Transport of clay particles and radioelements in a salinity gradient: experiments and simulations

M. -H. Fauré[a], M. Sardin[b] and P. Vitorge[a]

[a] Section de GéoChimie, CEA, BP 6, F-92265, Fontenay-aux-Roses, France

[b] Laboratoire des Sciences du Génie Chimique, CNRS-ENSIC, BP 451, F-54001, Nancy, France

The problem of the transport of radioelements sorbed on colloids often occurs when assessing the safety of radioactive waste disposal. A methodology for studying the influence of particles on the transport of solute is proposed. A salinity gradient of NaCl is flowed through a chromatographic column filled with a mixture of sand and bentonite clay (5% by weight). As long as the NaCl concentration stays above a threshold value equal to 0.16 *M*, no particle migration out of the column is detected. A dramatic variation of the hydrodynamic properties of the column occurs just before the output of the clay particles: preferential pathways and dead water volumes are formed. The clay migration is first detected when NaCl concentration is <0.16 *M*, and it is then controlled by varying NaCl concentration. For a given length and composition of the porous medium, the amount of that migrates depends only on the NaCl concentration of the feed solution. An empirical function is proposed to account for this. This function is included in a transport model to account for kinetic mass transfer between immobile and mobile water zones, and adsorption of trace solute such as cesium. The adsorption is assumed to be governed by cation exchange with sodium. This built model is in good agreement with the experimental results.