CEFIC Long-range Research Initiative
Request for Proposals (RfP)

Title and Code Number:
Refine sediment toxicity testing methods for application to very hydrophobic substances - **LRI ECO43**

Background
Sediment toxicity testing is often required under international chemicals management regulations, but it is challenging to select appropriate test methodologies/parameters to obtain reliable and meaningful results for very hydrophobic chemicals. Unreliable data based on uncertain methods could result in ineffective management solutions for hazard and risk assessments.

Tests are usually performed at very elevated concentrations exceeding the sorptive capacity of the media and without proper equilibration of dosed sediment phase and water phase, and it is difficult to obtain homogeneous distribution of the tested chemicals in sediment. In addition, water solubility limits (in sediment pore-water) for hydrophobic substances might be reached at relatively low test concentrations, thereby hampering the determination of reliable concentration response curves. Testing at elevated concentrations may introduce neat substance into the sediment exposures that may confound interpretation of test results due to physical effects. Further, such tests may not be considered appropriate given the estimated environmental concentrations following emissions from typical use patterns.

The equilibrium partitioning (EqP) method provides a framework for interpreting toxicity data in soil, sediment, and aquatic exposures. This approach assumes organisms are at equilibrium with their surroundings and that effects can be related to the freely dissolved concentrations in the aqueous media. This is a commonly utilised approach for filling sediment data gaps during chemical registration activities. Application of EqP framework to extrapolate from aquatic toxicity data to the sediment compartment for very hydrophobic chemicals is limited by the lack of reliable empirical sediment toxicity data to validate this approach. Prior work indicates success of the EqP approach for chemicals with $\log K_{OW} < 6$ [1], but demonstrated uncertainty for very hydrophobic chemicals ($\log K_{OW} > 6$).

There is a need for standardised spiking protocols, as well as exposure quantification protocols, that are specific to very hydrophobic substances. Standardised protocols for sediment testing, for example adapted spiking protocols and the use of passive sampling techniques to quantify exposure concentrations and account for bioavailability, could potentially help in the improved design, conduct and interpretation of sediment toxicity testing with these substances.

Objectives
The objective of this project is to develop additional guidance on sediment toxicity testing methods for very hydrophobic chemicals in sediments that ensure reproducibility and realism in the test results to support product risk assessments [2]. A second objective is

to evaluate the use of equilibrium partitioning theory for evaluating very hydrophobic chemicals.

Scope

A tiered testing approach is suggested, to first compile data from publicly available sources, which will inform later steps in the research. Testing should characterise the impact of study design parameters on toxicity results for very hydrophobic chemicals. Testing should include single chemicals with logK_{OW} > 6 (primarily baseline toxicants) that span a range of chemical classes of interest and are representative of REACH registered chemicals.

Activities will include:

- Conduct literature review:
  - Compile sediment toxicity data for very hydrophobic substances included in relevant databases/recent peer reviewed literature;
  - Evaluate trends with regard to test species and experimental design parameters (including consideration of susceptibility of test organisms to physical effects such as oiling);
  - Identify existing sediment test methods; evaluate effects on basis of general mode of action, physicochemical properties; evaluate sediment test results in use of EqP.
- Subsequent experimental sediment toxicity tests should be based on the outcome of the literature review.
- Testing should focus on a representative set of single, very hydrophobic (log K_{OW} >6) chemicals, primarily liquids, to simplify interpretation of study results.
- Evaluate EqP model, in that effects can be related to freely dissolved in porewater independent of exposure route
- Research themes could include the following:
  - Identify upper-limit concentrations for testing based on solubility in porewater, or other scientific rationale, e.g., “intelligent testing” design
  - Identify (and pilot) methods/test species that can be used for discriminating between toxicity from chemical activity of substance in porewater and physical oiling
  - Consider the potential implications for test substance loss/degradation as a result of different sediment aging protocols.
  - Evaluate use of passive samplers as exposure metric to measure freely dissolved concentrations and to address variability introduced through sediment fate processes
- Provide recommendations and guidance on spiking protocols and aging methods, as well as exposure quantification, to achieve reproducible and realistic study results

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Deliverables

1. Literature review followed by sediment toxicity testing research to characterise the impact of study design parameters on toxicity results for very hydrophobic chemicals, and make recommendations for specific aspects of the testing protocol in order to ensure meaningful and reliable results to support product risk assessments.
2. Evaluation of the use of equilibrium partitioning theory for evaluating very hydrophobic chemicals.

The final report shall contain an executive summary (2 pages max), a main part (max. 50 pages) and a detailed bibliography.
It is expected that the findings will be developed into at least one peer reviewed publication, following poster(s) and presentation(s) at suitable scientific conference(s).

Cost and Timing

Start in January 2018
Duration: 3 years
Budget: in the order of €400K

Partnering/Co-funding

Applicants should provide an indication of additional partners and funding opportunities that can be appropriately leveraged as part of their proposal. Partners can include, but are not limited to industry, government/regulatory organisations, research institutes, etc. Statements from potential partners should be included in the proposal package.

Fit with LRI objectives/Possible regulatory and policy impact involvements/ Dissemination

Applicants should provide information on the fit of their proposal with LRI objectives and an indication on how and where they could play a role in the regulatory and policy areas. Dissemination plans should also be laid down.

References

1. Redman AD, Parkerton TF, Paumen ML, McGrath JA, den Haan K, Di Toro DM. 2014. Extension and validation of the target lipid model for deriving predicted no-effect concentrations for soils and sediments. *Environmental Toxicology and Chemistry* 33:2679-2687.
2. Ortega-Calvo J-J, Harmsen J, Parsons JR, Semple KT, Aitken MD, Ajao C, Eadsforth C, Galay-Burgos M, Naidu R, Oliver R. 2015. From bioavailability science to regulation of organic chemicals. ACS Publications.

DEADLINE FOR SUBMISSIONS: 31 August 2017

Please see www.cefic-lri.org for general LRI objectives information, project proposal form and further guidance for grant applications.