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Emerging Chemicals of Concern: Preface

On June 29, 2015, the Chemical Abstracts Service (CAS), the world's authority for chemical information, registered the 100 millionth chemical substance in the CAS REGISTRY, the world's largest database of unique chemical substances (http://www.cas.org/news/media-releases/100-millionth-substance). There are different estimates of the number of chemicals in commercial use. Depending on the source, that number could range from around 8,000 (counting only those produced in "significant amounts") to 84,000 (counting "active and inactive" chemicals). Either way, there are still a lot of existing chemicals, not to mention new ones that are being manufactured for the market.

In the past decade, several groups of compounds, e.g. halogenated flame retardants (HFRs) and per-/polyfluoroalkyl substances (PFASs), have attracted much attention due to their persistence, toxicity, bioaccumulation and long-range transport potential. Indeed, some of these compounds have been added to the Persistent Organic Pollutants (POPs) list of the Stockholm Convention. Although the production and use of some of these substances have been restricted worldwide and the demand for these compounds is expected to decline, production of their alternatives or replacements is projected to increase. It is, therefore, not surprising that large amounts of potentially toxic substances, including classes of compounds referred to as "Emerging Chemicals of Concern (ECCs)", have been detected in municipal wastewaters, surface and ground waters, drinking waters as well as sediments and aquatic biota.

The public now demands that chemicals, especially ECCs, be assessed for their potential impacts on humans and ecological systems. To properly screen, assess, and prioritize chemicals for further investigation and/or control, important information is needed on the environmental fate and behaviour of individual or specific groups of chemicals. Furthermore, the production, storage, use and disposal options/scenarios of the concerned substances are also of relevance. Indeed, for better protection, risks need to be assessed. A simple step in risk assessment is to identify and quantify toxic substances present in our environment, i.e. determining environmental concentrations (ECs), and determine the threshold concentrations below which exposure is not expected to cause adverse effects, i.e. determining the predicted no-effect concentrations (PNECs) (e.g. Du et al., 2015). The risk quotient (RQ) analysis could then be employed to compare ECs with PNECs, i.e. determination of EC/PNEC ratio.

Although the concept of RQ analysis is simple, collection of data on ECs and PNECs, especially the latter, is time-consuming, labour-intensive and, at times, technically challenging. As a result, there are often complaints that the process is too slow and it is necessary and more desirable NOT to "wait for science", but to evoke the precautionary principle to address the problem. Following this approach, mere suspicion of an effect would be sufficient to elicit a management action. Clearly, inadequate protection may cause harm to human health and deterioration of ecological systems and thus undesirable. Less obvious, but equally important, is the realization that over-protection can lead to wastage of valuable resources which could/should be used to protect genuinely vulnerable and important systems/targets. Despite the enormous challenge facing environmental scientists and regulators, an approach based on risk/benefit analysis (e.g. Haslam et al., 2016) remains, in our view, the only viable/sustainable option.

The 12 papers in this "special collection" cover topics that range from degradation of ECCs in the presence of nanoparticles and in the sewage treatment processes; incineration of hexabromocyclododecane; occurrence and risks of PFASs in fish and American alligators; through to the toxicological effects of ECCs in mammals. Together, they have, to some extent, served to represent some of the important scientific questions and management issues that we need to consider in managing ECCs. Clearly, environmental scientists need to devise methods to "speed up" the risk assessment procedures. Attempts made have ranged from using simple assays based on whole-organism assays (e.g. Martínez-Sales et al., 2015) through to mechanistic pathway-based techniques (e.g. Zhou, 2015). By simplifying the risk assessment procedure, we will have a better chance of convincing the public that the work we are doing has relevance to the real world.

REFERENCES

Du, M., Wei, D., Tan, Z., Lin, A., Du, Y., 2015. Predicted no-effect concentrations for mercury species and ecological risk assessment for mercury pollution in aquatic environment. J. Environ. Sci. 28, 74–80.

https://doi.org/10.1016/j.jes.2017.11.011

Haslam, A., Robb, S.W., Bonner, M.R., Lindblad, W., Allegra, J., Shen, Y., Vena, J.E., 2016. Polychlorinated biphenyls and omega-3 fatty acid exposure from fish consumption, and thyroid cancer among New York anglers. J. Environ. Sci. 41, 270–277.

Martínez-Sales, M., García-Ximénez, F., Espinós, F.J., 2015. Zebrafish as a possible bioindicator of organic pollutants with effects on reproduction in drinking waters. J. Environ. Sci. 33, 254–260.

Zhou, B., 2015. Adverse outcome pathway: Framework, application, and challenges in chemical risk assessment. J. Environ. Sci. 35, 191–193.