

The mesocosm approach to study the exposure, accumulation and toxicity of nanoparticles to aquatic/marine organisms.

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Estimations give that 40 000 km³/year of freshwater flows into the worldwide oceans through the main rivers. Consequently, the Engineered Nanomaterials (ENMs) accidentally released or not in the aquatic environment will flow directly into the rivers, and be transported by waters, sediments, and organisms until reaching estuarine or coastal areas. Several questions rise regarding the effects of these ENMs towards media represented by a salinity gradient or salted aquatic media (seawater). The aims of this work was to elucidate using a mechanistic and holistic approach the principles governing ENMs behavior and ecotoxicity across a salinity gradient.

One novel aspect of this work is to use mesocosms to assess the impacts of ENMs across such a salinity gradient, taking into account both the exposure and hazards. The physico-chemical behavior of ENMs was followed across a salinity gradient, informing on the colloidal stability, heteroaggregation, complexation with natural organic matter, and consequently the exposure pathway at the marine-continental interface. This influences the bioaccumulation processes (trophic transfers) and the localization in the different tissues and cellular compartments of the exposed organisms.

Scrobicula plana bivalve was studied, covering a large salinity gradient under increasing realistic environmental exposure conditions (water, food-borne and mesocosms) [1]. The ecotoxicity and ecophysiology testings are performed across a salinity gradient in mesocosms using several biochemical and behavioral responses (multi-biomarker approach).

Such a degree of complexity in term of exposure to ENMs and of the related impacts is a real challenge for the scientific community, and will provide necessary data for Environmental Risk Assessment.

References:

[1] Buffet PE, Tankoua OF, Pan JF, Berhanu D, Herrenknecht C, Poirier L, Amiard-Triquet C, Amiard JC, Bérard JB, Risso C, Guibbolini M, Roméo M, Reip P, Valsami-Jones E, Mouneyrac C. (2011) Behavioural and biochemical responses of two marine invertebrates Scrobicularia plana and Hediste diversicolor to copper oxide nanoparticles. Chemosphere 84:166-174