TiO_2 nanomaterials detection in calcium rich matrices by spICPMS.

A matter of resolution and treatment.

MICKAEL THARAUD[1]*, ANDREAS P. GONDIKAS[2,3], MARC F. BENEDETTI[1], FRANK VON DER KAMMER[2], THILO HOFMANN[2], GEERT CORNELIS[4].

[1] Institut de Physique du Globe de Paris, Sorbonne Paris Cité, Univ Paris Diderot, CNRS, F-75005 Paris, France (*correspondence: tharaud@ipgp.fr)

[2] University of Vienna, Department of Environmental Geosciences and Environmental Science Research Network, Althanstr. 14, UZA II, 1090 Vienna, Austria.

[3] Department of Marine Sciences, University of Gothenburg, Kristineberg 566, 45178 Fiskebäckskil, Sweden

[4] Swedish University of Agricultural Sciences, Uppsala, Sweden

High Ca concentrations in complex matrices such as river waters often hamper detection of titanium nanomaterials (TiO_2 NPs) by single particle inductively coupled plasma mass spectrometry (spICPMS), because of isobaric interferences of ^{48}Ca on the most abundant Ti isotope (^{48}Ti). Several approaches were used to reduce this interference while measuring TiO_2 in solutions with different Ca concentrations up to 100 mg/L. ICP-MS/MS was used with ammonia as reaction cell gas and high resolution (HR) ICP-MS was used at different resolution settings. These approaches were compared with measuring different Ti isotopes (^{47}Ti, ^{49}Ti). spICPMS data was then treated with a deconvolution method to filter out dissolved signals and identify the best approach to detect the lowest possible corresponding spherical size of TiO_2 NP (D_{min}). ICP-MS/MS allowed for an important decrease of D_{min} compared to standard quadrupole ICP-MS, down to 64 nm in ultrapure water, however sensitivity was reduced by the reaction gas and increasing Ca concentrations also increased the $D_{min.}$ The comparably higher sensitivity of HR-ICP-MS allowed for measuring D_{min} of 10 nm in ultrapure water. Combined with the deconvolution analysis, the highest resolution mode of the HR-ICP-MS leads to the lowest D_{min}, even though significant broadening of the measured TiO_2 mass distributions occurred at Ca concentrations up to 100 mg/L. Thereby, this work shows the feasibility of quantifiying TiO_2 NPs and consequently Ti-colloïds in presence of Ca.