Session: Session: Grouping and read across in environmental risk assessment of nanomaterials: possible approaches, knowledge, gaps and regulatory challenge
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Grouping of nanomaterials regarding their behaviour and fate in the environment – hypotheses and experimental results

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1. Introduction

Engineered nanomaterials (ENM) are used in many different applications and products and can be released into the environment [1, 2, 3]. After ENM are released, transformation processes will occur affecting their further mobility and behaviour.The fate and behaviour in the environment and the amount of releas are important information for a thorough risk assessment and a safe handling and optimal use of ENM along the whole life cycle. The application of the nanomaterial based product, the ENM properties and the exposure pathway will affect the behaviour and fate of the ENM in the environment and in consequence lead to an (modified) exposure of the environment and/or humans.

Given the large varieties of ENM, the effort for the individual investigation and assessment would be enormous. Therefore, it is necessary to develop approaches that allow an adequate risk assessment of nanomaterials while avoiding individual testing of a large number of the different forms. A grouping of ENM and read across between different materials is therefore one major target for future risk assessment.

Within nanoGRAVUR different aspects of grouping, read across and tiered approaches for release, exposure, hazard potential and risk analysis in view of all relevant protective targets, i.e. workers, consumers and environment are examined. The aim is to develop usable and practicable approaches within the framework of (pre-)regulative testing. Concepts for a grouping of ENM regarding their fate in the environment will be presented.

2. Materials and methods

Based on a literature review, parameters relevant for a grouping of ENM regarding their fate in the environment were deduced. Here we divided behaviour and fate into processes of a) transformation and b) mobility. Parameters important for a grouping for theres processes were identified for air, water and sediment / soil and will be presented.

The plausability of the identified parameter will be tested with so far ungrouped ENM and the following experiments to verify the grouping approach developed based on the literature review. First results will be presented at the conference.

Air – Transformation

Experiments in a wind tunnel according to DIN 71460. Experiments will be conducted at different humidity, UV irradiation and temperature.

Water – Transformation

Any change of the surface chemistry like the zetapotential in media with differing ionic strength ($CaCl_2$ concentration), pH and NOM concentration (SRFA) will be tested.

Water - Mobility

The agglomeration behaviour and sedimentation in media with differing ionic strength ($CaCl_2$ concentration), pH and NOM concentartion (SRFA) will be tested.

Soil – Transformation

Based on OECD TG 307 the transformation will be analysed in loamy sand.

Soil - Mobility

Based on OECD TG 312 the mobility of ENM will be analysed in soil columns filled with loamy sand

3. Results and discussion

3.1. Identified criteria

For the two endpoints and the different environmental compartments the following parameters were identified as important for grouping and read across (Table 1).

Air	Air	Water	Water	Soil	Soil
Transformation	Mobility	Transformation	Mobility	Transformation	Mobility
Polarity	Density	Zetapotential	Zetapotential	Zetapotential	Zetapotential
Surface chemistry	(Primary) particle size	Polarity	Isoelectric point	Polarity	Morphology
Chemical composition	Solubility	Chemical composition	Polarity	Surface chemistry	Solubility
Solubility		Solubility	Surface chemistry	Chemical composition	Surface chemistry
		Surface chemistry	(Primary) particle size	Solubility	
			Solubility		

Table 1: Identified physico-chemical criteria affecting the fate in the environment which may be used for a grouping

3.2. First results of the experiments

Experiments as outlined above have been conducted and first results will be presented. Based on the results of these experiments the identified parameters for a grouping will be reevaluated and a grouping scheme suggested.

4. Conclusion and Outlook

Different physico-chemical parameters for a grouping of ENM regarding their fate in the environment are identified based on a literature research. Based on the results, it seems that the surface properties are of major relevance for a grouping of ENM. Whether this observation still holds true in natural environments with different types and concentrations of natural organic matter has yet to be tested, as Mitrano et al. [4] observed a unified behaviour of different ENM under environmental conditions. However, experiments for verification or falsification of the identified parameter have started and first results will be presented.

5. References

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