

Detection of titanium dioxide nanoparticles (TiO₂ NPs) in natural aquatic environment

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Engineered TiO₂ nanoparticles (TiO₂ NPs) are currently one of the most extensively used metal oxide nanoparticles. They are ranked at the 2nd place of the most synthesized, with an estimated global production between 550 and 5500 tonnes per year [1]. These compounds are used in several fields like construction, cosmetic and food which leads to mass production and inevitably to releases and emissions in all environmental compartments. This makes their detection and quantification in natural environment more important than ever. This study takes place in this context and consists of detecting and quantifying TiO₂ NPs in natural water and sediments near a production site in France (Great East) located next to a river and in an urban area. The plant produces anatase TiO₂ NPs (5 and 20 nm) and release their effluents in an industrial canal connected to a natural river.

Results show that sampling points located near and downstream of the production site have higher concentrations of total titanium in water and sediments (factor 2.5 to 120) than upstream. This is directly due to the release of industrial effluents into the canal where most of TiO₂ NPs will aggregate and being deposited in sediments. Nevertheless, a part of them has been detected in the canal water, which shows that a downstream transport of TiO₂ NPs takes place. In addition, the presence of TiO₂ NPs in the natural aquatic compartment downstream of the industrial site has also been highlighted. TEM (Transmission Electronic Microscopy) analysis show that TiO₂ NPs found in the aquatic environment have the same characteristics (shape, size, crystallinity) as those manufactured by the production site.

[1] Piccinno *et al.* (2012) *Journal of Nanoparticle Research* **14**(9), 1109-1120.