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Bivalve mollusks as nanoparticle flux bio-indicators in natural waters.

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Over the past two decades, the emergence of a new potential pollutant, nanoparticles, has led to numerous concerns about their impact on human health and natural systems. Estimating nanoparticle fluxes in water, the major vector is therefore essential to assess the risks and to better understand their transport and fate. At a large scale (i.e. river), where continuous monitoring is impossible, bio-indicators can be used to integrate nanoparticle fluxes as was done previously in the trace metal studies. At present, soft tissue mineralization remains one of the main difficulties of using bio-indicators like bivalve mollusks to estimate nanoparticle flux in surface water over time. The mineralization process should not disrupt nanoparticles within the soft tissue for a single particle Inductively Coupled Plasma Mass Spectrometry (spICP-MS) or single particle time of flight Inductively Coupled Plasma M*ass S*pectrometry (spICP-tof-MS) analysis. Alkaline digestion with tetramethylammonium (TMAH) and enzymatic digestion using a pancreatin and lipase combination are the most promising to recover nanoparticles in the mollusk tissues. These two methods were first tested on supermarket freshwater mussels, then on Dreissenes bivalves caged for three weeks in the Seine river (France). The mollusks were first freeze-dried and grounded for a more representative particle concentration in the whole animal and so the surface water. The reproducibility and efficiency of both protocols were evaluated. One of the digestion methods was chosen for the quantification and characterization of particles in Dreissenes from the different PIREN Seine campaigns.