Transformation and distribution processes governing the fate and behaviour of nanomaterials in the environment: an overview

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MO166 Transformation and distribution processes governing the fate and behaviour of nanomaterials in the environment: an overview N.B. Hartmann, Technical University of Denmark DTU / DTU Environment; L.M. Skjolding, DTU / DTU Environment; S.F. Hansen, Technical University of Denmark DTU / DTU Environment; F. Gottschalk; J. Kjolholt, Cowi AS; A. Baun, Technical University of Denmark / Department of Environmental Engineering. To develop a more complete understanding of the potential risks posed by manufactured nanomaterials, it is necessary to further examine their transport and fate in all environmental compartments. At present analytical chemistry methods are limited when it comes to detecting low concentrations of nanomaterials. Furthermore, distinguishing between naturally occurring, anthropogenic and manufactured nanomaterials in an environmental matrix poses additional analytical-chemical challenges. This situation leaves a gap between the present scientific state-of-the-art and the increasing demand for reliable measured or predicted environmental exposure concentrations for environmental risk assessment of ENMs. To fill this gap within a limited time frame modeling appears to be a suitable approach. Chemical fate modeling for nanomaterials is still in its infancy. Informed choices on the basis of available knowledge are needed during model formulation and development to ensure the reliability of predicted environmental concentrations of nanomaterials. A major knowledge gap hampering the further development of such model-based approaches is our current lack of understanding of the interplay between the novel physico-chemical properties, exhibited by many nanomaterials, the properties of the surrounding media/matrix and the underlying processes that determine particle behaviour. Here we identify and summarize key processes governing the fate and behaviour of nanomaterials in the environment. This is done through a critical review of the present state-of-knowledge. We describe the (photo)chemical, physical or biologically mediated transformation of manufactured nanomaterials from their pristine form (as produced or in a product) due to degradation, aggregation, agglomeration, or through association with dissolved, colloidal or particulate matter present in the environment. Specific nanomaterials are used as case studies to illustrate these processes where relevant. Key environmental processes are identified and ranked and key knowledge gaps are identified, feeding into the longer-term goal of improving the existing models for predicted environmental concentrations.