

Perfluorinated Alkyl Substances (PFAS) in Drinking Water: Extraction Using the PS2 Cartridge in Accordance with EPA 537.1

Kari L. Organtini, Keil Brinster, Kenneth J. Rosnack

Waters Corporation

This is an Application Brief and does not contain a detailed Experimental section.

Abstract

This application brief demonstrates the extraction of PFAS from drinking water samples using the Sep-Pak PS2 Cartridge as an equivalent SPE chemistry for the methodology described in EPA 537.1.

Benefits

Demonstration of the Sep-Pak PS2 Cartridge to extract PFAS from drinking water according to EPA method 537.1.

Introduction

In the United States, many laboratories performing analysis of perfluorinated alkyl substances (PFAS) in drinking water will follow the EPA 537 methodology. The EPA 537 method for analysis of PFAS in drinking water was updated in 2018 to include emerging PFAS in the list of compounds covered by the method. EPA 537.1 requires the use of a styrene divinylbenzene (SDVB) substrate for solid phase extraction (SPE) of drinking water samples.

The method does not allow modifications to the sample extraction step, therefore the SPE chemistry used must provide suitable results following the prescribed methodology. The analysis method covers 18 PFAS, including legacy carboxylate and sulfonates, like PFOA and PFOS, as well as the addition of four emerging PFAS, including GenX (HFPO-DA).

The Sep-Pak PS2 Cartridge (p/n: WAT200610) is a direct equivalent to the chemistry mandated in the 537.1 method and meets all the necessary analytical requirements.

Results and Discussion

Tap and bottled drinking water samples were evaluated following the sample collection and extraction procedures required by EPA 537.1 and subsequently analyzed by LC-MS/MS using an ACQUITY UPLC I-Class PLUS System coupled to a Xevo TQ-S micro Tandem Quadrupole Mass Spectrometer. To comply with the accuracy requirements designated in EPA 537.1, recovery of the 18 PFAS in the method must be in the range of 70–130%. Using the Sep-Pak PS2 Cartridge, all 18 PFAS demonstrated recoveries well within the required range over a number of fortified concentrations. Figure 1 highlights the recovery of each PFAS at 0.5, 1.0, 4.0, and 16.0 ng/L. Recoveries were within 80–125% for every concentration level evaluated.

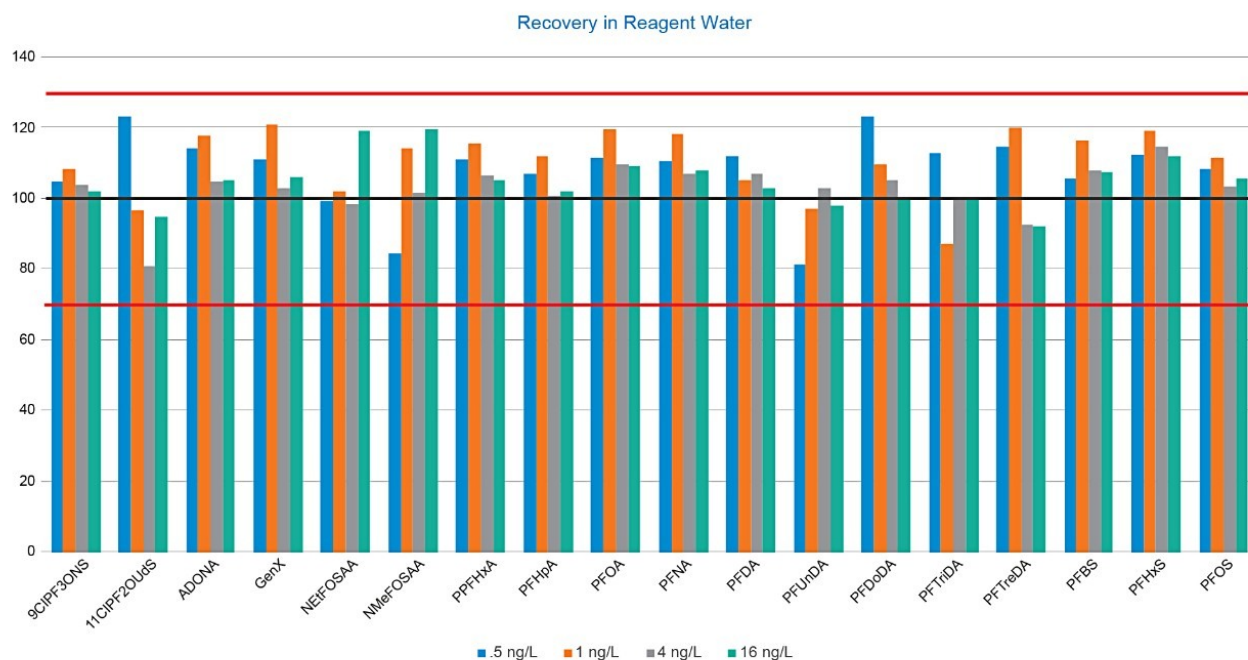


Figure 1. Recovery of EPA 537.1 PFAS in reagent water. All compounds are well within the method recovery guidance of 70–130%.

Another requirement of 537.1 is that method precision must be demonstrated by showing that the %RSD of sample replicates is below 20%. This was evaluated by performing six replicate extractions in both tap and bottled drinking water that were fortified with PFAS at a known concentration. Figure 2 shows the %RSDs are well within the acceptable range for all compounds, with a majority of PFAS exhibiting RSDs well below 10%.

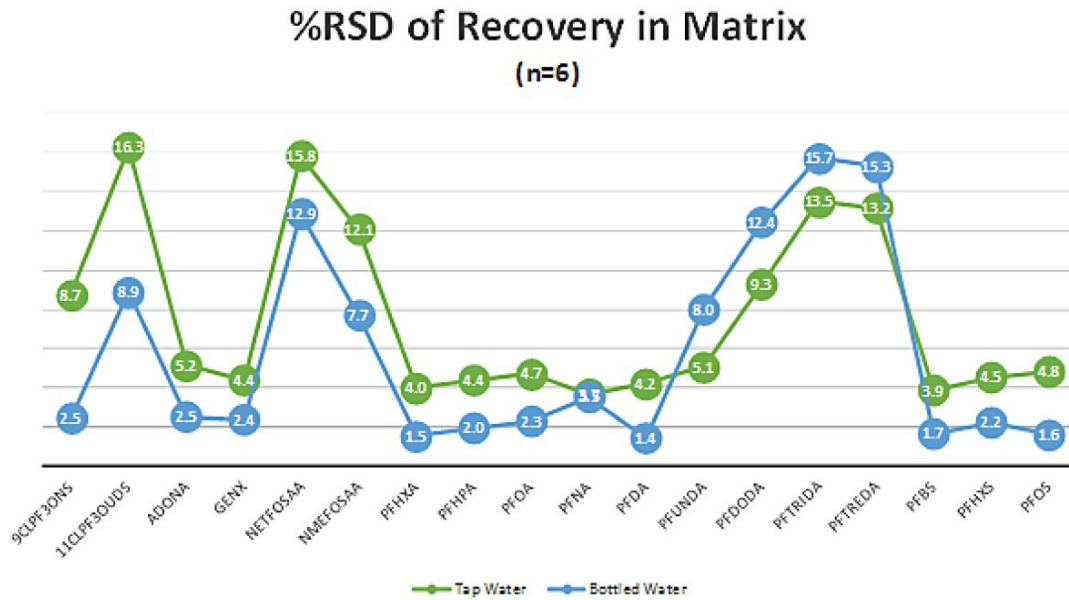
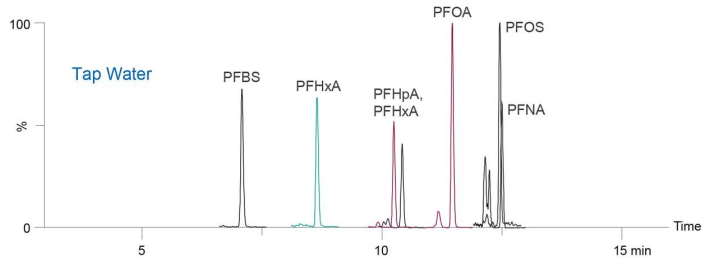
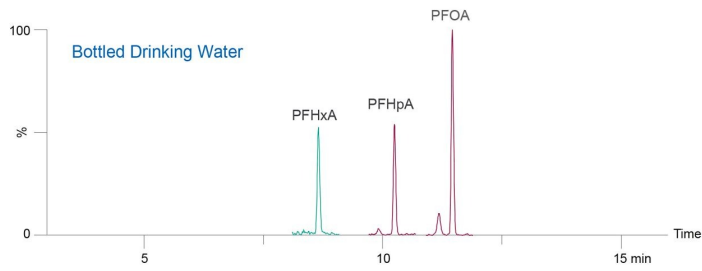


Figure 2. %RSD of recovery values for six replicates each of tap and bottled drinking water matrices. Using the EPA 537.1 methodology, which was demonstrated to be precise and robust using the Sep-Pak PS2 Cartridge, tap and bottled drinking water were analyzed for incurred PFAS residues. The results from this analysis are highlighted in Figure 3. Three PFAS (PFHxA, PFHpA, and PFOA) were detected in the bottled drinking water ranging from 0.02–0.22 ng/L. The tested tap water contained seven PFAS, including PFHxA, PFHpA, PFOA, PFNA, PFBS, PFHxS, and PFOS, and they were detected at concentrations ranging from 0.39–1.99 ng/L.



Compound	Tap Water	Bottled Water
9CIPF3ONS	ND	ND
11CIPF3OUdS	ND	ND
ADONA	ND	ND
GenX	ND	ND
NEtFOSAA	ND	ND
NMeFOSAA	ND	ND
PFHxA	1.99	0.02
PFHpA	1.37	0.09
PFOA	2.98	0.22
PFNA	0.39	ND
PFDA	ND	ND
PFUnDA	ND	ND
PFDoDA	ND	ND
PFTriDA	ND	ND
PFTreDA	ND	ND
PFBS	1.98	ND
PFHxS	0.63	ND
PFOS	0.53	ND

Figure 3.

PFAS identified in the two tested samples of drinking water.

Concentrations are reported in ng/L.

Conclusion

The Sep-Pak PS2 Cartridge is directly equivalent to the SDVB phase required for EPA 537.1. PS2 has been demonstrated to reliably extract PFAS in drinking water samples with the required precision and accuracy of the EPA method, with percent recoveries of all required PFAS between 80–120% and %RSDs of replicate extracts below 16%. A range of PFAS were detected and quantitated in tap and bottled drinking water using this approach. Therefore, the Sep-Pak PS2 Cartridge and methodology herein meet the regulatory requirements of EPA 537.1 analysis for PFAS.

Featured Products

- [ACQUITY UPLC I-Class PLUS System <https://www.waters.com/134613317>](https://www.waters.com/134613317)
- [Xevo TQ-S micro Triple Quadrupole Mass Spectrometry <https://www.waters.com/134798856>](https://www.waters.com/134798856)

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