Keynote

Assessing the environmental toxicity of nanomaterials: the case of silver nanoparticles

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Developments in nanotechnology are leading to a proliferation of consumer products containing nanomaterials (NM). These products are likely to become a source of nanoparticles to the environment (Fig. 1) where their possible impacts are largely unknown [1]. There are no specific regulations covering nanomaterials in the European Union, and the use and disposal of these materials is ruled by separate regulations, including REACH. Current regulations usually assimilate nanomaterials to bulk materials from which they are formed. However, nanomaterials exhibit novel and unexpected physicochemical properties, as well as some unusual biological effects. Current standard procedures for environmental risk assessment rely on a set of standardized ecotoxicity tests that may not be adequate for NM [2]. For example, there are concerns that existing protocols may not account for aspects of dosimetry and dispersion of NM, and that some new biological measurements may be needed in some tests. Many challenging questions remain unanswered [3], among them: a) the physical and chemical characterization of the NMS in relevant media; b) the mechanisms allowing NM physically to destroy or pass through cellular membranes and cell walls; c) the specific properties that are related to NM toxic effects, and d) the mechanisms underlying NM trophic transfers. The multidisciplinary approaches needed to address these questions stress the importance of collaborative efforts between ecotoxicologists, biologists, chemists, biophysicists and analytical researchers with groups that develop NM, and the companies that incorporate them into consumer products. This talk will show how to address the toxicity one of the most currently used materials: silver nanoparticles, as a good example of all the issues presented above. Direct vs. indirect effects and the role played by different chemicals used as coatings for nanoparticles will be presented [4].

References

[1] Navarro, E., et al., Environmental behavior and ecotoxicity of engineered nanoparticles to algae, plants, and fungi. Ecotoxicology, 2008. 17(5): p. 372-386.

[2] Handy, R.D., et al., Practical considerations for conducting ecotoxicity test methods with manufactured nanomaterials: what have we learnt so far? Ecotoxicology, 2012. 21(4): p. 933-972.

[3] Behra, R. and H. Krug, Nanoecotoxicology - Nanoparticles at large. Nature Nanotechnology, 2008. 3(5): p. 253-254.

[4] Navarro, E., et al., Toxicity of Silver Nanoparticles to Chlamydomonas reinhardtii. Environmental Science & Technology, 2008. 42(23): p. 8959-8964.

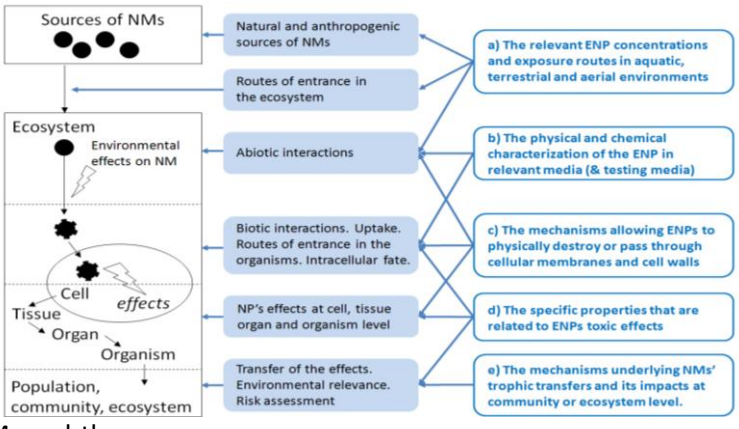

Figure 1. Chain of events linking the sources of NMs with their environmental impacts, and the relevant research questions at each step.