



## **Effect of gravity on virus and clay colloid cotransport through vertical water-saturated columns**

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The cotransport of clay colloids and viruses in vertically oriented laboratory columns packed with glass beads was investigated. Bacteriophages MS2 and  $\Phi$ X174 were used as model viruses, and kaolinite (kGa-1b) and montmorillonite (STx-1b) as model clay colloids. A steady flow rate of  $Q=1.5$  mL/min was applied in both vertical upward (VU) and vertically downward (VD) flow directions. For most of the cases examined in this study, estimated mass recovery values were higher for VD than VU flows, suggesting that the flow direction significantly influenced particle deposition. kGa-1b hindered the transport of  $\Phi$ X174 under VD flow conditions, while STx-1b facilitated the transport of  $\Phi$ X174 under both VU and VD flow conditions. Moreover, kGa-1b hindered, while STx-1b facilitated the transport of MS2 in all of the cases examined. Also, the experimental data were used for the estimation of virus surface coverages, and virus surface concentrations for virus diffusion-limited adsorption, and virus adsorption by sedimentation. The sedimentation limited virus adsorption was higher for VD than VU flows, and the diffusion-limited adsorption was higher for MS2 than  $\Phi$ X174.