

Analysis of Poly- and Perfluoro Alkylsubstances in Drinking Water Using EPA Method 537.1 with Semi-Automated Solid Phase Extraction (EZPFC®)

Introduction

Per and polyfluoroalkylated substances (PFAS) is a general term used to describe compounds that are largely comprised of or contain a perfluorinated or polyfluorinated carbon chain moiety such as $F(CF_2)_n-$ or $F(CF_2)_n-(C_2H_4)_n-$. Perfluorooctane sulfonate (PFOS) and other PFAS are widely used in industrial and consumer applications, including stain-resistant coatings for textiles, leather, and carpets; grease-proof coatings for paper products approved for food contact; firefighting foams; mining and oil-well surfactants; floor polishes; and insecticide formulations. In recent years, there has been increasing concern over the levels of PFAS such as PFOS and PFOA (perfluorooctanoic acid) in the global environment and their fate and possible adverse effects.

To meet demands for a low cost method that requires less financial investment than automated systems, FMS developed a simple semi - automated system which is fast, inexpensive and yields high quality data.

Instrumentation

- FMS EZPFC® System
- FMS SuperVap®
- Vacuum pump
- Acquity UPLC coupled to a Q-TOF (Xevo G2-XS) and HR-MS (Waters, Milford, MA)

Consumables

- FMS, Inc. 500 mg PFC SDVB cartridge
- Ultra pure DI water
- Methanol pesticide grade
- Isopropyl alcohol pesticide grade

- Wellington Labs native PFAS standard
- Wellington Labs labeled PFAS standard

Procedure

- 12 samples (250 mL water each) were spiked with 2, 5, 25, or 50 ppt PFAS standards
- Put sample bottles in place and fill rinse bottles with 7.5 mL water
- Cartridges are installed in each of the 12 positions.

Stage 1:

- Vacuum is turned on
- Cartridges are conditioned with 15 mL methanol (soak 2 min) and 18 mL water (soak 2 min)
- Samples are loaded across cartridges under vacuum (20 - 25 min, ~ 8 inch Hg)
- Rinse sample bottles with 7.5 mL water from rinse bottles and load across cartridge; repeat process (15 mL water total)
- Cartridges are dried with nitrogen for 5 min

Stage 2:

- Fill rinse bottles with 4 mL methanol and use to rinse sample bottles
- 4 mL methanol from sample bottles is loaded across the cartridges with nitrogen and the eluent is collected for analysis into collection vessels
- Repeat process so 8 mL methanol total is collected across cartridge as eluent

FMS SuperVap®

- Pre-heat temp: 60-65 °C
- Pre-heat time: 20 minutes
- Heat in Time mode at 60-65 °C under nitrogen (7-10 psi)
- Reduce to dryness

Analysis

- Reconstitute as per method
- Analyze with LC/MS

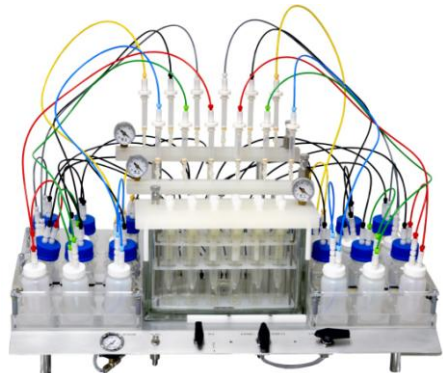


	2 ppt	5 ppt	25 ppt	50 ppt	EPA window
PFBS	94%	93%	98%	99%	70%-130%
PFHxA	99%	104%	101%	109%	70%-130%
GenX	102%	98%	106%	123%	
PFHpA	99%	103%	102%	103%	70%-130%
PFHxS	95%	97%	97%	102%	70%-130%
ADONA	90%	97%	99%	104%	70%-130%
PFOA	116%	109%	105%	103%	70%-130%
PFNA	95%	107%	111%	110%	70%-130%
PFOS	93%	96%	95%	101%	70%-130%
9CI-PF3ONS	88%	88%	95%	100%	70%-130%
PFDA	91%	99%	105%	111%	70%-130%
N-MeFOSAA	93%	97%	92%	92%	70%-130%
PFUdA	93%	101%	104%	108%	70%-130%
N-EtFOSAA	95%	110%	98%	98%	70%-130%
11CI-PF3OUDS	86%	88%	86%	91%	70%-130%
PFDoA	90%	92%	99%	101%	70%-130%
PFTrDA	86%	89%	97%	93%	70%-130%
PFTeDA (PFTA)	84%	82%	91%	93%	70%-130%

Table 1. Average native recoveries for various PFAS (%) at 2, 5, 25 and 50 ppt.

Conclusions

The results of the water samples in Table 1 demonstrate the ability of the FMS EZPFC system to deliver accurate results with excellent reproducibility. The semi-automated EZPFC is superior to traditional, time-consuming, inconsistent and expensive liquid/liquid extractions. Native background contributions from the system are negligible. The system can run 12 samples in parallel.



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FMS EZPFC System