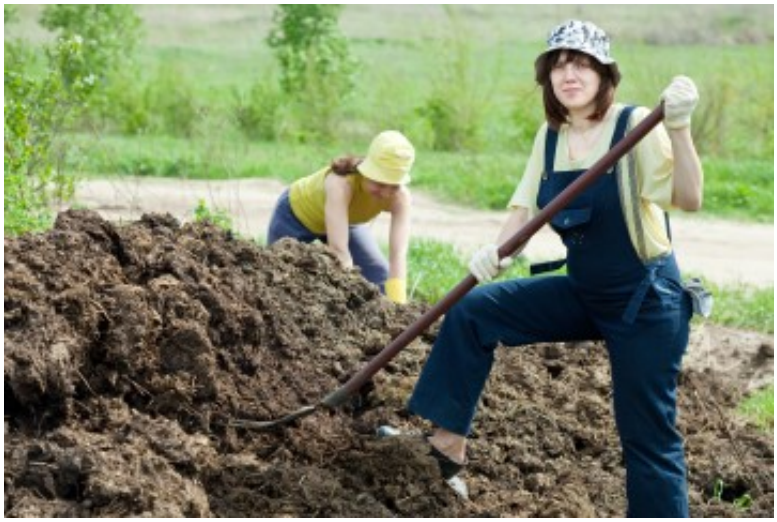
Compostable Plastic in the Waste Stream: How Do Aerobic and Anaerobic Decomposition Work?

Biodegradable and Compostable Means it Decomposes Expediently, like all Organic Waste

By Laura Mauney

The positive environmental impact of MHG's compostable PHA plastics (polyhydroxy-alkanoates) goes far beyond replacing petro-plastic with a clean and green alternative.



One of the most valuable features of PHA is that, after disposal, it will decompose both aerobically and anaerobically, resulting in a zero-waste outcome, no matter what kind of waste stream is involved.

When adopted at the mass market level, PHA will thus dramatically reduce the amount of non-degradable plastic that pollutes the air, clogs up landfill space, and litters roadsides, waterways, and oceans on a daily basis.

Because it is created from microorganisms, PHA completely disappears when it enters the waste stream, without a trace. PHA decomposes the same way as all other organic matter, re-integrating fully and easily into the basic nutrient and atmospheric cycle that sustains life on the planet.

Better yet, PHA ONLY degrades when it enters the waste stream. Just like most other biologically sourced products, including bamboo, linen, cotton, cardboard, and paper, PHA maintains its strength, durability, and integrity while in use.

In this sense, PHA biodegradable plastic fully succeeds as a replacement for petro-plastics along all steps of its life cycle: sourcing, production, use, disposal, and renewal.

Aerobic Decomposition – Why Autumn Leaves Left on the Ground Eventually Crumble to Bits

The *aero* part of *aerobic* refers to the Greek word for *air*. The *b* part of *bic* is shorthand for the Greek word *bios,* or life. The add-on, *ic,* simply means *pertaining to*.

Thus, we have *aero+b+ic*: life that can survive in an oxygenated environment.

Human beings are aerobic organisms, as are fish and most other creatures on the planet. Aerobic organisms also include earthworms, insect larva, bacteria, and the hundreds of trillions of other microbes that thrive in soil and water.

That bit of science explained, aerobic decomposition refers to the process by which small, oxygen-dependent organisms consume, digest, and chemically break down biological material, including PHA.

The result of aerobic decomposition is a treasure trove of life-sustaining elements like carbon and nitrogen that serve as new energy and nutritional sources for plants, and eventually animals.

Aerobic decomposition occurs all around us all the time, every day, throughout the year.

When an apple core is tossed out the window of a car, it will be digested by aerobic organisms within three months at the most, if not sooner.

When grass is mowed, the fragmented pieces that are left behind become instant food for aerobic organisms.

Leaves that fall from trees are also digested by aerobic organisms, just like every other form of plant or animal waste left to lie in open air.

Aerobic decomposition is a common means of creating backyard compost from food scraps, leaves, and grass clippings. The aerobic degradation process, when managed correctly in a compost heap, is fairly healthy and safe. Aerobic compost can be used to provide nutrient rich soil or humus for use on farmland, as well as in backyard vegetable and ornamental gardens.

Anaerobic Decomposition – Why a Flower Bouquet Left too Long in Vase Water Begins to Smell Bad

In Greek, *an* simply means *without*.

An+aerobic, therefore, refers to organisms that can survive without oxygen.

When organic matter, including PHA, is sunk into water, or piled up in livestock manure pits, or buried deep in landfills, anaerobic microorganisms get to work consuming and digesting it. Anaerobic organisms do not require oxygen to survive. For many varieties, oxygen is toxic. Anaerobic organisms include protozoa, and some bacteria, worms, and parasites.

Unlike aerobic decomposition, which occurs rapidly, in about 90 days, anaerobic decomposition occurs more slowly, usually taking at least one full year to completely break down organic matter into more basic compounds and elements.

Because anaerobes work without oxygen, the chemical outcomes are different from those in aerobic decomposition.

Certain anaerobic organisms – different types at different stages – create and release a host of gasses during the decomposition process. These include the microbes that make hydrogen sulfide, the unpleasant smelling gas that occurs when bouquets are left in water for too long. Other anaerobic organisms that feed off of decay can be pathogenic (creators of disease), including listeria, strep and staph bacteria, and intestinal parasites.

For this reason, backyard anaerobic composting can turn into a nasty health hazard if not managed properly. Controlled anaerobic composting in industrial facilities can be used, however, to provide healthy, usable compost for farms and gardens, and to better manage release of anaerobically produced gasses.

How Decomposition Affects the Biosphere

The final phase of anaerobic decomposition is called methanogenesis, the creation of methane by microorganisms that are disingenuously referred to as *methanogens*. Methanogens thrive in most anaerobic environments, including healthfully in our own intestines as they digest our food.

Methane gas created by methanogens in soil or water that escapes to the surface is often consumed by another set of microorganisms – called *methanotrophs* – that feed off the carbon in methane for energy.

Methane that escapes to the stratosphere eventually is oxidized via chemical reactions with heat and light from the sun.

Anaerobically generated methane can also be manually captured in landfills, for use as low-impact natural gas to heat homes and fire cook-stoves.

Methane can explode if too much builds up in a confined space. Like carbon dioxide, methane can asphyxiate, meaning that it can smother oxygen-dependent animals. Due to its greater ability to trap heat, methane is often and legitimately touted as a more dangerous greenhouse gas than carbon dioxide, but it takes two to tango in that scenario.

Why is PHA Compostable Plastic Healthier for the Waste Stream and the Biosphere?

Untempered methane buildup is unlikely as long as Earth's temperature remains below a certain level, and the natural processes that destroy methane – like methanotrophy and atmospheric oxidation – remain in balance with its production.

Unfortunately, methane floating up into the atmosphere due to leaky natural gas fracking equipment and pipelines bypasses the surface-level methanotrophic process and thus upsets the balance of methane-to-oxidation in the air. Carbon dioxide, which also requires oxidation to break down, has likewise overloaded the atmosphere due to excessive petroleum usage combined with worldwide deforestation.

Plastic made from petroleum further requires up to five hundred years to chemically break down in the waste stream.

By contrast, production and disposal of biodegradable PHA are no different than growing and mowing a lawn.

Additionally, at MHG, PHA is sourced from Canola plants, which, like all other plants, consume carbon dioxide from the air during growth, and convert it into the oxygen that animals breathe.

Whether a product made from MHG PHA decomposes aerobically or anaerobically, it serves as a simple participant in the natural organic processes that keep all life on Earth in balance, just as every other living thing has done since the beginning of time.

Does Your Company Manufacture Plastic Products?

*Please visit **MHGBio.com** (http://www.mhgbio.com/), to find out more about how biodegradable plastics from MHG can be adapted to a wide range of product manufacturing and packaging requirements.*

***Learn more** (http://www.mhgbio.com/mhg-sustainability/mhg-certifications/) about how MHG's biodegradable PHA plastic is **Certified** (http://www.mhgbio.com/mhg-sustainability/mhg-certifications/) for all six levels of biodegradability and compostability.*

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