Ecotoxicity CoR: Bioaccumulation, ecotox testing, systems biology approaches

Chairs: Henriette Selck, Elijah Petersen
Rapporteur: Teresa F Fernandes

Break out session

Thursday March 12, Venice

Agenda

1. Revisit CoR scope
2. Co-chair rotation
3. Selected key research needs
4. Presentations
   - Jason White
   - Claus Svendsen
   - Phil Sayre
5. Discussion:
   - can we provide guidance on what to report to ensure good quality of ecotoxicological results and the possibility to re-assess results once we have a better understanding of environmental fate and concentrations (Risk assessment = f(exposure, hazard).

Ecotox CoR scope

- To engage the scientific communities in the European Union and the US currently conducting environmental research on nanomaterials, to connect similar efforts, and
- To encourage the evolution of hazard assessment methods and predictive models built on
  - The foundations of fundamental research characterizing fate (including ageing) of nanomaterials in different environmental compartments and the interactions of nanomaterials with biota and ecosystems
  - Communication among regulators, experimentalists, modellers (e.g., to make data available / useful data format) to help modellers, experimentalists and risk assessors

Key issues

- Exposure
  - Routine analytical techniques relevant to ecotox tests
  - Characterisation methods for complex media and simple to implement
  - Confirmation of exposure
- Dosing
  - Sediment mixing or via water
  - How to optimise tests with NM that mostly settle
  - Linking external to internal dose
  - Linking internal fate (biodistribution) to tox effects
- Hazard testing
  - Artefacts
  - Soil/sediment systems
  - Bioaccumulation /kinetics
  - Trophic transfer

What to report to 'secure' future use/revisit ecotoxicological data

- As the characterization techniques develops (including fate models) it enables increasing our understanding of Fate and thus measurement and determination of Environmental concentrations in different compartments (water, sediment, soil, plants, tissue)
- Can we pinpoint key parameters that we should measure and report when conducting ecotoxicological studies to enable re-assessment of results when we know more about ENM fate and environmental exposure concentratons?
- These should be parameters that can be measured in a standard laboratory - i.e., not the scientific fate descriptors that require more sophisticated equipment BUT rather standard parameters that can easily be determined (pH, temp., salinity, CHN etc etc)

What to report to 'secure' future use/revisit ecotoxicological data

- Synthesis
  - Sonication using reliable procedures e.g., how much power is delivered ….
  - Storage condition (time, Light/Dark, temperature…)
- Characterization
  - Before experimental use (in DI, test media..)
  - During/End of exposure:
    - Water?
    - Sediment/soil: desirable but challenging
- Experimental
  - All: pH, temp., salinity, natural vs artificial
  - Test media:
    - What type?
    - Sediment (OM, CHN, black carbon, sediment particle size)
    - Soil

Jason White
Nanomaterials and Agriculture

- The key questions for the past few years have been is the NM/NP more toxic than the bulk/ion and if so, is it by a different mechanism?
  - Thus, including comparisons to bulk and ionic forms are important for "securing" data quality
- Moving forward, it is now important to consider more challenging environmentally relevant topics such as the potential for trophic transfer and for chronic effects of low concentrations of NPs

Claus Svendsen

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Nanomaterials in ecotox what should we report to maximise future potential of data?

- Issue 1 – Ranking and Species sensitivity (NPs compared to ions, types of NPs, different sizes of same type of NP)
- Issue 2 – Comparing PEC and PNEC (Across Studies) Enables Basic Environmental Risk Assessment
- Issue 3 – NP form & Transformations (Brings in more environmental realism)

Phil Sayre phil.sayre@verizon.net

Nanomaterial Categories: Context, State of Play, and Future Directions

- Category Use in Traditional Chemical Assessment
  - Category Concepts
  - Utility and Bases
- Potential Uses for Nanomaterial Categories
  - Range of Options
  - What May work
  - A case study with CNTs

Key discussion points

- Vigorous discussion about what level of characterization is necessary for different environmental matrices (water, soil, sediment)
- Motivations described for publishing all relevant data to facilitate modeling and also for detailed characterization
  - Differences of opinions among what is needed for "sufficient" characterization?
- Are nanoecotoxicology studies being held to higher characterization standards than those for all other chemicals?
- It is important to bring in collaborators specializing in characterization in the beginning to be involved in the experimental design

Future directions

- Ecotox CoR focus article nearly complete summarizing breakout session discussions from previous EU-US meetings
- Strong interest in writing a peer-reviewed perspective manuscript on the level of characterization needed for nanoecotox studies in different matrices
- Several ideas for potential research needs were discussed
- Additional work is needed in future months to finalise decisions regarding a new EU co-chair and redefine the Ecotox CoR scope