

Compostability vs. Biodegradability

101 Material
Report

Material ConneXion®
A SANDOW Company



What you need to know

This document serves as a brief overview of the concepts of compostability and biodegradability as defined by existing regulations. Both terms have been defined only for plastics that are incorporated into a product or in its packaging. Before jumping into the definitions

and scope of these concepts, it is essential to understand that existing standards have been defined for final products and packaging material only and not for the specific materials within that product.

01 What is Biodegradability?

Biodegradability denotes the ability of a product to undergo chemical breakdown due to the action of biological agents to produce carbon dioxide, water and other by-products.

02 What is Compostability?

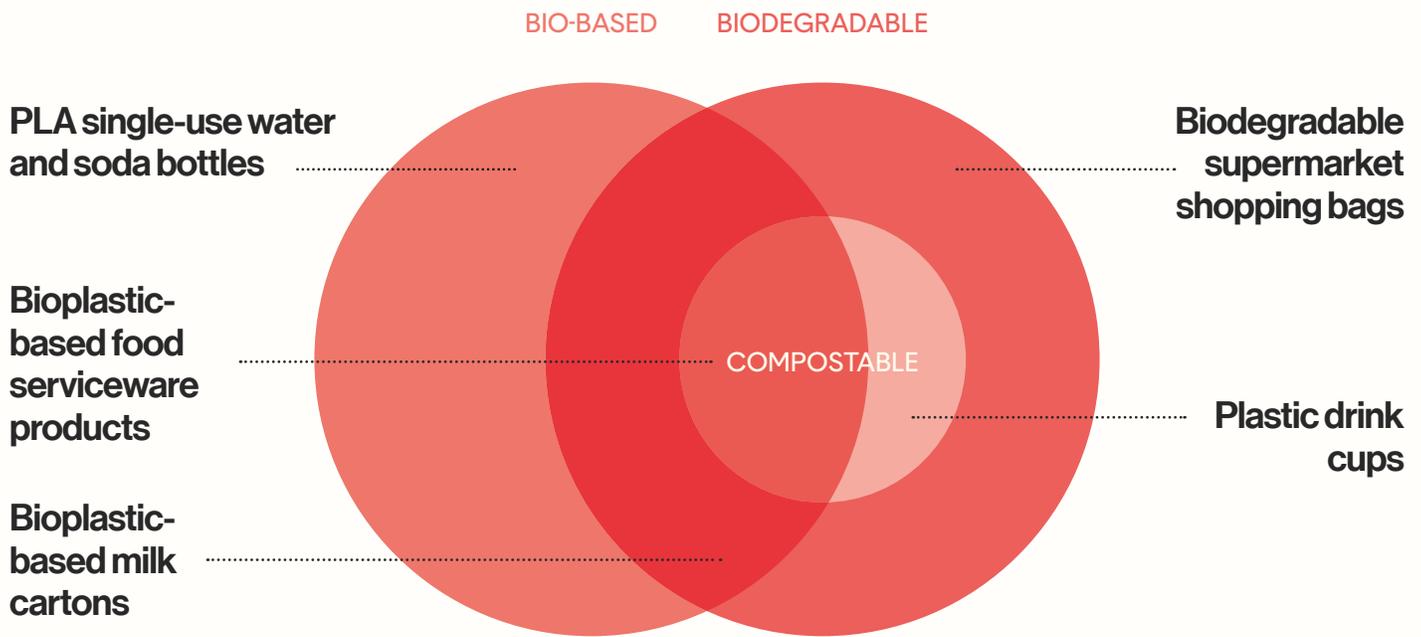
Compostability is the biodegradability of a product under specific conditions of temperature and pressure, which also meets certain criteria such as the rate of biodegradation and its impact on the environment. Compostable materials are required to leave behind stabilized organic matter with no distinguishable toxic residue. Additionally, compostability promotes plant growth.

03 Home vs. Industrial Composting

Compostability is most often associated with backyard compost bins. While this is certainly a popular form of the term, international standards primarily refer to industrial compostability. This form of compostability takes place under closely controlled physical, chemical, and biological conditions. Each process has very different standards and final products must be segregated and disposed of accordingly.

Bio-based vs. Biodegradable Materials

Almost all things grown in nature biodegrade. You, trees, roses, moss, whales, and your cat. In addition, some materials processed from an originally natural source also biodegrade, including paper, leather and your 'I love cats' cotton t-shirt. One further category that biodegrades are plastics made from oil, because originally this oil was organic plants and animals (such as prehistoric cats) that died millions of years ago. It is this final category that is most interesting in this report since these are not thought of as 'natural' materials and therefore are not considered 'inherently' biodegradable.



Bio-based

Plastics comprised of polymers where a portion of the carbon used is derived from renewable sources such as corn or soy rather than fossil fuels.

Biodegradable

This is the degradation of plastics (bio-based or petro-based) through biological process that turns them into water, carbon dioxide, and other by-products such as humus.

Compostable

Biodegradability of a product under specific conditions of temperature and pressure, which also meets certain criteria such as the rate of biodegradation and its impact on the environment. Compostable materials are required to leave behind stabilized organic matter with no distinguishable toxic residue that also promotes plant growth.

Process Comparison

In comparing processes, it is important to note that composting has been defined to mean composting conducted in an industrial/ municipal facility under controlled conditions, which is very different from a home composting environment. Industrial processes have well-controlled and uniform parameters, and much higher heat than home systems.

Time for Process



Consideration as defined by commonly accepted international standards.

Compostable

Maximum 6 months.

Biodegradable

No time limit assigned.

Form



The physical state of the waste that each process covers, considering three primary forms of waste: solid, liquid, and gas.

Compostable

Generally applicable only to solids.

Biodegradable

Relevant to both solids and liquids. Biodegradability is most commonly related to waste breakdown in a landfill.

Environmental Conditions



Differentiating each process based on the environmental conditions at which they are required to occur.

Compostable

Composting conditions are generally defined for industrial composting. Conditions of light, heat and micro-organisms are tightly controlled to yield a specific outcome.

Biodegradable

Biodegradability is less specified and takes place under a broader range of conditions. Biodegradability can occur in oxygen-rich and oxygen-deficient environments.

Quality of Leftovers



Regulation-defined conditions for the chemical composition and toxicity of the byproducts of each process.

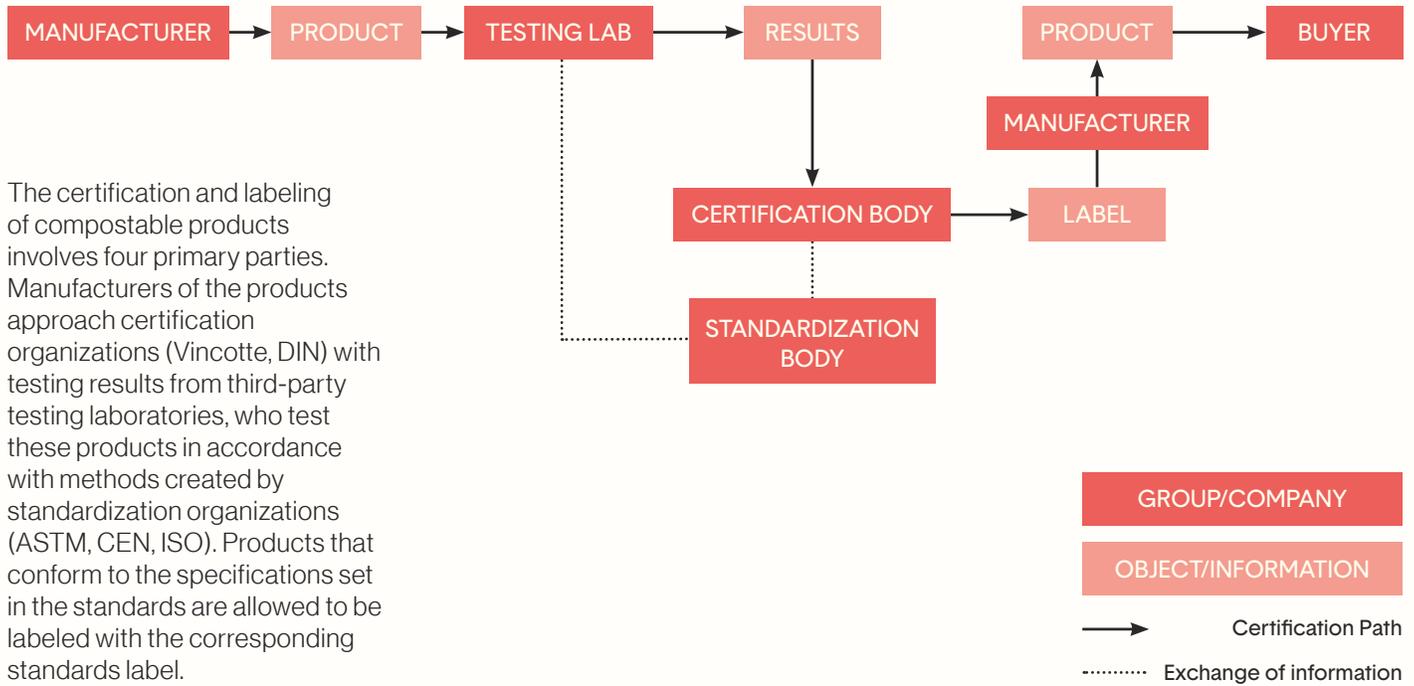
Compostable

The byproduct of compostability must be able to support plant growth. This means that no metals or toxins must be left behind and the compost must also be able to provide nutrition to the soil.

Biodegradable

No specific toxicity and byproduct composition conditions have been defined for biodegradability. Biodegradable materials have to undergo significant change in their chemical structure into water, CO₂, and minerals.

Certifications



Standardization Organization Logo



Certification Organization Logo



Manufacturer Created Logo



Certifying organizations add their own label as well with a certificate registration number for validation. Reliable labeling must indicate the certifying authority, the standard on which the certification is based, and the certificate serial number. This bolsters consumer assurance about the product, helps manufacturers substantiate claims made about the product, enables better handling of waste, and also provides a competitive advantage to manufacturers.

Compostability vs. Biodegradability

Both biodegradability and compostability refer to forms of chemical decomposition of plastics, differing primarily in environmental conditions and time for each process. Existing regulations pertain only to industrial composting (in a facility) of plastics. As most natural

materials are biodegradable in their untreated forms, they have been excluded from existing regulations. However, the introduction of various chemicals into such materials has made it imperative to regulate their disposal as well. There is significant variation in the labeling

of compostable and biodegradable products. Maintaining reliability in this regard ensures efficient waste handling, thereby reducing environmental pollution and degradation.

Plastics in the Ocean

Plastics in our oceans are a rising concern. Unfortunately, there is a serious lack of standards on this front. Currently, there is no standard providing a clear pass/fail criterion for materials or products. ASTM and ISO have developed Standard Test Methods, which serve as guidelines, but have not defined clear specifications for conditions and timeframes. Some private and independent organizations have developed certification schemes for freshwater and marine compostability.

Recyclability

The idea of recyclability is often found alongside that of compostability and biodegradability. While not necessarily signifying an end-of-life process, recyclability is of critical importance, especially with numerous multi-material products in the market.

References

Biodegradable And Compostable

<https://biobagworld.com/environment/biodegradable-and-compostable/>

Certification of Bioplastics

[Link](#)

Focus on “Bio-based,” “Biodegradable,” & “Compostable” Plastics

[Link](#)

Biodegradability, Compostability & Ecotoxicity (BCE)

http://www.ows.be/lc_divisions/biodegradability-compostability-ecotoxicity-bce/

European Bioplastics guide to Environmental Communication of product claims

[Link](#)

US Composting Council: Labeling and important definitions

[Link](#)

Biodegradable plastic ‘false solution’ for ocean waste problem

<https://www.theguardian.com/environment/2016/may/23/biodegradable-plastic-false-solution-for-ocean-waste-problem>

FAQs - Composting & Recycling

https://www.ecoproducts.com/faqs-composting_and_recycling.html

Compostable vs. Biodegradable vs. Recyclable

By Earth911 TV

[Video Link](#)

Learning Guide

Discussion Questions

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What products/items do you associate with the term biodegradable? How do plastics figure into this association?

Choose three packaging products around you. Can you identify which products, if any, are bio-based, biodegradable, and compostable?

Have you seen any compostability and biodegradability labels on products? On what types of products have you seen the labels?

Both compostability and biodegradability have different specifications about the environmental conditions of each process. Which of these might be more relevant in the ocean?

Natural materials such as apple cores, paper, and wood are all biodegradable, leaving such materials unregulated. Is this justified? Explain. What concerns might you have when such products biodegrade in landfills?

Sam sees a compostable label on his soda cup and puts the cup into the home-compost bin in his backyard. Was this the right decision? How might this affect his home compost bin?

Short Answer Questions

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Where can you compost a material or product? What is the difference between home and industrial composting?

How do compostability and biodegradability differ time-wise? How long do you think biodegradable plastics take to break down?

What happens when a biodegradable plastic is accidentally sent to an industrial composting facility? (Hint: What are the differences between the two processes?)

What is the difference between compostable and biodegradable?

Where are biodegradable products disposed of?

Compostability and biodegradability are different based on the quality of their leftovers. What are the leftovers of these processes used for? How does the quality of each process' leftovers affect its use?

Learning Guide

Long Form Essay

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Give an account of the lifecycle of a food container that is intended for compostability. Provide information on what it can be made of, what types of certification would be needed, and a method for disposal. How does this affect the type of material that the container could be made of? Specify the type of food, since temperature and moisture content will affect the type of container.

Team Activity

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Aim: The power of labeling in marketing; know your labels:

- a. Divide the class into teams of equal members. One team represents consumers and the others are manufacturers or product creators.
- b. The product creators choose a common product around them, say a plastic bag, water bottle, or even a phone cover. Creators are now given the freedom to create and label their products.
- c. Consumers then choose products solely based on labeling.
- d. Discussion: What influenced the consumers' decision to buy a product? (Depicts the importance of correct labeling)

Materials relevant to this report



EarthMatter™
MC 8185-01

This plant- and mineral-based additive ensures that a biodegradable plastic has all the performance needed in terms of color and UV barrier, but is also completely safely biodegradable at end of life.



Paptic
MC 7634-01

Paper that's plastic yet feels like paper. It's got the enhancements of a plastic paper such as heat sealability and basic water resistance, but can be biodegraded at end of life.



Terratek® BD
MC 7000-02

Starch- and grain-based biopolymer that has excellent heat tolerances compared to other bio-based polymers, yet is easily compostable.



PLMS6040
MC 5924-03

Adding fine wood fibers to biopolymers improves strength and stiffness, and still allows for easy compostability. The surface texture is enhanced, too.



Ecomply
MC 7146-01

Vinyl or PVC is now available in a biodegradable version, with all the medical and performance certifications and properties, but decomposes in an actively managed compost when no longer in use.