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Bioplastics vs. petroleum-based plastics

What are the differences?

- Most plastic products are made from petroleum. These include polyethylene, PVC, polypropylene, polystyrene, polyester, nylon and acrylic.
- Some plastics are made from plants. These include plastic products that are labeled as compostable or referred to as being edible. These plastics are most often made from sugar cane or corn starch, although they can also be made from potatoes, or other plants. These plastics are sometimes referred to as PLA (polylactic acid). PLA is one of the plastics commonly used for 3-D printing. Cellulose acetate is another type of plant-based plastic.
- A different type of bioplastic (made from living things, rather than petroleum) is referred to as PHA (polyhydroxyalkanoate) plastic. PHA is a unique polyester made naturally by certain bacteria.

Is cellulose the same as cellulose acetate?

No. Cellulose is an insoluble fiber, made up of glucose (a type of sugar). It makes up part of the cell wall in plants. Cellulose is a natural polymer (made up of repeating units—in this case, glucose). Cotton and hemp are examples of types of ropes/threads that are made from cellulose fibers. If you heat cellulose fibers too much, they will burn. Cellulose acetate is a semi-synthetic (human-made) polymer. It is made by reacting cellulose with acetic acid or acetic anhydride. The resulting fiber is a thermoplastic (it can be re-shaped by heating and will melt if it gets hot enough).

Aren't all bioplastics biodegradable?

Not really. It is important to distinguish between degrading (physically breaking apart into pieces) and biodegrading (being decomposed by living organisms). It is also important to consider the timeline for decomposition—most people do not expect something that is called "biodegradable" to persist in the environment in its original form for decades.

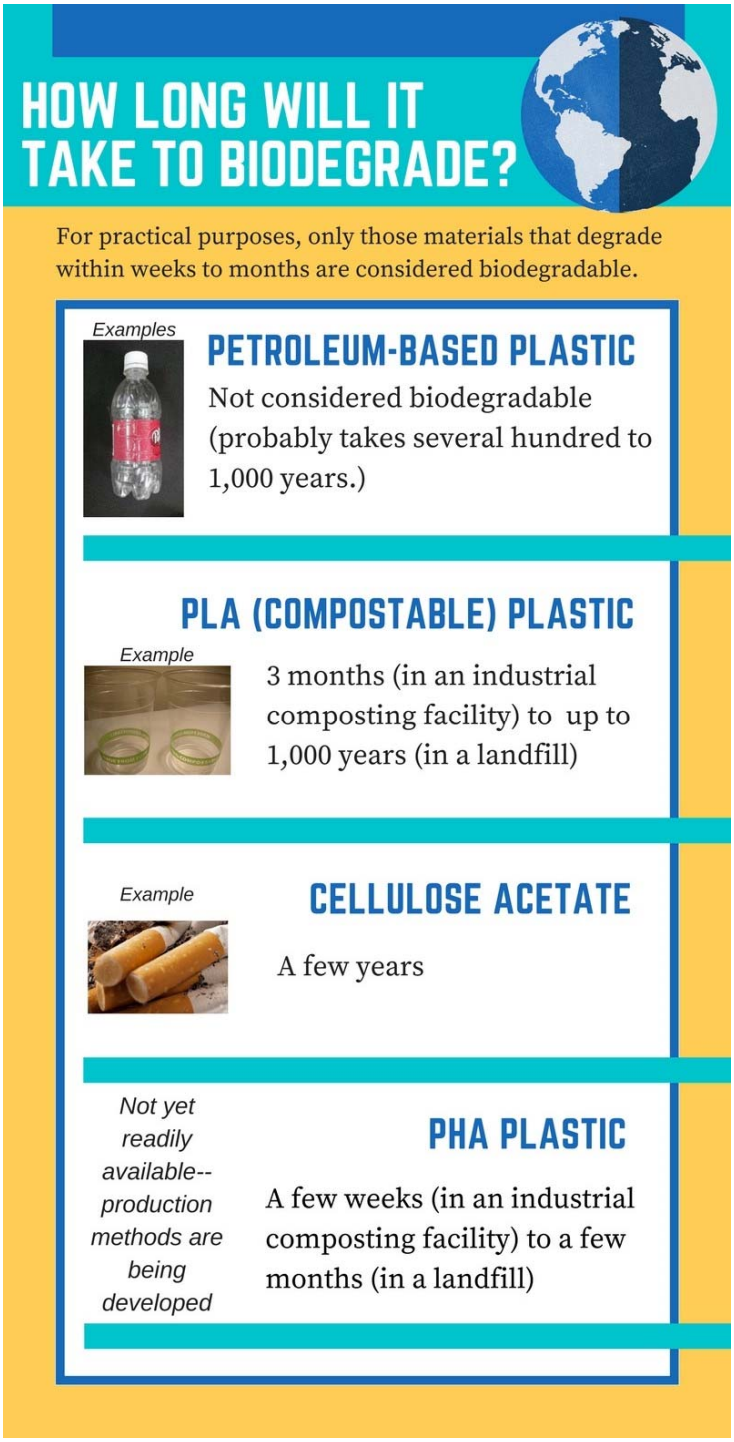
My plastic product says that it is compostable. What does this really mean?

PLA plastics may say "compostable" on them, or they may say that they comply with ASTM 6400 or ASTM 6868[1]. What these labels mean is that the product is compostable *in an industrial composting facility*. The product will not compost in a home compost heap. Industrial composting facilities use heat and oxygen to facilitate the composting process. If the products are not composted under these conditions, they will likely persist in the environment for decades or longer.

[1] ASTM D6400: standards for plastics and products made from plastics that are designed to be composted in municipal and industrial aerobic composting facilities. ASTM D6868: standards for biodegradable plastic coatings where the product or package is designed to be composted in municipal and industrial aerobic composting facilities.

Are plant-based plastics more environmentally-friendly than petroleum-based plastics?

Whether made from petroleum or plants, plastics that have similar chemical compositions will have similar properties. Both may have chemicals added to them (called plasticizers or additives) to make them more flexible or stiffer, depending on the application. Some of these plasticizers may affect hormone metabolism/regulation. In the ocean, persistent organic pollutants are likely to be attracted to both groups.



Document compiled by Dr. Maia McGuire, Florida Sea Grant Extension Agent. Thanks to Dr. Evan White (New Materials Institute, University of Georgia) for providing information for this fact sheet.