New class of fast-degrading fluorinated plastics can help prevent PFAS accumulation

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Christoph Fornacon-Wood (left) and Prof. Dr. Alex J. Plajer, in collaboration with researchers from Berlin, have produced a new class of fluorinated polymers. Credit: Bayreuth University

Chemists at the University of Bayreuth, in collaboration with researchers from Berlin, have produced a new class of fluorinated polymers that

degrade 20 times faster than their non-fluorinated equivalents. These results can help to prevent the accumulation of the industrially used fluorine compounds PFAS, also known as "forever chemicals," in the environment. The study has been published in the journal *Chemical Communications*.

Plastics containing fluorine have become irreplaceable in many areas of everyday life due to their water-repellent and low-friction surfaces. Well-known examples are the coatings on raincoats and non-stick frying pans. However, these polymers have been criticized as "forever chemicals" that accumulate in the environment over a long period of time and can now even be detected in pets, Antarctic ice and newborn babies.

A new class of fluorinated polymers with accelerated degradation, in which the fluorine can be recovered in a reusable form, is an important step towards a sustainable circular economy for plastics.

The majority of consumer goods containing fluorinated plastics, such as Teflon pans, currently end up in landfill sites: As a result, the polymers end up in the environment. These potentially toxic compounds accumulate there so that they are now detectable almost everywhere.

A research team involving Christoph Fornacon-Wood and Prof. Dr. Alex J. Plajer from the Department of Macromolecular Chemistry at the University of Bayreuth has tackled this problem.

The researchers have succeeded in producing a new class of fluorinated polymers that contain ester bonds. Ester bonds in polymers, i.e. plastics, facilitate degradation; however, fluorinated polyesters are very rare.

Like ordinary fluorinated plastics, this new class of polymers also has non-stick properties. In addition, the new polymers can be easily degraded again via the ester bonds.

"Fluorine atoms normally slow down degradation, but here it is actually accelerated by the fluorine in the material," says Plajer. The fluorine can then be recovered from the degraded material to be reincorporated into all kinds of chemicals.

"The design of future fluorinated polymers should include an integrated option for degradation and recycling to enable a sustainable circular economy for fluorine," says Fornacon-Wood. This is because fluorine is a limited resource and could become rare and therefore expensive in the future without recovery.

More information: Christoph Fornacon-Wood et al, Fluoride recovery in degradable fluorinated polyesters, *Chemical Communications* (2024). DOI: 10.1039/D4CC02513J

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