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Effect of kaolinite on the transport of graphene oxide nanoparticles in porous media

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This study examines the influence of pH and ionic strength (IS) on the cotransport of graphene oxide (GO) nanoparticles and kaolinite (KGa-1b) colloids. Several flowthrough experiments were conducted in water-saturated columns, packed with either glass beads or quartz sand, in order to determine the transport behavior of GO and KGa-1b independently, as well as the cotransport behavior of GO together with KGa-1b. Various water chemistry conditions (pH=4, 7, 10 and IS=7, 12, 27 mM) were considered. Collision efficiencies were calculated using the classical colloid filtration theory. Interaction energy profiles between GO nanoparticles or KGa-1b colloids and glass beads or quartz sand were constructed for the various experimental conditions, by using measured zeta potentials and applying the classical DLVO theory. The cotransport experimental breakthrough data suggested that at by lowering the pH, the retention of GO nanoparticles is enhanced, due to a possible increase in heteroaggregation between GO nanoparticles and KGa-1b colloids. Also, by increasing the IS values, the retention of GO nanoparticles was slightly increased. The mass recovery of GO nanoparticles was reduced and the transport of GO nanoparticles was retarded in the presence of KGa-1b colloids. Furthermore, the retention of GO nanoparticles was greater for columns packed with quartz sand than glass beads.