**The Risks of Manufactured Nanomaterials: A New Research Challenge for Environmental Chemistry**

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Nanotechnology is one of the key emerging technologies identified in the European Union 2020 Strategy. It has enormous potential to contribute to innovation and economic growth, which fosters large investments in developing new industrial applications. However, current uncertainties around the Environmental, Health and Safety (EHS) risks of manufactured nanomaterials (MN) are raising societal concerns that can reduce the benefits from nanotechnology. The introduction of unsafe nanoproducts to the market can cause serious health effects as well as enormous economic costs for enterprises in the form of over-balancing regulations and demolished consumer confidence. In order to avoid future liabilities, sound scientific analysis of the risks of MN is required, taking into consideration all stages of their life cycles, thus protecting the safety of workers, downstream users, consumers and ecosystems.

The production and use of MN are addressed by the European REACH regulation № 1907/2006, which requires that industries perform Chemical Safety Assessment (CSA) for any produced or imported industrial substance. The required CSA follows the traditional risk assessment (RA) framework, including hazard assessment, exposure assessment and risk characterization steps. It has been recognized, however, that substantial limitations and uncertainties hinder the RA of MN, including serious gaps in our basic understanding of key nano-bio interactions, mechanisms of biological uptake, fate, distribution and bioaccumulation. In response to this, the academic community has been working together with industries and regulators for more than a decade to develop tools to assess the risks from MN, in spite of the limitations.

Most of these tools, however, are not intended to facilitate regulatory decision making, but instead to serve as hazard/risk screening and/or research prioritization approaches to identify sources of risk in the lifecycle of MN and to pinpoint areas of knowledge deficits. The present deficit of quantitative data and scientifically sound approaches will lead in the near and in the medium terms to uncertain and ambiguous, largely qualitative risk estimations based on expert judgments, which may fail to support proper risk management actions. Therefore it is important to study the possibilities to aid the traditional RA framework with complementary/alternative tools in an attempt to achieve quantitative RA of MN.

Although a significant amount of research has been performed, so far the acquired knowledge and data are insufficient for regulatory RA. A major reason behind this is the sparse approach towards testing of individual nanomaterials, which has been adopted until now, rather than a targeted research agenda aiming at rational grouping of MN according to their a) physicochemical properties (especially in situ in complex milieu), and b) biological characteristics.

Rational grouping of MN on the basis of standardized data can be itself a way of risk screening as in given circumstances groups of physicochemical characteristics may be associated to strong toxic effects and/or to high exposure potentials. Such an approach has been developed by the European Centre for Ecotoxicology and Toxicology of Chemicals ‘Nano Task Force’ and will be implemented into a tiered framework for RA of MN currently being developed in the FP7 MARINA project.