Statement of the German Fluorine Chemistry Division on the Proposed ban of PFAS-like Molecules by the ECHA

PFAS stands for "per- and polyfluorinated alkyl substances" as defined by ECHA. It is a group of chemical compounds containing covalently bonded fluorine atoms to carbon units. The C-F bonds they contain represent the strongest in organic chemistry and give PFASs their remarkable durability and resistance to even severe chemical and physical influences and their unique properties. Due to their intriguing chemical properties, some PFAS show water, grease and dirt repellent behavior. They can be heat resistant and possess great chemical stability against solvents, acids and bases, which make them so valuable or even essential in many industrial applications and in everyday life.

Due to their high stability, some PFAS are difficult to degrade and persistent in the water supplies. They can therefore accumulate in the environment or in our food chain, which can lead to problems in various ecosystems (water, soil and air), especially in the case of bioaccumulative substances. Some PFAS are potentially toxic and are suspected of having negative health effects on humans if they are ingested in sufficiently high concentrations. Consequently, this requires regulation of the input of PFASs into the environment and the establishment of a circular economy.

Use of PFAS: PFAS are used in a wide range of applications in almost all apects of life and industry due to their unique properties. This includes, among others, the fields of pharmaceuticals, agrochemicals, material sciences and consumer goods. For example, about 20-30% of the most widely sold pharmaceuticals approved in recent years contain at least one fluorine atom in the active pharmaceutical ingrediaent (API).[1] About half of all newly developed agrochemicals (insecticides, fungicides, herbicides) contain (multiply) fluorinated units.[2] In the field of materials, a wide variety of PFASs play a significant role. This includes polymers as well as small molecules with a wide range of applications. Examples include membranes (drinking water treatment, energy storage), refrigerants (air condition, heat pumps), electronics (displays, batteries), lubricants, sealants, impregnating agents, extinguishing agents, insulating gases for high-voltage switchgear, etching gases for semiconductor technology and coatings in medical technology (heart valves, stents). PFASs are also widely used in the consumer goods sector, for example as coatings for textiles, packaging materials, ski waxes, cosmetics, dental floss and many other everyday products.

Differentiation problem: It is essential that PFAS be classified according to their significance with regard to possible regulation. A classification of PFASs into the following three groups is therefore proposed:

- Essentials: Applications of PFAS whose substitution by other substances is not possible or drastically alters function, e.g. pharmaceuticals, medical devices, electronic materials. Either there are no PFAS-free alternatives due to the property requirements or a substitution would lead to major disadvantages, e.g. increased material use, which would be disadvantageous from an environmental point of view.

[1] M. Inoue, Y. Sumii, N. Shibata *ACS Omega*, **2020**, *5*, 10633
[2] Y. Ogawa, E. Tokunaga, O. Kobayashi, K. Hirai, N Shibata, *iScience*, **2020**, *23*, 101467

- Non-Essentials: Replaceable PFASs in industry and everyday life, e.g. coatings in textiles, cosmetics, ski waxes, paper production etc.

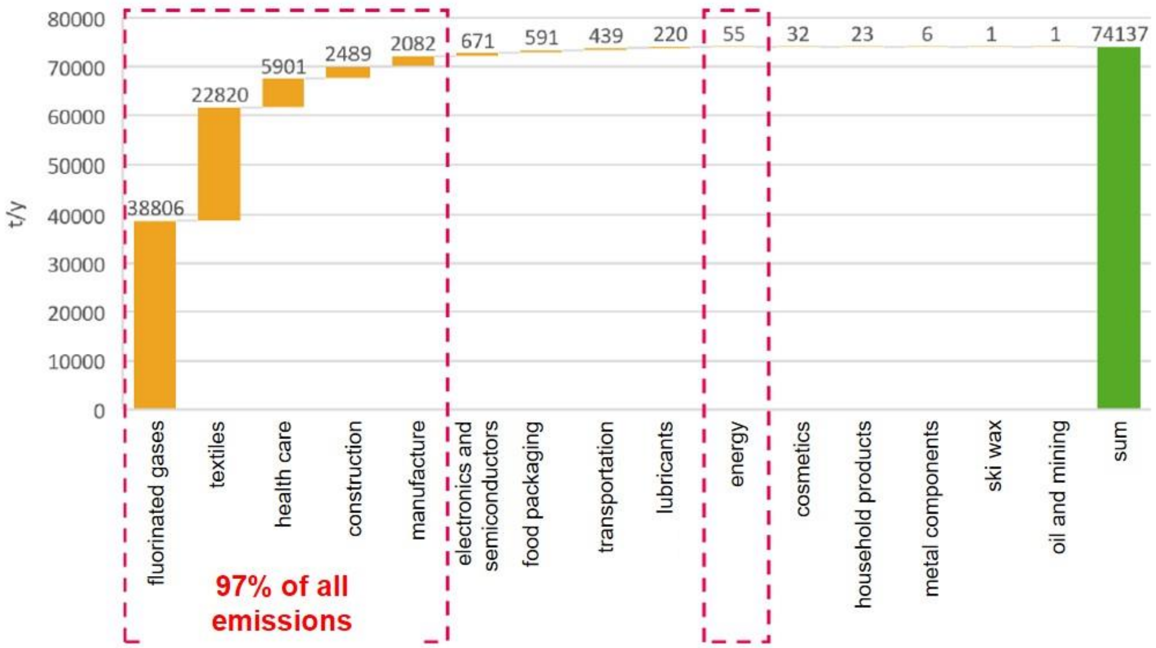
- Potential Substitutables: Substances in which medium- or long-term substitution seems reasonable. Their properties as well as their influence on other value chains must be taken into account, e.g. fire extinguishing agents, refrigerants, insulating gases, corrosive gases. Furthermore, it is essential to consider the actual input into the environment in terms of quantity, see below. Again, the production volume as well as the use of PFASs in the production and circular economy must be considered.

The manufacturers or users should be obliged to carry out a substitution test under strict consideration of the relative environmental compatibility of the PFAS and their corresponding substitutes. A sensible approach would be to weigh up alternatives, as is common practice in industry, for example, when evaluating the hazard potential of solvents.

Systemic consideration / value chain: In the case of compounds that can be replaced in the medium and long term, systematic consideration must be given to the value chains in order to avoid serious adverse cuts in industry and everyday life in the course of a phase-out. For example, the production of important basic chemicals may be at risk. Examples include the production of sulphuric acid or chlor-alkali electrolysis, for which Teflon components such as seals and membranes are indispensable.

Furthermore, efforts must be made to develop closed-loop processes for PFAS used. Ideally thiw oudl require the the consistent recycling of PFAS. Corresponding processes are already being developed in industry. It must also be taken into account that some PFAS are degraded to harmless compounds during their use, for example when PFAS are used as etching gases in the semiconductor industry.

An important point in the discussion of the ban on PFAS is the quantitative input into the environment in relation to the area of application. More than 95% of PFAS currently emitted into the environment come from the application areas of fluorinated gases, textiles, medical devices, building materials and PFAS manufacture (manufacture), see Figure 1. Many essential applications of PFAS, for example in the energy and electronics & semiconductor sectors, are responsible for comparatively small emissions. It logically follows that speciality chemicals based on or containing PFAS should be regulated differently from substances used in very large quantities.



Biodegradability: The biodegradability of PFAS is highly relevant and its investigation should continue to be part of current research.

Conclusion: It is the view of the Fluorine Chemistry Division, that an almost complete ban on all PFASs sought by the ECHA is not a scientifically guided process. The socio-economic consequences cannot be fully assessed at present and negative impacts are likely. A scientifically based, and more differentiated, approach therefore seems warranted.

Comment on the exemptions of the ECHA classification[3]:
From a closer look, ECHA's exemption is not sufficient as it does not sufficiently consider scientifically proven degradation processes. This may prevent the development of PFAS substitutes.

ECHA's exemption definition reads:

"A substance that only contains the following structural elements is excluded from the scope of the proposed restriction:

CF_3-X or X-CF_2-X',

where X = -OR or -NRR' and X' = methyl (-CH_3), methylene (-CH_2-), an aromatic group, a carbonyl group (-C(O)-), -OR'', -SR'' or –NR''R'''; and where R/R'/R''/R''' is a hydrogen (-H), methyl (-CH_3), methylene (-CH_2-), an aromatic group or a carbonyl group (-C(O)-)"

Thus X and X' would have to be extended to the effect that X and X' can be any other heteroatom. Furthermore, for many heteroatom compounds, motifs such as $(CF_3)_2X$ and $(CF_3)_3X$ are also unobjectionable. This suggests that the current draft of the proposed action requires further refinement.

[3] ECHA – Annex XV Restriction Report

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