Geophysical Research Abstracts
Vol. 17, EGU2015-10731, 2015
EGU General Assembly 2015

Transport of carbon-based nanoparticles in saturated porous media

Fritjof Fagerlund (1), Maryeh Hedayati (1), Prabhakar Sharma (1,2), and Deeksha Katyal (3)

(1) Uppsala University, Earth Sciences, Uppsala, Sweden (fritjof.fagerlund@geo.uu.se), (2) Nalanda University, School of Ecology and Environment Studies, Bihar, India, (3) Guru Gobind Singh Indraprastha University, New Delhi, India

Carbon-based nanoparticles (NPs) are commonly occurring, both with origin from natural sources such as fires, and in the form of man-made, engineered nanoparticles, manufactured and widely used in many applications due to their unique properties. Toxicity of carbonbased NPs has been observed, and their release and distribution into the environment is therefore a matter of concern. In this research, transport and retention of three types of carbon-based NPs in saturated porous media were investigated. This included two types of engineered NPs; multi-walled carbon nanotubes (MWCNTs) and C60 with cylindrical and spherical shapes, respectively, and natural carbon NPs in the extinguishing water collected at a site of a building fire. Several laboratory experiments were conducted to study the transport and mobility of NPs in a sand-packed column. The effect of ionic strength on transport of the NPs with different shapes was investigated. Results were interpreted using Derjaguin-Landau-Verwey-Overbeek (DLVO) theory. It was observed that the mobility of the two types of engineered NPs was reduced with an increase in ionic strength from 1.3 mM to 60 mM. However, at ionic strength up to 10.9 mM, C60 was relatively more mobile than MWCNTs but the mobility of MWCNTs became significantly higher than C60 at 60 mM. In comparison with natural particles originating from a fire, both engineered NPs were much less mobile at the selected experimental condition. Inverse modelling was also used to calculate parameters such as attachment efficiency, the longitudinal dispersivity, and capacity of the solid phase for the removal of particles. The simulated results were in good agreement with the observed data.