PFAS Testing in Food and Food Contact Materials

Cheat sheet

Meat, offal, poultry, and seafood

Targets

- Core: PFOS, PFOA, PFNA, PFHxS. Extend to long-chain PFCAs/PFSAs.
- Seafood: include PFOS isomers if required.

Objective

Low ppt across high fat and protein tissues, variable moisture in seafood.

Sample prep

- Homogenize chilled.
- Record fat percent and species for seafood.
- Use PFAS-screened tubes, blades, and solvents.
- Add isotopically-labeled surrogates before extraction.
- Avoid PTFE in caps, filters, and tubing.

Extraction

- Protein precipitation with acidified ACN or MeOH. Optional salt-out partitioning for phase separation.
- Seafood: dual extraction, aqueous then organic.
- Centrifuge and collect supernatant.

Cleanup

- Dispersive cleanup to reduce lipids and proteins.
- EMR-type sorbent or SPE for high fat cuts.
- WAX SPE where broad PFCA/PFSA panels or background persist.
- Non-PTFE membrane filtration.

Analysis

- LC/MS/MS negative ESI, PFAS-low bleed C18 column.
- Scheduled dMRMs, early window for C4–C7, extended gradient for C8+.
- Seafood: monitor PFOS isomer profile when method requires.
- Isotope dilution with matrix-matched calibration.
- GC/MS/MS for volatile PFAS: HS-SPME or thermal desorption for FTOHs/FOSAs/FOSEs with NCI or EI dMRM; include inlet and liner blanks.

Dairy and infant formula

Targets

- Core four plus selected precursors when under surveillance.
- Sub-10 ppt often needed for milk and formula.

Objective

Strong lipid management with low background and tight recovery windows.

Sample prep

- Milk: gentle vortex, avoid foam carryover.
- Butter and cheese: cryogenic grind for uniformity.
- Infant formula: gentle homogenization to prevent loss.
- Add surrogates before extraction.
- Use PFAS-screened disposables.

Extraction

- Milk and formula: protein precipitation with acidified ACN.
- High fat dairy: liquid–liquid partitioning with hexane and MeOH, salt-out to break emulsions.

Cleanup

- EMR-type lipid removal or freeze-out.
- SPE polish to reduce late-eluting co-extractives.
- Extra reagent and system blanks for infant formula.

Analysis

- LC/MS/MS negative ESI, shortened dwell for early eluters, longer run for long chains.
- Instrument blank between heavy matrices.
- IDMS with matrix-matched curves.
- Infant formula: verify sub-ppt LOQ in matrix.
- GC/MS/MS (volatile PFAS): HS-SPME or purge-and-trap for FTOHs from milk or reconstituted formula using NCI; report wet weight or fat basis as required.

Grains and plant-based foods

Targets

- Broad 30-analyte panels are common.
- Include precursors when requested.

Objective

Low ppt with pigments and polyphenols controlled.

Sample prep

- Cryo-mill leafy greens.
- Fine-grind grains and legumes.
- Record moisture to support recovery assessment.
- Add surrogates before extraction.
- Acidified ACN extraction with salt-out.

Extraction

- Buffered QuEChERS variant for challenging plant matrices.
- EMR-like pigment removal.
- WAX SPE when precursors are included or suppression persists.

Cleanup

- LC/MS/MS on PFAS-optimized C18 in negative ESI; two-segment gradient to separate early short chains and late long chains.

Analysis

- Scheduled dMRMs to maintain cycle time across pigments.
- Isotope dilution with matrix calibration.
- Check suppression with postextraction spike or postcolumn infusion.
- GC/MS/MS (volatile PFAS): HS-SPME or stir bar sorptive extraction for FTOHs from milled matrix on a low-bleed column with NCI or EI dMRM.

Food contact materials

Targets

- PFOS, PFOA, PFNA, PFHxS; mid- and long-chain PFCAs/PFSAs; fluorotelomer alcohols and precursors when required.
- For migration studies, report migrants rather than total content unless the method specifies total PFAS.

Objective

Quantify PFAS that can migrate from packaging into foods or simulants at low ppt to low ppb, with matrix controls for inks, adhesives, and coatings.

Sample prep

- Define study type: migration (food or simulant contact) or total content (extractable PFAS from material).
- Record material and layer: paper, paperboard, molded fiber, plastic film, laminates, coatings, inks, adhesives.
- For migration: measure surface area, contact time, and temperature per intended use; choose simulant accordingly (e.g., 3% acetic acid, 10% ethanol, 95% ethanol, isooctane).
- Use PFAS-screened forceps, scissors, and containers; avoid PTFE.
- Add isotopically-labeled surrogates before extraction or before simulant collection.

Extraction

- Paper/fiber: MeOH or ACN extraction; consider mild alkaline assist for stubborn coatings when allowed by method.
- Plastic/laminate: Simulant-based extraction per study design or solvent extraction with EtOH/isooctane where applicable.
- Adhesives/inks: Targeted solvent extraction of the printed/adhesive layer; avoid pigment carryover by brief prerinse.
- For total oxidizable precursors work, include an oxidative step only if the method requires it and run paired nonoxidized controls.

Cleanup

- Dispersive cleanup to reduce dyes, plasticizers, and oligomers.
- WAX SPE for acidic PFAS; graphitic sorbent or EMR-type cleanup to reduce pigments and ink residues.
- Non-PTFE membrane filtration; screen solvent lots with reagent blanks.

Analysis

- LC/MS/MS negative ESI for PFCAs/PFSAs; positive ESI for select precursors if panel includes them.
- Scheduled dMRMs with retention-time locking; early window for short chains, extended gradient for long chains.
- Calibrate in matrix or simulant; isotope dilution quantitation.
- For migration tests, normalize to contact area and report as mass per area or concentration in simulant as required.
- GC/MS/MS (volatile PFAS): thermal desorption of materials or HS-SPME from simulants for FTOHs with ECNI; run instrument blanks to control liner and septa background.

Common pitfalls

- PTFE exposure from caps, filters, or tubing causing background
- Nonscreened solvents and wash fluids elevating baseline
- Carryover after high-level samples without system blanks
- Inconsistent homogenization that drives variable recoveries
- Calibrating in solvent only for heavy matrices
- Surrogates added after extraction
- Pigment or lipid overload exceeds cleanup capacity

QA/QC essentials

- Add surrogates and internal standards before extraction for each analyte class
- Run procedural blank every batch, reagent blank for new solvent lots, instrument blank after heavy matrices
- Track matrix spikes and duplicates at defined frequency, track bias and precision by class
- Continue calibration verification every 10 to 20 injections
- Verify MDL and LOQ per matrix with target recoveries
- Document retention times, qualifier ratios, and any isomer criteria
- Maintain chain-of-custody and audit trail with timestamps

Reporting and decisions

1. Report solids in µg/kg and liquids in µg/L unless specified otherwise
2. Apply required sum rules such as Sum of PFOS, PFOA, PFNA, PFHxS where mandated
3. State method ID, analyte list, matrix-specific LOQs, measurement uncertainty, and surrogate recoveries
4. Flag exceedances versus matrix limits and add data qualifiers where applicable
5. Note any method deviations and the reason

Toolbox

1. Agilent LC/MS/MS and GC/MS/MS platforms with stable dMRM scheduling and streamlined review software
2. Agilent PFAS dMRM database for short and long chain targets including isomers
3. Agilent HPLC conversion kits optimized for PFAS - for system background PFAS reduction
4. Agilent Captiva EMR PFAS Food I cartridge for lipid and pigment removal to reduce reruns
5. Agilent PFAS-optimized vials, caps, and LC/MS-grade solvents for lower baseline noise
6. Certified PFAS standards and application kits for traceable calibration
7. Agilent SLIMS for custody, audit trail, and ISO 17025 documentation

Know more:
https://www.agilent.com/en/solutions/food-beverage/food-safety/pfas-food-beverages-packaging

See how Agilent supports PFAS analyses:
https://explore.agilent.com/pursuit-of-pfas

PAN_26_POPFAS_AP
DE-010031

Published in India, September 2025

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