

The environmental impacts of plastics and micro- plastics use, waste and pollution: EU and national measures ¹

ABSTRACT

This study, commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the Committee on Petitions (PETI), focuses on the pervasive use of plastics and reviews the rising consensus on the potential eco-toxicological impacts of these materials, in particular of smaller plastic particles, dubbed microplastics. It discusses possible mitigation strategies aimed at curtailing the prevalence of (micro)plastics, as well as emerging alternatives and their environmental adequacy.

Propelled by increasing awareness of the impacts of plastics and by public opinion, in recent years a multitude of norms, regulations, laws and recommendations have been proposed and/or implemented. These vary greatly across local, national, regional and international levels, and it is not clear what the beneficial impacts of these tools are. This study assesses these existing instruments, analyses whether they are based on sound scientific data, and discusses foreseeable challenges that could restrain the relevance and suitability of existing and future legislative proposals.

Plastics are a modern marvel, they have benefited society across all sectors, including in the health and food sectors, saving countless lives. Since the industrial production of plastics began in the 1950s, the volumes of plastics produced have outpaced those of almost any other material. However, the same characteristics that render plastics highly desirable are also those that render them ubiquitous in the environment, especially as a large fraction of plastics is designed to be discarded almost immediately following their use. Society's ability to cope with the sheer amounts of plastic produced and discarded is vastly overwhelmed, and only 9% of all the plastic ever manufactured has been recycled. Most of the plastic waste ends up in landfills and, ultimately, in the environment.

Most plastics do not degrade. Instead, they slowly fragment into smaller particles, referred to as microplastics, and, probably, nanoplastics. These particles, whether in the form of larger or smaller plastics, have profound detrimental consequences for ecosystems, biota, and the environment, but also for the economy and human health. Plastics have been found in the stomach contents of numerous organisms, including earthworms, birds, turtles, dolphins and whales. Smaller particles may be even more pervasive, as these may be ingested by organisms that are at the basis of different food webs.

¹ Full study in English: [https://www.europarl.europa.eu/RegData/etudes/STUD/2020/658279/IPOL_STU\(2020\)658279_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2020/658279/IPOL_STU(2020)658279_EN.pdf)



One such example is the recently discovered new species *Eurythenes plasticus*, an amphipod found at a depth of 6,900 meters and named after the plastic found to contaminate its gut. Before we even knew it, we had already contaminated it.

Hydrophobic and exhibiting high surface area-to-volume ratios, smaller plastic particles can adsorb other contaminants and act as either sinks or sources of contamination in organisms. In addition, chemicals used to improve the characteristics of plastics - known as plasticisers - can leach into the environment and constitute new routes of exposure to organisms, potentially leading to bioaccumulation phenomena.

The inherent economic impact due to plastic waste is also vast. Studies suggest an economic damage to the global marine ecosystems surpassing € 11 billion. In Europe, € 630 million are spent every year to clean plastic waste from coasts and beaches while the failure to recycle costs the European economy € 105 billion.

In January 2018, China banned the import of waste in order to stop the crushing flow of low-grade plastic waste. This ban had a profound impact throughout the world, as Western nations were suddenly confronted with vast amounts of such waste with no management strategies to deal with them. This highlights the urgent need to restructure existing recycling systems and policies on the production of plastic and its disposal. Additionally, the announcement of the Chinese ban led to a sharp fall in EU export prices for plastic waste in 2016. From over € 320/tonne, the extra-EU export price has fallen to € 244/tonne in 2019.

The environmental, health and economic reasons to act are clear. Consequently, there is a growing international determination to reconsider and evaluate the use of plastics at all stages of their life-cycle. This not only includes design and manufacture, but also use, reuse, and end of life management, with a special focus on the inputs and removal of plastics from the environment.

A variety of regulatory and legislative tools exists, aimed at controlling, reducing and managing the use of plastics, with a particular emphasis on single-use plastics. Existing legislation consists mainly of levies, bans, and voluntary efforts through the 3R rule: reduce, reuse and recycle. However, these regulatory instruments have had a limited impact, in volume, scope, or both, especially when considering the exponential yearly increase in production and use of plastics, including the growing synthesis of new materials with new applications.

Moreover, recycling of plastic waste remains problematic because of the inherent difficulties with the collection and separation of the feedstocks used in the recycling process. Alternative solutions, such as energy conversion (incineration) have severe environmental impacts and detrimental consequences for the climate. Improvements on plastic legislation are therefore needed to be able to better consider and address environmental and human health impacts. Importantly, most of the existing tools are designed to address plastic waste at the end of its life-cycle, i.e. following its manufacture. Upstream legislative approaches are needed to stimulate a zero-waste target, which will undoubtedly improve the feasibility and efficacy of future plastic policies.

Key findings

Plastic production has exponentially increased and presently surpasses the 359 million tonnes mark. Of this, nearly 40% is intended to be used as packaging, i.e. destined for immediate or near immediate disposal.

Approximately two-thirds of all plastic ever produced has been released into the environment, where it continues to impact ecosystems as it fragments and degrades.

In the form of debris, micro- and nanoplastics, these materials are found in the oceans, the air and soils. Some of these materials (e.g. nanoplastics) are intentionally added to various types of products and are therefore present in water supplies and even in the human body.

Uncertainties and knowledge gaps undermine the full understanding of the ecological, toxicological and environmental impacts of plastics.

Reducing toxic exposure to plastic waste, in all its forms, requires a plethora of solutions, both voluntary and legislative.

Ideally, production, use and disposal of plastics should be dealt with at a global level, as existing supply chains cross and re-cross borders, continents and oceans.

“Stick and carrot” legislative approaches are needed, aimed at rewarding those – consumers, producers and suppliers – working towards a zero-waste strategy, while highly punitive actions should be developed for offenders.

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