Hunting Nanoparticles in the Environment: the Case of nano-TiO_2 from Sunscreens

F. VON DER KAMMER[1], A. GONDIKAS[1], R. REED[2] AND T. HOFMANN[1]

[1]University of Vienna, Department of Environmental Geosciences, Althanstrasse 14, Vienna, Aut frank.kammer@univie.ac.at

[2]Arizona State University, School of Sustainable Engineering and the Built Environment, Tempe, Az

The analysis of engineered nanoparticles (ENPs) in consumer products, food and the environment is still a challenging task. Advances in the study of the fate, transport, and (eco-) toxicological effects of ENPs are hampered by a lack of adequate techniques for the detection and quantification at relevant (low) concentrations and in samples with a complex composition. The analysis of ENPs differs from traditional chemical analysis because both chemical and physical forms must be considered. Since ENPs are colloidal systems, their appearance and physicochemical properties depend upon the surrounding conditions and may be of transient character. The consequence is that while trying to observe, isolate, and quantify ENPs, their physical-chemical properties may be changed, making the analysis extremely susceptible to artifacts. Frequently the direct and non-invasive detection of ENPs in complex samples is hampered by the presence of sample components interacting with the NPs and/or interfering with the analytical technique. Separation and isolation of the ENPs is therefore necessary in most cases.

Natural surface waters which are used for recreation are receiving titanium dioxide from bathing activities in still unknown amounts. We have used bulk and nano-specific analysis in a 2-year sampling campain to quantify the emission of TiO_2 particles from sunscreens into bathing waters. We applied concepts of elemental ratios to distiguish the anthropogenic particles from the relatively high background of natural titanium-bearing particles. By combining results from time-series (surface water sampling) with surface sediment samples, sediment cores, water-air interface sampling, and background soil analysis with comparison to a non-polluted nearby reference site we were able to quantify the average increase of Ti-concentrations in the water phase by sunscreen emissions and relate this to the amount of TiO_2 particles emitted into the surface water during the bathing season.