Biodegradation of Plastics - New Recycling Possibilities for The Planet

GARDEN CITY, ID, UNITED STATES, April 26, 2024 /EINPresswire.com/ -- Plastics, known for their durability and resistance to degradation, are a major source of global pollution. However, advances in chemistry have made it possible to develop plastic additives that can accelerate plastic biodegradation. The Pristine® biodegradable plastic additive promotes the safe and quick decomposition of plastics. Explore how it can help address the escalating issue of plastic waste.

Plastic Biodegradation

Pristine is the Leading Biodegradation Additive

As the global demand for plastic rises every year, the amount of plastic waste generated also increases. The OECD estimated in 2019 that the world generates approximately 353 million tons of plastic waste, of which only 9% is recycled.

Most plastic waste on Earth is either landfilled or discarded into the environment, where it can remain almost indefinitely. Studies have shown that a typical plastic bottle can take up to 500 years to degrade naturally.

Recent studies published in peer-reviewed journals indicate that appropriate pretreatments can enhance the biodegradability of plastics. Pristine, LLC, is at the forefront of this innovation. Their Pristine® biodegradable plastic additive improves the biodegradability and composting speed of most plastics after disposal.

Independent third parties have tested the efficiency of the Pristine® additive through industry-recognized standard methods, including:

- ASTM D5511. Measures the rate of anaerobic biodegradation of plastic materials, such as when

left in a landfill.
- ASTM D5338. Evaluates the rate of aerobic degradation under controlled conditions, assessing how quickly it can decompose.
- ASTM D6691. Determines the rate of anaerobic biodegradation of plastic materials in marine environments, such as when disposed of in the ocean.

Pristine® is compatible with a wide range of plastic materials, including:

- Polyester (PE) and variations like HDPE, LDPE and LLDPE
- Polypropylene (PP)
- Polyvinyl chloride (PVC)
- Thermoplastic elastomers (TPE)
- Acrylonitrile butadiene styrene (ABS)
- Styrene Acrylonitrile (SAN)
- Polyethylene Terephthalate (PET/PETE), polyethylene terephthalate-glycol (PCTG), Recycled and Amorphous variations (RPET, APET), and glycol-modified versions (PETG)
- EPDM rubber
- Polyester (PE)
- Polycarbonate (PC), Polyurethanes (PU)
- Plastic nylons
- Plastic styrenes, polystyrenes (PS), and General Purpose Polystyrene (GPPS)
- Ethylene vinyl acetate (EVA)
- High Impact Polystyrene (HIPS)
- Tritan
- Butyl rubber (BR)
- Low MW

What is the Biodegradation of Plastics?

Biodegradation is a natural process where materials in the environment are slowly broken down and consumed by living organisms, such as bacteria or fungi. It can occur naturally or be driven by human action, which is why it is referred to as composting. The biological degradation of plastics can be broken down into the following steps:

- Initial contact. Microorganisms come in contact with plastic materials and start producing enzymes that can break them down.

- Biological breakdown. The more biodegradable a material is, the more efficiently these enzymes can break the plastics into smaller, simpler molecules.

- Absorption. Once sufficiently broken down by the enzymes, microorganisms absorb these smaller molecules, converting them into energy. This process effectively turns plastic into food for these organisms.

- Conversion into natural waste. After absorption, the microorganisms leave natural waste material such as water, gases like carbon dioxide or methane, and biomass.

Almost all materials, including plastics, can biodegrade. However, the exact rate of plastic biodegradation depends on multiple factors:

- Material composition. The plastic material's chemical structure determines how quickly it will biodegrade. The more stable and complex the chemical bonds, the more resistant they are to degradation. The quantity and thickness of plastic material also affect its biodegradation rates; the higher the level of plastics and the thicker the materials, the more time needed to degrade naturally.

- Microorganism populations. The types and concentrations of microorganisms present affect the biodegradation rates. Different materials attract various species, and degradation tends to occur faster in environments abundant with microbes or fungi, like compost heaps and oceans.

- Environmental conditions. The environment's ambient temperature, moisture levels, and oxygen levels influence how quickly a plastic material can degrade. For example, plastics may degrade quickly in hot, humid, and oxygen-rich environments. Exposure to sunlight, ultraviolet (UV) rays, and mechanical stressors like pressure and currents can damage or break down plastics into smaller fragments.

- Presence of additives. Plastic additives like Pristine® can accelerate degradation rates because they help break down the material's chemical bonds over time.

Biodegradation must not be confused with fragmentation. Biodegradation is the consumption of materials by microbes and fungi. Fragmentation is the breakdown of plastics into smaller pieces, which larger animals and organisms can more easily ingest. These fragments are called microplastics when they measure 5 mm or less in diameter. Microplastics are extremely damaging to marine life as they are often mistaken for a food source.

Challenges of Biodegradation

Landfill conditions are typically dry with low oxygen quantities. Untreated plastic materials degrade very slowly in these environments, often requiring several decades, if not centuries, to begin degrading.

For example, a 2020 study has demonstrated that simple plastic bottles of high-density polyethylene (HDPE) can take as much as 58 years in a landfill to degrade to half their original weight. Thicker HDPE materials, such as piping, are more resistant and can take up to 1,200 years.

Plastics disposed of in oceans and other underwater environments are constantly exposed to ocean currents, UV rays, and high pressures. These conditions favor their fragmentation into microplastics, which are then ingested by marine organisms long before they can biodegrade naturally.

Regardless of the environment, most plastic materials are not intended to degrade quickly in natural conditions. They require pretreatment and solutions to accelerate their degradation rates and safety at the manufacturing stage, such as the Pristine® biodegradable plastic additive. Additionally, this means that already-manufactured plastic must be disposed of through other methods like recycling.

Pristine® is a Biodegradation Solution

At Pristine®, we aim to be part of the solution for our planet's future. Our biodegradable plastic additive is designed to help the industry continue addressing the world's growing need for plastics without further endangering the planet. Treating plastic materials with Pristine® helps ensure they are easier to recycle or biodegrade faster, reducing environmental harm.

Contact Pristine® for the leading plastic additive that ensures efficient plastic biodegradation in standard landfills, compost sites, and marine environments.

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