Nanomaterial fate and toxicity - Implications of the environment as a global reactor for nanomaterials along their life-cycle

Susana Loureiro, Claus Svendsen, Kees van Gestel, Iseult Lynch

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Nanomaterials (NM) enter the environment through direct application, runoff from fields to aquatic systems, recreational activities, and waste water treatment plant effluent and sludge, among others. During the application, the emission and the treatment, and in the environment, NM undergo several changes and reach biological targets in complex forms with altered properties compared to the pristine NM. In contact with organisms, NM can change their structure and proceed their life-cycle again in a different form. Therefore, it is crucial to understand processes that modify the properties of the NM and to what extent the environment acts as a global reactor, consisting of several small-scaled reactors. It is important to assess impact of the transformations of NM on their environmental fate and speciation, which adds more complexity to the evaluation of hazard and risk of NM. This session, therefore, aims at covering studies related to changes of NM properties along their life cycle. This includes changes of NM induced by i) emission from bulk materials, ii) waste water treatment, iii) reactions within different environmental compartments such as soils and surface waters, vi) interactions with soil and aquatic microbiomes, plants, invertebrates and vertebrates. Processes that change NM properties and consequently affect their environmental fate and speciation will affect the exposure and toxicity of NM to organisms. The concept of eco-corona is a key-aspect in understanding how the formation of a biomolecule corona changes NM properties and consequently the way NM interact with organisms. Toxicokinetic and toxicodynamic modelling will provide a vital input when looking at biota as a bio-reactor that can induce speciation changes or store nanomaterials in a less harmful form.