

## How EcoPure® Works

Plastics (or polymers) are made of long molecular chains of organic molecules called monomers. Polymers do not exist naturally and most are designed to be incredibly stable. The common perception is that these materials do not easily biodegrade and may last in the environment for centuries and possibly forever. Many plastic products, such as bottles and food containers, are air-tight and water-tight

***EcoPure® is an organic additive that causes plastic to biodegrade\* through a series of chemical and biological processes when disposed of in a microbe-rich environment, such as a biologically active landfill.***

Ingredients in the EcoPure® allow the acceleration of the biodegradability\* of otherwise non-biodegradable plastics by providing a foothold for colonies of microorganisms. This foothold allows the microorganisms to begin metabolizing the EcoPure®, and over time, the microorganisms expand to, and break down, the rest of the plastic product. These microbes then send out chemical signals attracting other microbes. Collectively, they then feast on the polymer chains, breaking down the chemical bonds.

EcoPure® requires the action of certain enzymes for the biodegradation process to begin, so plastics containing EcoPure® will never begin to biodegrade during normal use. The by-products of the biodegradation process depend on the disposal environment, but are non-toxic and some are even economically valuable for energy, such as Methane. Other by-products include humus (which can be used to make soil richer) and carbon dioxide.

## EcoPure® Testing

EcoPure® additives are tested and validated to show accelerated rates of biodegradation\* in treated plastic. The test method used to determine the degree and rate of biodegradation\* of plastic materials in an oxygen-free (anaerobic) environment is the ASTM D5511 Standard Test Method for Determining Anaerobic Biodegradation of Plastic Materials Under High-Solids Anaerobic-Digestion Conditions. The sample materials are placed in an inoculum derived from anaerobic

digesters operating on household waste. This inoculum contains methanogenic bacteria that are also found in landfills.

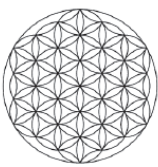
After the inoculum is prepared, the samples are placed in incubation vessels and kept within strict temperature and moisture tolerances. The vessels are airtight and are not exposed to UV radiation. Gas samplings are taken daily to show the rate of gas production.

Plastic materials, treated with EcoPure® additive, tested under the ASTM D5511 method show highly accelerated rates of biodegradation\*.



*\*Using the ASTM D5511 test. Actual biodegradation rates will vary in biologically-active landfills according to the type of plastic used, the product configuration, and the solid content, temperature and moisture levels of the landfill. Find out more about biodegradability testing at [www.bio-tec.com](http://www.bio-tec.com).*





# Eden Research Laboratory EcoPure® Test Results



## Interpretation of ASTM D5511 Test Reports

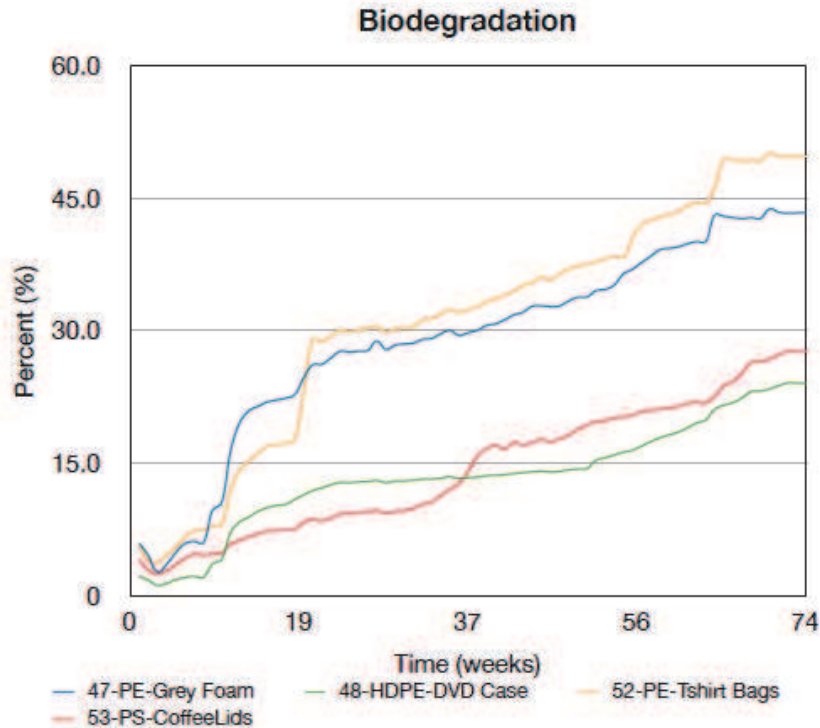
### Interpret the ASTM D5511

The test report shown here is from an extended ASTM D5511 test Bio-Tec Environmental is conducting at Eden Research Laboratory. The anaerobic biodegradation test report includes HDPE, PS, PE film and PE foam samples treated with EcoPure®. All sample material has been running in the test for over 518 days.

This type of test (ASTM D5511) measures carbonaceous gas produced by anaerobic microorganisms. This test report shows data gathered from plastic products treated with EcoPure®, a negative control featuring untreated plastic, an inoculum control that contains no plastic, and a positive control consisting of fast-degrading cellulose.

The row labeled "Percent Biodegraded" shows how much of the carbon mass of the sample material was converted into gas through the process of biodegradation. This can be calculated by adding the carbon masses of the CO<sub>2</sub> and CH<sub>4</sub> produced and subtracting this number from the "Theoretical Sample Mass," which is the original carbon weight of the test sample.

For more detailed information regarding biodegradation testing please contact your testing institution or Bio-Tec Environmental, LLC.



Regarding: Various Samples (518 days)

	Incu- lum	Nega- tive	Posi- tive	PE- Grey Foam	HDPE- DVD Case	PE- Tshirt Bags	PS- Coffee Lids
Cumulative Gas Volume (mL)	4483.9	4827.8	20218.3	11056.2	16538.0	13712.3	15094.3
Percent CH <sub>4</sub> (%)	44.1	50.1	61.5	40.2	40.6	50.2	50.4
Volume CH <sub>4</sub> (mL)	1975.4	2417.2	12443.0	4441.8	6712.7	6880.1	7600.3
Mass CH <sub>4</sub> (g)	1.41	1.73	8.89	3.17	4.79	4.91	5.43
Percent CO <sub>2</sub> (%)	25.6	27.6	35.8	25.4	24.3	30.4	28.8
Volume CO <sub>2</sub> (mL)	1146.2	1332.0	7238.1	2810.0	4014.7	4173.5	4349.3
Mass CO <sub>2</sub> (g)	2.25	2.62	14.22	5.52	7.89	8.20	8.54
Sample Mass (g)	1,000	10	25	6	20	10	20
Theoretical Sample Mass (g)	0.0	8.6	11.1	5.1	17.1	8.6	17.1
Biodegraded Mass (g)	1.67	2.01	10.54	3.88	5.75	5.92	6.40
Percent Biodegraded (%)		3.9	80.3	43.0	23.8	49.6	27.6
* Adjusted Percent Biodegraded (%)		4.9	100.0	53.6	29.6	61.8	34.4

\* The adjusted percent is not within the method but is informative and very likely the actual degraded amount when biomass is considered.

### EcoPure® Applications



EcoPure® is an extremely versatile additive that can be used in a wide variety of applications, from bulk trash bags to custom engineered durable goods.

For processing ease EcoPure® is available in forms specific for use in EVA, EVOH, HDPE, LDPE, LLDPE, Nylons, PET, PETG, Poly Carbonate, and PP. EcoPure® additives are also compatible with certain grades of TPE, TPU and various grades of Polystyrene.