



Composting of packaging and products made from compostable or biodegradable plastics is no recycling

Position paper

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The terms “biodegradable” or “compostable” describe the property of plastics to degrade under biological action and controlled conditions during composting, respectively. Packaging or Products labeled with these terms must meet certain requirements that are specified in standards such as EN 13432:2000 or EN 14995:2006. We like to note that biodegradable/compostable plastics could be made from renewable raw materials, but there are also many biobased plastics that are not degradable. This paper evaluates degradable/compostable plastics and does not assess non-degradable plastics from renewable sources.

The current definition of recycling in the Waste Framework Directive (2008/98/EC) is: “any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.”

We agree that reprocessing of kitchen and garden/park waste is classified as recycling and that the development and maintenance of a composting infrastructure for this waste stream is very important. Composting allows recycling of nutrients contained in these materials since via the produced composts, nutrients – mainly nitrogen, phosphorus and potassium – are reinserted back into agricultural production replacing fertilizers. Additionally, the addition of organic matter via compost is very beneficial for soil fertility and humus reproduction. This contributes to reducing and optimizing the use of fertilizers, in line with the EU Farm-to-Fork strategy. It also needs to be taken into account that no techniques for material recycling exists at scale and in practice for biowaste such as organic kitchen waste or green cuttings.

However, this rationale is not necessarily transferrable to packaging and products made from compostable or biodegradable plastics officially collected and composted along with bio-waste. This assessment is based on the following reasons:

1. In contrast to classical biowaste, there are more environment-friendly alternatives to recycle plastics.

According to the waste hierarchy, products and materials should be designed durable in order to prioritize reuse and maximum value retention. Therefore, compostable or biodegradable plastics should mainly be used for reusable or recyclable applications. Mechanical recycling of plastics allows reprocessing the materials to plastic recyclates, which are directly usable for products of similar purposes substituting virgin materials from fossil fuels or natural sources.

During composting, on the other hand, material and contained energy are lost completely. From an environmental point of view, it is not justifiable to completely decompose biodegradable plastics and completely reproduce the material for new bioplastics through agricultural cultivation. Such agricultural production is associated with serious environmental impacts such as greenhouse gas emissions, eutrophication, biodiversity loss etc. If used at all, we recommend to design biodegradable plastics recyclable in order to promote both decarbonisation and circular economy. Biodegradable plastics should fit in the current collection, sorting and recycling systems and if such recycling is not technically possible or the infrastructure buildup is too expensive, we demand replacing biodegradable plastics by other recyclable materials. In addition, single-use applications should be substituted by reusable and refillable alternatives.

2. Composting of compostable and biodegradable plastics cause technical problems in composting facilities and will be rejected as refusal by composting facilities, whatever the legal status of compostable plastics.

A survey carried out by DUH showed that products made from biodegradable plastics are usually classified as interfering substances/impurities in German composting plants (80% of surveyed operators) and not composted according to EN 13432 (95% of surveyed operators)¹. Plant operators report of plastic residues at the end of the composting processes (e.g. coffee capsules or foil remnants). Consequently, waste managers are speaking against treatment of biodegradable plastics in organic waste treatment plants (see position paper² and campaign³) and packaging materials from biodegradable plastics are not allowed for composting in Germany.

Also in other member states, the acceptance of biodegradable products in biowaste is limited to only a few certain applications. Often, packaging is excluded and there are only exceptions for biowaste collection bags with the reason that they have benefits, e.g. through increasing collection quantity.

Another important drawback of allowing products and packaging from compostable or biodegradable plastics for separate organic waste collection is that they may lead to conventional plastics (or non-degradable bioplastics) also ending up more frequently in the organic waste collection by mistake. A low percentage of plastic residues in the compost is an important quality criterion for marketing, regardless of the type of plastic.

3. Harmful substances from biodegradable or compostable plastics may pollute compost products and agricultural areas.

Studies have shown that biodegradable plastics may have a toxicity comparable to conventional plastics^{4,5,6}. Also for biodegradable plastics, considerable amounts of additives and lubricants are required and utilized. Since in contrast to conventional plastics, compostable or biodegradable plastics are intended to end up in soil, there is a significant risk to pollute agricultural areas with harmful substances through the addition of compostable or biodegradable plastics.

As an additional problem, there is the risk that microplastics originating from compostable and biodegradable plastics are still present in the compost at the end of the composting process. Indications that microplastics are released during the composting of biodegradable/compostable plastics or are a relevant intermediate product during biodegradation are provided by several studies^{7,8,9}. Biodegradable microplastics may have similar properties as conventional microplastics in terms of adsorption of pollutants in the environment^{10,11}. It should also be noted that microplastics originating from biodegradable plastics ending up in final composts may persist in the soil for long times since testing conditions for biodegradation e.g. in EN 13432 do not reflect environmental conditions in agricultural soils (e.g. cold temperatures, water or nutrient deficiency). It has been demonstrated that these plastics may withstand biodegradation for a similar period as conventional plastics under environmental conditions^{11,12}. This risk of microplastic generation is currently not prevented by the design of standards such as EN 13432, which is often applied to confirm compostability and biodegradability for packaging made from compostable or biodegradable plastics.

4. Composting of compostable and biodegradable plastics does not close material loops since it contains only negligible amounts of nutrients and contained carbon is not necessarily valuable for plants

Biodegradable plastics do not add nutrient value to compost and were reported to even reduce nutrient availability in soil^{13,14,16}. It is well known that plants essentially take up carbon from the air and cannot directly make use of the carbon contained in compostable or biodegradable plastics. Subsequently, there is only a negligible part of the material actually taken up by plants.

However, while addition of organic material (e.g. in the form of organic fertilizer) is undisputably valuable for the soil, the question remains if compostable and biodegradable plastics may have similar positive effects on soil physical parameters or soil biology. Currently, the biodegradation mechanism of compostable or biodegradable plastics indicates that these plastics are at least as an intermediate step degraded into fragments (see microplastic problem above) and there is no benefit of biodegradable plastics for structural compost quality^{14,15,16}. Additionally, there are indications that biodegradable plastics may even affect soil organisms^{17,18}. We recommend using agricultural areas preferably to produce green manures, with a proven positive effect for soil fertility and biodiversity, instead of producing short-lived biodegradable products with multiple ecological risks if added to natural environments.

The presented arguments show that composting of products or packaging made from compostable and biodegradable plastics is not demonstrably useful from an environmental point of view. Following the exception that exists in the recycling definition for backfilling operations, composting of such plastics must not be counted towards recycling but as recovery or disposal¹⁹. We would like to emphasize that this classification refers only to composting of so-called “compostable” plastics. For organic waste streams, composting is very beneficial for the environment and should definitely be preferred to recovery options, in particular towards techniques such as incineration, biorefineries or pyrolysis.

According to the waste hierarchy, waste from packaging and products should preferably be avoided. There is a great potential for waste prevention particularly by replacing single-use products and packaging with reuse systems. If reuse is not possible, products and packaging should be designed for material recycling. The setup of ambitious plastic recycling targets would completely miss the aim of circularity if composting may contribute to fulfilling these targets. Furthermore, labelling compostable/biodegradable packaging or products as “recyclable” although they are actually treated in composting plants may confuse consumers and would be a gateway for greenwashing.

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- ¹⁶ Bertram (2022), Müll und Abfall, Composting biodegradable plastics violates the Circular Economy Act
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- ¹⁹ signatories have different positions if composting of such plastics should be classified as recovery or disposal

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