
Food Contact Material: An enforcement project – results and challenges

Anders Appelblom, Susan Strömbom
Swedish Chemicals Agency

Background to the project

- Change in mandate for the enforcement of REACH for food contact material (FCM)
 - The Swedish Chemicals Agency took over the mandate for REACH enforcement of FCM from the Swedish Food Agency
 - Previously, the Swedish Chemicals Agency only held the mandate to enforce POPs with regard to FCM
 - The Swedish Chemicals Agency does not have the mandate to enforce specific FCM regulations such as (EC) 1935/2004 and (EU) No 10/2011
- New REACH restriction on C9-C14 PFCAs in force since 25th Feb 2023
- Proposal for a broad PFAS restriction submitted in Feb 2023
- FCM is a product category with previously confirmed use of PFAS
- FCM could potentially be a source of high PFAS exposure for consumers

FCM project outline

- Intended to be a two-part project
 - Part 1 – Consumer products
 - Part 2 – Business-to-business products
 - Currently on hold due to a lack of mandate to order companies to submit product samples
- So far only consumer products
- PFAS as a key focus area
 - Candidate list substances and other restricted substances according to REACH and POPs also included

Included products

- Non-stick coatings
 - Frying pans, Cake tins, Oven pans, Springforms
- Paper and board
 - Baking paper, Air fryer paper, Baking cups, Paper plates
- Silicone and soft polymers
 - Baking mats, Cooking liners, Baking moulds, Gaskets
- Miscellaneous other materials
 - Hard plastic (food containers, cups, plates), wood (bamboo straws)



PFAS Analysis

- Total fluorine screening
142 products
- Targeted PFAS analysis
105 products total:
 - Standard MeOH extraction
83 products
 - (Direct) Total Oxidizable Precursor (TOP) Assay
53 products
- Pyrolysis GC/MS
17 products
- Tests conducted at three external laboratories
 - ALS China
 - ALS Australia
 - RISE
- Flexible testing strategy based on
 - Sample material
 - Availability of methods
 - Cost
 - Administrative considerations
 - Contractual obligations

Results

- Few non-compliances related to regulated PFAS
 - Three products (2.9%) with regulated PFAS above applicable limit value (targeted PFAS analysis with standard extraction or TOP-assay)

Sample ID & Product Type	Total Fluorine (ppm)	ΣPFAS (ppb) - Standard MeOH extraction	Individual PFAS >25 ppb - Standard MeOH extraction	ΣPFAS (ppb) - (d)TOP-assay	Individual PFAS >200 ppb - (d)TOPA	Pyrolysis-GC/MS
Sample 114 - Baking-, Sandwich and Serving Paper	429	31,9	n.d.	11800	PFBA (3000 ppb) PFPeA (4630 ppb) PFHxA (2170 ppb) PFHpA (916 ppb) PFOA (506 ppb) PFNA (236 ppb) PFDA (232 ppb)	Not analysed
Sample 136 - Plates and Drinking Cups	69	28	PFUdA (26 ppb)	n.d.	n.d.	Traces of silicone chemistry, no verification of PFAS chemistry
Sample 291 - Baking-, Sandwich and Serving Paper	<LOQ	54	PFUdA (47 ppb)	209	n.d.	Verification of silicone chemistry, no verification of PFAS chemistry

Results cont.

- If the proposed broad PFAS-restriction would have been in force
 - 10 additional products with Σ PFAS above the proposed limit values

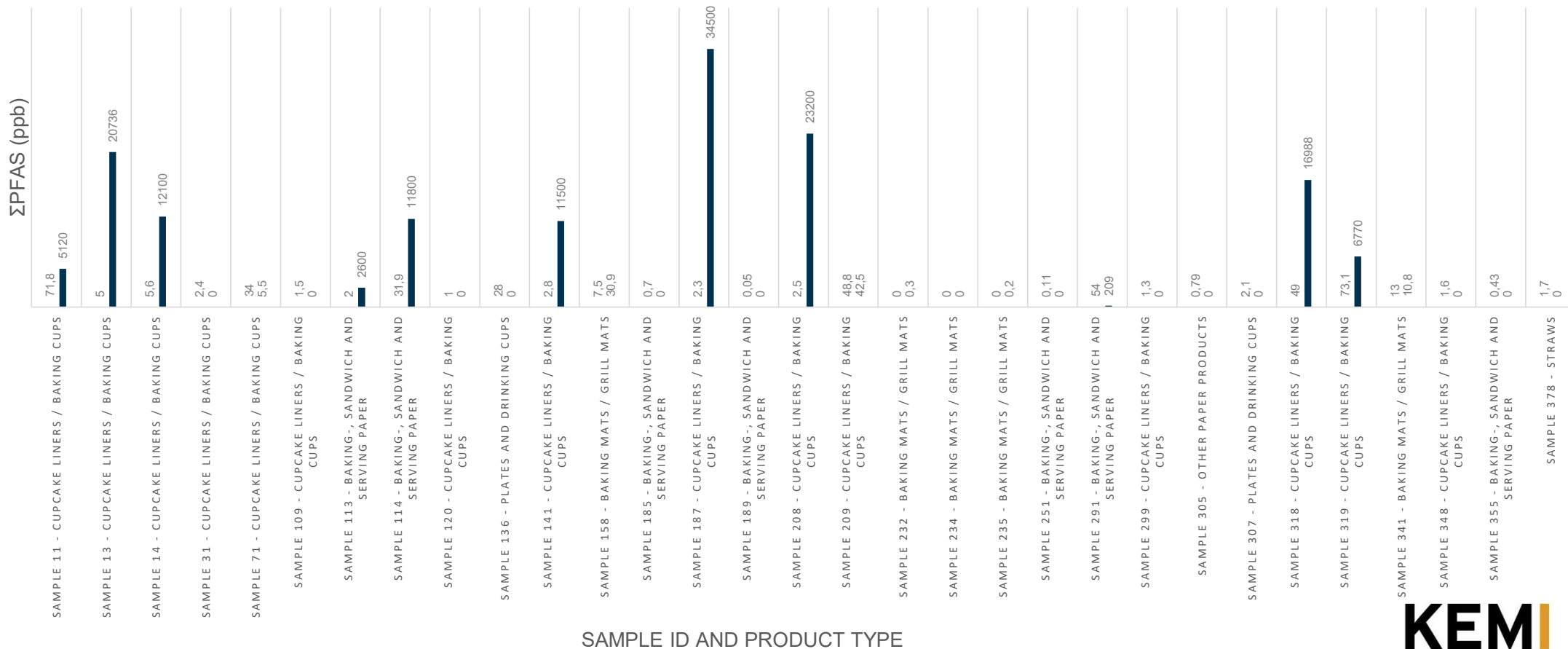
Sample ID & Product Type	Total Fluorine (ppm)	Σ PFAS (ppb) - Standard MeOH extraction	Individual PFAS >25 ppb - Standard MeOH extraction	Σ PFAS (ppb) - (d)TOP-assay	Individual PFAS >200 ppb - (d)TOPA	Pyrolysis-GC/MS
Sample 11 - Cupcake Liners / Baking Cups	201,5	71,8	PFHxA (47,4 ppb)	5120	PFBA (761 ppb) PFPeA (3880 ppb) PFHxA (463 ppb)	Not analysed
Sample 13 - Cupcake Liners / Baking Cups	300	5	n.d.	20736	PFBA (3700 ppb) PFPeA (15000 ppb) PFHxA (1800 ppb)	Verification of C6 PFAS chemistry
Sample 14 - Cupcake Liners / Baking Cups	322	5,6	n.d.	12100	PFBA (2710 ppb) PFPeA (8680 ppb) PFHxA (658 ppb)	Not analysed
Sample 71 - Cupcake Liners / Baking Cups	<LOQ	34	PFBA (34 ppb)	5,5	n.d.	Verification of silicone chemistry, no verification of PFAS chemistry
Sample 113 - Baking-, Sandwich and Serving Paper	154	2	n.d.	2600	PFBA (591 ppb) PFPeA (1740 ppb) PFHxA (256 ppb)	Not analysed
Sample 141 - Cupcake Liners / Baking Cups	269	2,8	n.d.	11500	PFBA (2470 ppb) PFPeA (8470 ppb) PFHxA (578 ppb)	Not analysed
Sample 187 - Cupcake Liners / Baking Cups	1227,5	2,3	n.d.	34500	PFBA (7480 ppb) PFPeA (24600 ppb) PFHxA (2390 ppb)	Not analysed
Sample 208 - Cupcake Liners / Baking Cups	221	2,5	n.d.	23200	PFBA (5370 ppb) PFPeA (15700 ppb) PFHxA (2000 ppb)	Not analysed
Sample 318 - Cupcake Liners / Baking Cups	320	49	n.d.	16988	PFBA (3200 ppb) PFPeA (13000 ppb) PFHxA (730 ppb)	Verification of C6 PFAS chemistry
Sample 319 - Cupcake Liners / Baking Cups	18529	73,1	PFHxA (50,8 ppb)	6770	PFBA (795 ppb) PFPeA (5220 ppb) PFHxA (731 ppb)	Not analysed

- 43 products with TF > 50 ppm that would be required to provide proof for the origin of the measured fluorine (PFAS or non-PFAS).
 - PFAS detected in 11 products by targeted analysis

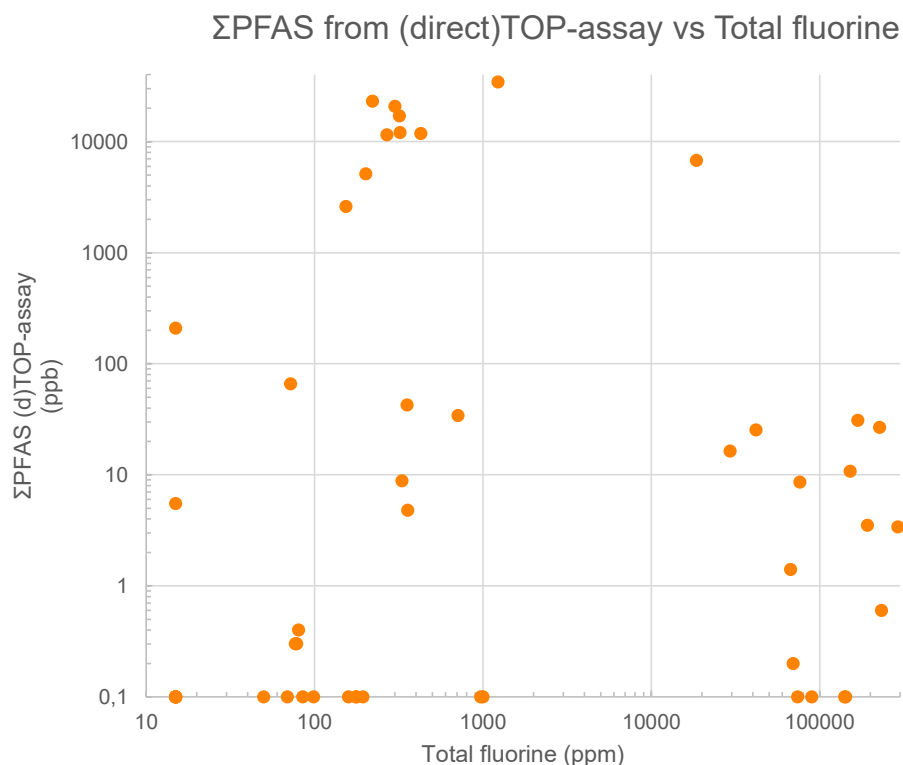
Results cont.

ΣPFAS - Standard MeOH extraction without oxidation vs (direct)TOP-assay

■ Standard MeOH extraction without oxidation ■ (d)TOP-assay



Results cont.



- Log-scale!
- The highest total fluorine measurements (>2%F) have low ΣPFAS (<40 ppb) following TOP-assay
- Mid-range total fluorine measurements (100-1500 ppm) tend to have the highest ΣPFAS (>1000 ppb) following TOP-assay

Analytical challenges

- Several performing laboratories – variable:
 - Methods/standards used
 - Availability of target PFAS
 - Detection-, quantification- and/or reporting limits (LOD, LOQ and LOR)
- Selection of target PFAS
- Choice of methods
- Sufficiently low limit of quantification/reporting
- Large number of sample matrices

Additional challenges

- Legal
 - Existing contractual obligations
 - Public procurement process
- Economical
 - Total fluorine:
1500 – 5800 SEK (~130 – 510 €) per analysis
 - Target PFAS, standard MeOH extraction:
3100 – 9000 SEK (~270 – 790 €) per analysis
 - Target PFAS, (direct) TOP-assay:
5000 – 9000 SEK (~440 – 790 €) per analysis
- Potential
 - Companies challenging the results - Lack of analytical standards and definition of “related substances”

Conclusions

- FCM for consumers rarely contain regulated PFAS
 - Non-regulated PFAS (C6-chemistry) are still in use
 - When regulated PFAS are found above legal limits, low concentrations suggests unintentional use / contamination
- Direct TOP-assay better captures intentional PFAS use compared to standard MeOH extraction techniques
- Large discrepancy between total fluorine levels and targeted PFAS-analysis
- Standardisation of analytical methods is needed
- The proposed broad PFAS-restriction, if adopted, would:
 - Lower analysis costs for enforcement authorities
 - Alleviate (some of) the current issues with “related substance” interpretations