

Development of an activated carbon-based trap for preconcentration of TiO₂ nanoparticles in aquatic systems

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The economic and societal impacts of nano-materials are enormous. However, releasing such materials in the environment could be detrimental to human health and the ecological biosphere. However, the low concentration of engineered nanoparticles (ENPs) expected in the environment make them difficult to be detected and quantified in such complex matrices. In addition, their removal from wastewater remains uncontrolled yet and poorly described in the literature.

In the present study, we assessed the potential of two granular activated carbons (AC, mineral and coconut based), and one activated fabric (AF, mineral based), to concentrate one of the most intensively produced nanoparticle in the world (TiO₂NPs). Both sorption kinetics and isotherms were performed. TiO₂NPs were put in interaction with each ACs and AF (S/L = 1/10) in a Ca(NO₃)₂ solution (ionic strength of 10 mM, pH 8), to mimic the Seine river water chemistry.

Kinetically, the minerals AC and AF displayed sorption properties faster than coconut based AC, with more than 60% and 26%, resp., of TiO₂NPs adsorbed after 3h of interaction. Conversely, the coconut based AC was able to sorb larger amounts of TiO₂NPs at equilibrium than mineral based AC and AF.

One strategy that emerges from the findings of this study would be to take advantage of these trapping properties to preconcentrate nanoparticles in natural or to remove them from contaminated wastewaters.