Plastic waste: For greater responsibility in dealing with plastics

Plastics are an indispensable part of our daily lives. Plastic packaging, textiles and car tyres all belong to a group of materials with specific properties – substances known as polymers. Some are particularly flexible, others rigid; some are useful because they are so lightweight. Common to them all is the fact they almost never decay completely in the environment. Instead they form small plastic particles known as microplastics which cause major problems for organisms and ecosystems.

More than three million tonnes of packaging waste arose in Germany in 2017, the majority of it plastic. The problem of the over-carefree handling of plastics is a global one: the industrialised countries frequently export plastic packaging waste to the countries of the Global South. In 2018 China halted the import of coarsely pre-sorted packaging for recycling, sending a shock wave through the German waste industry.

Finding new ways of dealing with plastics is a task for society as a whole. The top priority is to reduce the unnecessary mass consumption of plastic products that are used briefly and then thrown away. Many single-use plastic products and much plastic packaging could be dispensed with because alternatives such as reusable packaging are available. Plastics that enter circulation should be recycled in the best possible way, with material recycling taking precedence over energy recovery. Only at the end of the cycle should the plastics be disposed of – in as eco-friendly a manner as possible.

Plastics in the environment – far more than an aesthetic problem

We come across litter everywhere – there are plastic carrier bags on the beach, takeaway coffee cups in the park, PET bottles in the woods. It is unsightly, yet what we see is only the tip of the iceberg. Analysis of material flows shows how plastic waste steadily disintegrates (from macro- to meso- and microplastics), causing a range of problems specific to the various ecosystems.

Public attention has focused in particular on the pollution of the oceans, which has come to be known as “marine littering”. Sea birds strangled by fishing nets or the stomach contents of fish riddled with plastics make powerful pictures. Monitoring activities in connection with implementation of the EU Marine Strategy Framework Directive (MSFD) reveal that the requisite “good environmental status” is not being achieved in German marine areas.

Plastics in water and soil

The pollution of inland waters by plastics and plastic particles has been less well examined. However, in 2018 some studies found evidence of microplastics in the catchment areas of the Rhine, Danube and Weser at all the measurement stations in five German states that were analysed. The leaching of potentially hazardous additives such as fire retardants, which are contained in some plastics, is thought to be a problem, but comprehensive ecotoxicological studies have not been conducted.

There has likewise been insufficient research into plastics pollution in soils. However, studies show that plastics in and on the soil age and break down into smaller fragments over very long periods. There are signs that soil organisms such as earthworms can ingest plastic particles and transport them to deeper layers. It is certainly also possible for these particles to be carried with rainwater into groundwater, rivers and lakes and ultimately into the sea.

How do plastics get into the environment? And how can this be prevented?

Although further research is needed, models are available that depict the spread of plastics in the environment and the subsequent development of potentially harmful impacts on flora and fauna. And we do know where the plastics come from: the problem is a man-made one.

An important source is the everyday use of plastic products and careless disposal of them. Not only plastic bottles but also balloons, plastic confetti and cigarette filters end up in the environment as a result of thoughtless action. There are starting points here for preventing or reducing these plastic inputs to the environment.

Good waste management also prevents plastic waste entering the environment. Germany's law on the circular economy requires separate collection and recovery of plastic waste, with material recycling taking precedence over energy recovery in waste incineration plants and elsewhere. There is certainly scope for expanding the current recycling rate of 39 percent. Good product design that considers material flows from production to disposal can contribute to this, as can longer usage periods in general.

Plastics in rivers and oceans come partly from shipping and fishing, but tourism and leisure activities also result in large quantities of waste. Stricter and more frequent controls are needed to prevent the illegal disposal of waste at sea. Free disposal facilities should be available in ports for marine litter that is caught as by-catch in fishing nets. Initiatives such as "Fishing for Litter" show that this is possible.

Microplastics – direct and indirect sources

Direct sources of microplastics include detergents, cleaning products and cosmetics. Microbeads are added for scrubbing and cleaning purposes; they are also used to colour shower gel or increase its opacity, and they are incorporated into items such as glitter make-up for optical effect. Most of these primary microplastics are discharged directly into waste water. A statutory ban would be a logical step forward and this is what Germany's Federal Environment Agency (UBA) is calling for. However, consumers should not wait for a ban but should already start avoiding products on the supermarket shelves that contain microbeads.

Microplastics also arise indirectly when plastics are altered by abrasion. One of the most significant sources is abrasion of car tyres. In Germany, tyre abrasion is responsible for about 100,000 tonnes of microplastics per year – a third of the country's total microplastics input to the environment. As yet, not enough is known about how this particulate matter then spreads and what impact it has on ecosystems. Another source of microplastics is the shedding of fibres from synthetic textiles during washing.

Sewage sludge, digestates and composts, too, are often polluted with plastic particles. If they are used as fertiliser, the particles may enter the environment. This calls for a standard threshold for all plastics pollution irrespective of particle size and plastic type, coupled with appropriate detection methods. In addition, informing and educating the public can help prevent so many plastic bags and other inappropriate items being discarded in organic waste.

Particularly problematic plastic waste

It is not only the polymers from which plastics are made that pose problems in the environment. Plastics often contain additives that are to varying degrees environmentally hazardous. PVC, for example, often contains softening agents and heat stabilisers as well as the chlorine that is a basic component. Expanded polystyrene boards often incorporate fire retardants; polyolefins – a group of widely used plastics that includes polypropylene (PP) and polyethylene (PE) – have antioxidants and UV stabilisers added. The additives are not firmly bound to the polymers, which means that they can be released and enter the environment.

Risks arise, too, from the plastic casing of car batteries and plastics in electronic waste. These must be properly recycled, because they usually contain substances harmful to health, such as chlorinated and brominated flame retardants. Far too often, these complex wastes are still ending up in countries of the Global South, where their processing and disposal causes enormous damage to the environment and human health.

A spurious solution is the use of oxo-degradable plastics. These are not, as their name suggests, fully biodegradable. Instead they merely disintegrate slowly into tiny plastic fragments. These particles do not decay further and they persist in the environment, although they are imperceptible to the human eye. The European Commission has banned the use of oxo-degradable products from 2021.

Viable alternative plastics? Plastics from renewable resources, biodegradable plastics

In contrast to oxo-plastics, biodegradable plastics genuinely do decay slowly in the environment: microorganisms help convert them into harmless decay products, leaving behind water, carbon dioxide or methane and biomass. A frequent problem, though, is that the decay process takes too long. For example, organic waste bags made of biodegradable plastics take longer to break down than the organic waste they contain, and this causes problems in composting facilities.

Products that should not be confused with biodegradable plastics are those made from renewable resources such as maize, sugar cane or wood. They have a better carbon balance than traditional oil-based plastics, because the amount of carbon dioxide released cannot exceed the amount the plant has absorbed during growth. Nevertheless, they should not be viewed uncritically, because the crops from which these products are made are often grown on an industrial scale with large inputs of water, fertiliser and pesticides. Furthermore, biomass production uses land that would otherwise be available for growing food and puts pressure, either directly or indirectly, on natural ecosystems.

It is important to clarify the terminology used, because both types of plastics are often called “organic plastics”. There are plastics that are both biodegradable and made from renewable resources; they include polylactide (PLA) and polyhydroxyalkanoate (PHA). Others have only one of the two properties.

Researchers at the Oeko-Institut study a very wide range of aspects of plastics use and disposal. They track material flows, analyse particularly problematic plastics and produce life cycle assessments.

Donation-funded project: “Living without plastics – but how?”

As part of a donation-funded project entitled “Living without plastics – but how?”, researchers at the Oeko-Institut explored the causes of the present mass consumption of plastics. The findings highlight various possible ways in which the causes of the microplastics problem – that is, our everyday consumption of plastic products – can be addressed.

The experts state clearly that collection and recycling of plastic waste is not a sufficient solution. Instead, the use of plastics must be significantly reduced. Both consumers and policy-makers can contribute to this.

The chief culprits: Food packaging, synthetic textiles, tyre abrasion

In the Oeko-Institut’s blog, three posts aimed at consumers set out ways of reducing plastic waste and microplastic emissions in daily life. They range from conscious shopping to new consumer attitudes to fashion and tips on more sustainable mobility.

All the posts also urge policy-makers to create a legal and fiscal framework that encourages plastics-free products and lifestyles. For example, legal requirements for tyre manufacturers could reduce tyre abrasion, standardised reusable containers could replace single-use packaging and particle filters fitted as standard in washing machines could minimise the discharge of microplastic particles from synthetic clothing into waste water.

#plastikfrei leben – an Oeko-Institut donation-funded project (all blog entries in one PDF)

Brief study: Comparison and contrasting of various recycling processes in terms of their costs and benefits

Plastic packaging in Germany is usually marked with the Green Dot, which means that after use it is deposited in a yellow sack or yellow bin and collected separately in the Dual System. Consumers assume that it then goes to recycling. But the proportion of plastic packaging that is actually recycled in a high-quality manner – and hence used to produce plastic products of similar quality – is still far too low.

Recycling is often “downcycling”: high-quality plastics are turned into products of lower quality, such as feet for construction site signs. More than half of the waste goes to energy recovery, which means that it is incinerated, for example in cement works.

Turning PET bottles into PET bottles

The company Werner & Mertz, which is known for its Frosch brand cleaning products, aims to market its products in packaging made of 100-percent recycled material. For the recyclate, Werner & Mertz uses 80 percent PET from drinks bottles returned under the deposit scheme, which are relatively well segregated upon collection. The remaining 20 percent comes from the Dual System.

In a short study for the company, Oeko-Institut researchers assessed the costs and benefits of this recycling initiative by comparison with other recycling concepts and alternative disposal methods (such as incineration in cement works).

By comparison with primary PET, the recycling process saves around 2,650 kilos of CO_2 per tonne of recycled PET. And because the PET is not incinerated in waste incineration plants or cement works, this saves a further 450 or 1,440 kilos of the greenhouse gas.

This shows that, despite the increased sorting effort and higher energy consumption involved, recycling PET waste – including waste from the Dual System – in a high-quality manner is environmentally worthwhile. Werner & Mertz is seeking to further increase the percentage of recycling material from the Dual System. The company also uses high-density polyethylene (HDPE), which overall has an even better balance than PET. It would be good if even more companies were to start using high-quality and innovative recycling processes and thus save resources.

“Vergleich und Gegenüberstellung verschiedener Recyclingverfahren bezüglich ihrer Aufwendungen und ihrem Nutzen” [Comparison and contrasting of various recycling processes in terms of their costs and benefits]: short study by the Oeko-Institut on behalf of the Werner & Mertz recycling initiative

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