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Assessing the heteroaggregation of manufactured nanoparticles with geogenic colloids in surface water

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To study and predict the fate of engineered nanoparticles (ENP) in surface water, relevant environmental conditions should be applied, regarding both the system composition and the ENP concentration. This is likely to favour the heteroaggregation of ENPs with naturally occurring colloids. In this work, we studied these interactions in natural surface waters from river (Rhone river, France) and lake (Cholet, France) displaying contrasted organic and inorganic compositions. TiO_2 nanoparticles were spiked in these systems, and the kinetics for heteroaggregation was assessed using laser diffraction and particle counting. A model approach was also followed with synthetic water of comparable composition in order to better understand the driving mechanisms.
It appeared that, depending on the solution physichal-chemistry (pH, ionic strength) and the nature of major colloids (mineral SPM, natural organic matter), ENPs show a significant affinity for the colloids, which induces rapid heteroaggregation of the system and sedimentation of the aggregates formed. The concentration ratio between ENP and colloid, appears highly determining for this mechanism, a critical ENP concentration being evidenced.
These data, coupled to a fate model, will enable to deliver a probability ranking of the potential scenarios on the fate of ENPs in natural aqueous systems at the river scale.
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