

Cod: 2.1019

AUTOMATED LOW BACKGROUND SOLID PHASE EXTRACTION OF PERFLUORINATED COMPOUNDS IN WATER

R. Addink¹, P. Germansderfer¹, H. Shirkhan¹, T. Hall¹

¹*Fluid Management Systems, 580 Pleasant St, Watertown, MA 02472, USA*

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(CF₂)_n- or F(CF₂)_n-(C₂H₄)_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-octanoic acid), in the global environment and their fate and possible adverse effects.

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.¹ Data from some human studies suggests that PFCs may also have effects on human health, while other studies have failed to find conclusive links.² 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.

Materials and methods

SPE Procedure

The SPE system was loaded with DVB 225 mg cartridges that were then each conditioned with 15 mL methanol and 40 mL water. Five hundred mL water samples were spiked with 25 uL of 1 ug/mL PFC standard solution. Samples were loaded onto the SPE system and passed across the 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 (typically 20 min). The cartridges were then eluted with 15 mL methanol.

Concentration

The collection tubes with sample were pre-heated in the SuperVap concentrator to 50 oC for 20 min, followed by heating in the sensor mode under 9 psi of nitrogen which assured automatic shut-off at 0.5 mL. 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.

Analysis

Samples were analyzed with a Waters Acquity H-class LC and Waters Xevo TQ MS.

Figure 1. Automated Solid Phase Extraction System for Perfluorinated Compounds.

Results and discussion

Figure 2. Recoveries for a number of Perfluorinated Compounds.

Figure 3. Background concentrations for a number of Perfluorinated Compounds.

Recoveries of spiked standards varied between ~ 75-125% (Figure 2) with low background contributions coming from the SPE system (Figure 3). The SPE system for PFCs produces reliable, reproducible results for perfluorinated compounds in water. The system, by design, has very low background PFC allowing for analysis of samples without any significant interference.

References:

1. Grasty, R.C., Bjork, J.A., Wallace, K.B., Wolf, D.C., Lau, C.S., Rogers, J.M. (2005) *Birth Defects Res B Dev Reprod Toxicol* 74 (5), 405-416.
2. Lau, C., Anitole K., Hodes, C., Lai, D., Pfahles-Hutchens, A., Seed, J. (2007) *Toxicological Sciences* 99 (2), 366 -394.



Figure 1

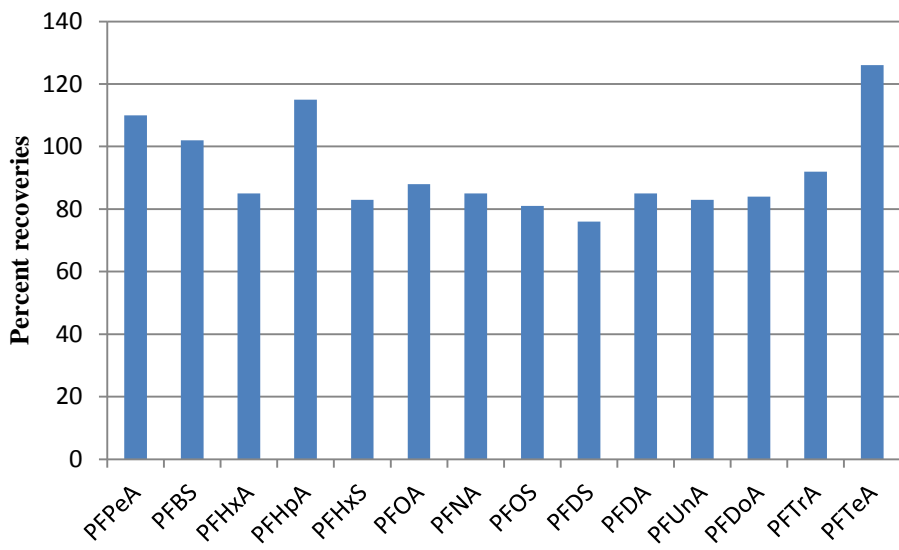


Figure 2.

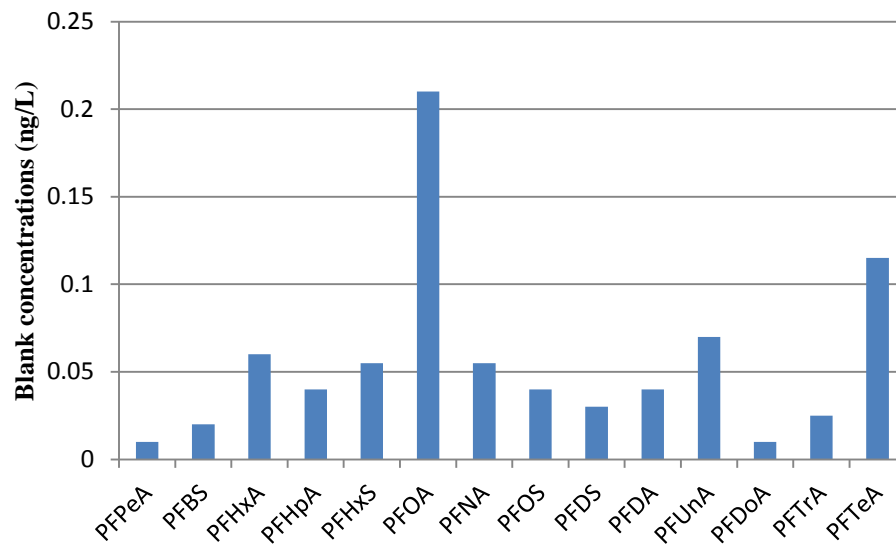


Figure 3.