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Nanoparticles in the Aquatic Environment – Aggregation Behaviour of TiO_2 Nanoparticles studied in a Simplified Aqueous Test Matrix (SAM)

S. Ottofuelling, F. v.d. Kammer, T. Hofmann

Department for Environmental Geosciences – Nanogeosciences Group, Vienna University, Austria (frank.kammer@univie.ac.at / Phone: +43-1-4277-53380)

Engineered nanomaterials and especially nanoparticles (ENPs) in the free non-fixed form are currently or will soon be emitted into the environment. To minimize possible adverse and unintended effects during production, use and disposal the development and application of nanotechnology must be accompanied by risk assessment [1,2,3]. The toxicity of different nanomaterials has been tested on a choice of organism and revealed that they may have ecotoxicological effects which depend on the characteristic properties of engineered nanomaterials and test conditions [4,5,6,7].

The most likely pathway of free nanoparticles from various sources like consumer products (cosmetics) is via the aquatic environment. It is essential to understand the transport behaviour in natural waters to predict the fate in surface and ground waters. As the characteristic properties of nanomaterials are caused by their high size surface to mass ratio, the aggregation behaviour in the environment is essential to study in detail. It could be estimated that under certain condition in the aquatic environment the particles tend to aggregate and therefore transport in the environment is restricted to e.g. sedimentation processes [8,9,10]. Parameters such as pH, presence of anions and cations (ion type and concentration) and presence of humic acids are influencing the surface properties and chemical reaction of engineered nanoparticles. A Simplified Aqueous Test Matrix (SAM) is developed to understand basic principles which then can be transferred to natural aquatic conditions which are more complex.

TiO_2 was suspended in batches with preset hydrochemical parameters and shaken for defined time. By centrifugation and sedimentation large particles were separated from smaller ones. Samples from a defined depth were taken and analysed by PCS and

DCP-OES. First results show different nanoparticles concentration and aggregation behaviour of TiO_2 in chosen hydrochemical conditions and revealed a strong pH and ionic strength relationship. The choice of cations and anions species or the presence of humic acids had an effect on the stability of TiO_2 suspensions.

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