical non-equilibria). In this study, numerical modeling is used to demonstrate the potential of stop-flow experiments for the detection of physical and chemical non-equilibria theoretically. We model the injection of a tracer a reactive solute into columns assuming steady-state flow versus stop-flow experiments and depicts the evolution of the outlet breakthrough curve. We clearly show that the stop-flow test allows the identification of non-equilibrium processes and their nature (physical versus chemical).