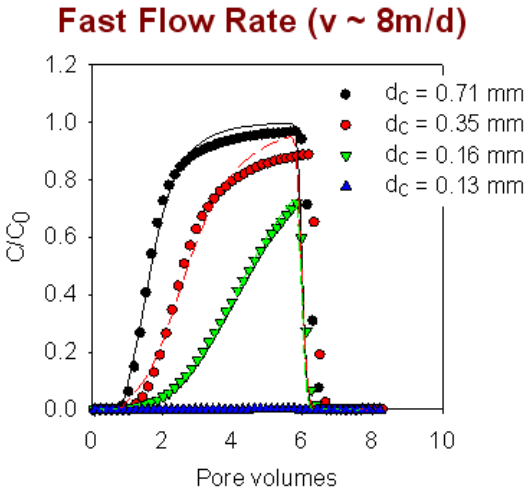
Transport and Retention of Fullerene (C60) Nanoparticles in Porous Media

In 2008, Professors Kurt Pennell, Linda Abriola, and Joe Hughes, together with Yusong Li, Yonggang Wang, and John Fortner reported (first reference below) that the transport of nanoscale fullerene (nC_{60}) aggregates through water-saturated quartz sands increased (and retention decreased) as the sand grain size or flow rate was increased.



Once deposited, nC_{60} retention was nearly irreversible, with minimal detachment observed after flushing with solution of low ionic strength (DI water), surfactant (1% wt Tween 80) or cosolvent (50% v ethanol), until the pH was raised to greater than 10. In subsequent experiments (second reference below), transport and retention of nC_{60} aggregates in water-saturated sands was shown to be strongly influenced by electrolyte species and concentration.

At low ionic strength (1 mM), nC_{60} aggregates were readily transported through quartz sands, while at higher ionic strength (10-100 mM) nC_{60} aggregates were strongly retained. To accurately simulate observed nC_{60} transport and retention behavior, traditional filtration theory was modified to include non-equilibrium attachment rate and a maximum retention capacity (first and third references below), both of which decreased with increasing sand grain size.

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Y Wang, Y Li, and KD Pennell, Influence of electrolyte concentration and species on the aggregation and transport of fullerene nanoparticles in quartz sand. *Environmental Toxicology and Chemistry*, **29**, 1860, 2008

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