Brominated Flame Retardants as Novel POPs and Their Management

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Brominated flame retardants (BFRs) have been increasingly used in consumer products such as electrical appliances and textiles and have been supposed to play a critical role in reducing the flammability of the products during fire. However, many BFRs are also chemicals of concern due to their potential for long-range transport, bioaccumulation, toxicity and exposure to humans and wildlife. They can enter the environment by a number of different pathways from the lifecycle of BFR-containing products such as production, usage, waste treatments, recycling and disposal. Consequently, those BFRs were found in a wide variety of biota and abiotic environmental samples on a global scale.

As international actions on persistent and hazardous BFRs, in May 2009 the Parties of the Stockholm Convention for Persistent Organic Pollutants (POPs) took the decision to list commercial pentabromodiphenyl ether (penta-BDE) (the main components are tetra-BDE and penta-BDE) and commercial octa-BDE (the main components are hexa-BDE and hepta-BDE) as POP substances. In addition, in May 2013 it was agreed to list hexabromocyclododecane (HBCD) as a POP for elimination. Furthermore, in October 2013 Norway made a proposal to list deca-BDE as a Persistent Organic Pollutant (POP) under the Convention.

Characterization of BFR emissions during the whole service life of products is essential to identify and quantify the sources, and conduct immediate and long-term measures toward strategic chemical and risk management considering their life cycle. In Japan, atmospheric emissions of deca-BDE were estimated based on the material flow of products and emission factors from each process (Sakai et al., 2006) and likewise atmospheric and aquatic emissions of HBCD were estimated by Managaki et al (2009). The Ministry of the Environment of Japan (2012) also has been conducting a survey to characterize emissions of polybrominated dizenzo-*p*-dioxins and furans, whose occurrence is closely relevant to PBDEs, from a variety of processes as well as BFRs including PBDEs. In view of human health risk to BFRs, lengthy exposure to BFRs (derived from product usage) via indoor dust at home and in office and, occupational exposure at production sectors are considered to be important. Technical control measures (*e.g.*, installing end-of-pipe technologies and altering production processes) are indeed required to reduce the BFR emissions and exposure at each emission sector, and more importantly substituting safer chemicals and redesigning products are preferable options. Material recycling of BFR-containing products could prolong the residence time of BFRs and increase its emission and exposure potential, which must be fully considered from a viewpoint of POP-BFR control. This requires a control approach specific to BFRs contained in recyclable products, not taken for the other POPs.

References

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