Application Note

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Simultaneous C1–C18 PFAS Analysis in Drinking Water by Large-Volume Direct Injection Using an Altura Poroshell 120 PFAS Column

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Abstract

Per- and polyfluoroalkyl substances (PFAS) are now routinely found in drinking water around the world. Ultra-short-chain (USC) PFAS (C1–C3) such as trifluoroacetic acid (TFA), perfluoropropanoic acid (PFPrA), and related species are especially challenging because they are very polar, sit near the solvent front on conventional C18 columns, and can be masked by background contamination from the LC system and solvents.

In this work, we developed a single-injection LC/MS method for C1–C18 PFAS in drinking water using a new Agilent Altura Poroshell 120 PFAS column together with a dedicated PFAS delay column. The method uses large-volume direct injection (up to 100 µL) of acidified water samples and delivers good retention and peak shape for USC PFAS while maintaining practical run times for the full C1–C18 panel. We compare performance with standard C18 columns and show how the new PFAS column and delay column design reduces system background, simplify workflows, and support routine drinking-water analysis.

Introduction

PFAS and ultra-short-chain PFAS

PFAS is a large family of fluorinated chemicals used in nonstick coatings, repellents, industrial fluids, and many other products. Because of their high chemical and thermal stability (for which they are known as "forever chemicals"), they persist in the environment and are now routinely detected in drinking water.

Most early regulations focused on a few long-chain PFAS, such as PFOA and PFOS. However, as manufacturing has shifted and monitoring programs expanded, ultra-short-chain PFAS (C1–C3) species such as TFA, PFPrA and small perfluorosulfonates—started to show up more frequently and, in some cases, dominate the PFAS profile in surface and drinking waters. These compounds are very polar and highly water soluble and are difficult to remove in conventional treatment. They are poorly retained on traditional reversed-phase columns. From an LC point of view, this combination makes the C1–C3 end of the panel the hardest to measure reliably.

Regulatory direction for USC PFAS

Globally, regulations are moving from "a few legacy PFAS" toward broader PFAS groups and lower reporting levels. Examples include:

- **US:** national drinking-water regulations for a set of priority PFAS, along with technical documents that highlight short-chain and USC PFAS as emerging concerns[1,2]
- **EU:** In its 2025 opinion, the European Commission's Scientific Committee on Health, Environmental and Emerging Risks (SCHEER)[3,4] reviewed draft environmental quality standards for "PFAS total" under the Water Framework Directive, confirming that TFA is included in the definition, recommending its addition to the existing list of 24 PFAS for group-based EQS values, and considering whether TFA should have a separate standard, referencing the proposed 2.2 µg/L drinking-water QS by RIVM and its classification as a reprotoxic 1B substance.
- **Other regions:** wider screening studies showing USC PFAS in tap, bottled, and surface waters, prompting local guidance and watch lists

Even when USC PFAS are not yet explicitly regulated, labs are already being asked to report them or to build methods that can easily expand as regulations tighten. This creates demand for LC columns and methods that can handle C1 through C18 in a single workflow.

Analytical challenges

From a chromatography point of view, USC PFAS presents three main issues. C1–C3 PFAS elute at or near the dead volume on typical C18 phases. Background PFAS, especially TFA and PFBA, can come from solvents, reagents, and LC system components. Many labs want to avoid SPE and would prefer direct injections, but large aqueous injections can cause poor peak shape and solvent effects for early eluters.

The Altura Poroshell 120 PFAS column and new PFAS delay column were developed specifically to address these points. This application note uses data from method development to show how this new column set can support single-injection C1–C18 PFAS analysis in drinking water.

Experimental

Instrumentation

Analysis was performed using an Agilent 1290 Infinity II LC equipped with a high-speed pump coupled to an Agilent 6475 triple quadrupole LC/MS. The LC was configured with a 100 µL injection loop and a multisampler.
To reduce PFAS contamination and background from solvents and the LC system, a PFC-free LC conversion kit was installed. Table 1 shows the LC parameters, and Table 2 shows the MS parameters.

Table 1. LC parameters optimized for this method.

Parameter	Value
LC Instrument	Agilent 1290 Infinity II with PFAS free kit (p/n 5004-0006) installed
Delay Column	Agilent Poroshell 120 PFAS, 4.6 × 30 mm, 2.7 µm (p/n 027403-007)
Analytical Column	Agilent Poroshell 120 PFAS, 2.1 × 100 mm, 2.7 µm (p/n 227210-007)
Column Temperature	40 °C
Mobile Phase	A) 5 mM Ammonium acetate + 0.05% acetic acid in water B) 5 mM Ammonium acetate in methanol
Gradient	Time (min) %B 0 10 1 50 14 100 16 100 16.1 10 21 10
Injection Volume	100 µL
Flow Rate	0.4 mL/min

Table 2. MS parameters optimized for this method.

Parameter	Value
MS Instrument	Agilent 6475 triple quadrupole LC/MS
Ionization Mode	Negative ESI
Capillary Voltage	2,500 V
Nozzle Voltage	0 V
Nebulizer Pressure	20 psi
Drying Gas Temperature	230 °C
Drying Gas Flow Rate	6.0 L/min
Sheath Gas Temperature	375 °C
Sheath Gas Flow Rate	11.0 L/min
Detector Gain Factor	5

MS acquisition method

Dynamic MRM (dMRM) acquisition by Agilent MassHunter (data acquisition version 12.2) was performed. All data processing was done using MassHunter quantitative analysis software (version 12.0). Table 3 shows the optimized transitions and compound parameters for all the PFASs analyzed and isotope standards in this note by the 6475 triple quadrupole LC/MS.

Table 3. Compound acquisition parameters (continued on next page).

Compound Name	Precursor *m/z*	Product *m/z*	RT (min)	RT Window (min)	Polarity
4:2FTS	327	307	9.23	1.36	Negative
4:2FTS	327	80	9.23	1.36	Negative
6:2FTS	427	407	11.07	1.34	Negative
6:2FTS	427	80	11.07	1.34	Negative
8:2FTS	527	507	12.44	1.21	Negative
8:2FTS	527	80	12.44	1.21	Negative
9Cl-PF3ONS	530.9	350.9	11.89	1.31	Negative
9Cl-PF3ONS	530.9	83	11.89	1.31	Negative
11Cl-PF3OUdS	630.9	450.9	12.91	1.2	Negative
11Cl-PF3OUdS	630.9	83	12.91	1.2	Negative
13C2-PFDoDA	615	570	13.45	1.2	Negative
13C2-PFDoDA	615	269	13.45	1.2	Negative
13C2-PFHxA	315	270	9.49	1.36	Negative
13C2-PFUnDA	565	519.9	13	1.2	Negative
13C3-PFPrA	166	120.9	5.83	1.38	Negative
13C4-PFBA	217	172	7.17	1.36	Negative
13C4-PFOA	417	372	11.19	1.33	Negative
13C4-PFOS	503	99	11.64	1.21	Negative
13C4-PFOS	503	80	11.64	1.21	Negative
13C-TFA	115	70	4.42	1.36	Negative
18O2-PFHxS	402.9	103	10.17	1.34	Negative
18O2-PFHxS	402.9	83.9	10.17	1.34	Negative
ADONA	377	251	10.37	1.21	Negative
ADONA	377	85	10.37	1.21	Negative
DFA	95	51.1	3.43	1.5	Negative
HFPO-DA	285	185	9.61	1.36	Negative
HFPO-DA	285	169	9.61	1.36	Negative
NFDHA	201	135	9.22	1.37	Negative
NFDHA	201	85	9.22	1.37	Negative
PFBA	213	169	7.17	1.38	Negative
PFBS	298.9	99	8.27	1.33	Negative
PFBS	298.9	80	8.27	1.33	Negative
PFDA	513	469	12.48	1.21	Negative
PFDA	513	269	12.48	1.21	Negative
PFDoA	613	569	13.45	1.2	Negative
PFDoA	613	269	13.45	1.2	Negative
PFEESA	314.9	135	8.66	1.36	Negative
PFEESA	314.9	69	8.66	1.36	Negative
PFEtS	199	79.8	5.89	1.32	Negative
PFHpA	363	319	10.41	1.21	Negative
PFHpA	363	169	10.41	1.21	Negative
PFHpS	448.9	99	10.96	1.21	Negative
PFHpS	448.9	80	10.96	1.21	Negative

Compound Name	Precursor *m/z*	Product *m/z*	RT (min)	RT Window (min)	Polarity
PFHxA	313	269	9.5	1.39	Negative
PFHxA	313	119	9.5	1.39	Negative
PFHxDA	812.9	769	14.77	1.2	Negative
PFHxDA	812.9	269	14.77	1.2	Negative
PFHxS	398.9	99	10.17	1.26	Negative
PFHxS	398.9	80	10.17	1.26	Negative
PFMBA	279	235	8.72	1.36	Negative
PFMBA	279	85	8.72	1.36	Negative
PFMeS	149	79.9	4.68	1.35	Negative
PFMOAA	179	135	6.29	1.35	Negative
PFMOAA	179	84.8	6.29	1.35	Negative
PFMPA	229	85	7.59	1.33	Negative
PFNA	463	419	11.89	1.21	Negative
PFNA	463	169	11.89	1.21	Negative
PFOA	413	369	11.19	1.31	Negative
PFOA	413	169	11.19	1.31	Negative
PFODA	912.9	868.9	15.24	1.2	Negative
PFODA	912.9	169	15.24	1.2	Negative
PFOS	498.9	99	11.64	1.2	Negative
PFOS	498.9	80	11.64	1.2	Negative
PFPeA	263	219	8.43	1.38	Negative
PFPeS	348.9	99	9.29	1.34	Negative
PFPeS	348.9	80	9.29	1.34	Negative
PFPrA	163	118.9	5.82	1.35	Negative
PFPrS	248.9	79.8	7.13	1.2	Negative
PFTeDA	712.9	669	14.19	1.2	Negative
PFTeDA	712.9	169	14.19	1.2	Negative
PFTrDA	663	619	13.84	1.31	Negative
PFTrDA	663	169	13.84	1.31	Negative
PFUnA	563	319	13	1.2	Negative
PFUnA	563	269	13	1.2	Negative
TFA	113	68.9	4.42	1.2	Negative

Sample preparation

Co-solvation sample preparation was applied for the water samples in this study. A set of 50 mL samples of drinking water were filtered through a 0.2 µm regenerated cellulose (RC) membrane. Precisely pipette 10 mL of the filtered water and add an appropriate amount of glacial acetic acid to it, stir evenly to make the final concentration of acetic acid in the water sample to 0.1%, and let it stand for equilibrium for 5 minutes; precisely pipette 0.5 mL of the above acidified water sample into a polypropylene sample vial and added with a 10 µL of internal standards (5 µg/L in methanol), then added with 0.5 mL of methanol, vortex oscillate for 1 minute to mix thoroughly and stored for LC/MS analysis. Recovery samples were prepared by spiking a standard mixture to the tap water samples to achieve concentrations of 20 and 100 ng/L.

Standard preparation

The standard stock was diluted appropriately to obtain a calibration solution of the following concentrations: 1000, 500, 200, 100, 50, 20, 10, 5, 2 and 1 ng/L. Each was prepared in a methanol/water (50:50) mix with 0.1% acetic acid added in water. Each was spiked with 10 µL internal standard solution. The internal standard solution was prepared by isotopically labeled surrogate standards dissolved in methanol to a concentration of 5 µg/L.

Method validation

The established method was validated for linearity, recovery and precision. Linearity was evaluated by plotting calibration curves with peak area ratios versus concentrations. The recovery and precision of the entire method were assessed by spiking a known concentration of all analytes into a sample of tap water. In this study, TFA was replaced by ^{13}C-TFA due to high contamination in water samples.

Results and discussion

Retention and peak shape for USC PFAS

We first compared the 2.1 × 50 mm Agilent InfinityLab Altura Poroshell 120 PFAS column to two conventional C18 columns (Agilent ZORBAX Eclipse Plus C18 and Agilent InfinityLab Poroshell 120 EC-C18) using a panel of early-eluting PFAS, including TFA, PFMeS, PFPrA, PFBA, and related compounds. The comparison chromatograms are shown in Figure 1. On the conventional C18 phases we observed TFA and the smallest sulfonates eluting close to dead time (t_0), broad or slightly distorted peaks for some C2–C4 analytes and interference from system background, especially for TFA and PFBA.

With the new PFAS column we found clear retention gain for C1–C3 PFAS, moving them away from the void and solvent front, sharper, more symmetric peaks across the USC group and better separation between PFBA and nearby background, which makes integration more straightforward.

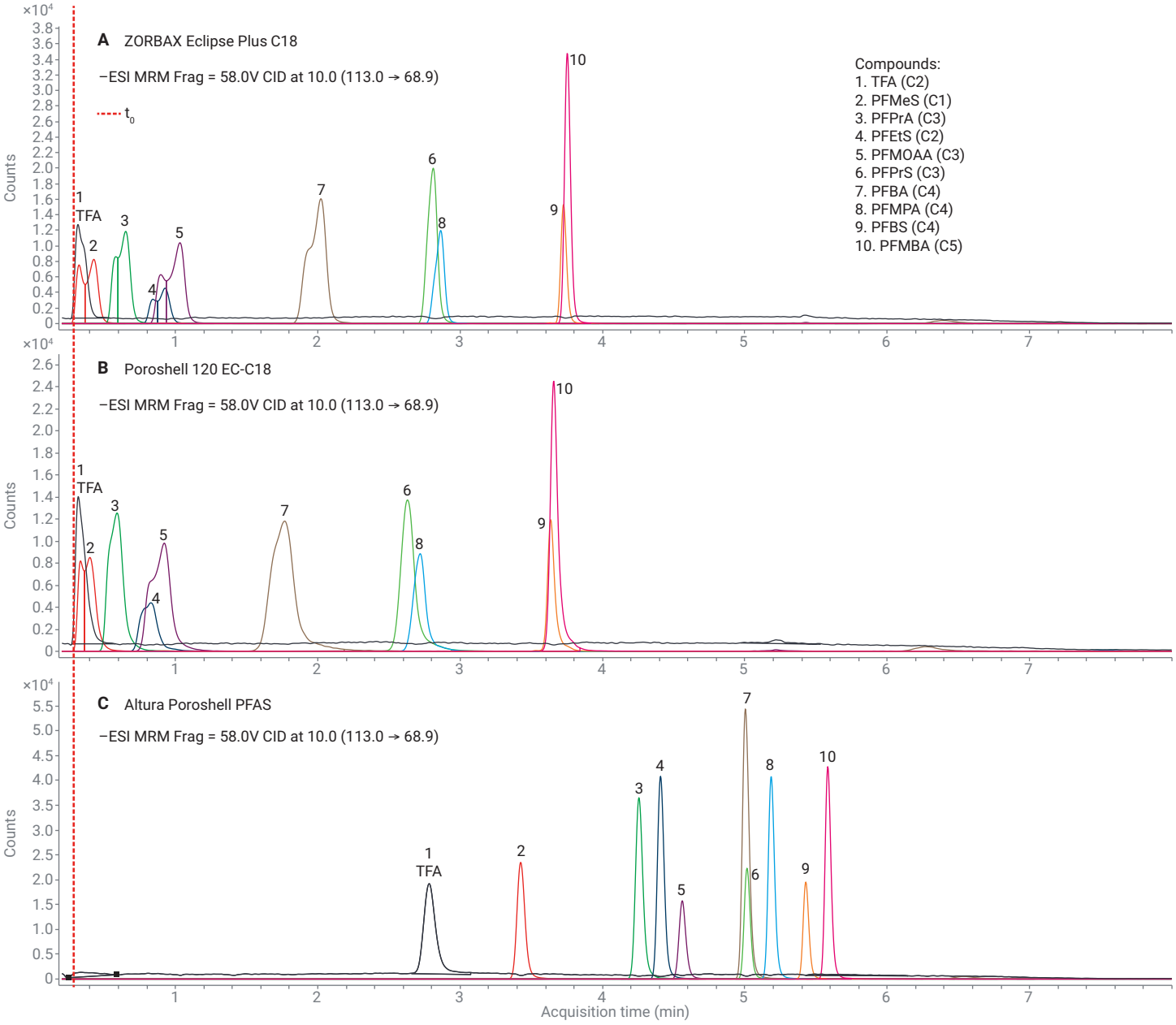

Figure 1. Chromatogram comparison between conventional C18 and Agilent Altura Poroshell PFAS columns. Columns used in this comparison are 2.1 × 50 mm.

This confirms that the new phase and hardware combination are tuned for early PFAS while still behaving like a modern Poroshell column in terms of efficiency and backpressure.

Performance of the new PFAS delay column

System-derived PFAS, especially TFA and PFBA, are a known issue in PFAS workflows. We compared configurations with and without delay columns. For TFA, without a delay column, a strong system background overlapped the target retention window. The new delay column removed the majority of the system TFA contaminates, leaving a clean baseline for the analyte shown in Figure 2.

For PFBA, a similar pattern was observed, with the new delay column providing the best separation between sample PFBA and system background shown in Figure 3.

Overall, the new delay column provides a cleaner baseline and makes it easier to interpret low-level USC peaks, especially when combined with the new analytical column.

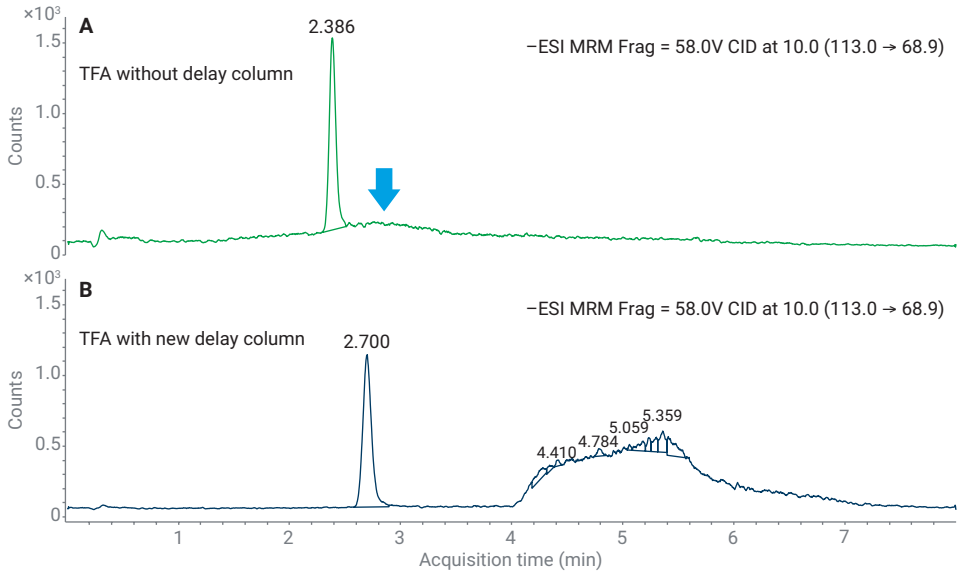

Figure 2. Chromatograms with and without new PFAS delay column for TFA.

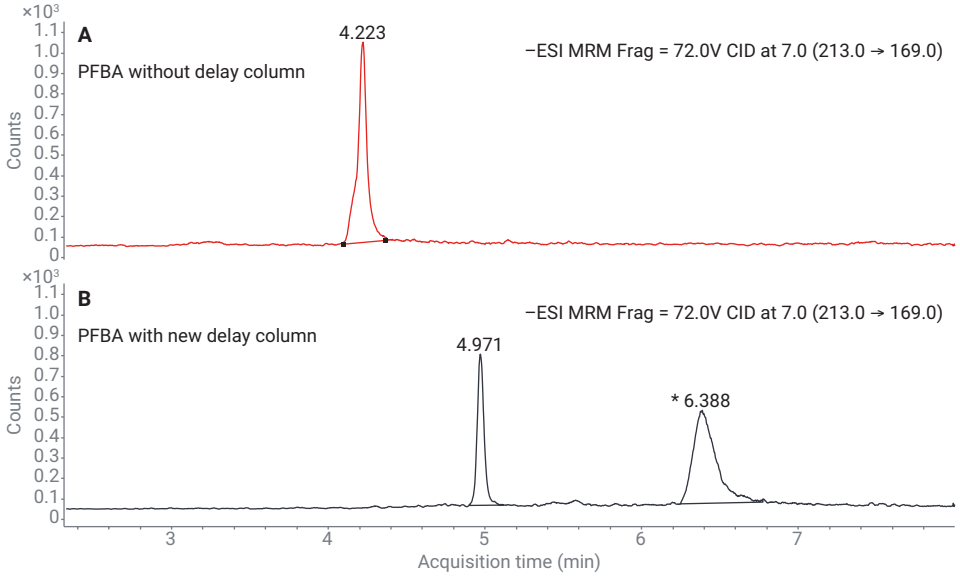

Figure 3. Chromatograms with and without new PFAS delay column for PFBA.

Effect of acetic acid on solvent effects and large-volume injections

During method development, we tested large-volume injections (up to 100 µL) prepared in water/methanol (50:50) without acid. Under these conditions, USC PFAS such as TFA and PFPrA showed noticeable solvent effects — splitting and broadening (see Figure 4A), especially at higher injection volumes.

Adding 0.1% acetic acid to the sample diluent and standards solved this problem. The peak shape for USC PFAS became narrow and symmetrical (see Figure 4B). The solvent effect essentially disappeared, even at 100 µL. The change was simple to implement and did not create backpressure issues. This adjustment is a key part of making large-volume direct injection realistic for routine labs.

Single-injection C1–C18 analysis with a 100 mm column

We then moved to the 2.1 × 100 mm Altura Poroshell 120 PFAS column to evaluate single-injection C1–C18 performance with 100 µL injection volume (Figure 5).

Key observations

Using the 2.1 × 100 mm Altura Poroshell 120 PFAS column, we achieved full C1–C18 coverage in a single run: DFA, TFA, and other USC PFAS were retained and cleanly separated, while long-chain PFAS eluted later in the gradient with good resolution. Retention for both USC and long-chain PFAS was stable over multiple injections, supporting routine use, and the 100 mm column under aqueous-rich conditions operated with backpressure well within the limits of a standard 1290 Infinity II system.

This configuration is well-suited for labs that want maximum sensitivity from large-volume injections without adding SPE.

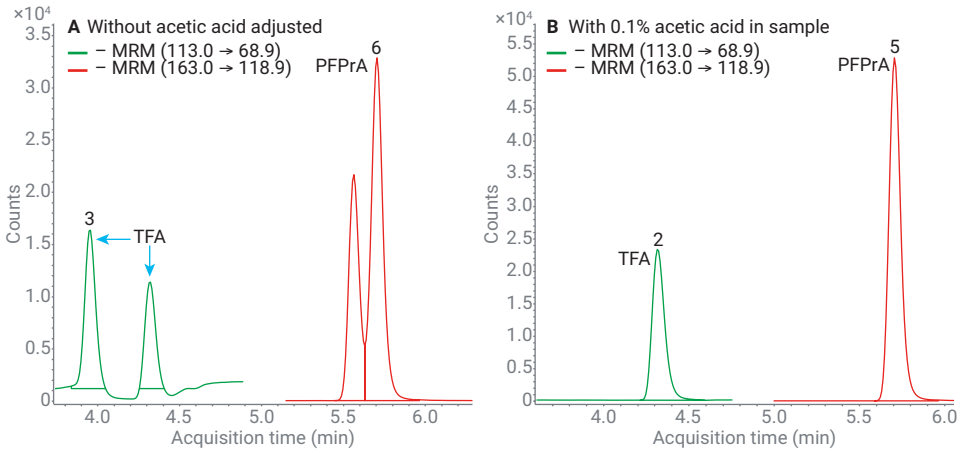

Figure 4. (A) 100 µL injection without acetic acid in sample for TFA and PFPrA; (B) 100 µL injection with 0.1% acetic acid in sample for TFA and PFPrA.

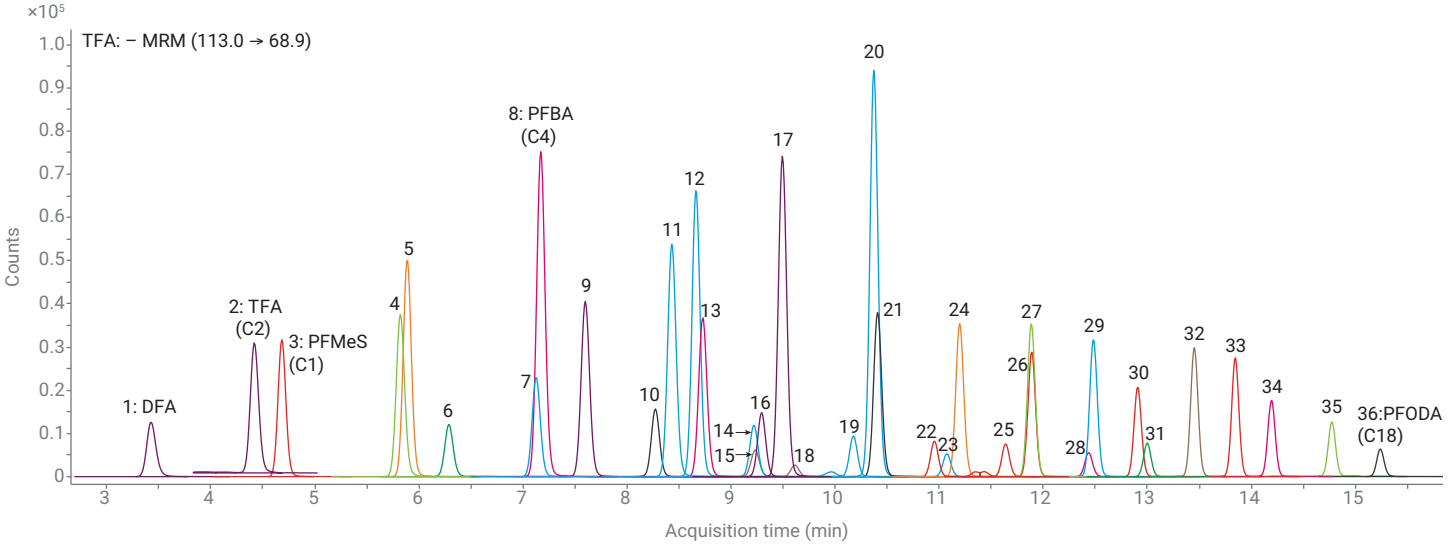

Figure 5. Compounds in the chromatogram: 1. DFA; 2. TFA; 3. PFMeS; 4. PFPrA; 5. PFEtS; 6. PFMOAA; 7. PFPrS; 8. PFBA; 9. PFMPA; 10. PFBS; 11. PFPeA; 12. PFEESA; 13. PFMBA; 14. NFDHA; 15. 4:2 TFS; 16. PFPeS; 17. PFHxA; 18: HFPO-DA; 19. PFHxS; 20. ADONA; 21. PFHpA; 22. PFHpS; 23. 6:2FTS; 24. PFOA; 25. PFOS; 26. 9Cl-PF3ONS; 27. PFNA; 28 8:2FTS; 29. PFDA; 30. 11Cl-PF3OUdS; 31. PFUnA; 32. PFDoA; 33. PFTrDA; 34. PFTeDA. 35. PFHxDA; 36. PFODA).

Linearity

Calibration curves were generated using a linear fit with 1/x weighting and an accuracy acceptable range of 70% to 130%. Excellent linearities, with R^2 > 0.995, were obtained in this study for all analytes (except for PFODA which is possibly due to nonspecific adsorption to the vials) with a minimum of five calibration standard points used for each compound. A higher methanol concentration of 80% might be used for long train PFAS for good linearities and recoveries in further study. The results are listed in Table 4. For a small number of very hydrophobic compounds with known solubility challenges in 50% methanol (for example, PFODA and PAHxDA), low-level behavior was more limited, which is consistent with their physical properties and not specific to this column.

Table 4. Results of calibration curves.

Compound	ISTD	Linearity Range (ng/L)	R^2
DFA	^{13}C-TFA	1–1000	0.999
^{13}C-TFA*	–	1–1000	0.998
PFMeS	^{13}C-TFA	1–1000	0.999
PFPrA	$^{13}C_3$-PFPrA	1–1000	0.999
PFEtS	$^{13}C_3$-PFPrA	1–1000	0.999
PFMOAA	$^{13}C_3$-PFPrA	1–1000	0.999
PFPrS	$^{13}C_4$-PFBA	1–1000	0.998
PFBA**	$^{13}C_4$-PFBA	10–1000	0.997
PFMPA	$^{13}C_4$-PFBA	1–1000	0.999
PFBS	$^{13}C_4$-PFBA	1–1000	0.999
PFPeA	$^{13}C_4$-PFBA	1–1000	0.999
PFEESA	$^{13}C_4$-PFBA	1–1000	0.999
PFMBA	$^{13}C_4$-PFBA	1–1000	0.999
NFDHA	$^{13}C_2$-PFHxA	1–1000	0.999
4:2FTS	$^{13}C_2$-PFHxA	1–1000	0.999
PFPeS	$^{13}C_2$-PFHxA	1–1000	0.999
PFHxA	$^{13}C_2$-PFHxA	1–1000	0.999
HFPO-DA	$^{13}C_2$-PFHxA	5–1000	0.997
PFHxS	$^{18}O_2$-PFHxS	1–1000	0.999
ADONA	$^{18}O_2$-PFHxS	1–1000	0.999
PFHpA	$^{18}O_2$-PFHxS	2–1000	0.999
PFHpS	$^{18}O_2$-PFHxS	1–1000	0.999
6:2FTS	$^{18}O_2$-PFHxS	1–1000	0.999
PFOA	$^{13}C_4$-PFOA	5–1000	0.998
PFOS	$^{13}C_4$-PFOS	1–1000	0.999
9Cl-PF3ONS	$^{13}C_4$-PFOS	1–1000	0.999
PFNA	$^{13}C_4$-PFOA	10–1000	0.999
8:2FTS	$^{13}C_4$-PFOA	1–1000	0.998
PFDA	$^{13}C_4$-PFOA	10–1000	0.998
11Cl-PF3OUdS	$^{13}C_4$-PFOA	2–1000	0.997
PFUnA	$^{13}C_2$-PFUnDA	1–1000	0.999
PFDoA	$^{13}C_2$-PFDoDA	1–1000	0.999
PFTrDA	$^{13}C_2$-PFDoDA	10–1000	0.997
PFTeDA	$^{13}C_2$-PFDoDA	5–1000	0.999
PFHxDA***	$^{13}C_2$-PFDoDA	50–1000	0.998
PFODA***	$^{13}C_2$-PFDoDA	–	–

*TFA might contaminate reagent water, methanol, and other reagents used for sample preparation, so it was replaced with ^{13}C-TFA for calibration curve.

**PFBA was found to contaminate reagent water or other materials during the sample preparation, which interfered with determination of low-level content.

***Linearity for PFODA was not reported due to poor and inconsistent response at low concentrations, likely caused by nonspecific adsorption to container and vial surfaces. A similar behavior was observed for PFHxDA5.

Recovery, and precision

The recovery and precision of the entire method were assessed by spiking a known concentration of all analytes into a 5 mL sample of tap water. Six tap water samples were spiked with 20 ng/L and 100 ng/L each of all analytes listed in Table 5. The mean recoveries and relative standard deviations (RSDs) are listed in Table 5. Recoveries were all well within the 80 to 120% range except for DFA. The RSDs were < 10% in all cases for tap water for all analytes tested in this note.

Of all target compounds, the recovery of DFA was low. In the study, ammonium acetate and sodium sulfite used for chlorine quenching agents were investigated, but both did not help improve the recovery of DFA. The low recovery of DFA is possibly because of matrix effects in tap water, so an isotope labeled DFA internal standard is recommended for DFA determination in tap water.

Table 5. Recovery and precision for standards spiked tap water.

Analyte	20 ng/L Spiked Tap Water		100 ng/L Spiked Tap Water	
	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)
DFA	46%	3.2	46%	1.2
^{13}C-TFA*	86%	1.3	86%	0.6
PFMeS	88%	1.2	106%	0.5
PFPrA	94%	1.3	100%	0.7
PFEtS	94%	1.8	97%	0.5
PFMOAA	94%	1.5	101%	1.3
PFPrS	95%	1.9	96%	0.6
PFBA	74%	4.6	114%	1.0
PFMPA	96%	0.7	99%	0.3
PFBS	91%	2.3	93%	0.9
PFPeA	96%	1.2	96%	0.7
PFEESA	91%	0.9	93%	0.4
PFMBA	95%	1.4	96%	0.3
NFDHA	96%	3.7	99%	1.6
4:2FTS	103%	5.9	105%	2.9
PFPeS	94%	2.4	93%	1.5
PFHxA	96%	1.0	99%	0.7
HFPO-DA	109%	5.0	106%	4.2
PFHxS	101%	3.8	102%	0.9
ADONA	101%	2.7	104%	0.7
PFHpA	104%	2.5	103%	1.7
PFHpS	101%	4.5	100%	1.0
6:2FTS	108%	4.7	111%	2.3
PFOA	96%	1.7	97%	1.5
PFOS	99%	3.2	97%	0.7
9Cl-PF3ONS	93%	2.9	95%	1.6
PFNA	107%	2.4	104%	1.3
8:2FTS	97%	8.6	101%	4.1
PFDA	109%	2.3	103%	1.7
11Cl-PF3OUdS	86%	3.6	93%	1.2
PFUnA	98%	5.9	99%	3.5
PFDoA	93%	2.8	97%	1.0
PFTrDA	94%	2.9	81%	2.7
PFTeDA	91%	4.8	94%	1.3
PFHxDA**	–	–	122%	6.2
PFODA**	–	–	–	–

*TFA might contaminate reagent water, methanol, and other reagents used for sample preparation, so it was replaced with ^{13}C-TFA for calibration curve.

**PFBA can also contaminate reagent water or other materials during sample preparation, interfering with determination of low-level content.

***Linearity for PFODA was not reported due to poor and inconsistent response at low concentrations, likely caused by nonspecific adsorption to container and vial surfaces. A similar behavior was observed for PFHxDA.

Real water samples

Finally, we applied the method to several water samples including bottled water, tap water and surface water. Across the set, multiple PFAS were detected, and USC PFAS made a noticeable contribution to the overall PFAS profile. The results are listed in Table 6.

The combination of Altura Poroshell 120 PFAS analytical column, new PFAS delay column and large-volume direct injection with acidified sample provided clean chromatograms and reliable integration for both USC and long-chain PFAS, without any sample preconcentration steps.

Table 6. Content results of real water sample.

Compound Name	Bottled Water (ng/L)	Surface Water #1 (ng/L)	Surface Water #2 (ng/L)	Tap Water (ng/L)
DFA	< 1.0	22.3	66.9	23.7
TFA	–	–	–	–
PFMeS	< 1.0	209.9	377.4	106.6
PFPrA	< 1.0	25.1	49.8	29.7
PFEtS	< 1.0	< 1.0	10.6	< 1.0
PFMOAA	< 1.0	11.8	28.9	11.1
PFPrS	< 1.0	< 1.0	< 1.0	< 1.0
PFBA	< 10.0	< 10.0	< 10.0	< 10.0
PFMPA	< 1.0	< 1.0	< 1.0	< 1.0
PFBS	< 1.0	12.0	18.7	4.1
PFPeA	< 1.0	2.7	< 1.0	< 1.0
PFMBA	< 1.0	< 1.0	< 1.0	< 1.0
PFEESA	< 1.0	< 1.0	1.1	< 1.0
NFDHA	< 1.0	< 1.0	< 1.0	< 1.0
4:2FTS	< 1.0	< 1.0	< 1.0	< 1.0
PFHxA	< 1.0	17.7	15.3	10.2
PFPeS	< 1.0	< 1.0	< 1.0	< 1.0
HFPO-DA	< 5.0	< 5.0	< 5.0	< 5.0
PFHxS	< 1.0	< 1.0	1.2	< 1.0
PFHpA	< 2.0	< 2.0	< 2.0	< 2.0
ADONA	< 1.0	< 1.0	< 1.0	< 1.0
6:2FTS	< 1.0	< 1.0	< 1.0	< 1.0
PFHpS	< 1.0	< 1.0	< 1.0	< 1.0
PFOA	< 5.0	10.8	22.5	< 5.0
PFNA	< 10.0	< 10.0	< 10.0	< 10.0
9Cl-PF3ONS	< 1.0	1.4	< 1.0	< 1.0
PFOS	< 1.0	< 1.0	< 1.0	< 1.0
8:2FTS	< 1.0	< 1.0	< 1.0	< 1.0
PFDA	< 10.0	< 10.0	< 10.0	< 10.0
11Cl-PF3OUdS	< 2.0	< 2.0	< 2.0	< 2.0
PFUnA	< 1.0	< 1.0	< 1.0	< 1.0
PFDoA	< 1.0	< 1.0	< 1.0	< 1.0
PFTrDA	< 10.0	< 10.0	< 10.0	< 10.0
PFTeDA	< 5.0	< 5.0	< 5.0	< 5.0
PFHxDA	< 50.0	< 50.0	< 50.0	< 50.0
PFODA	–	–	–	–

Conclusion

The new Agilent Altura Poroshell 120 PFAS column and PFAS delay column support a straightforward, single-injection LC/MS/MS method for C1–C18 PFAS in drinking water, delivering improved retention and peak shape for C1–C3 USC PFAS compared with standard C18 columns, while the delay column effectively separates TFA and PFBA system peaks from the analytes to reduce background. The method supports robust large-volume direct injection—up to 100 µL with 0.1% acetic acid—without severe solvent effects or peak distortion, and provides good linearity, recovery, and precision across the panel with run times and pressures compatible with typical LC/MS setups. As regulations and customer expectations move toward broader PFAS panels and increased attention to USC PFAS, this column set offers a simple way for labs to extend capability from the traditional panel to a full C1–C18 range in a single method.

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