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Transport of human adenoviruses in porous media

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Groundwater may be contaminated with infective human enteric viruses from various wastewater discharges, sanitary landfills, septic tanks, agricultural practices, and artificial groundwater recharge. Coliphages have been widely used as surrogates of enteric viruses, because they share many fundamental properties and features. Although a large number of studies focusing on various factors (i.e. pore water solution chemistry, fluid velocity, moisture content, temperature, and grain size) that affect biocolloid (bacteria, viruses) transport have been published over the past two decades, little attention has been given toward human adenoviruses (hAdVs). The main objective of this study was to evaluate the effect of pore water velocity on hAdV transport in water saturated laboratory-scale columns packed with glass beads. The effects of pore water velocity on virus transport and retention in porous media was examined at three pore water velocities (0.39, 0.75, and 1.22 cm/min). The results indicated that all estimated average mass recovery values for hAdV were lower than those of coliphages, which were previously reported in the literature by others for experiments conducted under similar experimental conditions. However, no obvious relationship between hAdV mass recovery and water velocity could be established from the experimental results. The collision efficiencies were quantified using the classical colloid filtration theory. Average collision efficiency, α, values decreased with decreasing flow rate, Q, and pore water velocity, U, but no significant effect of U on α was observed. Furthermore, the surface properties of viruses and glass beads were used to construct classical DLVO potential energy profiles. The results revealed that the experimental conditions of this study were unfavorable to deposition and that no aggregation between virus particles is expected to occur. A thorough understanding of the key processes governing virus transport is pivotal for public health protection.