Occurrence of halogenated flame retardants in Belgian foodstuff

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Halogenated flame retardants (HFRs) are man-made chemicals that are added to a wide range of consumer products to reduce their flammability. Because most HFRs are not chemically bonded to the products which they are added to, they can easily leach into the environment, ending up in air, sediments, biota, and food[1–3].

The primary objective of the project was to respond to the EU Recommendation on the monitoring of BFRs in food (Commission Recommendation 2014/118)[4], providing data on HFR occurrence and levels in the main food categories consumed in Belgium. The presence of polybrominated diphenyl ethers (PBDEs), novel BFRs (hexabromobenzene (HBB), bis(tribromophenoxy)ethane (BTBPE), tetrabromobenzoate (TBB), tetrabromophthalate (TBPH)), tribromoanisole (TBA), dechlorane plus (DPs), hexabromocyclododecanes (HBCDDs), tetrabromobisphenol A (TBBPA), brominated phenols (BrPhs) and their derivatives was determined in 183 composite food samples of diverse food categories (including fish/seafood, dairy products, oil/fats, eggs, grain and potatoes, meat, and food for infants). To achieve this goal, and due to the diverse nature of the considered HFRs, two analytical methods, based on gas chromatography in combination with electron capture negative ionization mass spectrometry (GC-ECNI/MS) and ultra-high performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS), were developed and in-house validated.

The HFR content in all foodstuff ranged from <LOQ to 23 ng/g ww (4-BP in canned king crabs) with an average content of 73 pg/g ww. The highest average levels were measured for 4-BP (441 pg/g ww), followed by PBDEs (418 pg/g ww), 24-DBP (114 pg/g ww), TBA (112 pg/g ww), a-HBCD (73 pg/g ww), 246-TBP (63 pg/g ww). Mean concentrations from 1 to 6 pg/g ww were measured for DPs, TBPH, TBBPA, b-HBCD and g-HBCD, whereas HBB, TBB, BTBPE, TBBPS and 26-DBP were not detected in any analyzed food group, and thus excluded from the following elaborations.

The most frequently occurring HFRs were PBDEs (detection frequency of 56 %), followed by 246-TBP (28 %) and TBA (21 %); 4-BP, HBCDs, 24-DBP, TBBPA, TBPH, and DPs were found in less than 15 % of all analyzed food samples. The highest number of detects was observed in the group fish/seafood, with 95 % of the samples where at least one compound was quantified above the LOQ. BDE-47 was the most representative congener (41 %) of the mean BDE contamination in the composite fish/seafood samples (mean 179 pg/g ww), followed by BDE-209 (32 %) and BDE-100 (12 %). Regarding the analysis of BDEs in the other analyzed food categories, BDE-47 and BDE-209 were the only detected congeners in food for infants, eggs, grains, and other food.

References

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