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The role of pesticides in stabilization of TiO₂ nanoparticles in aquatic environments

S. M. ILINA¹, P. OLLIVIER¹, N. BARAN¹, D. SLOMBERG^{2,3}, N. DEVAU¹, A. PARIAT^{2,3}, N. SANIKAST⁴, M. SCHERINGER^{4,5}, J. LABILLE^{2,3}

¹ BRGM (French Geological Survey), 3 av. C. Guillemin, BP 6009, 45060 Orleans Cedex 2, France

² CNRS, Aix-Marseille University, CEREGE UM34, UMR 7330, 13545 Aix-en-Provence, France

³ International Consortium for the Environmental Implications of Nanotechnology iCEINT, Aix-en-Provence, France

⁴ Institute for Chemical and Bioengineering, ETH Zürich, CH-8093 Zürich, Switzerland

⁵ RECETOX, Masaryk University, 625 00 Brno, Czech Republic

The influence of pesticides (glyphosate, aminomethylphosphonic acid (AMPA) and 2.4-D) on the surface charge and aggregation of pure TiO₂ nanoparticles (NP; 5-30 nm; anatase and rutile) have been investigated in modeled water solutions. The dependence of the surface charge and the size distribution at upon the various factors (including surface chemistry of NP and pesticides, presence of mono- (Na⁺) and bi-valent (Ca²⁺) cations, pH value, and ionic strength (IS) of an aqueous solution) has been studied.

The presence of glyphosate (5 µg/L) affects rutile TiO₂ NP (5 mg/L) stabilization in NaCl solution of IS=10⁻⁴M - 10⁻³M (>CCC) and in CaCl₂ solution of IS =10⁻⁴M (>CCC) with pH=5 near the pH point of zero charge (PZC) (pH_{PZC}=4.5). With adding of the glyphosate no changes in NP aggregation were observed in very high (IS= 10⁻¹M) ionic strength solutions for rutile NP and in all studied conditions for anatase NP. No significant changes in NP aggregation were observed in the presence of AMPA and 2.4-D. Compared to mono-valent cations, bi-valent cations favored an increase in zeta potential at pH8 and no changes at pH5. These results show new evidences of the role of pesticides on the NP mobility in aquatic environments.