



Perfluorinated Compounds

Uses, Legislation and Analysis





ALcontrol Laboratories

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History

- Both PFOS and PFOA were originally manufactured by 3M
- PFOS was originally used in Scotchguard water proofing.
- PFOA has been widely used in Gore tex and Teflon.
- Both are widely used in aqueous Film Forming Foam (AFFF)





Current Uses of PFOA

2009 USEPA study showed PFOA in the following groups products:

- Pre-treated carpets
- Carpet care liquids
- Treated home textiles
- Treated non-woven medical garments
- Stone, tile and wood sealants
- Membranes for clothes
- Food contact paper
- Dental floss
- Thread sealant tape
- PTFE cookware

Source: Perfluorocarboxylic Acid Content in 116 Articles of Commerce (Zhishi Guo, Xiaoyu Liu, Kenneth A. Krebs and Nancy F. Roache)



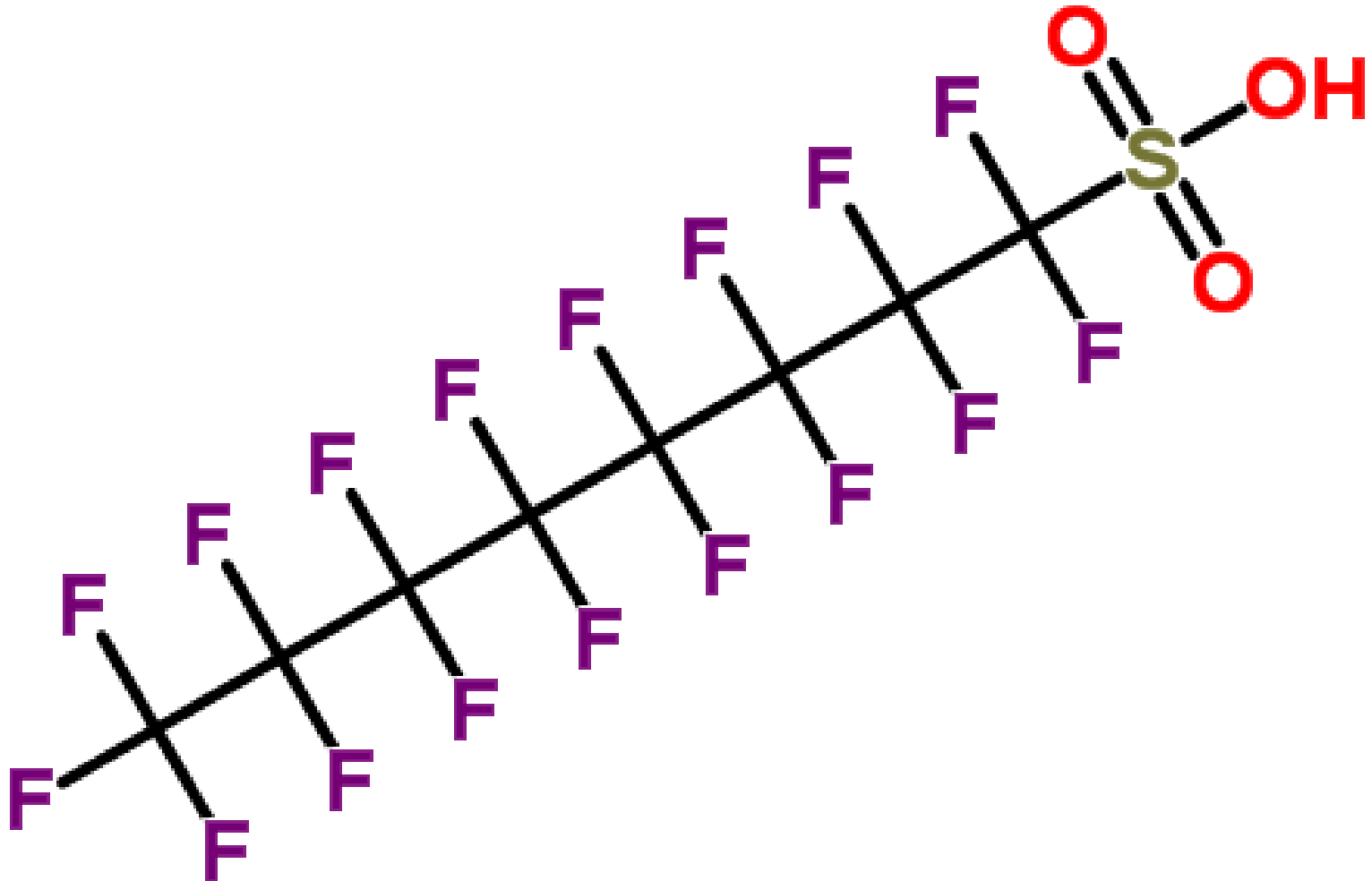
Perfluorinated Compounds

Definition:

“A perfluorinated compound (PFC) is an organofluorine compound with all hydrogens replaced by fluorine on a carbon chain—but the molecule also contains at least one different atom or functional group”

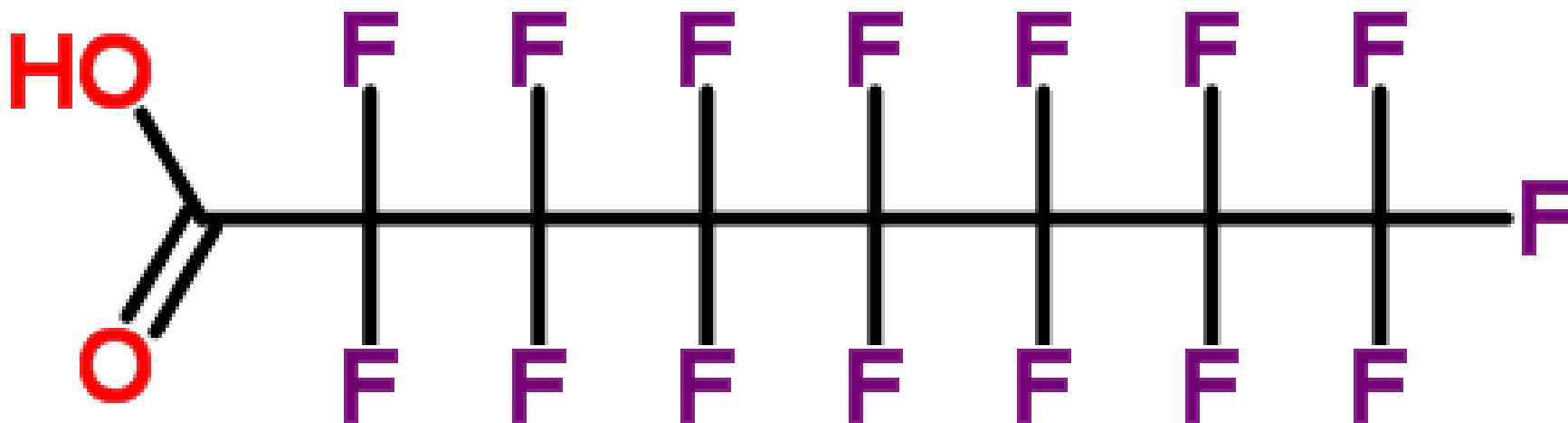


PFOS – perfluorooctanesulfonic acid





PFOA – Perfluorooctanoic acid





Chemical properties

- Chemically resistant to acids and alkalis
- Thermally resistant
- Hydro- and lipophobic





Environmental Concerns

Environmentally PFOS and PFOA have been shown to be:

- Persistent
- Toxic
- Bioaccumulative

This by definition makes them
Hazardous Substances





Production

- DuPont now the major worldwide producer
- Until 2002 USA was main producing country
- Now almost exclusively made in China





International Regulations

- PFOS is covered by the Stockholm Convention on Persistent Organic Pollutants
- Added in 2009
- Restricted uses





EU Regulations

- WFD includes PFOS
 - Water 0.65 ng/l for inland waterways and 0.13 ng/l other waterways
 - Biota 9.1 µg/kg
- Most individual countries now have drinking water limits for PFOS
 - UK limit 0.3 µg/l for PFOS
 - UK limit 10 µg/l for PFOA





Remediation

- As highly persistent chemicals, they do not biodegrade, hydrolyse, metabolise or breakdown under photolysis.
- Current proven techniques include GAC for water and landfilling for soil.
- High energy persulphate oxidation has been shown promise in laboratory bench trials.
- When oxidising PFOA, some shorter chain perfluorinated carboxylic acids may be formed in the destruction process.

Source: http://environmental.fmc.com/media/resources/FMC_Peroxygen_Talk_2011-12_Treatment_of_PFOS_and_PFOA.pdf



Analysis - Instrumentation

- As strongly ionic compounds PFC's are not amenable to GC analysis.
- LC instrument required with triple quadrapole detector (LC-QQQ).
- This allows accurate low level detection.





Analysis Suites

Compound	CAS Number	LOD	
		Water (ng/l)	Soil (µg/kg)
H4PFOS (also known as 6:2 PFS)	27619-97-2	x	10
PFBA	357-22-4	x	10
PFPA	2706-90-3	10	10
PFHxA	307-24-4	1	10
PFBS	375-73-5	1	10
PFHpA	375-85-9	1	10
PFOA	335-67-1	1	10
PFHxS	355-46-4	1	10
PFNA	375-95-1	1	10
PFHpS	375-92-8	1	10
PFDA	335-76-2	1	10
PFOS	1763-23-1	1	10
PFAunA	2508-94-8	10	10
PFDaA	307-55-1	10	10



Sampling

- Water samples into HDPE 500ml bottles – no preservative
- Don't use teflon borehole liners or bailers
- Don't re-use bailers
- Soil samples into plastic tubs
- PFC's can stick to glass



Summary

- Some PFC's are hazardous substances
- Of increasing environmental concern
- Not biodegradable
- Require specialist kit to analyse for
- Expertise in analysis available at ALcontrol



Questions?

- Please type any relevant questions in 'Q&A box'.



For more information please contact –
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