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

D. SLOMBERG[1], J. LABILLE[1], P. OLLIVIER[2], A. PRAETORIUS[3], N. SANI-KAST[3], S. ILINA[2], O. RADAKOVITCH[1], M. SCHERINGER[3], J. BRANT[4]

[1]Labex Serenade, CEREGE, Aix-Marseille Université, 13545 Aix en Provence, France
[2]BRGM, UMR 7327, BP 36009, 45060 Orléans, France (p.ollivier@brgm.fr)
[3]Institute for Chemical and Bioengineering, ETH Zurich, 8093 Zurich, Switzerland (scheringer@chem.ethz.ch)
[4]University of Wyoming, Dept. Civil & Architectural Eng., Laramie, WY 82071, USA (jbrant1@uwyo.edu)
*correspondence: labille@cerege.fr

To assess the risk posed by nanotechnology-enabled products, the exposure of engineered nanoparticle (NP) through aqueous media must be considered, as it is a receptacle of these materials throughout their lifecycle. The low predicted concentrations of NPs in surface water systems implie that the probability that NPs interact with each other is lower relative to their collision frequency with natural - colloids present at higher concentration. Colloids may thus strongly affect the fate and transport of NPs via heteroaggregation processes. Thus, fate studies aimed at predicting realistic NP behaviour and concentration profiles in surface water must account for this heteroaggregation[1]. Here, we present a novel method for determining heteroaggregation mechanism by using a combination of experiments and modeling. Interactions between TiO_2 NPs and different types of larger mineral colloids [2] were studied at low NP concentrations (0.1 to 4 mg/L) with regard to the colloid occurrence (100 mg/L). The effects of ionic strength, pH, and natural organic matter were also explored.

Our data show that at relevant concentrations, NP behaviour is mainly driven by heteroaggregation with colloids, while homoaggregation remains negligible[3,4]. The NP/colloid number ratio was found to be a critical component in the heteroaggregation mechanism. Work funded by the French National Research Agency as NANOHETER program under the frame of ERA-NET SIINN.

References

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