

Fluorinated “forever chemicals” and where to find them



What are fluorochemicals?

Fluorochemicals are organic (carbon-based) compounds that contain fluorine atoms in place of hydrogen atoms.



These compounds are often referred to as “per and polyfluoroalkyl substances”, or PFAS. The fluorinated chain repels water and fats, while the atoms at the end of the molecule mix with them. This allows these molecules to act as surfactants, helping water and oils mix.

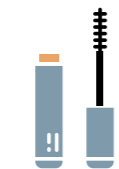
Key uses of PFAS



Water-resistant coatings

Firefighting foams

Non-stick coatings



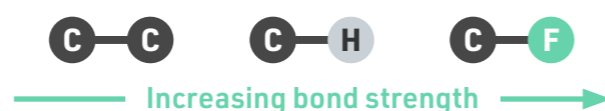
Stain-resistant coatings

Fast food packaging

Cosmetic products

PFAS issues and alternatives

The bond between carbon and fluorine atoms are very strong and stable. Because of this, PFAS don't break down easily and can accumulate, posing potential problems for human health and the environment.



Key PFAS concerns



PFAS can contaminate water intended for human consumption.



PFAS can enter living organisms and bioaccumulate through the food chain.



PFAS are linked to health problems including cancers and hormone disruption.

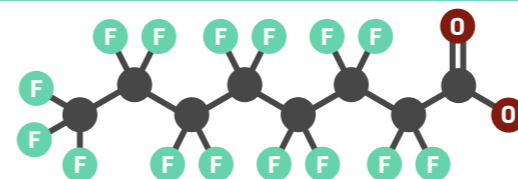
PFAS alternatives

Use of PFAS in cosmetics is nonessential, making them easy to remove. For other uses, substitutes are needed. Hydrocarbon-based surfactants such as sodium alkyl sulfate can be used in fluorine-free firefighting foams, and cerium oxide can be used in membranes for hydrogen production from water.

Selected per and polyfluoroalkyl substances (PFAS)

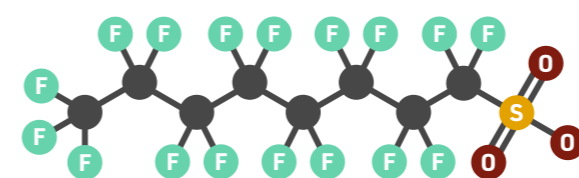
KEY: ● Carbon ○ Oxygen ● Sulfur ● Fluorine ● Hydrogen

Perfluorooctanoic acid (PFOA)



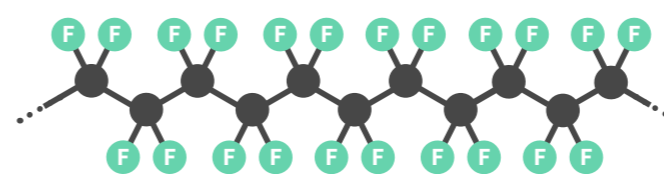
PFOA was used to make fluoropolymers for non-stick cookware, electronics and clothing. Its production and use is now banned worldwide with some exceptions.

Perfluorooctanesulfonic acid (PFOS)



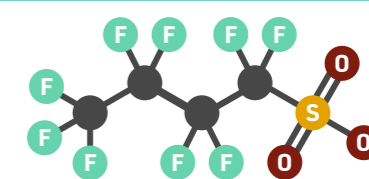
PFOS was used in stain repellents, fire-fighting foams and semiconductor manufacture. It has been phased out, banned or restricted in most countries.

Polytetrafluoroethene (PTFE)



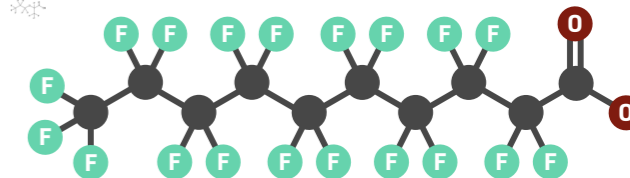
More commonly known as Teflon®. Used to make non-stick pans, in waterproof clothing and some dental floss. Breaks down and releases PFOA at very high temperatures.

Perfluorobutanesulfonic acid (PFBS)



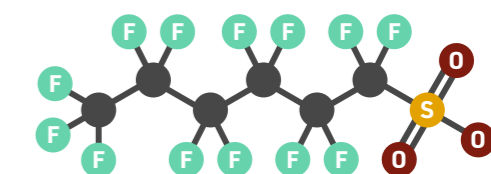
Manufacturers use PFBS as a replacement for perfluorooctanesulfonic acid (PFOS) in water and stain repellent coatings for fabrics. It's also used in firefighting foams.

Perfluorodecanoic acid (PFDA)



Used in textile treatments for outdoor clothing and water-resistant protective equipment, as well as in non-stick coatings and electronic component manufacturing.

Polyfluorohexanesulfonic acid (PFHxS)



Manufacturers use PFHxS as a surfactant in cleaning agents and surface treatments for textiles. It is also used in the production of firefighting foams.