

Supporting Information
**Identification and quantification of fluorinated polymers in
consumer products by combustion ion chromatography and
pyrolysis-gas chromatography-mass spectrometry**

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Particle induced gamma-ray emission (PIGE)

Samples were mounted across a stainless steel target frame and bombarded with a 3.4 MeV beam of protons (~ 50 nA for 180 s) to produce γ -rays, which were measured using a high-purity germanium detector (HPGe, Canberra, 20%) located at approximately 75° to the beam. The combined number of counts of two γ -rays characteristic of the decay of the ^{19}F nucleus at 110 and 197 keV/ μC of beam delivered is proportional to the TF. The beam intensity was measured in a suppressed Faraday cup before and after each 3 min run and normalized to a current measured in a tantalum collimator near the beam exit window. For the powdered CRM material, replicate targets were prepared by hydraulically compressing the powder into a self-supporting pellet at approximately 350 bar for 30 s and then taped onto target frames.

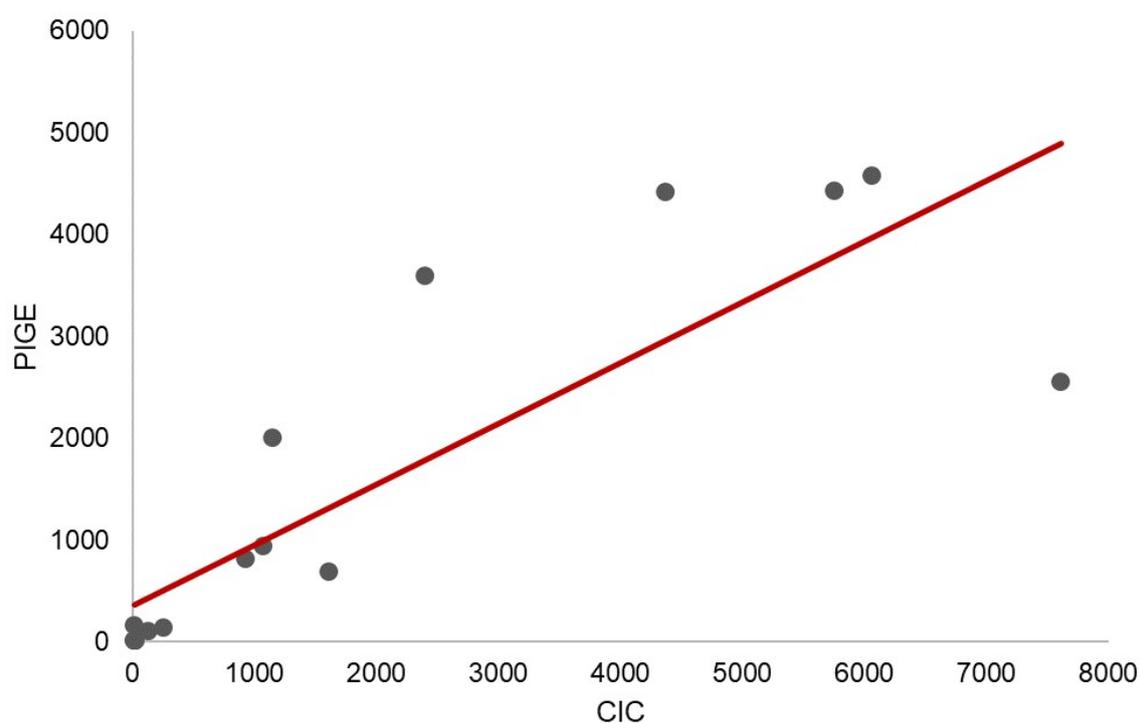


Figure S1. Correlation analysis of the data obtained from the PIGE and CIC measurements for verification of methods.

In order to validate the obtained measurements from the PIGE analysis, a comparison with the CIC data was performed. The correlation analysis applying a Spearman Correlation revealed a rho of 0.91 which indicates an overall strong correlation between these two TF methods. This is confirmed by a further linear regression, with an $r^2 = 0.71$, demonstrating a strong linear relationship between PIGE and CIC.

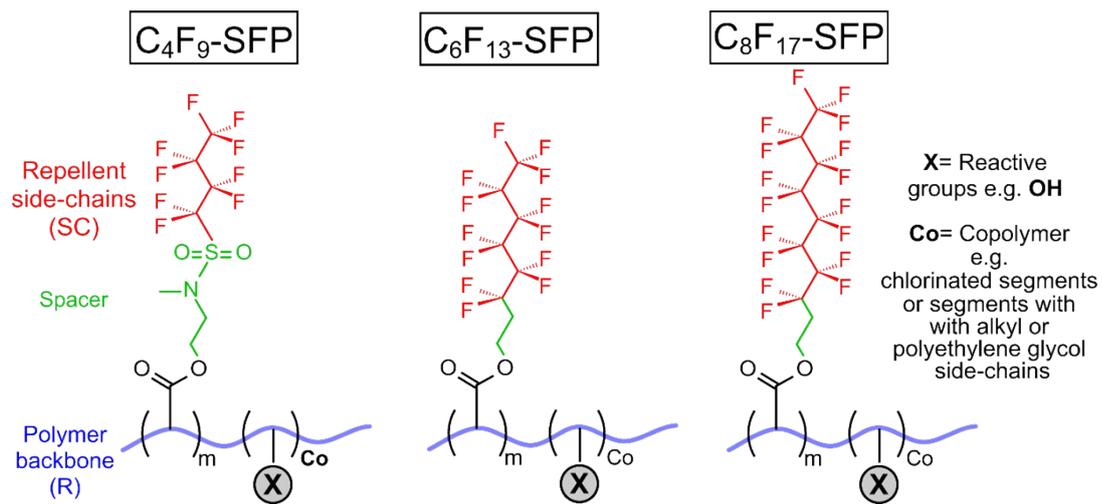


Figure S2. SFP-based DWRs with different side-chain modifications.¹

Table S1. Overview of samples with description and the respective analytical method performed. The respective ID comes from a longer list of samples and therefore the sample IDs may appear unlogic.

Sample ID	Sample description	CIC	PIGE	Pyr-GC
C1	Ceramic baking plate			x
C2	Oven form	x		x
C4	Bake form	x		x
C9	Air fryer	x		x
C11	Frying pan	x		x
C17	Hamburger press	x		x
C19	Air fryer	x		x
C72	Air fryer	x		x
E14	White plastic from bottom plate of a kettle	x		x
E18 - 1	Papermetal heat protection plate in coffee maker	x		x
E18-2a	Plastic cable blue	x		
E18-2b	Glass fibre cable blue	x		x
E18-3a	Transparent plastic tube for transporting the water in coffee maker	x		
E18-4	Coating on metal heat plate in coffee maker	x		x
E18-5	Small black plastic holder near heat source in coffee maker	x		
E18-6	Glass fibre cable yellow	x		x
E18-7	Glass fibre cable white	x		
E25 - 2	Printed circuit board (PCB) from loudspeaker	x		x
E25 - 5	Plastic battery cover plate from loudspeaker	x	x	x
E25-3a	Black soft material from top of the PCB from loudspeaker	x		
E25-6	Tape wrapped around cables in loudspeaker	x		x
E38	Plastic case for wireless headphones	x	x	x
E39	Plastic case for wireless headphones	x		x
T20	Shade sail textile	x		x
T21	Wipe clean tablecloth	x		x
T22	Textile from commercial backpack	x		x
T23	Polyamide (C0-treatment)	x		
T24	Polyamide (C6-treatment)	x		
T44	Polyester textile with polyurethane laminate (C0-treatment)	x	x	x
T45	Polyester textile with polyurethane laminate (C6-treatment)	x	x	x
T46	Polyamide 6:6 textile (no treatment)	x	x	x
T47	Polyamide 6:6 textile (C6-treatment)	x	x	x
T48	Polyester textile with polyester laminate (C0-treatment)	x	x	x
T49	Polyester textile with polyester laminate (C6-treatment)	x	x	x
T50	Cotton textile (C0-treatment)	x	x	x
T51	Cotton textile (C6-treatment)	x	x	x
H54	Floss brackets	x		x
H55	Soft-picks	x		
H56	Interdental toothbrush	x		
H57	Water resist band-aid	x		x
H58	Waterproof band-aid	x		
H59	Sterile dressing	x		
H61	One use sachees (this specific one contained serum)	x		
H74	Floss picks* (marketed with PTFE)	x		x
H79	Floss "easy to slide" – contains fluoride	x		x

Table S2. Overview of found fragments with m/z and the respective proposed molecular formula.

m/z	Molecular formula
48	[SO] ⁺
50	[CF ₂] ⁺
51	[CF ₂ H] ⁺
64	[SO ₂] ⁺
69	[CF ₃] ⁺
77	[C ₃ H ₃ F ₂] ⁺
81	[C ₂ F ₃] ⁺
93	[C ₃ F ₃] ⁺
95	[C ₃ H ₂ F ₃] ⁺
100	[C ₂ F ₄] ⁺
119	[C ₂ F ₅] ⁺
131	[C ₃ F ₅] ⁺
150	[C ₃ F ₆] ⁺
169	[C ₃ F ₇] ⁺
181	[C ₄ F ₇] ⁺

Table S3. Overview of the measured total fluorine concentrations in the selected consumer products.

Product category	Sample ID	Type of sample	Total F (µg/g)
Electronics	E14	White kettle plastic	24
Electronics	E18 - 1	Papermetal sheet	1580
Electronics	E18-2a	Plastic cable	42
Electronics	E18-2b	Glass fibre cable	958
Electronics	E18-3a	Plastic tube	38
Electronics	E18-4	Coating	198
Electronics	E18-5	Plastic holder	53
Electronics	E18-6	Glass fibre cable	3043
Electronics	E18-7	Glass fibre cable	2121
Electronics	E25 - 2	Printed circuit board	130
Electronics	E25 - 5	Plastic battery cover plate	2064
Electronics	E25-3a	Soft material from PCB	70
Electronics	E25-6	Tape	132
Electronics	E38	Plastic case headphones	1595
Electronics	E39	Plastic case headphones	1641
Personal care	H54	Floss brackets	12
Personal care	H55	Soft-picks	32
Personal care	H56	Interdental toothbrush	27
Personal care	H57-1	Waterproof band-aid	41
Personal care	H58-1	Waterproof band-aid	11
Personal care	H59-1	Sterile dressing	23
Personal care	H61	Serum sachees	50
Personal care	H74	Dental floss	632670
Personal care	H79	Dental floss	573835
Cookware	C2	Oven form	553064
Cookware	C4	Bake form	120
Cookware	C9	Air fryer	22723
Cookware	C11	Frying pan	335127
Cookware	C17	Hamburger press	150
Cookware	C19	Air fryer	88
Cookware	C72	Air fryer	70
Textiles	T20	Shade sail textile	291
Textiles	T21	Wipe clean tablecloth	16
Textiles	T22	Backpack	310
Textiles	T23	Polyamide C0	54
Textiles	T24	Polyamide C6	425
Textiles	T44	Polyester C0	30
Textiles	T45	Polyester C6	1078
Textiles	T46	Polyamide 6:6	21
Textiles	T47	Polyamide 6:6 C6	209
Textiles	T48	Polyester C0	14
Textiles	T49	Polyester C6	931
Textiles	T50	Cotton C0	15
Textiles	T51	Cotton C6	1615

Table S4. Estimated average density (g/dm²) for the textile samples.

Sample	Average density (g/dm²)
Shade sail textile (T20)	1.655
Wipe clean tablecloth (T21)	1.159
Backpack (T22-1)	3.195
Nylon (T23)	1.188
Nylon (T24*)	0.763
Polyester C0 (T44)	1.615
Polyester C6 (T45*)	1.589
Polyamide 6:6 (T46)	2.157
Polyamide 6:6 C6 (T47*)	2.045
Polyester C0 (T48)	2.370
Polyester C0 (T49*)	2.319
Cotton C0 (T50)	3.759
Cotton C6 (T51*)	3.908

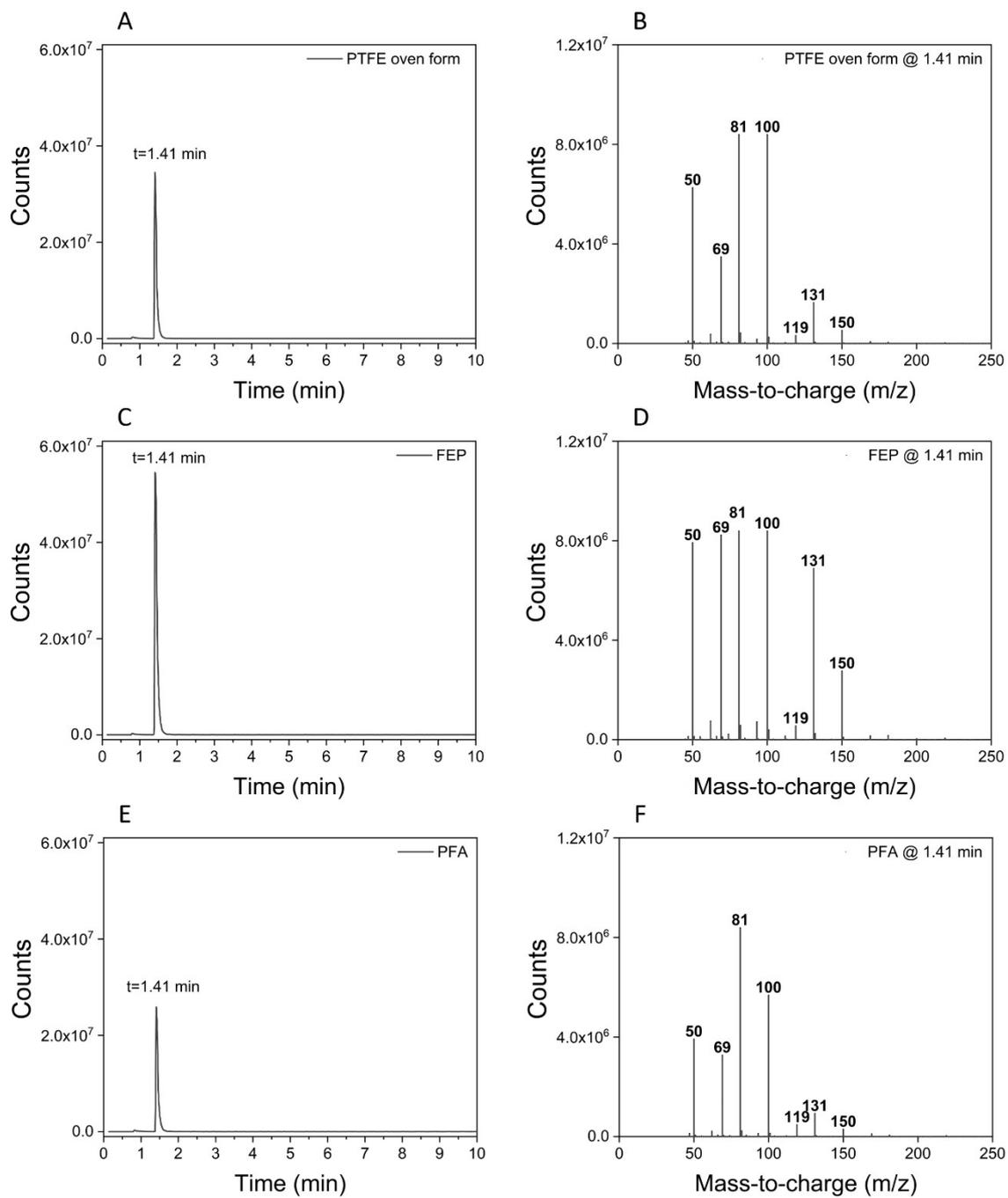


Figure S2. Total ion chromatograms (left) and mass spectra (right) at retention time 1.41 min for PTFE (A, B), FEP (C and D), and PFA (E and F).

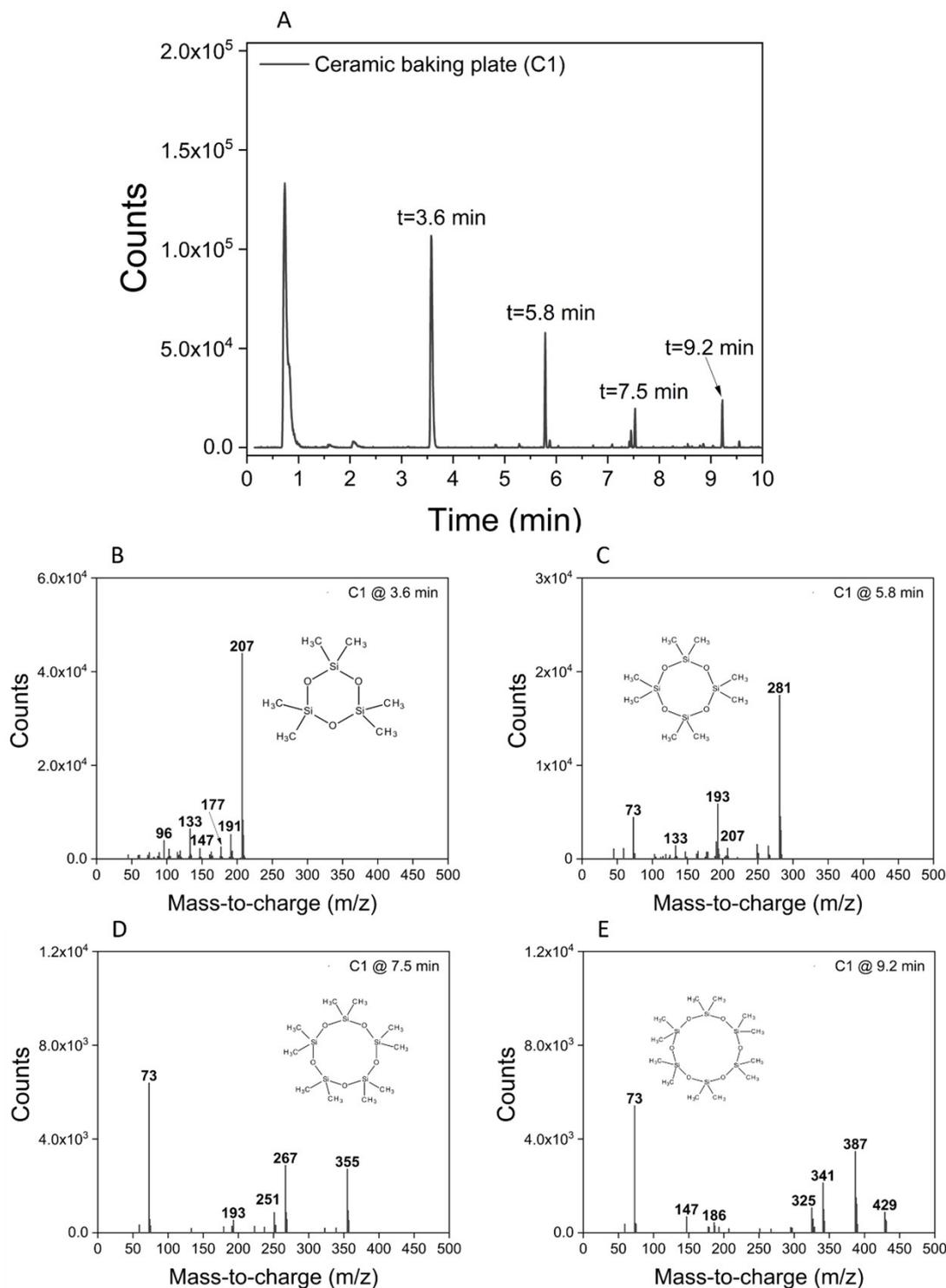


Figure S3. The total ion chromatogram for the ceramic baking plate (C1) and the corresponding mass spectra at 3.6 min (B), 5.8 min (C), 7.5 min (D), and 9.2 min (E), where the NIST mass spectral library suggests cyclic siloxanes as pyrolysis products where hexamethylcyclotrisiloxane (D3), octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5) and dodecamethylcyclohexasiloxane (D6) are the different peaks in the total ion chromatogram. No PFAS/PTFE were found in the extracted ion chromatograms m/z 100 or m/z 131 indicating that this product is free from intentionally added PFAS.

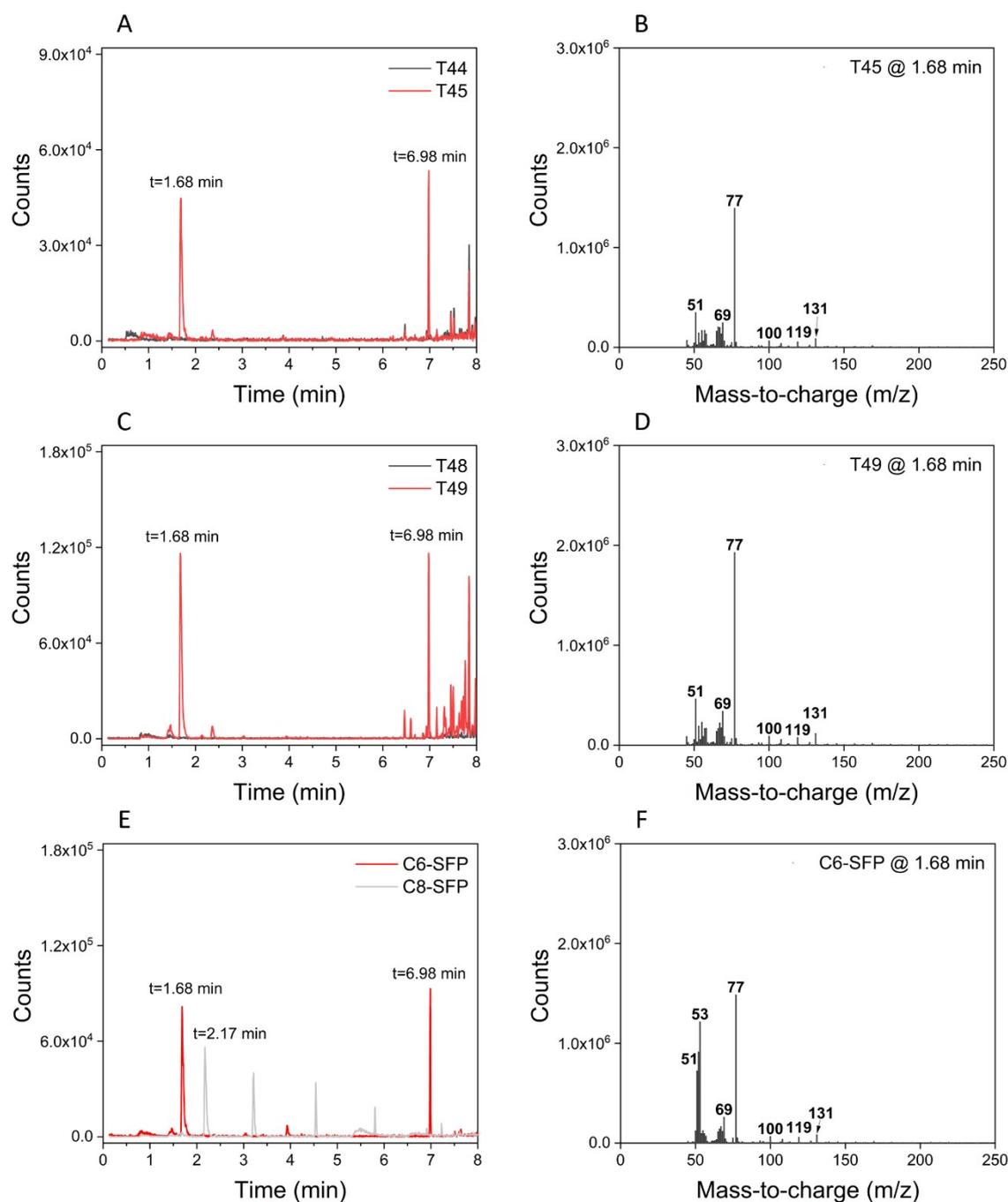


Figure S4. Extracted ion chromatograms comparing PFAS-free and PFAS-treated (C6-SFP) polyester fabrics (A and C) and the reference C6-SFP and C8-SFP textile (E). The right column panels (B, D, and F) show the mass spectra for eluting PFAS-peak at 1.68 min. The retention times for the C6-SFP reference fabric are different from Figure S5/ Figure 2 due to a retention time shift (~ 0.2 min longer) coming from a new GC column.

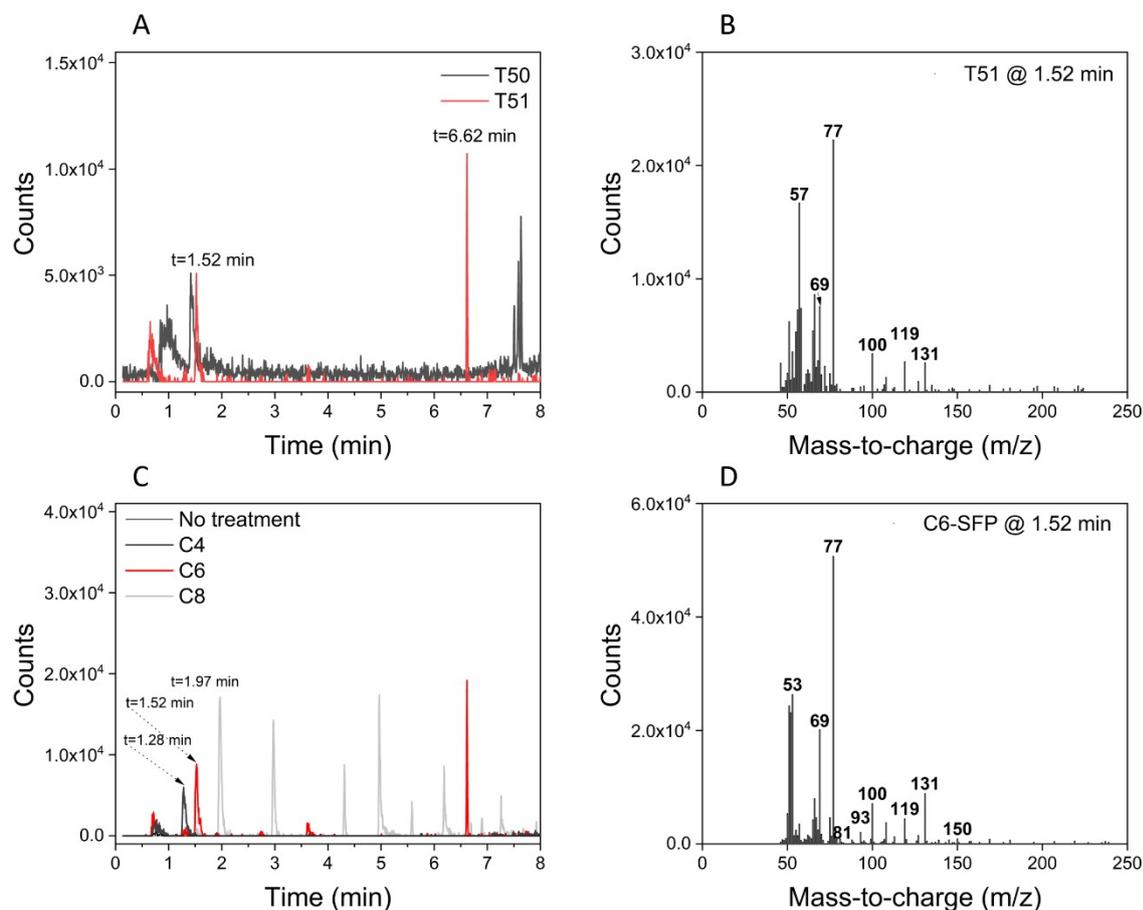


Figure S5. A) Extracted ion chromatograms (m/z 131) comparing PFAS-free (T50) and C6-SFP (T51) cotton fabric. B) Mass spectra for T51 at 1.52 min containing typical m/z peaks suggest that T51 contains a C6-SFP. C) Extracted ion chromatograms for the reference fabrics. D) Mass spectra for the C6-SFP reference fabric at 1.52 min.

References

- 1 S. Schellenberger, I. Liagkouridis, R. Awad, S. Khan, M. Plassmann, G. Peters, J. P. Benskin and I. T. Cousins, An Outdoor Aging Study to Investigate the Release of Per- And Polyfluoroalkyl Substances (PFAS) from Functional Textiles, *Environ. Sci. Technol.*, 2022, **56**, 3471–3479.