Cotransport of clay colloids and viruses in water saturated columns packed with glass beads

ABSTRACT

This study examines the cotransport of clay colloids and viruses in laboratory saturated packed columns. Bacteriophages MS2 and ΦX174 were used as model viruses, kaolinite (kGa-1b) and montmorillonite (STx-1b) as model clay colloids and glass beads as model packing material. Clay colloid presence and pore water velocity both impact virus transport in porous media. Their combined and synergistic effects on virus transport and retention in porous media was examined at three pore water velocities (0.38, 0.74, and 1.21 cm/min). The results indicated that the mass recovery of viruses and clay colloids decreased as the pore water velocity decreased; whereas, for the cotransport experiments no clear trend was observed. Temporal moments of the breakthrough concentrations suggested that, in the absence of clay colloids, both MS2 and ΦX174 traveled faster than the conservative tracer only at the highest pore water velocity tested. For the other two velocities both viruses were slightly retarded. The presence of clays significantly influenced the irreversible virus deposition onto glass beads. Both MS2 and ΦX174 were attached in greater amounts onto KGa-1b than STx-1b. Also, MS2 exhibited greater affinity than ΦX174 for both clays. The results suggest that Lewis acid-base interactions worked to the advantage of clay colloid attachment but did not significantly affect virus attachment onto glass beads.