

MS2 inactivation by TiO_2 nanoparticles in the presence of quartz sand

Vasiliki I. Syngouna and Constantinos V. Chrysikopoulos

School of Environmental Engineering, Technical University of Crete, 73100 Chania, Greece (vsyngouna@isc.tuc.gr)

Virus inactivation by nanoparticles (NPs) is hypothesized to affect virus fate and transport in the subsurface. This study examines the interactions of viruses with titanium dioxide (TiO_2) anatase NPs, which is a good disinfectant with unique physiochemical properties, using three different virus concentrations. The bacteriophage MS2 was used as a model virus. A series of batch experiments of MS2 inactivation by TiO_2 NPs were conducted at room temperature (25 °C), in the presence of quartz sand, with and without ambient light. The virus inactivation experimental data were satisfactorily fitted with a pseudo-first order expression with a time dependent rate coefficient. Quartz sand was shown to affect MS2 inactivation by TiO_2 NPs both in the presence and absence of ambient light, because, under the experimental conditions of this study, the quartz sand offers a protection to the attached MS2 against inactivation. Moreover, in most cases similar inactivation rates were observed in reactor and control tubes (absence of TiO_2 NPs) suggesting that low TiO_2 concentration (10 mg/L) affects only slightly MS2 inactivation with and without ambient light.