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PERFLUORINATED ALKYLATED SUBSTANCES IN HUMAN FOOD ITEMS FROM CHINA; GEOGRAPHICAL DIFFERENCES BETWEEN MANUFACTURING AND DOWNSTREAM APPLICATION REGIONS IN CHINA

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Introduction

The human diet is considered a general source contributing to the overall PFAS burden of the human population. Possible exposure pathways include beverages, food in general and migration from food packing or cookware 7,8.

Most European countries carry out national monitoring programs (food basket studies) in order to assess the daily intake of persistent organic pollutants. PFAS have only recently been added to the national monitoring in some countries, on a voluntary basis. However, data on a comprehensive variety of common food items is still scare, especially from emerging economies.

In the RCN project PFC CHINO, standardized selection of food items, sampling procedures and analytical methods as well as evaluation strategies were applied, enabling a unique assessment of the occurrence of PFASs in Chinese food as well as the identification of major sources of PFAS exposure via food. During the project period, raw and untreated food items covering most types of food stuff were selected in respect to their average consumption amounts typical in for the Chinese diet. During the sampling campaign more than 200 raw food items were purchased on local markets or directly from the farmers. This presentation will cover the results of the analyses of 15 perfluoroalkyl acids (PFAAs) and perfluorooctane sulfonamide (PFOSA) in widely consumed food items from Hubei province and Zhejiang province in comparison to European dietary exposure.

Materials and methods

In fall 2012, more than 20 different food types of plant origin were included and grouped into 9 different food categories; cereals (n=9 samples), tubers (n=8), legumes (n=14) and other vegetables (n=100). Animal origin types included livestock meat (n=6 samples), poultry meat (n=30), offal (n=29), eggs (n=14), fish and shellfish (n=18). Only the edible parts were processed for analyses. Hubei and Zhejiang province in China were respectively chosen as the manufacturing and downstream application regions. The sampling sites are shown in Figure 1.

Figure 1: Sampling sites in China

Results and discussion

Overall, perfluorooctane sulfonic acid (PFOS) was the dominant homologue in fish (arithmetic mean (AM) 0.548 and 24.8 ng g-1 for Zhejiang and Hubei respectively), egg (AM 9.14 and 167.3 ng g-1 for Zhejiang and Hubei, respectively) and offal samples (AM 0.541and 28.7 ng g-1 for Zhejiang and Hubei respectively). Highly elevated concentrations of perfluorobutanoic acid (PFBA) and other short-chain PFAAs were also found in vegetable (AMPFBA=149 ng g-1), legumes (AMPFBA =72.1 ng g-1), egg (AMPFBA=40.2 ng g-1) and poultry samples (AMPFBA=17.9 ng g-1), from the Hubei province. Average dietary intake of ΣPFASs for adults were estimated to 12.8 ng g-1 day-1 and 1452 ng kg-1 day-1 in Hubei and Zhejiang respectively, indicating significant geographical differences in dietary exposure to PFASs within China. In Hubei province, the estimated average dietary intake of PFOS for adults (101 ng kg-1 day-1) was close to the tolerable daily intake limits set by the European Food Safety Agency (150 ng kg-1 day-1). Yet, PFOS could only account for a minor fraction (~13%) of the dietary intake of ΣPFASs in the Hubei province which was dominated by short-chain PFASs present in vegetables. The large contribution of short-chain PFASs underscores the importance of improved exposure- and risk-assessment tools for numerous PFAS replacements which are currently considered to be more benign alternatives due to their lower bioaccumulation potential.

Figure 2. Contribution to the EDI in different food categories from Hubei and Zhejiang province in comparison with the average of four European countries (Belgium, Czech Republic, Italy, Norway) in a lower bound approach.

When comparing with edible daily intake (EDI) estimations for Europe, a more than four-fold daily intake occurs in the region of China with PFAS production. However, the EDI estimated for the region with PFAS application is with 6 ng/g considerable lower than for Europe (Figure 2). Hen asessing the contribution of different food items to the EDI, interesting diffrences can be found. We will give more details on them in our presentation.

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