Biodegradable Definition

A “biodegradable” product has the ability to break down, safely and relatively quickly, by biological means, into the raw materials of nature and disappear into the environment. These products can be solids biodegrading into the soil (which we also refer to as compostable), or liquids biodegrading into water. Biodegradable plastic is intended to break up when exposed to microorganisms (a natural ingredient such as cornstarch or vegetable oil is added to achieve this result).

Sustainable disposal of any product requires that its wastes return to the earth and are able to biodegrade. Nature biodegrades everything it makes back into basic building blocks, so that new living things can be made from the old. Every resource made by nature returns to nature - plants and animals biodegrade, even raw crude oil will degrade when exposed to water, air and the necessary salts. Nature has perfected this system - we just need to learn how to participate in it.

By the time many resources are turned into products, however, they have been altered by industry in such a way that they are unrecognizable to the microorganisms and enzymes that return natural materials to their basic building blocks. Crude oil, for example, will biodegrade in its natural state, but once it is turned into plastic, it becomes an unsustainable pollution problem. Instead of returning to the cycle of life, these products simply pollute and litter our land, air and water.

Of all the environmental buzzwords “biodegradable” has perhaps been the most misused and the most difficult to understand. Because in the past there have been no guidelines or regulations, many products have called themselves biodegradable without any real justification. Unfortunately, the word biodegradable has frequently been applied to products that generally aren’t (such as detergents or plastics) and almost never used for products that really are (such as soap or paper).

A leaf is a perfect example of a biodegradable product -- it is made in the spring, used by the plant for photosynthesis in the summer, drops to the ground in autumn and assimilated into the soil to nourish the plant for the next season. The basic concept seems straightforward enough, however, there are several factors to consider in determining the biodegradability of a product or material.

The first is the question of the inherent biodegradability of the material. Any material that comes from nature will return to nature as long as it is still in a relatively natural form. Therefore, any plant-based, animal-based or natural mineral-based product has the capability to biodegrade, but products made from man-made petrochemical compounds generally do not. When a manmade compound is formulated in a laboratory, combinations of elements are made that do not exist in nature and there are no corresponding microorganisms to break them down.

The next issue is how long it takes for the material to actually break down. In nature, different materials biodegrade at different rates. A leaf takes approximately a year to become part of the forest floor. An iron shovel, on the other hand, can take years to rust away to nothing and a large tree can take decades to completely break down. Common sense tells us that any material will ultimately biodegrade, even if it takes centuries.

So what is the proper rate for a material to be biodegradable? It really depends on the material itself. The leaf example suggests that the proper rate is that which is appropriate to the ecosystem. A liquid going into a waterway should biodegrade fairly quickly, whereas there's no harm done if it takes a while for a newspaper to break down. Plastics, on the other hand, will not biodegrade in anyone's lifetime and certainly will never break back down into the petroleum from which it is made.

And then there is the question of what exactly does the product or material break down into and are there any toxic substances formed along the way or as the end result. In his book *The Closing Circle,* ecologist Barry Commoner gives the example of the benzene unit in synthetic detergents being converted as it biodegrades into phenol (carbolic acid), a substance toxic to fish. To be truly biodegradable, a substance or material should break down into carbon dioxide (a nutrient for plants), water and naturally occurring minerals that do not cause harm to the ecosystem (salt or baking soda, for example, are already in their natural mineral state and do not need to biodegrade).

The characteristics of the environment that the substance or material is in can also affect its ability to biodegrade. Detergents, for example, might break down in a natural freshwater “aerobic” (having oxygen) environment, but not in a “anaerobic” (lacking oxygen) environment such as sewage treatment plant digestors, or natural ecosystems such as swamps, flooded soils or surface water sediments.

Many products that are inherently biodegradable in soil, such as tree trimmings, food wastes, and paper, will not biodegrade when we place them in landfills because the artificial landfill environment lacks the light, water and bacterial activity required for the decay process to begin. The Garbage Project, an anthropological study of our waste conducted by a group at the University of Arizona, has unearthed hot dogs, corn cobs and grapes that were twenty-five years old and still recognizable, as well as newspapers dating back to 1952 that were still easily readable. When the conditions needed for biodegradable materials to naturally biodegrade are not provided, major garbage problems are the result.

Once it is determined that a substance or material will actually biodegrade under particular conditions, then there is the problem of actually using the product in those conditions and in an amount that can be sustained by the ecosystem that is receiving it. The sustainable rate of biodegradation is that amount which a given ecosystem can absorb as a nutrient, and if necessary, render harmless.

Soap, for example, is a natural organic product that is inherently biodegradable. The soapy greywater from a single household may biodegrade easily in a backyard, however, if that same soap went down a sewage line that fed into a waterway along with the soap used by a million or more residents that live along that waterway, there may be waves of soapsuds on the beaches, simply because more soap would be going into the waterway than it has microorganisms to biodegrade.

Oil spills are devastating not because oil doesn’t biodegrade, but rather because the amount of oil is much greater than the number of microorganisms available to degrade it. It has been estimated that it will take 50 years for the oil spilled in 1989 by the Exxon Valdez to degrade. Lakes and streams have become polluted because the amount of sewage dumped into them has been overwhelming. As much as we need to consider the biodegradability of the product, we need to consider the capacity of the system the biodegradable substance or material is being placed into.

Those who have attempted to define biodegradable for product labels run into the same dilemma encountered when defining recyclable -- should a product be called biodegradable if it inherently has the ability to biodegrade, or should it only be called biodegradable if it also is commonly disposed of in a way in which it really will biodegrade? For example, should a paper grocery bag be labeled biodegradable? It will biodegrade if placed in nature, however, it won't biodegrade in a landfill because the conditions aren't right.

Here's how long it takes for some commonly used products to biodegrade when they are scattered about as litter:

Cotton rags	1-5 months
Paper	2-5 months
Rope	3-14 months
Orange peels	6 months
Wool socks	1 to 5 years
Cigarette butts	1 to 12 years
Plastic coated paper milk cartons	5 years
Leather shoes	25 to 40 years
Nylon fabric	30 to 40 years
Plastic 6-pack holder Rings	450 years
Glass bottles	1 million years
Plastic bottles	Forever