



Effect of the ambient light on MS2 and titanium dioxide heteroaggregation in the presence of quartz sand

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Nanoparticles (NPs) are used in numerous applications and have been observed to accumulate in natural water bodies, including aquifers where they can interact with suspended colloids and viruses. This study examines the heteroaggregation of bacteriophage MS2 and titanium dioxide (TiO₂) anatase NPs using three different MS2 concentrations. Batch experiments were conducted at room temperature (25°C) to investigate the effect of ambient light and the presence of quartz sand on MS2 and TiO₂ NPs heteroaggregation. Appropriate attachment isotherms were determined. The results from experiments of MS2 attachment onto TiO₂ NPs in phosphate buffered saline solution (PBS) and in distilled deionized water (ddH₂O) were compared. Extended DLVO (XDLVO) theory was used to quantify the various interaction energy profiles. The results of batch experiments demonstrated that MS2 attachment onto TiO₂ NPs was favored in the presence of sand under ambient light while under dark conditions no clear trend was observed. Estimated XDLVO interaction energy profiles, indicated that hydrophobic interactions may play a major role and influence the attachment of MS2 onto TiO₂ NPs, as well as the simultaneous attachment of MS2 and TiO₂ NPs onto quartz sand.