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Retention and transport of multi-walled carbon nanotubes in saturated porous media: Effect of inflow concentration and solution chemistry

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Carbon nanotubes (CNTs) have been one of the widely manufactured nanoparticles which incorporate into various consumer products, such as bicycle frame, tennis racket, and other biomedical applications. After its increased production and use in several products, CNTs may create a potential environmental risk to soil and groundwater system. It is therefore essential to improve the current understanding of environmental fate and transport of CNTs at an extreme subsurface condition. It is possible that the nanoparticle can aggregate or deposit at the solid surfaces at different background chemistry and nanoparticle concentration while moving into the porous media. The current study systematically investigates the effect of inflow concentration of functionalized multi-walled carbon nanotubes (MWCNTs) on change in retention on the solid surfaces using a series of column experiments under fully saturated condition. A one-dimensional convection-dispersion model incorporated with collector efficiency for cylindrical nanoparticles was used to simulate the transport of MWCNTs in porous media. The result showed that higher particle number concentration led to higher relative retention. It is caused by possible aggregation within the soil pores but not influenced by greater surface coverage due to higher inflow concentration.