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Impact of Size and Concentration on Carbon Nanotube Transport in Sand

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Carbon nanotubes are the subject of intense research due to their unique properties: light weight, significant strength, excellent conductivity, and outstanding chemical resistance. This has led to their application in a wide variety of industries (e.g., in composite materials). As a result of their potential impact to humans and ecosystems, there is increasing interest in understanding the factors that control the transport of carbon nanotubes in the environment, and of particular interest to this study, their transport in porous media. In this work, the transport behavior of multi-walled carbon nanotubes (MWCNTs) is investigated in sand packed column experiments. To determine the importance of MWCNT diameter, experiments were conducted using four commercially available MWCNTs. Results suggest that smaller MWCNTs are less mobile than their larger counterparts, likely due to the increase in Brownian motion leading to more MWCNT collisions with the porous media with decreasing MWCNT size. A numerical model was used to simulate observed MWCNT transport behaviour and facilitate comparison with published studies. These results suggest that careful characterization of MWCNT characteristics (i.e. dimensions and initial MWCNT mass in suspension) is essential to adequately interpret observed results. Results from this study suggest that MWCNTs may be mobile under conditions expected in subsurface aquifers.