

## Plastics 101

### Defining “Biodegradable” and “Biobased”...and “Compostable”

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Many are confused by the terms “biodegradable” and “biobased.” They do not mean the same thing and cannot be used interchangeably. The fact is that not all materials that come from renewable or biobased feedstocks are biodegradable. Manufacturers, and others, need to use the appropriate ASTM tests to pinpoint the percentage of a product that comes from biobased resources. Also, they must use the correct ASTM specifications to determine if the products are biodegradable or compostable.

### Biobased

Words like *biobased* and *renewable* refer to the sources of the raw materials for products. Wood, corn, soybeans, and grasses are all forms of renewable or biobased feedstocks. The agricultural crops like corn and soybeans can be harvested every year and are *annually renewable*. These feedstocks “renew” themselves on a predictable timeframe, ranging from annually in the case of grains or grasses to as long as a human lifespan in the case of lumber from sustainably managed forests. Think of these products as *biologically based*.

The American Society for Testing and Materials (ASTM) defines a biobased material as *an organic material in which carbon is derived from a renewable resource via biological processes. Biobased materials include all plant and animal mass derived from carbon dioxide recently fixed via photosynthesis, per definition of a renewable resource.*

But note: just because a product is labeled “biobased” or contains “renewable resources” does not mean that it is based entirely on renewable resources. Rather, many of these products combine petroleum-based materials with naturally based ones, in order to provide the properties that consumers desire, while at the same time reducing the overall amount of synthetic polymers contained in the product.

The United States Department of Agriculture (USDA) has the task of defining the percentage of renewable resources in a product that is necessary in order for the product to be called “biobased.” ASTM D6866—“Standard Test Methods for Determining the Biobased Content of Natural Range Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry Analysis”—is a method that accurately determines the percentage of the product that comes from renewable resources.

### Biodegradable

If, under the right conditions, the microbes in the environment can break down a material and use it as a food source, that material is called *biodegradable*. Biodegradation is a process that can take place in many environments, including soils, compost sites, water treatment-facilities, marine environments, and even the human body. This process converts carbon into energy and maintains life. Not all materials are biodegradable under all conditions. Some are susceptible to the microbes found in a wastewater-treatment plant, while others need the conditions and microbes found in a compost pile or in soils.

For plastics to biodegrade, they must go through a two-step process. First, the long polymer chains are shortened or “cut” at the carbon-carbon bonds. This process can be started by heat, moisture, microbial enzymes, or other environmental conditions, depending upon the polymer. This is called “degradation,” and you know it is taking place because the plastics become weak and fragment easily. This first step is *not* a sign of biodegradation!

The second step takes place when the shorter carbon chains pass through the cell walls of the microbes and are used as an energy source. This is biodegradation—when the carbon chains are used as a food source and are converted into water, biomass, carbon dioxide, or methane (depending upon whether process takes place under aerobic or anaerobic conditions).

### **What Is a Compostable Material?**

When products are designed to be composted, they should meet ASTM Standard D6400 (for Compostable Plastics) or ASTM D6868 (for Compostable Packaging). Products that meet the requirements in these two specifications will:

- Disintegrate rapidly during the composting process (so no large plastic fragments remain on the composter’s screens when the process is finished).
- Biodegrade quickly under the composting conditions.
- Not reduce the value or utility of the finished compost. The humus manufactured during the composting process will support plant life.
- Not contain high amounts of regulated metals.

### **Where Confusion Exists**

Some consumers and manufacturers believe that if a material is based on a renewable resource, then it must be biodegradable and compostable. This is not true. Some natural materials do not biodegrade; for example, some forms of cellulose are not biodegradable. The only way to know if the material or product is biodegradable or compostable is if it meets ASTM D6400 or D6868.

Conversely, many people believe that materials based on petroleum will not biodegrade or compost. Again, this is not the case. There are synthetically based plastic resins that will biodegrade and compost, just like paper and yard trimmings. All these materials meet ASTM D6400 or D6868.

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