

Disclaimer: This focus sheet is not intended as an endorsement of “biobased,” “biodegradable,” and/or “compostable” plastic products by the Washington State Department of Ecology. It provides general definitions, clarifies misconceptions, and discusses end-of-life management.

Over the last few years, a number of bioplastic products have emerged. They are sometimes labeled “biobased,” “biodegradable,” and/or “compostable.” Bioplastics, according to the Society of the Plastics Industry (SPI) Bioplastics Council, are defined as a plastic that is biodegradable, has biobased content, or both.

For biodegradable bioplastics, products are typically intended for short life applications such as single-use packaging, food waste collection bags, or food service ware (e.g. utensils, cups, plates), and are promoted for composting at the end-of-life¹. Compostable products have the potential to streamline collection of food scraps and yard trimmings for composting, helping to divert it from disposal in landfills and incinerators.

The driving factors for creating these products include²:

- Conserving fossil fuel reserves, such as oil and natural gas.
- Reducing greenhouse gas emissions that cause climate change.
- Helping to reduce the amount of organic waste, like food and yard debris, going to disposal.

To make the right choice to recycle, compost, or dispose of these products at their end-of-life, consumers need to know the differences, and be able to identify these products from traditional plastics.

Labeling can be confusing. And, if products are improperly sorted at their end-of-life, they can cause problems with traditional plastic recycling, contaminate compost, and cause more products to end up in landfills.

What is a “biobased” plastic³?

A biobased plastic is made from renewable resources instead of fossil fuels. Examples of renewable carbon resources include corn, potatoes, rice, soy, sugarcane, wheat, and vegetable oil. A biobased plastic can be partly or entirely biobased.

The United States Department of Agriculture’s (USDA) Bio-Preferred Program recently created a method for promoting products with biobased content⁴. A voluntary program, BioPreferred allows products meeting or exceeding the minimum biobased content to use the USDA Certified Biobased Product Logo (Figure 1).



Figure 1. USDA Certified Bio-based Product

Note that just because a plastic product is biobased does not necessarily mean the product is biodegradable or compostable.

1. Thompson, R.C., Moore, C.J., vom Saal, F.S, and Swan, S.H. 2009. *Plastics, the environment and human health: current consensus and future trends. Philosophical Transactions of the Royal Society B.* 364:2153-2166.

2. Shen, L., Haufe, J., and Patel, M.K. 2009. *Product overview and market projection of emerging bio-based plastics. PRO-BIP.* Utechet University, Netherland.

3. Greene, P.J. 2014. *Sustainable Plastics: Environmental Assessments of Biobased, Biodegradable, and Recycled Plastic.* Wiley. ISBN: 978-1-118-10481-1.

4. USDA BioPreferred Program: <http://www.biopreferred.gov/WhatLabelMeans.aspx>.

What is a “biodegradable” plastic⁵?

A biodegradable plastic can degrade by naturally occurring microorganisms such as bacteria, fungi, and algae to yield water (H₂O), carbon dioxide (CO₂) and/or methane (CH₄), biomass, and inorganic compounds.

However, the environment and timeframe must be specified in which biodegradation is expected to occur, otherwise the claim is meaningless. For example, a yard waste collection bag may be biodegradable in a composting environment; agricultural mulch film may be soil biodegradable.

Without these qualifications, the term “biodegradable” can be problematic, since it may lack clearly definable information about recycling or composting facility process requirements and timeframe for biodegradation. To limit this confusion and the potential for misleading consumers with “green” claims, the State of California banned use of the term “biodegradable” for any plastic sold in the state.

“Biodegradable” does not mean a material is compostable or recyclable. California does allow plastic to be labeled as certified compostable, if it meets American Society for Testing and Materials (ASTM) standards.

What is a “compostable” plastic⁶?

A compostable plastic is biodegradable in a composting environment⁷, yielding H₂O, CO₂, biomass, and inorganic compounds. The biodegradation during composting should be at a rate similar to other known compostable materials, and should not leave visual or toxic residue.

In order for a plastic to be labeled compostable, it must meet scientific standards, such as the ASTM specification D6400-12⁷:

- **Disintegration:** No more than 10 percent of the original dry weight of a product must remain after 84 days in a controlled composting test.
- **Biodegradation:** 90 percent of the organic carbon in the test materials must be converted to carbon dioxide within 180 days.
- **Nontoxic to plants:** The product must have less than 50 percent of the maximum allowable concentrations of certain heavy metals regulated by biosolids (U.S. EPA 503). Compost must also be able to support germination of two different plant species at a rate at least 90 percent of that in a “control” sample.

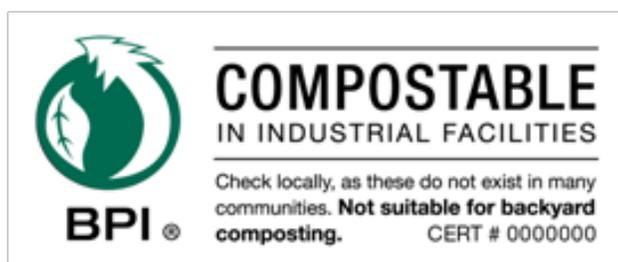


Figure 2. BPI Compostable Logo

Biodegradable Products Institute (BPI) established criteria to certify products meeting compostable specifications. If a product meets the specifications, it can bear the BPI Compostable Logo (Figure 2).

5. ASTM Standard D833-12. 2012. Standard terminology relating to plastics. ASTM International. West Conshohocken, PA. 2012. DOI: 10.1520/D833-12.

6. ASTM Standard D6400-12. 2012. Standard specification for labeling of plastics designed to be aerobically composted in municipal or industrial facilities. ASTM International. West Conshohocken, PA. 2012. DOI: 10.1520/D6400-12.

7. Definition of composting, WAC 173-350-100: <https://fortress.wa.gov/ecy/publications/publications/1307054.pdf>.

What are common misconceptions about bioplastics?

- Biobased plastics are always biodegradable, and fossil-based plastics are never biodegradable or compostable.
Fact: Bioplastics can be biobased and/or compostable. USDA's BioPreferred Program only refers to the biobased content, and does not mean an item is biodegradable or compostable. Other bioplastics are completely biodegradable/compostable, but are made with fossil materials. Whether a material can biodegrade or be accepted at a compost facility does not depend on its origin (renewable or fossil). It depends on its chemical structure, if it can be a food source for bacteria, fungi, and algae in a set environment and timeframe, and if a composter will accept them.
- Biodegradable plastics are always compostable.
Fact: The terms "biodegradable" and "compostable" are often used interchangeably, but they are not the same. Composting is one environment where biodegradation occurs. The term "biodegradable" must be qualified by the environment and timeframe. Compostable plastics are those that biodegrade in industrial composting operations at the rate of other compostable materials.
- Compostable plastics are suitable for all industrial composting operations.
Fact: The standard for compostability (ASTM 6400) is based on complete biodegradation within 180 days under active composting conditions. However, many industrial composters finish their active composting process between 60 and 90 days, or less. This may not allow enough time for some products to completely biodegrade in those operations. Incompletely degraded fragments must then be screened out of the finished compost, leading some facilities to not accept compostable plastics with incoming feedstocks.
- All compostable plastics are suitable for home composting.
Fact: Certification schemes in the US only test according to professionally managed industrial composting conditions. These typically operate at higher temperatures than those found in backyard composters. However, Europe does have a home composting certification, which some compostable plastics meet. There are many variables for determining if a compostable plastic product will break down in your backyard, such as the type of composting system and conditions that it is able to achieve (heat, moisture, etc.), as well as the compostable plastic composition (type of biopolymer, thickness of the finished product, etc.).
- Bioplastics are always more environmentally friendly than traditional plastics.
Fact: Bioplastics have certain benefits, depending on the desired attributes. For instance, biobased plastics use renewable materials things like plants, replacing the use of limited fossil materials. Biodegradable and compostable plastics can help reduce the amount of waste sent to landfills and incinerators, such as diverting organics to composting. However, bioplastics are not always a solution, and must be linked to specific environmental goals.
- Biodegradable plastics will break down in the landfill.
Fact: Modern landfills are designed to reduce oxygen and moisture, limiting biodegradation. The Federal Trade Commission cautions that items destined for landfills, incinerators, or recycling facilities will not degrade within a year, so marketers should not make unqualified degradable claims for these items.

- Biobased plastics are not recyclable.

Fact: A growing number of biobased plastics are chemically identical to petroleum based materials. For example, polyethylene terephthalate (PET, #1) can be made with renewable resources and recycled where PET is collected for recycling.

What are possible management practices for these products at their end-of-life?

- **Recycling.** Some biobased bioplastics, like Coke's PlantBottle™, can be recycled with traditional recyclables. That's because the PlantBottle is made with biobased PET and is chemically identical to PET made from fossil materials. However, many bioplastics are not currently accepted in curbside recycling schemes, and could possibly contaminate traditional plastic recycling.
- **Composting.** Bioplastics that are compostable can be used as tools for collecting and diverting organic wastes like food scraps to composting. However, check with your local municipality or composting facility first, as not all allow the use of compostable plastics. Non-compostable biobased plastics (like biobased PET) are not suitable for composting.
- **Disposal.** Some bioplastics are not currently recyclable or compostable. They still may have benefits (e.g. reduction of greenhouse gases, use of renewable resources instead of fossil materials, etc.), but should be disposed of with the trash.

Your local recycling, compost, or solid waste operators can help you make the right choice to recycle, compost, or dispose of the products at their end-of-life. Whenever possible, use reusable or durable items.

Learn more about bioplastics:

- SPI Bioplastics Council: www.plasticsindustry.org/BPC/
- US Composting Council's Compostable Plastic Toolkit: www.cptoolkit.org.
- Biodegradable Products Institute: www.bpiworld.org
- ASTM International standard test methods: <http://www.astm.org>.

Contact: Canming Xiao, 509-575-2842 or cxia461@ecy.wa.gov.

Accommodation Requests:

To request ADA accommodation including materials in a format for the visually impaired, call Ecology at 360-407-6900. Persons with impaired hearing may call Washington Relay Service at 711. Persons with speech disability may call TTY at 877-833-6341.