

# 生物與毒性分析

台灣地區市售食品中全氟烷基化合物含量調查及攝食風險評估

## Investigation and dietary intake risk assessment of poly- and perfluoroalkyl substances in food

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### Abstract

Perfluoroalkyl substances (PFASs) are a large class of synthetic fluorinated compounds known for their high temperature resistance, waterproofing, oil resistance, and stability. They are widely used in industrial processes including semiconductor industries and commercial products such as textiles, waterproof and oil-resistant coatings, leather, cosmetics. Due to their high persistence and bioaccumulation potential, PFASs are commonly found in various environmental media and can accumulate in the food chain. PFASs are considered as an emerging contaminant in the food chain, and humans may be exposed to PFASs through inhalation of dust and dietary intake including drinking water. PFASs have adverse health effects such as carcinogenicity, hepatotoxicity, immunotoxicity, neurotoxicity, and reproductive or developmental toxicity.

A total of 180 food samples were investigated in 12 categories. All the samples were pretreated and cleanup, and then 20 PFASs congeners were quantitatively analyzed by high-performance liquid chromatography coupled with tandem mass spectrometry (HPLC-MS/MS). The dietary intake risk assessment of PFASs was conducted by integrating the PFASs levels in foods and foods consumption data of different ages and sex from National Food Consumption Databank.

180 food samples were analyzed for the concentration of 20 PFASs congeners in this study, with 37 samples were detected at least one PFASs congener, resulting in a detection rate of 21%. The average concentration of 180 samples was 0.557 ng/g wet weight, with the highest concentrations found in imported beef with 36.78 ng/g wet weight, followed by duck meat with 8.03 ng/g wet weight. The 95th percentile estimated daily exposure doses of PFASs in foods for Taiwanese is ranged from 0-3 years old males with the highest (1.93 ng/kg bw/day) to those over 65 years old females with the lowest (0.63 ng/kg bw/day). The hazard index (HI) was estimated based on the 95th percentile exposure doses ranged from 1.01 to 3.06 for the sum of PFOA, PFOS, PFNA, and PFHxS, all exceeding 1 across all age and sex groups, indicating may have potential health risks. However, the HIs estimated based on the 50th percentile exposure doses ranged from 0.13 to 0.33, all below 1. Using the slope factor 0.07 (mg/kg/day)<sup>-1</sup> provided by the USEPA, the calculated carcinogenic risks for male and female through dietary intake of perfluorooctanoic acid (PFOA) were  $3.62 \times 10^{-9}$  and  $2.61 \times 10^{-9}$ , respectively. Additionally, based on the relative potency factor announced by the RIVM (Rijksinstituut voor Volksgezondheid en Milieu), the calculated lower and upper bound carcinogenic risks for male and female were  $6.53 \times 10^{-8}$  to  $2.09 \times 10^{-7}$ , and  $9.75 \times 10^{-8}$  to  $3.14 \times 10^{-7}$ , respectively, all below  $10^{-6}$ , indicating acceptable risks.

Keywords: PFASs, foods, dietary intake, Risk assessment