Highly Hydrophobic Chemicals: Reliable Investigations on Environmental Fate and Effects

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Highly hydrophobic chemicals with very low aqueous solubility are used in a broad range of applications ranging from personal care products to heavy industry. Large numbers of substances with Log Kow ≥ 5.5 are already registered in the European Chemicals Agency (ECHA) database under the EU Chemical Legislation regulation. Further to their high production volumes, the release of these chemicals into wastewater and the aquatic environment cannot be precluded. Therefore, reliable assessments of the environmental fate and potential environmental toxicity are urgently needed for poorly soluble chemicals. However, investigations into their environmental fate and toxicity are not straightforward. Their high hydrophobicity results in extensive sorption to solids such as soils, sediments, organisms, and other surfaces. Therefore, standard tests for determining their toxicity or (bio)degradation that follow national and international guidelines are often not suitable for these chemicals. In particular, it can be challenging to provide defined and constant exposure concentrations in laboratory experiments but also to measure these concentrations. This is even more difficult when attempting to measure the exposure concentrations in the environment. The lack of consistent and reliable results due to these difficulties can lead to improper assessment of their environmental risks. Additionally, there are ongoing discussions about the presence of a general aqueous toxicity threshold (i.e., no toxicity below a certain concentration) or a general hydrophobicity toxicity cut-off (i.e., no toxicity above a certain Log Kow). Reliable toxicity data in the high Log Kow range are therefore urgently needed to clarify this issue, which in turn requires improved testing methods. Bioconcentration kinetic models and thermodynamic concepts will also be needed for setting and challenging such cut-offs. This session will discuss the above issues by addressing the following questions: What are adequate methods for a reliable assessment of fate and effects of highly hydrophobic chemicals? How can the present guidelines be improved to arrive at a more reliable assessment of the fate and effects of highly hydrophobic chemicals? What are the impacts of sorption on the toxicity and biodegradation of highly hydrophobic chemicals under realistic conditions? How can the fate and effects of highly hydrophobic chemicals be modelled and predicted?