Geophysical Research Abstracts
Vol. 19, EGU2017-10608-1, 2017
EGU General Assembly 2017

Effect of solution chemistry, aggregate size and temperature on the attachment of TiO_2 nanoparticles onto quartz sand

Alexandros K. Papaioannou and Constantinos V. Chrysikopoulos
Technical University of Crete, Environmental Engineering Laboratory, Chania, Greece (cvc@enveng.tuc.gr)

In this study, the influence of pH, ionic strength (IS), and temperature on titanium oxide nanopar-ticles (TiO_2 NPs) attachment onto quartz sand was investigated. Batch experiments were con-ducted at three controlled temperatures (8, 13, and 25 °C) in solutions with different pH values (pH 4, 7, and 10), and ionic strengths (IS = 2, 6, and 20 mM), under static and dynamic condi-tions. For each experiment, 21 glass tubes were employed, which were divided into three groups. The first group consisted of the "reactor tubes," which contained a TiO_2 NP suspension and 14 g of quartz sand, the second group consisted of the "blank tubes," which contained a buffer solution and 14 g of quartz sand, while the third group consisted of the "control tubes," which contained a TiO_2 suspension without sand. The dynamic batch experiments were per-formed with the tubes attached to a rotator. Control tubes were used to monitor TiO_2 aggrega-tion and sedimentation. The surface properties of TiO_2 nanoparticles and quartz sand were evaluated by electrophoretic mobility measurements. Derjaguin-Landau-Verwey-Overbeek (DLVO) potential energy profiles were constructed for the experimental conditions, using meas-ured zeta potentials. The experimental results showed that the stability of TiO_2 NPs is quite var-iable in time, because TiO_2 NPs tended to aggregate rapidly under the experimental conditions. Both temperature and pH play a significant role in the attachment of TiO_2 NPs onto quartz sand. Moreover, the attachment of TiO_2 particles onto quartz sand decreased significantly under dy-namic conditions at high IS. Under static conditions substantial sedimentation of aggregated TiO_2 NPs occurred, while under dynamics conditions the attachment of TiO_2 particles onto quartz sand was reversible. Therefore, the attachment of TiO_2 NPs onto quartz sand is con-trolled by the size of the aggregates formed.