Side navigation

# Measuring biodegradability

In nature, different materials biodegrade at different rates. If you throw your apple core into the bushes along with a steel toy car, your apple core will have disappeared in a few months and your toy car will be rusty but still recognisable. It may take many years before the toy car disappears entirely.

Image: Rusty toy car

To be able to work effectively, most microorganisms that assist the biodegradation need light, water and oxygen. Temperature is also an important factor in determining the rate of biodegradation. This is because microorganisms tend to reproduce faster in warmer conditions.

Many products that are 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 is a study of waste conducted by a group at the University of Arizona, USA. The project has unearthed from landfill hot dogs, corn cobs and grapes that were 25 years old and still recognisable, as well as newspapers dating back to 1952 that were still easily readable!

Image: Biodegradable waste

## How fast do things biodegrade?

This table shows how long some common items will take to break down if left in the environment.

| | |
|---|---|
| Vegetables | 5 days –1 month |
| Paper | 2–5 months |
| Cotton T-shirt | 6 months |
| Orange peels | 6 months |
| Tree leaves | 1 year |
| Wool socks | 1–5 years |
| Plastic-coated paper milk cartons | 5 years |
| Leather shoes | 25–40 years |
| Nylon fabric | 30–40 years |
| Tin cans | 50–100 years |
| Aluminium cans | 80–100 years |
| Glass bottles | 1 million years |
| Styrofoam cup | 500 years to forever |
| Plastic bags | 500 years to forever |

## How do we measure biodegradability?

Plastic bags have only been around for about 50 years, so how do the scientists know how long they take to degrade?

To make long-term estimates, scientists often use respirometry tests. The experimenters place a solid waste sample – like a newspaper, banana peel or plastic bag – in a container with microorganisms and soil, and then they aerate the mixture. Over the course of several days, microorganisms digest the sample bit by bit and produce carbon dioxide – the resulting amount of $CO_2$ serves as an indicator of degradation.

**NATURE OF SCIENCE**

Sometimes scientists use estimates to give data on biodegradability. These are usually based on known quantities and extrapolated to take account of time or other environmental factors.

Respirometry tests work well for newspapers and banana peels, but when scientists test plastic bags, nothing happens – there's no $CO_2$ production and no decomposition. Why? The most common type of plastic shopping bag – the kind you get at supermarkets – is made of polyethylene, a man-made polymer that microorganisms don't recognise as food. So, if there is no $CO_2$ production for plastic in respirometry tests, where does the 500-year estimate come from? Although polyethylene bags don't biodegrade, they do photodegrade. When exposed to ultraviolet radiation from sunlight, polyethylene's polymer chains become brittle and start to crack. This suggests that plastic bags will eventually fragment into microscopic granules. As of yet, however, scientists aren't sure how many centuries it takes for the sun to work its magic. That's why some people give a 500 year estimate, while others prefer a more conservative 1000 year lifespan. According to some plastics experts, all these figures are just another way of saying 'a really, really long time'.

**Useful links**

Find out more about backyard composting in this guide,
www.epa.gov/wastes/conserve/tools/greenscapes/pubs/compost-guide.pdf

**Published:** 19 June 2008