

Position of European Bioplastics

BIODEGRADABLE PLASTICS DO NOT CAUSE PERSISTENT MICROPLASTICS

Microplastics¹ and their potential environmental and health impacts have been of growing concern in recent years. Everything, including every material originated in or produced by nature, will eventually abrade or degrade. This is just as much true for plants that will turn into humus, as it is for mountains and rocks that will, over the course of many centuries, grind down to the size of sand grains and smaller. The same is true for all man-made materials, including synthetic polymers and plastics. The only difference is that the latter will not easily be incorporated back into the natural cycle – as this is not their natural origin – but will persist in the environment for a longer period of time.

In view of the fact that these microplastics can cause harm to the environment and human health, biodegradable plastics and polymers are gaining more significance as a potential solution. Although biodegradable and compostable plastics do – as all solid materials – produce small particles through abrasion when in use, they are not the same kind of persistent microparticles that are caused by conventional, non-biodegradable materials. Instead, these particles will biodegrade, and the merits

of using biodegradable materials as intentionally added microplastics² (for certain applications such as cosmetics) will be reflected in this discussion.

European Bioplastics supports all efforts to gain a better understanding of the origin and creation of microplastics and their release into and effect on the environment, in order to minimise environmental impacts. Scientific studies are looking into the option of biodegradable materials to be a potential solution for microplastics accumulation.³ Therefore, data on the residence time of materials in nature needs to be collected and should also be included in the risk assessment of life cycle assessments.⁴ Biodegradable polymers have the advantage that they do not erode into permanent secondary microplastics upon degradation, because most natural environments harbour microbes that are able to metabolise these polymers. Thus, the residence time is considerably lower for biodegradable polymers compared to conventional plastic materials.⁵ This way, biodegradable plastics can help to minimise environmental impacts and reduce the accumulation of plastic particles in different environmental habitats.



¹ Microplastics are defined by ECHA as a material consisting of solid polymer containing particles, to which additives or other substances may have been added, and where $\geq 1\%$ w/w of particles have (i) all dimensions $1\text{ nm} \leq x \leq 5\text{ mm}$, or (ii), for fibres, a length of $3\text{ nm} \leq x \leq 15\text{ mm}$ and length to diameter ratio of >3 .

² Microplastics can be distinguished in: 1. Primary microplastics (including for example intentionally added microparticles in cosmetics or fiber abrasions from textiles) and 2. Secondary microplastics (resulting from the breakdown of larger plastics items through weathering)

³ <https://www.finnceres.fi/post/defining-plastic-like-materials-controversy-on-the-single-use-plastics-directive>

⁴ SAPEA, European Commission's independent Group of Chief Scientific Advisors (2020), Biodegradability of plastics in the open environment, Berlin. www.sapea.info/topics/biodegradability-of-plastics

⁵ M. Tosin et al., Biodegradation kinetics in soil of a multi-constituent biodegradable plastic, *Polymer Degradation and stability*, Volume 166, pp. 213-218, 2019

Industrial compostable plastics significantly reduce the amount of persistent, non-biodegradable microplastics in the compost and thus a subsequent leakage into the environment.

Compost produced from separately collected biowaste is increasingly contaminated with (micro)plastics stemming from conventional plastics impurities that were wrongly disposed of together with the biowaste.^{6, 7, 8} Industrially compostable plastics help to separately collect more organic waste and to divert larger volumes of biowaste towards organic recycling. At the same time, they help to reduce the contamination of biowaste with conventional plastics, and ultimately reduce microplastics from conventional fossil-based polymers in the compost.⁹

Bioplastic products that are certified for industrial compostability are fully biodegradable, i. e. they are metabolised into CO₂, H₂O, and biomass, and disintegrate in less than 12 weeks, in line with acknowledged standards such as EN 13432^{10, 11}. In this context, disintegration is a necessary part of the whole biodegradation process and leads to smaller particles, which should not be confused with persistent microplastics that remain in the final compost. Even in the case of suboptimal compost processing, the biodegradation process of the disintegrated smaller particles does not stop at this point, but further continues in the soil.¹²

Soil-biodegradable mulch films help to stop leakage and accumulation of persistent microplastics in agricultural soils.

Just as described for compost, soil-biodegradable mulch films can support the reduction of microplastics in agricultural soils. The European standard EN 17033 sets the requirements for biodegradation of mulch films used in agriculture and horticulture. They include biodegradation in less than two years, comprehensive ecotoxicity testing considering all relevant exposure pathways, and clear best practice guidelines. Unlike mulch films made of conventional PE that lead to an accumulation of plastic particles in soil – even after cultivation is ceased, biodegradable films do not cause accumulation in soils.¹³

About European Bioplastics

European Bioplastics represents the interests of more than 70 member companies throughout the European Union. With members from the entire value chain, European Bioplastics serves as both a contact platform and catalyst for advancing the objectives of the growing bioplastics industry. For further information, please visit www.european-bioplastics.org.

Standards support the establishment of biodegradable alternatives to substitute persistent microplastics that are intentionally added to cosmetic products. Non-biodegradable microplastics and microbeads should be banned.

Biodegradable polymers also offer a better solution in applications where there is a need to intentionally add microparticles or so-called microbeads, for example in certain cosmetic products where microplastics are used as fillers, peeling particles, or emulsifying agents. Several biopolymers are already used as substitutes for conventional microplastics that will accumulate and persist in the environment, as more and more countries worldwide prohibit the use of intentionally added microplastics made of non-biodegradable materials, and many cosmetic companies choose to remove or replace them with biodegradable solutions in their products.¹⁴

Biodegradability of intentionally added microplastics should be tested under the conditions prevailing in the environment the microparticles are most likely to end up in, which, in many cases, would be soil, marine environments, or fresh waters. There are several standards in place to test biodegradation behaviors, and biodegradable plastic particles should pass these test methods in an acceptable time frame, which is determined by using natural microparticles as a reference.¹⁵ Additionally, comprehensive ecotoxicity testing must be part of the assessment to avoid any danger for flora and fauna by harmful substances.¹⁶

Biodegradable plastics that are certified and tested for composting, for biodegradation in soil, or aqueous environments:

- will reduce the amount of non-biodegradable microplastics in compost,
- help to reduce the accumulation of non-biodegradable (micro) plastics in agricultural soils,
- are a suitable alternative for intentionally added microplastics in cosmetics or related products.

⁶ M. van der Zee, K. Molenveld, The fate of (compostable) plastic products in a full scale industrial organic waste treatment facility, Wageningen Food&Biobased Research, 2020, pp. 52

⁷ <https://www.sepa.org.uk/media/327640/investigation-into-plastic-in-food-waste-derived-digestate-and-soil.pdf>

⁸ Weithmann et al., Science Advances 04 Apr 2018; Vol. 4, no. 4: "Organic fertilizer as a vehicle for the entry of microplastic into the environment"

⁹ Kern et al., Müll und Abfall 05/2020 „Kunststoffe im Kompost (Plastics in compost)"

¹⁰ EN 13432:2000 "Packaging - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation"

¹¹ Similar requirements for organic recycling are also laid down in EN 14995, or ISO 18606 and ISO 17088

¹² This has been proven for PBAT at ambient temperatures in: Zumstein et al., Sci. Adv. 2018; 4: "Biodegradation of synthetic polymers in soils: Tracking carbon into CO₂ and microbial biomass"

¹³ OWS, Expert Statement "(Bio)degradable mulch films", 2017

¹⁴ See final results of BioSinn Project with product profiles of biodegradable applications for which biodegradability is feasible (Microplastics in cosmetics - pp. 97);

<https://renewable-carbon.eu/publications/product/biosinn-products-for-which-biodegradation-makes-sense-pdf/> (accessed 9 May 2021)

¹⁵ Applicable standards in this context would be, for example ISO 17556, ISO 18830, ISO 19679, or ISO 22404.

¹⁶ A proposal for an ecotoxicity testing scheme under marine conditions is currently discussed in ISO/TC 61 SC 14 WG 2 (Plastics – Biodegradability)