Broad chemical industry research initiative on microplastics to support developing an environmental risk assessment framework

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There are still many knowledge gaps around the scientific understanding of the impacts of microplastics (MP) on aquatic and terrestrial populations and ecosystems. Thus, various industry groups and initiatives work together to improve knowledge and data quality in regard to hazard and exposure of MP. The aim of the presented research activities is to improve the mechanistical understanding of exposure and effects associated with MP particles needed to support the development of a reliable environmental risk assessment (ERA) framework.

In addition, gathering knowledge in the field of degradation, bioaccumulation, effects as well as exposure and environmental behaviour of microplastic particles is essential for innovation in material and product development and the establishment of meaningful regulatory frameworks.

EXPOSURE & EFATE

A regional and global scale **environmental fate and transport model** for microplastics will be developed which:

1. Takes into account and leverages existing **fate and transport modelling frameworks** for similar particulate matter (i.e., Nano-particles, sediment transport models);
2. Identifies **physical/chemical properties** of microplastics that are useful for informing efate and transport of microplastics (e.g., size, density, mechanical durability, aging…);
3. Determines **environmental characteristics** that are useful for informing efate and transport of microplastics (i.e., effects of water chemistry on agglomeration/dispersion of microplastic particles);
4. Informs the **expected environmental concentrations** of microplastics in different compartments to help define **realistic exposure scenarios.**

Learn more about the ECO48 – Nano2plast project

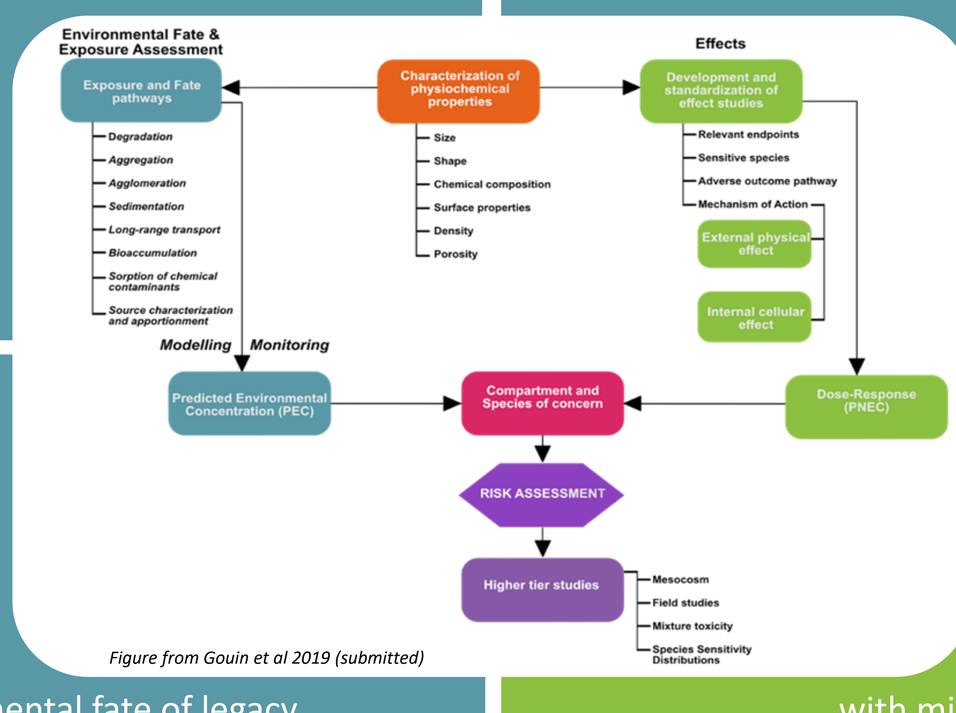

Figure from Gouin et al 2019 (submitted)

BIOACCUMULATION

A **critical review of the literature** and clarification of processes for risk and hazard assessment is ongoing. Key questions are: Can the extent to which microplastic is bioaccumulating in aquatic/terrestrial organisms be quantified? Is it possible to identify mechanistic processes that are key to the bioaccumulation process?

Preliminary results indicate that the majority of field-based monitoring data observe particles within the gastrointestinal tract and/or stomach of individuals. Environmental concentrations showed typically to be in the order of 10's to 100s P/L. Biological concentrations in the 1's to 10's P/Ind. An operationally defined bioaccumulation metric does not appear to be supported by existing data.

Key challenges in moving forward are:

- Is presence in the GIT representative of (bio) accumulation?
- Would data in relation to the bioaccumulation be more effectively utilized as a metric in monitoring the environmental status of ecosystems, such as used within the Marine Strategy Framework Directive?

Data will be presented at SETAC NA, Toronto

PERSISTENCE

Persistence represents an important regulatory hazard criterion used in screening chemicals. The existing persistence assessment framework is largely based on knowledge related to the environmental fate of legacy persistent organic pollutants obtained from test data and models that have been designed and parameterized for this suite of chemicals (i.e. neutral, non-polar organics).

Limitations associated with applicability domain challenges therefore limit the application of a consistent and transparent framework for screening and prioritizing substances for persistence that can address polymeric substances, such as microplastics.

A **consistent and transparent assessment framework** that accounts for expanding the applicability domain for evaluating persistence to address a broad range of chemistries, built around a weight-of-evidence methodology that includes system-dependent variance and adaptation, is thus needed to strengthen confidence in the use of P and vP as a risk screening and prioritization tool.

An LRI project around developing such a robust science-based framework is in preparation

TOXICITY & PHYSICAL EFFECTS

A comprehensive **literature review** will be conducted to identify both key ecological hazard research gaps and the appropriate methodologies for conducting hazard tests with microplastic materials to fill these research gaps.

This literature review focus on the **applicability, adaptability, and usage of existing toxicity testing methods** for evaluating the hazards of solid polymer materials for representative test organisms (i.e., fish, invertebrates, algae/Lemna) and organisms which have been identified as potentially sensitive to solid polymer particles. Relevant literature, expert input from stakeholder workshops, and relevant summary reports and guidance from regulatory groups and various task forces are consulted during the comprehensive literature search.

Based on the review, targeted ecological hazard research will be conducted to evaluate how both intrinsic and extrinsic factors influence the effects of microplastics on sensitive environmental species.

Learn more about the ECO49 – METAS project

Specific MP research projecst are being supported each organization: ICCA[1], Cefic LRI[2], and ECETOC[3]

([1]International Council of Chemistry Associations; [2]The European Chemical Industry Council Long-Range Research Initiative; [3]European Center for Ecotoxicology and Toxicology of Chemicals)