

Plastics—not simply garbage

May 8 2017, by Peter Hergersberg



Credit: AI-generated image ([disclaimer](#))

For good reason, plastics are found in almost everything that makes our lives easier – computers, cars and, of course, packaging. However, because it is so stable, and often not disposed of properly, more and more plastic refuse is gathering in the oceans. To explore the risk presented by plastics and possible alternatives, Frederik Wurm and his team at the Max Planck Institute for Polymer Research in Mainz are taking part in the PlastX project.

The plastic bag is the light bulb of the waste management industry. Like the ban on the light fixtures, which generate more heat than light, the EU-wide prohibition on free plastic bags, which enters into force in 2018, has also attracted a great deal of public attention - and not all of it sympathetic. Both cases involve measures with symbolic power capable of raising awareness about a problem, but whose impact in terms of achieving the actual objective remains modest. Another thing both bans have in common is undesired side effects.

Energy-saving light bulbs only make a small contribution to reducing Europe's CO₂ emissions to an acceptable level climatically. And the heavy metals they contain can become a source of toxin in normal household waste. A ban on free plastic bags in Europe will probably not result in much less plastic being pumped into the world's oceans. "Above all, plastic often ends up in the environment due to a lack of care in developing and emerging countries," explains Frederik Wurm, Research Group Leader at the Max Planck Institute for Polymer Research in Mainz. "However, in countries like Germany, where plastic refuse usually ends up in the bin or in yellow recycling bags, the problem tends to be inadvertent plastic waste where micro-particles that come off car tires or clothing made of synthetic fibres during washing find their way into bodies of water." This cannot be prevented by any ban or good will or, thus far, by any treatment plant either.

The PlastX project aims to reduce environmental pollution through plastics

To estimate the risk presented by plastics when they accumulate in the environment instead of in the garbage bin, the team of chemists led by Frederik Wurm are working on the PlastX project with social scientists from Goethe-Universität in Frankfurt and the Institute for Social-Ecological Research. The researchers are seeking to present potential

alternatives to the customary polymer materials and to put forward proposals on how [environmental pollution](#) by plastics can be reduced, not just in Germany but primarily in developing and emerging countries. The North-Rhine Westphalia consumer advice centre, the "Gesellschaft für Internationale Zusammenarbeit" and various companies – such as the supermarket chain Tegut – are also taking part in the project being funded by the German Federal Ministry of Education and Research.

The researchers working on the PlastX project soon realized that there were no straightforward solutions to the issues they were seeking to resolve. First of all, there is the danger that plastics in the environment pose to animals and humans. The materials are today perceived as a threat for this reason alone because they are so durable and accumulate on a large scale in the environment unless they are properly disposed of. The figures in themselves are alarming: A US study conducted by, among others, researchers from the University of Georgia revealed that the volume of plastic waste is increasing by 4.8 to 12.7 million tons a year – mainly because [packaging](#) and unwanted devices are carelessly thrown away. According to a study by IUCN, an international nature conservation organization, between 0.8 and 2.5 million tons of plastic micro-particles are pumped into the oceans each year.

"It is not yet clear to what extent plastics – particularly in the form of micro-particles – are hazardous to animals and humans," says Frederik Wurm. "For example, we do not yet know whether they produce nanoparticles that are much more easily absorbed by the body than micro-particles." There is also uncertainty over whether harmful substances find their way into animal or human organisms through the plastic particles or whether they are then detached from the [plastic particles](#) there.

Plastics are lightweight, stable, airtight, watertight

and not least inexpensive

Even though there are risks associated with plastics, simply banning them is oversimplifying matters. The materials have many plus points. Plastics have rightly been an indispensable part of everyday life for several decades and are found in almost every device that makes our lives easier. Their benefits include the fact that they are so durable, even though it is precisely this quality that can make them an environmental issue. They are also light, stable, airtight, watertight and not least inexpensive.

Plastics are not easy to replace owing to their advantages. With regard to plastic bags, for example, paper ones do not provide an eco-friendly alternative either, according to the "Deutsche Umwelthilfe" environmental organization. Producing them requires much more energy, and water and chemicals are used that are harmful to the environment. The environmental footprint of a paper bag is thus worse than that of a plastic one disposed of properly.

While fabric bags, which can be reused for every purchase, help with the bag conundrum, it is much more difficult to find solutions in other cases. There are few alternatives to plastic especially when it comes to packing moist and quickly perishable foods in accordance with current hygiene standards. Even taking one's own plastic or glass container to the supermarket to fill with yogurt or to pack sausages does not provide the answer, according to Frederik Wurm. "Washing containers places a greater strain on the environment than the proper disposal of plastic packaging." What's more, consumers would also have to ensure that their containers were always clean.

Degradable yogurt pots must not start breaking down in the refrigerator

A solution to the problem would be provided by plastics that are either biodegradable or decompose through contact with water, air and light within a reasonable period of time. The chemist in Mainz and his team are working on exactly this kind of polymers. They are carrying out research into synthesis routes for phosphate-containing polymers. These plastics gradually decompose in water and would already appear to lend themselves to certain applications, such as degradable fire retardants or coatings for micro and nano-transporters which carry active medical substances directly to the source of illness in the human body. "Our polyphosphoric esters are only suitable to relatively specialized applications," indicates Frederik Wurm. "They are too expensive for short-life mass products, such as packaging." Even if the broad application of phosphate-containing polymers is ruled out, the Mainz-based scientists hope to use the experience gained from research into these materials to develop degradable plastics for bags and other forms of packaging. At least that was the plan when the PlastX project started. "We quickly realized that it is much more complex than we imagined," says Wurm. Firstly, the chemists have to control when a plastic is degraded. After all, yogurt containers that are broken down in water should not decompose when still in the refrigerator with their water-containing contents. "We also have to control the points at which polymers are split to prevent the creation of products that are environmentally harmful." The degradable plastics, on which research is currently being conducted or that have even already been made into packaging, produce surfactants as soon as they decay. They are just as unwelcome in the waters as plastics because they cause eutrophication. Many of the plastics that are advertised as degradable only meet this claim in the composting plant.

Only filters at the treatment plants help against micro-particles

The chemists in Mainz are therefore now adopting a different approach: "We are now firstly analysing what we want, which alternatives to common plastics already exist and which of them are best for the environment in the final analysis," explains Frederik Wurm. The only way to keep micro-particles out of the waters is probably to equip treatment plants with filters that remove this contamination from the wastewater.

However, regardless of the refuse issue, the environmental footprint of plastics could be improved. Plastics made from regenerative raw materials or even carbon dioxide, which is produced during the combustion of coal, could help here. They could replace the plastic that is currently still almost exclusively made from petroleum. Above all, such materials could improve the climate assessment of the all-purpose material and help to save on fossil resources. "The post-petroleum age is easier to achieve than resolving the problem of plastic waste."

Recycling may remain the only option to deal with environmental pollution by [plastic waste](#) as plastics are difficult to replace in shopping but also in telephones, computers and cars, and as there is no prospect of polymers that break down by themselves. The "Green Dot" label has long given consumers in Germany hope of recycling plastic. However, this procedure is not as straightforward as with glass bottles from which another glass bottle is normally produced.

Thanks to the one-way deposit system, plastic bottles are being reused

"Packaging can only be recycled as new packaging if the plastic is sorted by type," according to Frederik Wurm. This means that polyethylene, polypropylene, polyester and all the other types of plastic cannot be mixed. But that is exactly what happens in the garbage, but also in the

yellow recycling containers and yellow recycling bags. In addition, various additives and dyes also make it more difficult to recycle the material. "There is the possibility of separating plastics through flotation in the air flow, but this is an extremely complex and expensive procedure and does not ultimately produce plastics that are pure enough to make high-quality products from," says the chemist. The one-way deposit system has nevertheless helped to achieve progress in this respect. While it has not increased the recycling rate, only bottles made of the same plastic are collected in the collection banks of the deposit machines, which means they can be turned back into [plastic bottles](#) or made into fleece pullovers. Other forms of packaging are not usually used to manufacture more packaging, but instead just park benches.

And even though some packaging indicates that it is made of recycled plastic, this does not necessarily mean that the material comes from household refuse. "These materials are usually made of waste from industrial production already sorted by type," Frederik Wurm points out. Even though genuine recycling of plastics is difficult, putting them in the refuse container they belong in probably remains the best option. "We are therefore developing a concept in the PlastX project to raise awareness among consumers, not just in Germany but all over the world, that plastics are a raw material," says Wurm. Scientists thus hope to encourage people not to simply throw away packaging and other products made of [plastic](#), but to dispose of them properly. Currently, some are burned, and thus at least generate electricity in their afterlife. And even if they are disposed of at a garbage dump, at least they don't end up in the oceans.

Provided by Max Planck Society

Citation: Plastics—not simply garbage (2017, May 8) retrieved 26 April 2024 from <https://phys.org/news/2017-05-plasticsnot-simply-garbage.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.