Geophysical Research Abstracts
Vol. 16, EGU2014-6627, 2014
EGU General Assembly 2014

Behaviour of TiO_2 nanoparticles in saturated porous media under different water velocities: measurements and modelling.

Ivan Toloni, François Lehmann, and Philippe Ackerer
LHyGeS, University of Strasbourg, France (ivan.toloni@etu.unistra.fr)

Behaviour of manufactured titanium dioxide (TiO_2, rutile) nanoparticles was investigated in water-saturated porous media. Experiments were carried out under a range of ionic strength and water velocity in laboratory columns, packed with quartz sand, in order to evaluate effects on nanoparticle retention. Columns were packed as uniformly as possible in order to get the same hydrodynamic parameters for each experiment (porosity, dispersivity) and all column experiments were conducted at least in duplicate. Conductivity, pH and UV-absorption (280 nm) were measured automatically during the experiments for both inlet and outlet flows by means of on-line sensors.
The obtained TiO_2 break through curves (BTC) had a shape characterized by the time increasing concentration, typically related to blocking retention mechanism. Mass retention decreased with an augmentation of water velocity and increased with an augmentation of the ionic strength of the solution. A transport model coupling convective-dispersive transport with a kinetic deposition was used to fit the BTC. A Langmuirian dynamics was proposed for kinetic deposition, coherently with the blocking mechanism that controls the BTC shape. The deposition term depends on two parameters: the deposition coefficient and the maximum solid phase concentration. The parameters were optimized for each BTC through the resolution of the inverse problem. An analysis was conducted to relate the optimized parameters with the filtration theory.