

Responsibly managed, certified biodegradable plastic products help eliminate persistent microplastics in appropriate applications

Microplastics and their potential environmental and health impacts have been of growing concern in recent years. However, certified biodegradable plastics can be part of the solution, as they are designed to biodegrade and mineralise rather than persist as microplastics in the environment.

What is meant by Microplastics, Persistence, and Biodegradability?

Microplastics:

Generally, there are two types of microplastics:

- Primary microplastics: particles (typically smaller than 5 mm) intentionally used in various consumer, professional, and industrial products.
- Secondary microplastics: particles created as a result of the breakdown of a (macro-) plastic, for example during use, exposure to the sun, water, wear, etc.

Currently, there is no commonly agreed definition for microplastics.

Regulation (EC) 1907/2006 including its amendments (known as REACH Regulation)¹, for example, defines synthetic polymer microparticles as: “polymers that are solid and which fulfil both of the following conditions:

- (a) are contained in particles and constitute at least 1 % by weight of those particles; or build a continuous surface coating on particles;
- (b) at least 1 % by weight of the particles referred to in point (a) fulfil either of the following conditions:
 - (i) all dimensions of the particles are equal to or less than 5 mm;
 - (ii) the length of the particles is equal to or less than 15 mm and their length to diameter ratio is greater than 3”.

Note: The REACH restriction EU Reg. 2023/2055 only covers the primary microplastics. The REACH restriction does exclude certain polymers that are proven to be [bio-]degradable² in accordance with the criteria of its Appendix 15.

Persistence:

Plastics could leave persistent microplastics when they do not biodegrade in accordance with relevant standards³ within the time frame linked with their functional life plus the reasonable additional time allowed to biodegrade, given its function⁴ or end of life target⁵. Non-biodegradable plastics (such as polyethylene, polypropylene, etc.) leave persistent microplastics to accumulate for estimated periods of hundreds of years^{6,7}.

Biodegradability:

Biodegradability is a property that is determined by the fundamental chemical composition and structure of any material.⁸ Similar to organic materials in nature (e.g., trees, leaves, etc), chemical bonds of biodegradable polymers are recognised by naturally occurring enzymes and microorganisms, which initiate and complete the biodegradation.

The rate and extent of biodegradation depend on the polymer's chemical composition, molecular weight, etc. and environmental parameters such as temperature, moisture, pH, and microbial community composition.

Reducing the possibility of persistent microplastics in the environment

Given the growing concern regarding the environmental impacts associated with persistent microplastics, biodegradable polymers and derived plastic articles are increasingly being recognised as a complementary solution for specific applications where environmental release cannot be entirely prevented. The European Commission has already acknowledged biodegradability as a risk-mitigation measure for intentionally added microplastics under REACH and as a relevant property for certain applications under the Fertilising Products Regulation (FPR). As noted by the Commission, "Once in the environment, microplastics do not biodegrade and tend to accumulate, unless they are specifically designed to biodegrade in the open environment."⁹ This recognition reflects the potential of certified biodegradable materials to help prevent the long-term persistence and accumulation of plastic residues in appropriate use cases.

Plastic products form micro- and nanoplastics primarily through exposure to UV light, abrasion, and mechanical action¹⁰. One of the key environmental benefits of biodegradable plastics is their ability, under the appropriate conditions, to biodegrade rather than fragment

into persistent secondary microplastics. In environments where the relevant microorganisms and conditions are present, biodegradable polymers can be metabolized and ultimately converted into natural substances such as carbon dioxide, water, mineral salts, and biomass through the biodegradation process.¹² By contrast, conventional non-biodegradable plastics, including polymers such as polypropylene (PP) and polyethylene (PE), primarily undergo physical fragmentation due to exposure to UV radiation, weathering, abrasion, and mechanical stress.¹³ This process can generate secondary microplastics and nanoplastics that may persist in the environment for extended periods of time.^{14, 15}

However, biodegradable plastics should not be viewed as a remedy for inadequate waste management or inappropriate disposal practices, including littering. Their environmental benefits can only be fully realized when they are used in applications for which biodegradability provides a clear environmental advantage and when they are supported by appropriate standards, regulatory frameworks, and effective waste management systems. Certified biodegradable plastics must continue to be responsibly managed at the end of their functional life. For example, certified biodegradable mulch films should be incorporated into the soil following use (to be fully metabolised by microorganisms) in accordance with applicable standards and recommended agricultural practices to enable their intended biodegradation process.

Certified Biodegradable Plastics and Standards

Products made of biodegradable materials should be certified according to recognised certification schemes (e.g. certification for Industrially Compostable, Soil biodegradable, Home compostable, Freshwater or Marine biodegradable products)¹¹. The standards used for certification are, for example, EN 13432, EN 17033 and ISO 22403.

Certification verifies that products are capable of biodegrading in their intended end-of-life environment and helps distinguish substantiated biodegradable claims from misleading ones. Owing to their intrinsic material properties, certified biodegradable plastics can continue to biodegrade until they are fully assimilated into natural processes.

Laboratory and mesocosm studies have demonstrated that certified soil-biodegradable mulch films and certified industrially compostable plastics undergo complete biodegradation in their intended end-of-life environments and therefore do not exhibit persistence under those conditions.^{12,13,14,15,16}

Using certified biodegradable plastics could help to significantly reduce the presence of persistent, non-biodegradable microplastics, thereby lowering the risk of their transfer into the environment.

Compost produced from separately collected biowaste is increasingly affected by contamination from conventional non-biodegradable plastics that have been improperly disposed of in biowaste streams.^{17,18,19} Certified compostable plastics can facilitate the collection of organic waste and increase the amount of biowaste directed to organic recycling. When implemented within well-designed and properly managed biowaste collection systems, certified compostable plastics contribute to reducing contamination from conventional non-biodegradable plastics and thereby lowering the presence of persistent microplastics in resulting compost.²⁰

In agricultural environments where biowaste is collected for industrial composting, substituting conventional non-biodegradable agricultural and horticultural plastic items²¹ (such as threads, clips, nets, shelters...) with industrially compostable alternatives will also help to avoid persistent microplastics in compost and contribute to soil health.

In cases where there is no collection of the biowaste for industrial composting purposes, and where unintended release of these plastic items may occur, certified soil and marine degradable materials could help to limit leakage of microplastics from such items into the environment.

Certified soil-biodegradable mulch films significantly reduce microplastics in agricultural soils⁷. The European standard EN 17033 mandates that these films biodegrade in under two years, undergo comprehensive ecotoxicity testing, and follow best practice guidelines. It has been shown that soil-biodegradable mulch films do not cause accumulation of microplastics in soil²². Starting in 2024, the European Union officially recognised certain soil-biodegradable products (including biodegradable mulch films) through the Fertilising Products Regulation²³. This recognition grants them the status of Soil Improver, highlighting their adherence to rigorous safety and environmental standards.

Other products that are designed to be left in the environment, or have a high risk of being left, should ideally be certified soil, freshwater or marine biodegradable, e.g., marine/fishing gear, forestry/tree protection, outdoor sports which may leave products in the environment, synthetic grass, etc.

Certified biodegradable plastics are part of the solution to persistent microplastics.

The targeted use of certified biodegradable plastics in applications where biodegradation is a benefit, can contribute to addressing the challenge of persistent microplastics. Transitioning from conventional plastics to biodegradable plastics certified for composting or biodegradation in soil or aqueous environments is key to:

- help prevent the long-term accumulation of persistent microplastics in relevant receiving environments;
- reduce the generation of persistent microplastics associated with conventional plastic products used in agricultural and horticultural applications, including twines, threads, clips, nets, shelters, and mulch films;
- support the separate collection and organic recycling of biowaste, while reducing contamination of compost by conventional non-biodegradable plastics;
- limit leakage of persistent microplastics from products that are designed to be left in the environment, or have a high risk of being left e.g., marine/fishing gear, forestry/tree protection, outdoor sports which may leave products in the environment, synthetic grass, etc.

European Bioplastics calls on the EU institutions to distinguish demonstrably biodegradable plastic products from persistent plastics across relevant legislation and policy, and to recognise their targeted use in applications where they have been shown to prevent long-term microplastic accumulation and provide a verified environmental benefit.

¹ Entry Nr 78 of EU Reg. 2023/2055 amends the Regulation (EC) 1907/2006 (REACH Regulation), however, this REACH restriction EU Reg. 2023/2055 only covers intentionally added microparticles. Polymers that are degradable as proven in accordance with Appendix 15 of this REACH Amendment, are excluded from the scope.

² REACH Appendix 15 of entry 78: „Rules on proving degradability.

This appendix lays down the rules for proving degradability of polymers for the purposes of entry 78, namely the permitted test methods and the pass criteria for those methods. The test methods were designed to measure biotic degradation, although it cannot be excluded that some abiotic degradation takes place during the test and contributes to the test results.“

³ Relevant standards include, e.g., EN 17033 or EN 13432 or ISO 22403 or as appropriate to its application.

⁴ The function could be, e.g., as defined for agricultural applications in the Fertilising Products Regulation, EU Fertilising Products Regulation (FPR) 1009/2019, “FPR”.

⁵ The end of life target could be, e.g., as determined in EN 13432 for industrial composting.

⁶ Britannica Editors (2025, November 19). How Long Does It Take for Plastic to Decompose? Encyclopedia Britannica. <https://www.britannica.com/science/How-Long-Does-It-Take-for-Plastic-to-Decompose>

⁷ F. Degli-Innocenti, M. Barbale, S. Chinaglia, E. Esposito, M. Pecchiari, F. Razza, M. Tosin, Analysis of the microplastic emission potential of a starch-based biodegradable plastic material, Polymer Degradation and Stability, Volume 199, 2022, 109934, ISSN 0141-3910, (<https://www.sciencedirect.com/science/article/pii/S0141391022001173>)

⁸ Any biodegradability claim should refer to the complete biodegradation of a material into naturally occurring substances. Materials that merely undergo fragmentation into micro-fragments or chemical decomposition are not thereby biodegradable. Consistent with the Single-Use Plastics Directive (SUPD), fragmentation of a plastic material into micro-fragments should not be regarded as evidence of biodegradation. Therefore, so-called oxo additives- or oxo-biodegradable additives are not a path towards biodegradation and are banned by the SUPD.

⁹ Microplastics - The EU is addressing the growing volume of microplastics in the environment by tackling the main sources of release. (An Official website of the European Union) Microplastics - Environment - European Commission

¹⁰ Lott C, Stemmer-Rau K, Weber M (2024) [Report] PeToPLA - A meta-study on the persistence and toxicity of PLA, and the formation of microplastics in various environments. Technical Summary Report. Commissioned and sponsored by Holland Bioplastics, TotalEnergies Corbion, NatureWorks, Futerro.

¹¹ Certification schemes for industrial compostability include: Seedling (EUBP), OK Compost Industrial (TÜV AUSTRIA Belgium), DIN-Geprüft Industrial Compostable (DIN CERTCO).

¹² Pfohl, P., Rueckel, M., Meyer, L. *et al.* Influence of plastic shape on interim fragmentation of compostable materials during composting. *Micropl. & Nanopl.* 4, 7 (2024). <https://doi.org/10.1186/s43591-024-00084-8>

¹³ Cheick Abou Coulibaly, Sandra Domenek, Paul Greuet, Matthieu George, Pascale Fabre, Rafael Auras, Emmanuelle Gastaldi, Residual biodegradable microplastics derived from compostable packaging under large-scale industrial composting fully degrade in soil, *Bioresource Technology*, Volume 451, 2026, 134496, ISSN 0960-8524, <https://doi.org/10.1016/j.biortech.2026.134496>.

¹⁴ Mattia Cerri, Flora Wille, Silvan Arn, Thomas D. Bucheli, Franco Widmer, Rhayn Werz, Kristopher McNeill, Alessandro Manfrin, and Michael Sander, „An Analytical Workflow to Quantify Biodegradable Polyesters in Soils and Its Application to Incubation Experiments“, *Environmental Science & Technology* 2025 59 (16), 8108-8118, DOI: 10.1021/acs.est.4c10664

¹⁵ Michael Thomas Zumstein, Arno Schintlmeister, Taylor Frederick Nelson, Rebekka Baumgartner, Dagmar Woebken, Michael Wagner, Hans-Peter E. Kohler, Kristopher McNeill, and Michael Sander, „Biodegradation of synthetic polymers in soils: Tracking carbon into CO₂ and microbial biomass“, *Science Advances*, 25 Jul 2018, Vol 4, Issue 7. DOI: 10.1126/sciadv.aas9024

¹⁶ Patrizia Marie Schmidt, Lukas Leibig, Lars Meyer, Christian Roth, Patrick Bolduan, Glauco Battagliarin, Andreas Künkel, Sam Harrison, Cansu Uluseker, Wendel Wohlleben, „Soil-biodegradable mulch film: Distinguishing between persistent microplastics and fragments released from certified soil-biodegradable products“, *Science of The Total Environment*, Volume 1009, 2025, 181048, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2025.181048>.

¹⁷ 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

¹⁸ <https://www.sepa.org.uk/media/327640/investigation-into-plastic-in-food-waste-derived-digestate-and-soil.pdf>

¹⁹ 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”

²⁰ Kern et al., Müll und Abfall 05/2020 „Kunststoffe im Kompost (Plastics in compost)“

²¹ European Bioplastics Fact Sheet, „Bioplastics in agriculture“, https://docs.european-bioplastics.org/publications/fs/EUBP_FS_Bioplastics_in_agriculture.pdf, October 2024.

²² M. Mazzon, C. Edo, S. Guerrini, P. Gioacchini, J. Cupi, P. Malena, R. Rosal, C. Marzadori, “Long-term biodegradable mulch films application in agricultural fields: effects on soil functionality and microplastic generation“, *Journal of Environmental Management* 298 (2026) 128594, January 2026.

²³ EU Fertilising Products Regulation (FPR) 1009/2019

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About European Bioplastics

European Bioplastics (EUBP) is the European association representing the interests of the bioplastics industry along the entire value chain. Its members produce, refine, and distribute bioplastics i.e. plastics that are biobased, biodegradable, or both. More information is available at www.european-bioplastics.org

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