Estimation of per capita intake of phosphorus flame retardants (PFRs) using Swedish market basket food samples

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INTRODUCTION

✓ The ban worldwide of the main brominated flame retardants (BFRs), such as PBDEs and HBCDs, led to the increased usage of phosphorus flame retardants (PFRs) as alternatives.

✓ PFRs have been already measured in environmental abiotic matrices (air, dust, surface water, and sediments) all over the world.†

✓ Data on the human exposure to PFRs from food are scarce.

✓ In this study, eight PFRs were analyzed in composite food samples (n=53) obtained from a recent Swedish Market Basket Study in 2015, in order to contribute to a better knowledge about dietary intake of phosphorus flame retardants.

✓ Based on the results obtained and on the food consumption pattern in Sweden, the per capita intake of PFRs from food was estimated.

MATERIALS and METHODS

✓ The following food categories (n=13) were considered: cereals, pastries, meat, fish, fluid dairy products, solid dairy products, eggs, fats/oils, vegetables, fruits, potatoes, sugar/sweets, and beverages.

✓ The composite samples were lyophilized and homogenized.

✓ PFRs were extracted by solid-liquid extraction in 5 mL of acetonitrile, cleaned up through d-SPE and Florisil, and analyzed by GC-EI/MS.

✓ The per capita intake was determined by multiplying the per capita consumption of a specific food group with the concentration of the compound found in the considered food sample. Then, all the investigated food groups were added to give the total per capita intake.

RESULTS and DISCUSSION

✓ TEHP, TBPB, TBOEP were < LOQ in all samples.

✓ Fig. 1 - Highest levels of PFRs were measured in cereals, pastries, fats/oils and sugar; EHDPHP showed the highest levels among the five PFRs.

✓ Table 1 - Contributions to the total intake: EHDPHP (57 %) > TDCIPP (14 %) > TPHP (11 %) > TCIPP (10 %) > TCEP (7 %); cereals (26 %) > beverages (17 %) > sugar/sweets (11 %) > pastries (10 %).

✓ per capita intakes of PFRs from food were between 6 and 12 ng/kg bw/day, several orders of magnitude lower than the indicated reference dose values and representing from 0.01 to 0.3 % of the reported RfD.

CONCLUSIONS

✓ Detectable levels of PFRs found in the majority of the 13 food categories. Highest PFR levels measured in cereals, pastries, fats/oils, and sugars/sweets. These categories were also the main contributors to the PFR per capita intake.

✓ The contamination due to PFRs during food industrial processing is possible.

✓ Human per capita exposure to PFRs from food was estimated and found much lower than the health-based reference points.

✓ Although lower levels of PFRs could be found in food than in dust, the exposure to PFRs via diet is equally important to the one via ingestion of indoor dust, as the food intake is comparably much higher.

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