

Determination of Perfluorinated Compounds in Breast Milk Samples

Heinrich Juerling¹, R. Suchenwirth², R. Huppmann², Mark Buecking¹

¹ Fraunhofer Institute for Molecular Biology and Applied Ecology (Fraunhofer IME), 57377 Schmallenberg, Germany

² State Health Authorities of Lower Saxony (NLGA), 30499 Hannover, Germany

Introduction and Method

Perfluorinated chemicals (PFC) have been widely used in many industrial and technical applications in the last decades [1]. In consequence the compounds can be found ubiquitously in the environment, today. As they are highly persistent and there is only a small knowledge about their toxicological properties and potential effects the attention paid to the substance group is increasing. Calafat et al. found variable concentrations of PFOS in breast milk samples of rats [2]. Therefore especially information on the exposure situation towards human beings is needed.

Samples

12 pooled breast milk samples of different sampling years 2000 and 2004 and different ages of the females (<20 up to 39 years).

SU: women from Sudan, living in Sudan

RU: women from Russia, living in Germany

sample no.	NLGA code	number of pooled samples	age of women [years]
1	00-04/20-01 PFT	3	< 20
2	00-04/20-02 PFT	3	< 20
3	2000/20-24 PFT	10	20-24
4	2000/25-29 PFT	10	25-29
5	2000/30-34 PFT	10	30-34
6	2000/35-39 PFT	10	35-39
7	2004/20-24 PFT	10	20-24
8	2004/25-29 PFT	10	25-29
9	2004/30-34 PFT	10	30-34
10	2004/35-39 PFT	10	35-39
11	RU PFT	10	17-35
12	SU PFT	10	20-38

Target compounds

- PFOS Perfluorooctanesulfonic acid $C_8F_{17}SO_3H$
- PFHxS Perfluorohexanesulfonic acid $C_6F_{13}SO_3H$
- PFOSA Perfluorooctanesulfonamide $C_8F_{17}SO_2NH_2$
- PFOA Perfluorooctanoic acid $C_7F_{15}COOH$
- PFHxA Perfluorohexanoic acid $C_5F_{11}COOH$

Analysis

- Removing the milk lipids with hexane at pH 14
- Extraction of the PFC into methyl-*tert*.-butyl ether (PFOSA) and hexane (PFOS, PFHxS, PFOA, PFHxA)
- HPLC-MS-MS
- Calibration with internal standard MPFOA-¹³C₄
- Recoveries: 80-110 % (PFOS, PFHxS, PFOA, PFHxA)
- Recoveries: 41.5 % (PFOSA)

Results and Outlook

The concentrations of the analytes in the breast milk were relatively low. Only two compounds; PFHxA and PFOA were detected (figure 1). In contrast to the results of Calafat et al. [2], PFOS was not detected in any sample. The concentrations of PFOA were comparable to those, which we measured in human blood plasma (results not shown).

PFHxA is not known as a high impact PFC in environmental analysis; therefore we assume a metabolic background.

PFCs accumulate in liver, blood and milk also due to interactions with peptides / proteins. Therefore the amount of PFCs in dependence of amount proteins is calculated and shown in figure 2.

More detailed experiments are necessary to fully evaluate the importance of our findings.

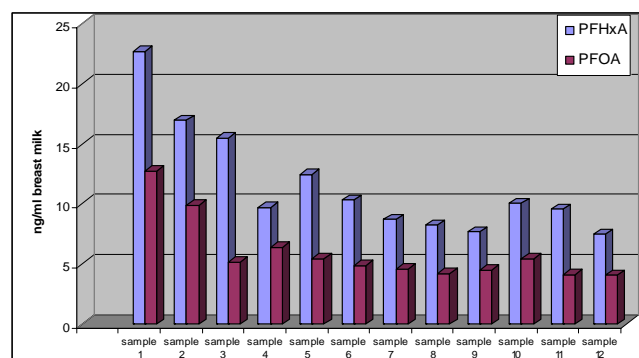


Figure 1: Results of PFHxA and PFOA in ng/ml breast milk.

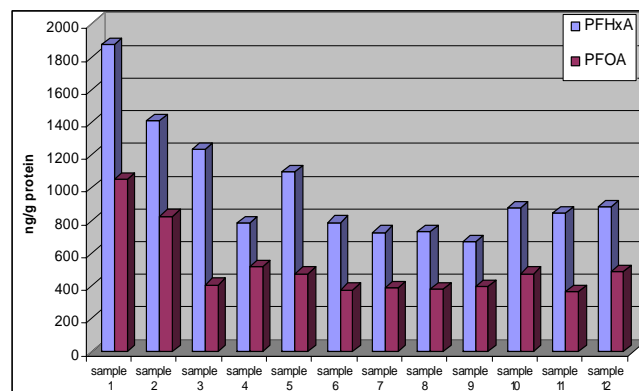


Figure 2: Results of PFHxA and PFOA in ng/g protein

References

- 1) Fricke M.; Lahl U. Z Umweltchem Ökotox 17 (1) 36-49 (2005)
- 2) Calafat A., Kuklenyik Z., Reich J., Butenhoff J., Needham L. Organohalogen Compounds, Volumes 60-65, Dioxin Boston MA, CD-Rom (2003)