Brominated Flame Retardants in food, baby foods and infant formulae

Area of research interest: Chemical hazards in food and feed

Brominated Flame Retardants in Baby Foods and Infant Formulae

Project code: FS102114

October 2014 - September 2015

Background

Brominated flame retardants (BFRs) are used in industrial and domestic materials, including furnishings, electrical and electronic equipment and building insulation, in order to delay the onset of fire. Some have been found to escape into the environment and to enter the food chain and certain groups are now listed as persistent organic pollutants under the Stockholm Convention. In 2014, the European Commission published a comprehensive call for data (Commission Recommendation 2014/118) on the occurrence of BFRs in various food categories, including baby foods and infant formulae. These are of particular concern because certain BFRs have been identified as neurodevelopmental toxins. This work was carried out in response to the call and to provide data for use in the assessment of risk to babies and infants associated with the presence of BFRs in food.

Objective/approach

Approximately 120 samples of baby food and 30 samples of infant formulae were analysed for polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecanes (HBCDDs). The samples were selected from a larger sample set previously collected for testing for other contaminants. The analytical methodology was as in previous studies carried out by Fera for the FSA, using internal standardization with 13C-labelled congeners. HBCDD stereoisomers and TBBPA were measured using liquid chromatography–tandem mass spectrometry (LC-MS/MS), whilst PBDEs were measured using gas chromatography-high resolution mass spectrometry (GC-HRMS).

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Investigation into the occurrence of existing and novel/emerging BFRs in food

Project code: FS513010

February 2013 - October 2015

Background

BFRs are a group of chemical compounds added to furniture, textiles, electrical products and building materials to delay the onset and spread of fire. Due to their very widespread use, BFRs are everywhere in the environment and have entered the food chain. Older BFRs such as brominated biphenyls (PBBs) were banned in the 1970s due to health concerns and some of their more recent replacements, eg polybrominated diphenyl ethers (PBDEs), have been subject to restrictions due to environmental and health concerns. Replacement compounds are continually being introduced and, according to the most recent European Food Safety Agency (EFSA) opinion on Emerging and Novel Brominated Flame Retardants (BFRs) in Food, there is a lack of safety and environmental information about these. Through this investigation, the FSA hoped to gain a better understanding of what newer BFRs might be entering the food and feed chain.

Objective/approach

A plan was prepared for the collection of about 300 food and 100 feed/feed ingredient samples. Foods/feed types that were suspected to contain a higher concentration of the known BFRs (e.g. fatty foods, composite feed) were targeted. Samples were collected by subcontractors and delivered to Fera for analysis. The samples were analysed by ICP-MS for total bromine content although attempts to distinguish organic bromine from inorganic forms were not successful. Approximately half of the samples with the highest bromine content were further analysed for PBDEs and hexabromocyclododecanes (HBCDDs) using the same methodology as in previous investigations carried out by Fera for FSA. The bromine content of the summed HBCDDs and PBDEs was compared to the total bromine content of the samples and a selection of those with the highest discrepancies were selected for further investigation. For this, purified extracts enriched by concentration were subjected to sensitive and high resolution, time-of-flight (TOF) mass spectrometric techniques in an attempt to identify significant unknown compounds.

New de-convolution software was used to target typical isotope patterns of brominated compounds in conjunction with programmed identification procedures, using mass characteristics of known emerging/novel BFRs such as the new compounds identified by EFSA Scientific Opinion on Emerging and Novel Brominated Flame Retardants (BFRs) in Food. This provided a more targeted approach to identifying unknown signals. The process was controlled using of available BFR standards for some of the new BFRs, eg bis(2,4,6-tribromophenoxy)ethane (BTBPE) and decabromodiphenylethane (DBDPE).

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