CONffIDENCE: Contaminants in food and feed: Inexpensive detection for control of exposure

Work package WP1b – Perfluorinated compounds (PFCs)

ANALYSIS OF PERFLUORINATED COMPOUNDS IN FISH: A PILOT STUDY FROM THE CZECH REPUBLIC

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Introduction

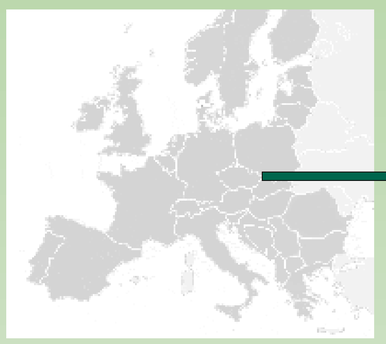
One of the research tasks within the 7FP CONffIDENCE EU project has been focused on the development of a rapid test for control of three major PFC representatives[1] in food of animal origin: PFOS, PFOA and PFOSA, since food forms one of their most important exposure source.

This newly developed method and its performance characteristics are in agreement with the current European Commission recommendation (2010/161/EU) from March 2010, LOQ < 1 µg/kg and recovery in the range 70–120%. In this document it is recommended to monitor a various groups of PFCs together with their precursors in food. Also the contamination of the aquatic ecosystem by this relatively new group of analytes should be monitored.

[1] The EFSA Journal (2008). Perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and their salts. Scientific Opinion of the Panel on Contaminants in the Food chain 653:1–131.

Aim of the study

- To apply a new simple and fast analytical method developed within the CONffIDENCE project on real life fish samples
- To assess the contamination of the Czech aquatic ecosystem by this emerging group of environmental pollutants

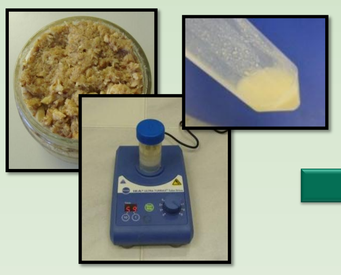


Map of Europe

Map of Elbe and Vltava

Analytical method

Extraction Methanol → **Clean-up Activated charcoal** → **LC-MS/MS**



Ultra Turrax

Shaking; Centrifugation; Filtration

UPLC Acquity (Waters, USA) Qtrap 5500 (AB Sciex, USA)

Limits of quantification (LOQs) were in the range 0.1-0.7 µg/kg. The average recovery was in interval 85-110% and the repeatability, expressed as RSD, ranged between 2 and 15%.

Samples

- 60 pooled fish muscle samples in 3 categories: 100–300 g; 300–900 g and > 900 g
- Fish species such as bream, roach and chub were examined
- 5 localities at the Elbe River – Verdek (1), Hradec Kralove (2), Obristvi (3), Usti nad Labem (4) and Decin (5)
- 3 localities at the Vltava River – Hluboka nad Vltavou (6), Podoli (7), Sedlec (8)
- Locality Trmice at the Bilina River (9)

Bream *(Abramis brama)*

Roach *(Rutilus rutilus)*

Chub *(Leuciscus cephalus)*

Results and Discussion

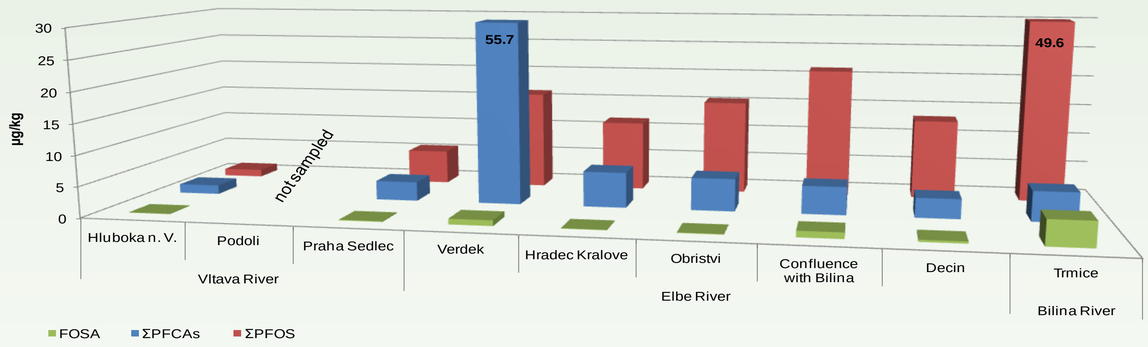


Figure 1 Levels of ΣPFOS, ΣPFCAs and PFOSA in different sampling sites
(ΣPFOS: L-PFOS and Br-PFOS; ΣPFCAs: PFBA, PFOA, PFNA, PFDA, PFUdA, PFDoA, PFTrDA, PFTeDA)
L- PFOS: linear PFOS isomer, Br-PFOS: branched PFOS isomers

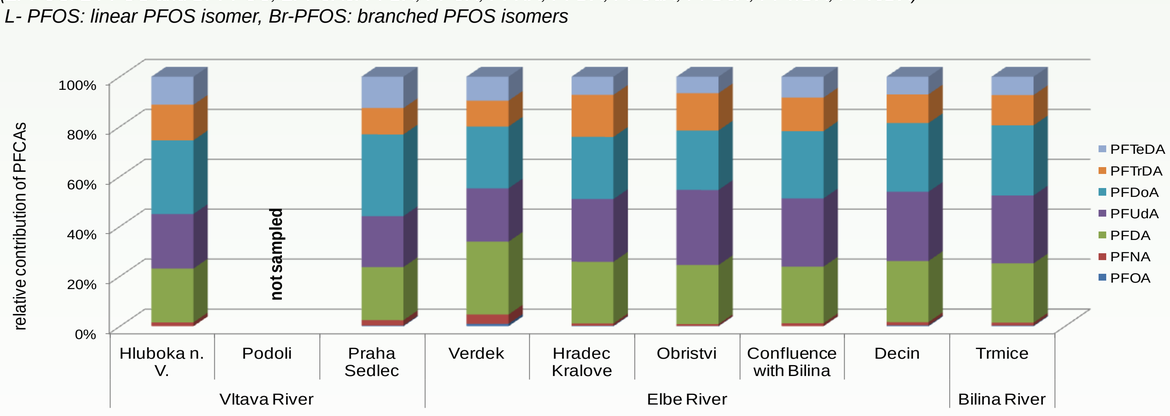


Figure 2 PFCAs profile in chub muscle in monitored localities

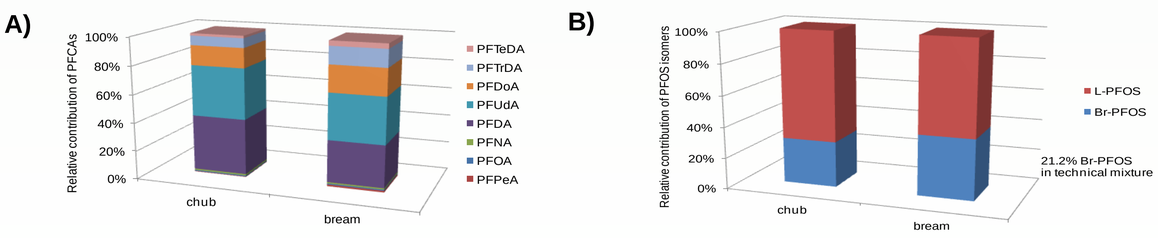


Figure 3 The PFCAs (A) and Br-PFOS / L-PFOS (B) profile in fish muscle in localities Verdek and Trmice, respectively

Table 1 Levels of target PFCs in fish muscle

	PFCAs								PFSAs			PFOSA
Analytes	C5	C8	C9	C10	C11	C12	C13	C14	C6	C8*	C10	C8
Positive samples (%)	36	40	100	100	100	100	100	100	60	100	98	100
Max. concentration (µg/kg)	0.4	0.4	0.6	22	20	7.8	3.7	0.9	0.1	136	0.1	7.8

*ΣPFOS

- PFOSA and PFOS were determined in 100% and PFOA only in 40% of examined samples
- Not only CONffIDENCE target analytes, but also other chemicals were examined, PFCAs with the longer chain (C9–C14) were found in 100% of samples, on the other hand PFBA, PFHxA, PFHpA and PFBS were not detected
- PFDA, PFUdA and PFDoA form the major contribution to ΣPFCA; see Fig. 2.
- The highest concentration, of PFOS in chub muscle was found in locality Trmice/ Bílina River (49.6 µg/kg) while ΣPFCA were dominant in locality Verdek/ Elbe River; see Fig. 1.
- The comparison of Br-PFOS / L-PFOS and PFCAs profiles in muscle tissue was performed on example of chub (*Leuciscus cephalus)* and bream *(Abramis brama),* see Fig. 3; the most common species in Czech rivers, in locality Trmice and Verdek, see Fig. 3, no significant differences were identified.

Conclusions

- The extensive monitoring study concerning PFCs in fish was conducted in the Czech Republic for the first time.
- Not only 3 selected compounds (PFOS, PFOA and PFOSA) but also 6 PFCAs were determined.
- The potential source of PFCAs and PFOS in Verdek / Elbe River and Trmice / Bílina River, respectively was located.

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