Application Note

Automated Low Background Solid Phase Extraction System for Perfluorinated Compounds in Water

Introduction

Perfluoralkylated substances is a general term used to describe substances which are largely comprised of or contain a perfluorinated or polyfluorinated carbon chain moiety such as $F(CF_2)_n$- or $F(CF_2)n$-$(C_2H_4)_n$. PFOS and other perfluorinated compounds 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 perfluorinated and polyfluorinated chemicals, such as PFOS (perfluorosulfonate) and PFOA (perfluoro-octanoicacid), in the global environment and their fate and possible adverse effects in the environment.

In animal studies, some PFCs disrupt normal endocrine activity; reduce immune function; cause adverse effects on multiple organs, including the liver and pancreas; and cause developmental problems in rodent offspring exposed in the womb. Data from some human studies suggests that PFCs may also have effects on human health, while other studies have failed to find conclusive links. Additional research in animals and in humans is needed to better understand the potential adverse effects of PFCs for human health.

Two compounds in particular, perfluorooctane sulphonate (PFOS) and perfluorooctanoic acid (PFOA), represent the final environmental degradation products of (and contaminants in) a wide range of other perfluorinated products and have been most extensively studied. PFOS is now subject to varying but increasing levels of control in a number of countries. PFOA, also a widespread contaminant but with a far lower bioaccumulation potential is still under evaluation.

Instrumentation and Consumables

- FMS, Inc. TurboTrace® PFC SPE system (solid phase extraction)
- FMS, Inc. SuperVap Concentrator
- FMS PFC 225 mg cartridge
- Waters Acquity H-class LC and Waters Xevo TQ MS.

Method Summary

TurboTrace PFC SPE

- Condition cartridge with 15 mL methanol
- Condition cartridge with 40 mL water
- Load 500 mL of water sample
- Rinse bottle with 25 mL water
- Load bottle rinse.
- Dry cartridge for 20 minutes
- Elute sample with 15 mL methanol

SuperVap Concentrator

- Pre-heat temp: 50 ^{O}C
- Pre-heat time: 20 minutes
- Heat in Sensor mode: 50 ^{O}C
- Nitrogen pressure: 9 PSI

TurboTrace SPE System for PFCs

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Procedure

Five hundred mL water samples were spiked with 25 uL of 1 ug/mL PFC standard solution. Samples were then loaded onto the FMS PFC SPE system and passed across a FMS PFC 225mg cartridge under -12 psi vacuum. After loading, the bottle was rinsed with 25 mL of water and loaded onto the cartridge under negative pressure. The cartridges were dried using nitrogen until no residual water was present, and the cartridges were subsequently eluted with methanol. The extracts were concentrated to 500 uL, after which internal standard was added. The samples were diluted to a final volume of 1 mL of water for LC/MS analysis.

Conclusion

The FMS TurboTrace PFC SPE system produces reliable, reproducible results for perfluorinated compounds in water. The system,by design, has very low background allowing for analysis of samples without any significant interference.

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Results

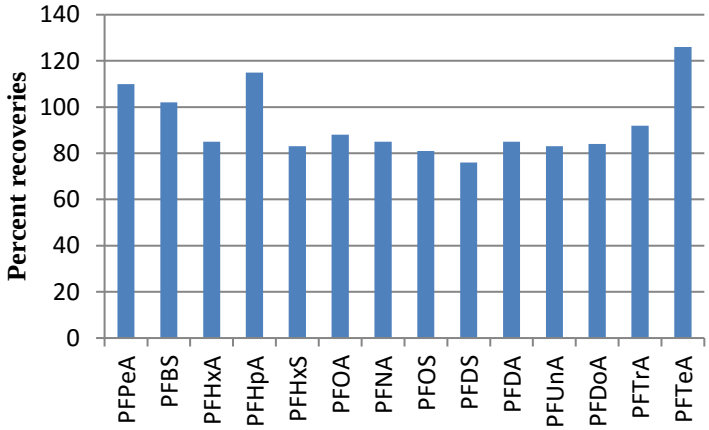

Figure 1. Recoveries for a number of Perfluorinated Compounds.

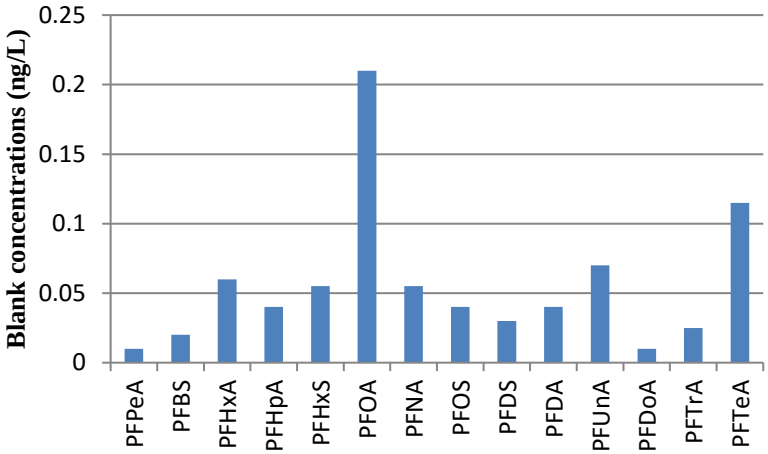

Figure 2. Background concentrations for a number of Perfluorinated Compounds.

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