

Self-experiment: Body can absorb fluorine-containing chemical PFOA through the skin

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Per- and polyfluoroalkyl substances (PFAS) are long-lasting fluorine-containing industrial chemicals. Due to their water-, grease- and dirt-repellent properties, they are incorporated into numerous consumer products such as paper packaging for food, outdoor textiles or non-stick pans. PFASs have spread throughout the world in the environment and are ingested in small quantities through food. Some of these compounds, such as perfluorooctanoic acid (PFOA), are excreted very slowly by humans. For this reason, they accumulate in the organism and are therefore considered particularly problematic.

To improve their properties, PFAS are added to a small proportion of cosmetics. These must be indicated on the packaging. Such cosmetics may contain problematic compounds such as PFOA as impurities or degradation products. Until now, it was assumed that these substances do not enter the body to any significant extent after application to the skin. However, data on the absorption of PFAS via human skin was not available. A scientist of the Federal Institute for Risk Assessment (BfR) has now tested for the first time in a self-experiment whether PFOA added to a sunscreen is absorbed by the body. As the researcher and a colleague reported in the scientific journal "Environment International" (<https://www.sciencedirect.com/science/article/pii/S0160412022004767>), this is indeed the case: A small amount of the substance crossed the skin barrier and could be detected in the blood.

PFOA may not be used in cosmetic products. The production, use, marketing and import of PFOA is prohibited in the EU with a few exceptions. As an unintentional and unavoidable contaminant, PFOA may only be contained in products at a maximum of 0.025 micrograms per gram as a result of the regulation in place at European level since July 2020. For important other perfluorine compounds with long half-lives, corresponding regulations will come into force in February 2023.

There are indications from epidemiological studies that the use of individual cosmetic products such as sunscreen, blusher powder and facial cleansers can be linked to increased PFAS levels in the blood. However, studies on rodents and skin models have so far provided no evidence that the substance PFOA enters the body through the skin in significant amounts. The current study was the first to investigate this uptake under realistic conditions in humans. For this purpose, 110 micrograms (millionths of a gram) of PFOA were mixed into 30 grams of a sunscreen and then the entire skin was applied as if before sunbathing. After two days, the residues were washed off.

Slow transfer into the blood

The blood of the test person was examined for PFOA over 115 days. It was found that the substance was only slowly absorbed through the skin and that the highest concentration in the blood was only reached after three weeks. After that, the level gradually decreased. The PFOA used has a half-life of an estimated 1.8 years in the organism. After this time, half of it is excreted. This corresponds to previous findings on the slow excretion of the substance in humans. The scientists estimate that about 1.6 percent of the PFOA from the cream entered the body. With this result, it could be shown in this pilot test that a noteworthy proportion of PFOA in cosmetics can pass into the organism and that this uptake route via the skin cannot be neglected if the substance is contained in relevant quantities. This probably applies not only to PFOA but also to other PFAS.

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The proportion of PFOA from the sunscreen in the total amount of PFOA in the blood of the test subject was a maximum of just under ten percent. This means that a high proportion of the total amount of PFOA in the body was already achieved after a single application. This is due to the experimentally high PFOA concentration of 3.7 micrograms per gram of sunscreen. Such high PFOA concentrations have only rarely been detected in cosmetic products worldwide in the past, but not at all in the EU.

According to Regulation (EU) 2019/831, PFOA may not be used in cosmetic products. The production, use, marketing and import of PFOA is generally prohibited in the EU, with a few exceptions (see Commission Delegated Regulation (EU) 2020/784). As an unintentional and unavoidable trace contaminant, PFOA may only be measurable at a maximum of 0.025 micrograms per gram in products as a result of the regulation in place at European level since July 2020. For important other perfluorine compounds with long half-lives, corresponding regulations will come into force in February 2023.

Risk assessment of PFAS

A high total amount of PFAS in the body is associated with various biological changes in epidemiological studies. Further research is needed to clarify the causal relationship. Reduced formation of antibodies observed in children after vaccination is considered particularly critical. The current risk assessment of the European Food Safety Authority (EFSA) is based on these immunological data. However, as a result of regulation, exposure to the substance PFOA has decreased significantly over the past 20 years.

Further information on the BfR website on the subject of PFASs

<https://www.bfr.bund.de/cm/349/pfas-in-food-bfr-confirms-critical-exposure-to-industrial-chemicals.pdf>

<https://www.bfr.bund.de/cm/349/industrial-chemical-pfba-does-not-accumulate-excessively-in-lungs-and-kidneys.pdf>

<https://www.bfr.bund.de/cm/349/pfas-industrial-chemicals-BfR-is-participating-in-the-eu-wide-restriction%20proposal.pdf>

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. The BfR advises the Federal Government and the States ('Laender') on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.