

About CSIR-NEERI

CSIR-NEERI is endorsed as Stockholm Convention Regional Centre (SCRC) on Persistent Organic Pollutants (POPs) for Asia Region at COP-5 meeting held during 25-29th April 2011 at Geneva. SCRC is serving different parties/countries in the Asia region to help them in their capacity building and transfer of technologies related to POPs and new POPs. Besides India, CSIR-NEERI is serving ten countries of Asia region viz. Bangladesh, Maldives, Mongolia, Myanmar, Nepal, Philippines Thailand, Sri Lanka, UAE and Vietnam. The goals of the SCRC is to provide technical assistance for building capacities of the parties of the Asia region in relation to monitoring and assessment of POPs in the environment, transfer of technologies, raise awareness and promote identification and environmentally sound management(ESM) of POPs and POPs contaminated sites in the region. The Centre is also assisting the parties of Asia region in fulfilling their obligations of the Stockholm Convention



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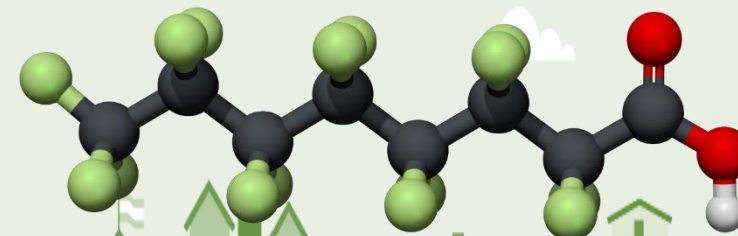
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Pentadecafluorooctanoic acid (PFOA, perfluorooctanoic acid), its salts and PFOA-related compounds

POPs
PERSISTENT ORGANIC POLLUTANTS



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1. What are PFOA and its salts?

- **Penta-decafluoro-octanic acid (PFOA)**, its salts and PFOA related compounds falls within a family of perfluoroalkyl and polyfluoroalkyl substances (PFASs). PFASs consist of carbon chains of different lengths where the H-atoms are completely or partly substituted by fluorine atoms.
- Fluorocarbon tail is both hydrophobic and lipophobic.
- Used in fire-fighting applications, cosmetics, greases and lubricants, paints, polishes and adhesives. Also considered as a surfactant.

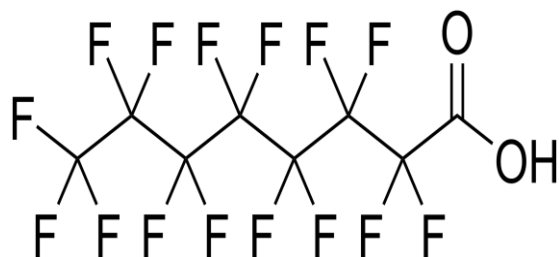


Fig. Structure of PFOA

2. What are the characteristics of PFOA?

- CAS number : 335-67-1
- Chemical formula (general) : $C_8HF_{15}O_2$
- Description : White to off-white powder
- Molecular mass : 414.069
- Boiling point : 192.4 °C
- Melting point : 54.3 °C
- Density : 1.792 g/cm³ at 20 °C
- Solubility : 9.5 g/L in water at 25 °C
- Vapour pressure : 0.0023 kPa at 20 °C (extrapolated);
0.127 kPa at 59.25 °C (measured);
0.070 kPa at 25 °C
- Stability : When heated decomposes to form toxic vapours
- pKa : 1.30
- Log K_{ow} : 4.8

Its Salts

- Branched perfluorooctanoic acid (PFOA); CAS no 90480-55-0
- Ammonium salt of branched PFOA (APFO); CAS no 90480-56-1
- Sodium salt of PFOA; CAS No. 335-95-5
- Potassium salt of PFOA; CAS No. 2395-00-8
- Silver salt of PFOA; CAS No. 335-93-3

3. What are the applications of PFOA?

- Used as emulsifiers to solubilize fluoromonomers and in the production of fluoropolymer polytetrafluoroethylene and fluoroelastomers.
- Used as non-stick coatings on cookware, membranes for clothing (that are both waterproof and breathable), electrical-wire casing, fire and chemical resistant tubing, and plumber's thread-seal tape.
- In cosmetics, greases and lubricants, paints, polishes, adhesives, and fluorinated surfactants [HSBD,2003] .
- Used as grease and water-repellent coating in food packaging [Fromme *et al*, 2009].
- Used as component in aqueous fire-fighting foam [Prevedouros *et al*, 2006].

4. What are the sources for release in the environment?

- Direct release to the environment
 - During production of raw substance (including PFOA as impurity in the manufacturing of PFOA-related compounds and some alternatives).
 - During the processing, use and disposal of the chemical, from treated articles.
 - Products contaminated with PFOA [UNEP, 2016].



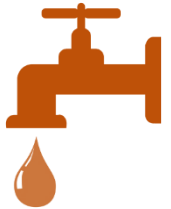
Main emission vectors of PFOA and its salts are water, wastewater and dust particles

5. What are the modes of exposure to humans?

- PFOA exposure to the general public typically occurs via “environment” by
 - Consumption of contaminated drinking water and food.
 - Inhalation of contaminated indoor air/dust.
 - Consumer products containing PFOA, its salts and related compounds.
 - Through breast feeding in infants [UNEP, 2016].



Contaminated food



Drinking water



Possible mode of exposure to
Humans



Breast feeding



Contaminated indoor air and dust

6. Why PFOA is a chemical of concern ?

- Persistent and does not undergo any abiotic or biotic degradation.
- Highly persistent in all environmental compartments, with a strong resistance to all conventional mechanisms of degradation [UNEP, 2016].
- IARC has classified PFOA as possibly carcinogenic to humans.
- Possibly found in all humans at very low levels but concentration increases in humans exposed to contaminated drinking water [American Cancer Society, 2016].
- Low to moderate potential to accumulate in aquatic species.
- Accumulate and bio magnify in air breathing terrestrial and marine mammals.
- The POPs Review Committee concludes that PFOA meets the screening criteria specified in Annex D.

**CAUSE FOR
CONCERN**

7. Evidences in support of prevalence of PFOA in the environment

- No known natural sources.
- Prevalent in environment due to human activity.
- Worldwide monitoring of water, air, sediment and biota at remote locations detected the presence of PFOA and related compounds.
- Can also be formed by environmental degradation or by metabolism in larger organisms from a large group of related PFASs or precursor compounds (ATSDR 2015).
- An assessment of sources of PFOA to the Baltic Sea estimated that 30% of the releases were due to transformation of fluorotelomers [UNEP, 2016].



8. What are the health effects of PFOA?

- Detected in human blood and breast milk from various countries [UNEP,2016].
- Humans are very slow eliminators of PFOA as compared with other species.
- Estimated half-life of PFOA elimination ranging from 2 to 4 years. PFOA accumulates in humans with increasing levels with age.
- Inhibited expression of genes involved in thyroid hormone biosynthesis, induced vitellogenin gene expression, development of oocytes in the testes of males and genes causing ovary degeneration in females (In fish).
- Oral exposure in animals showed alterations to the liver, reproductive/developmental toxicity and endocrine disruption.
- Kidney cancer, testicular cancer, thyroid disease, pregnancy-induced hypertension and high cholesterol.



9. What is the Indian scenario of PFOA?

- A study in 2008 from India found significant concentrations of PFOA in women from Chidambaram, Kolkata, and Chennai. The highest level of PFOA exposure was reported in Indian breast milk [Tao *et al*, 2008] (US EPA - 70 ppt in drinking water).
- Another study accounted for 93 ppt of PFOA in Noyyal River, Tamil Nadu [Yeung *et al*, 2009].
- In the Sundarbans mangrove area, PFOA was found at all five sampled sites at an average level of 11.61 ppb dry weight. The Sundarbans contains four protected areas that are listed as UNESCO World Heritage Sites [Yeung *et al*, 2009].
- Currently India doesn't have any specific regulation and policy.

10. Stockholm Convention

- Stockholm Convention on POPs is a global treaty adopted on 22 May 2001 in Sweden and entered into force in 2004, with the aim to protect human health and environment from chemicals that remain intact in the environment for more extended period, become widely distributed geographically, accumulates in fatty tissues of humans and wildlife and have harmful effects on human health or on the environment.
- India ratified and became a member of this Convention on 13 January 2006. India is one among the nations which ratified the Stockholm Convention and took various important steps in the progress of the prohibition of POPs. (<http://pib.nic.in/newsite/PrintRelease.aspx?relid=161203>)
- The Government of India, with financial and technical support from the Global Environment Facility (GEF), initiated the NIP development process which involved the ground-level assessment of situation of POPs through inventorization, samples collection, analysis and interpretations (Government of India, 2011).

