



Method Summary

The Determination of selected PFAS in Soils by LC-MS/MS.

PFAS are surfactants with many industrial uses, particularly in the production of PTFE and in coatings for paper. Historically they have seen use in foaming agents, particularly aqueous film-forming foams (AFFF) used in firefighting. The release of some of these compounds into the environment is now under regulation.

Perfluoroalkyl carboxylic Acids (PFCA)		CAS	LOD (µg/Kg)
PFBA	perfluoro-n-butanoic acid	375-22-4	<0.5
PFPA	perfluoro-n-pentanoic acid	2706-90-3	<0.5
PFHxA	perfluoro-n-hexanoic acid	307-24-4	<0.5
PFHpA	perfluoro-n-heptanoic acid	375-85-9	<0.5
PFOA	perfluoro-n-octanoic acid	335-67-1	<0.5
PFNA	perfluoro-n-nonanoic acid	375-95-1	<0.5
PFDA	perfluoro-n-decanoic acid	335-76-2	<0.5
PFUnA	perfluoro-n-undecanoic acid	2058-94-8	<0.5
PFDoA	perfluoro-n-dodecanoic acid	307-55-1	<0.5
PFTTrDA	perfluoro-n-tridecanoic acid	72629-94-8	<0.5
PFTeA	perfluoro-n-tetradecanoic acid	376-06-7	<0.5
PFHxDA	perfluoro-n-hexadecanoic acid	67905-19-5	<0.5
PFODA	perfluoro-n-octadecanoic acid	16517-11-6	<0.5
Perfluoroalkylsulfonates# (PFSA)			
PFBS	perfluoro-1-butanedisulfonate	375-73-5	<0.5
PFPeS	perfluoro-1-pentadisulfonate	2706-91-4	<0.5
PFHxS ¹	perfluoro-1-hexadisulfonate	355-46-4	<0.5
PFHpS ²	perfluoro-1-heptadisulfonate	375-92-8	<0.5
PFOS ¹	perfluoro-1-octadisulfonate	1763-23-1	<0.5
PFNS	perfluoro-1-nonadisulfonate	68259-12-1	<0.5
PFDS	perfluoro-1-decadisulfonate	335-77-3	<0.5
PFUnDS	perfluoro-1-undecadisulfonate	749786-16-1	<0.5
PFDoS	perfluoro-1-dodecadisulfonate	79780-39-5	<0.5
PFTTrDS	perfluoro-1-tridecadisulfonate	174675-49-1	<0.5
Fluorotelomer Sulfonates (X:2 FTS)			
4:2 FTS	4:2 fluorotelomer sulfonate	757124-72-4	<0.5
6:2 FTS	6:2 fluorotelomer sulfonate	27619-97-2	<0.5
8:2 FTS	8:2 fluorotelomer sulfonate	39108-34-4	<0.5
10:2 FTS	10:2 fluorotelomer sulfonate	120226-60-0	<0.5
Perfluoroethylcyclohexanesulfonate (PFECHS)			
PFechS	perfluoro-4-ethylcyclohexanesulfonate	13252-14-7	<0.5



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Perfluorooctanesulfonamides (FASA)		CAS	LOD (ng/L)
FBSA	perfluoro-1-butanefluoramide	30334-69-1	<0.5
FHxSA	perfluoro-1-hexanesulfonamide	41997-13-1	<0.5
PFOSA	perfluoro-1-octanesulfonamide	754-91-6	<0.5
N-MeFOSA	N-methylperfluoro-1-octanesulfonamide	31506-32-8	<0.5
N-EtFOSA	N-ethylperfluoro-1-octanesulfonamide	4151-50-2	<0.5
Perfluoroalkanesulfonamidoethanols (FASE)			
MeFOSE	2-(N-methylperfluoro-1-octanesulfonamido)ethanol	24448-09-7	<5
EtFOSE	2-(N-ethylperfluoro-1-octanesulfonamido)ethanol	1691-99-2	<5
Perfluorooctanesulfonamidoacetic Acids (FOSAA)			
MeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid	2355-31-9	<0.5
EtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid	2991-50-6	<0.5
Chloroperfluoroalkyl Ether Sulfonates (Cl-PFESA)			
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	756426-58-1	<0.5
11Cl-PF3OUDS	1-chloroeicosafuoro-3-oxaundecane-1-sulfonate	763051-92-9	<0.5
Fluorotelomer Carboxylic Acids (n:3 FTCA)			
3:3 FTCA	3-perfluoropropyl propanoic acid	356-02-5	<0.5
5:3 FTCA	3-perfluoropentyl propanoic acid	914637-49-3	<2.5
7:3 FTCA	3-perfluoroheptyl propanoic acid	812-70-4	<2.5
Per- and Polyfluoroalkyl Ether Carboxylic Acids (PFECA)			
HFPO-DA	2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)-propanoic acid (GenX)	13252-13-6	<1.0
HFPO-TA	perfluoro-2,5-dimethyl-3,6-dioxanonanoic acid	13252-14-7	<2.5
ADONA	dodecafluoro-3H-4,8-dioxanonanoate	919005-14-4	<0.5
PFMOPrA	perfluoro-4-oxapentanoic acid	377-73-1	<0.5
PFMOBA	perfluoro-5-oxahexanoic acid	863090-89-5	<0.5
NFDHA	perfluoro-3,6-dioxaheptanoic acid	151772-58-6	<0.5
Perfluoroalkyl Ether Sulfonates (PFESA)			
PFEESEA	perfluoro(2-ethoxyethane)sulfonate	113507-82-7	<0.5
Polyfluoroalkyl Phosphate Di-Esters (diPAP)			
8:2 diPAP	perfluorodecyl-phosphate	678-41-1	<0.5
Cationic/Zwitterionic PFAS			
N-CMAmP-6:2 FOSA	fluorotelomer sulfonamide alkylbetaine (6:2 FTAB)	34455-29-3	<10

Table 1 List of per- and polyfluorinated compounds contained within suite and associated limits of detection.

- The listed CAS numbers refer to the parent perfluoroalkylsulfonic acid. It should be noted that the method detects the perfluoroalkylsulfonate base anion which may derive from a range of substances, such as the parent acid and salts of the acid.

1 - Calibration standard contains both linear and branched components

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EPA Draft Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolid, and Tissue Samples by LC-MS/MS, July 2023. EPA document EPA 821-D-23-001.

Principle

A known mass of soil undergoes extraction using methanol and analysed by liquid chromatography coupled with a triple quadrupole mass spectrometer (LC-MS/MS). The identification of each analyte is confirmed by retention time combined with one or two mass transitions.

The standards used for calibration of PFOS and PFHxS contain both linear and branched components so all are integrated when quantitating these compounds. All other compounds are quantified for the linear component only.

Holding times are set at 90 days when stored between 0 - 6°C, with the following caveat:

If NFDHA is an important analyte for a given project; then samples should be extracted as soon as possible.

Interferences

Extracted samples may contain interferences from other compounds contained within the sample matrix. Using the principles of MS/MS, many of these interferences will be eliminated. However, there may be occasions when interferences from non-target compounds arise from similar precursor and product ions. In these cases, reported limits of detection may be raised.