Chemical Research in Toxicology

Editorial

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Perspectives on the Study of Fluorinated Alternatives

I am the leader of the Ecotoxicology Research Group and Director of the Key Laboratory of Animal Ecology and Conservation Biology at the Institute of Zoology, Chinese Academy of Sciences. This year it is my great honor to become an Associate Editor of *Chemical Research in Toxicology* (CRT). I am dedicated to the continuing success of CRT and encouraging the publication of a wide range of topics in the field of chemical toxicology. My own research interests are well-aligned with those of CRT. To date, research in my laboratory has centered on the environmental fate, health risks, and toxic mechanisms of per- and polyfluoroalkyl substances (PFASs), especially the emerging alternative perfluorochemicals.

PFASs are indispensable chemicals used in many industrial and commercial applications. Legacy PFASs, typically longer-chain (eight perfluorinated carbons or longer) perfluoroalkyl substances, are of great concern due to their environmental persistence, bioaccumulation potential, and toxicity. Thus, international regulations have been issued to phase out or reduce their production and use. However, to meet market demand, short-chain homologues and other fluorinated compounds structurally similar to legacy PFASs (mainly functionalized perfluoropolyethers) have been developed and used as replacements. To date, detailed structural information on many of these alternatives is not accessible to the public, making environmental and health risk assessment impossible. Of concern, growing evidence has shown that certain PFAS alternatives with known chemical identities may be more bioaccumulative and toxic than legacy PFASs. Therefore, to fill the considerable data gaps that exist, extensive risk assessment studies are needed based on cutting edge technology in analytical chemistry, organic chemistry, molecular biology, chemical genetics, and systems toxicology, including LC-MS/MS, GC-APCI-MS, Q-TOF, CIC, NMR, molecular docking, QSAR, gene knockout, RNA interference, RNA-seq, and high-throughput genomics and proteomics.

Based on the above technology, leading environmental scientists working on PFASs will be able to (1) identify fluorinated substances and investigate the occurrence, release, distribution, persistence, transformation, and bioaccumulation potential of novel PFAS alternatives in abiotic and biotic environments and characterize their sources, patterns, and exposure pathways in humans; (2) ascertain the most sensitive (critical) toxic effects and pathways of PFAS alternatives, explore the relationship between their toxicity and chemical structure (e.g., chain length, functionalized groups, and polymerization degree), elucidate the molecular mechanisms of PFAS alternative-induced toxicity, and build forecasting models of their toxicities; and (3) guide the structural design and optimization of novel PFAS alternatives based on toxicological data and consequently synthesize "green" alternatives with better performance, lower bioaccumulation potential, and lower toxicity levels. Such studies are expected to overcome the dilemma in which alternatives that have been developed to replace harmful and restricted chemicals exhibit an equivalent (or higher) toxicity themselves. Future research will hopefully change this passive situation from the origin and provide insight for assessing the toxicity of new chemicals and synthesis of green alternatives.

This vision for PFAS research mirrors strategies for advancing a wide range of areas in chemical toxicology, particularly those that have a major impact on the environment and human health. CRT welcomes all aspects of research on the mechanisms of toxicity and impact of chemicals such as legacy PFASs and their alternatives on human health. In addition to primary research articles and reviews, manuscript types like Chemical Profiles and ToxWatch, which was recently published based on multi-omics technology for various PFASs, are welcome. I am, therefore, committed to promoting high-quality and relevant scientific research for publication in CRT, while supporting global perspectives from the CRT community. My hope is that CRT will continue to provide an excellent opportunity and platform for advancing the above-mentioned topics.

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Notes

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