

Standardisation of surface water preparation for nanoparticle quantification and characterisation by spICP-MS or spICP-tof-MS analysis.

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The mass production of engineered nanoparticles (ENP) during recent decades has led to a non-negligible release in the environment and a rise of concerns about their fate and behaviour in natural systems. Nanoparticles, regardless of their origin, natural or engineered, eventually end up in aquatic systems. Therefore, nanoparticle flux estimation in surface waters has become a critical step in assessing their risk to the environment. At present, there is no consensus on natural water preparation for nanoparticle quantification and characterisation. However, sampling without external contamination, good sample preservation, and optimal sample preparation and dilution are required for accurate results when using single particle Inductively Coupled Plasma Mass Spectrometry (spICP-MS) or single particle time of flight Inductively Coupled Plasma Mass Spectrometry (spICP-tof-MS). When direct analysis (i.e. within 24h) is impossible, it is necessary to prepare the sample to be as close as possible to freshly collected water. Mechanical shaking, bath-sonication, centrifugation, and filtration were tested to evaluate their effects on the original sample. Mechanical shaking and bath-sonication ensure that particles were resuspended in the solution and no large aggregates remain. Bath sonication, even for a relatively long period (2 hours) does not disrupt particles. A filtration using a pre-rinsed filter with a pore size of 1.2 μm effectively removes particles over 1.2 μm and particle size distribution did not change significantly under 1 μm compared to the original. A five-minute centrifugation at 770g removes 42 % to 56 % of all particles, changing the particle size distribution in the sample. Even natural particles ($\rho = 2.5 \text{ g.cm}^{-3}$) under 1 μm were removed by centrifugation, then leading to an information loss. So mechanical shaking, bath-sonication, and filtration can be used for resuspending particles and setting a maximum particle size without altering the original size distribution.