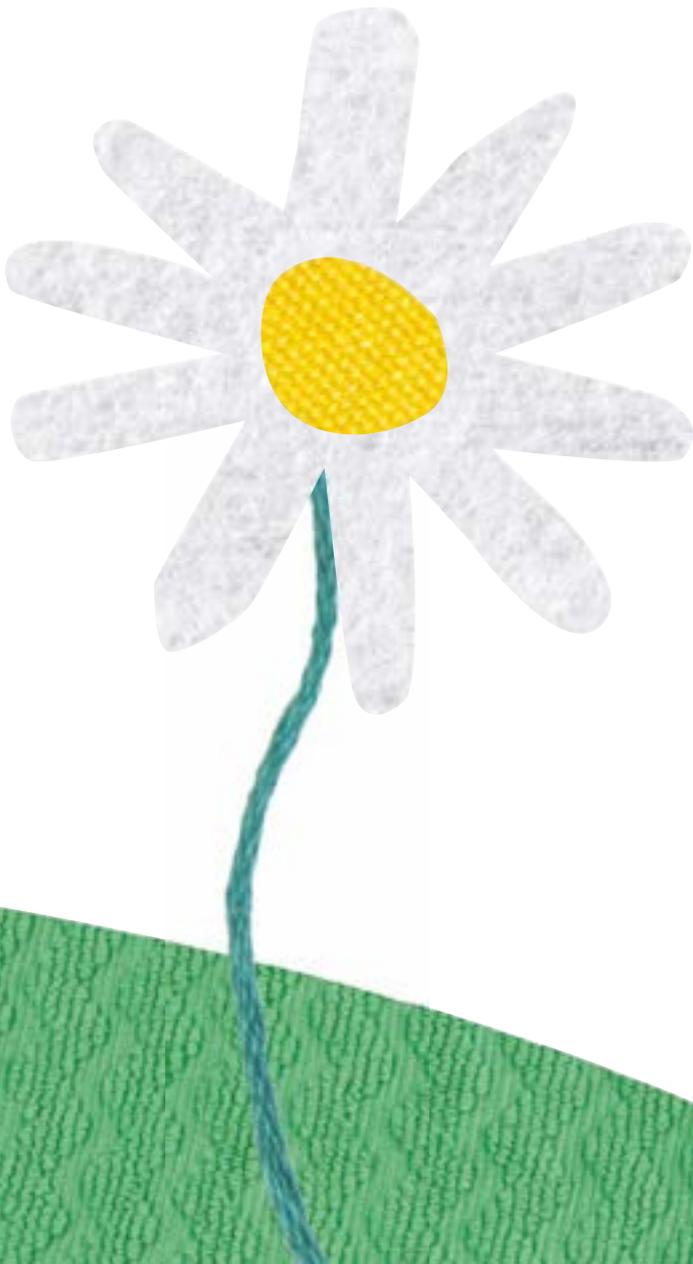




TESTING SUMMARY



Powered by
 **PRIMALOFT. BIO™**

Fibers supplied by
 **FIBER PARTNER®**

Landfill Simulation

Test method ASTM D5511

Summary: The amount of apparel that winds up in landfills instead of being re-used, repurposed or recycled is astronomical. The EPA in the United States indicates that the main source of municipal waste in our landfills is clothing. Over 10.5 million tons of clothing ends up in landfills each year. The PrimaLoft® Bio™ fiber (both with and without silicone based finish) was tested according to ASTM D5511 Standard Test Method For Determining The Anaerobic Biodegradation of Plastic Materials Under High Solids Anaerobic Digestion Conditions at Eden Research Laboratories in Albuquerque, New Mexico to determine the biodegradation rate of the fiber in landfill environments.

Test Procedure: The test method ASTM D5511 determines the degree and rate of anaerobic biodegradation (without the presence of oxygen) of synthetic plastic materials in a high solids, static inoculum. The method simulates an accelerated biodegradation process in an anaerobic environment that is typically present in an average landfill. Samples are exposed to an inoculum (containing microbes) that is derived from kitchen waste, municipal waste, and other materials found in compost and landfills. The samples are tested at 52°C with at least 20% solids in the test vessel. The determination of the degree and rate of biodegradation is calculated from the quantity of carbon dioxide and methane biogas that is generated over a certain period of time from the biodegradation of the plastic materials. A positive control and a negative control are included in the test procedure to assure the test has achieved the proper conditions for expected biodegradation levels.

Results: The PrimaLoft® Bio™ (siliconized) fibers biodegraded 93.8% at 646 days compared to only 1.1% biodegradation of the standard recycled polyester fiber (negative control) at the same time period. No biogas was further observed at this point and the PrimaLoft® Bio™ (siliconized) fiber was determined to have completed the biodegradation process at this time period. The PrimaLoft® Bio™ (dry) fibers biodegraded 65.0% at 646 days and 83.4% at 899 days compared to only 1.8% biodegradation of the standard recycled polyester fiber (negative control) at the same time period. Biogas continues to be observed and so the biodegradation process has been allowed to continue on the PrimaLoft® Bio™ (dry) fiber.

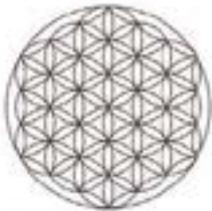
Conclusion: PrimaLoft® Bio™ polyester fibers (both siliconized and dry) have been confirmed by an independent third-party laboratory using method ASTM D5511 to biodegrade in an anaerobic landfill environment.

ASTM D5511

Standard test method for determining anaerobic biodegradation of plastic under high-solids anaerobic-digestion conditions.

This ASTM test method is equivalent to ISO 15985.





Eden Research Laboratory

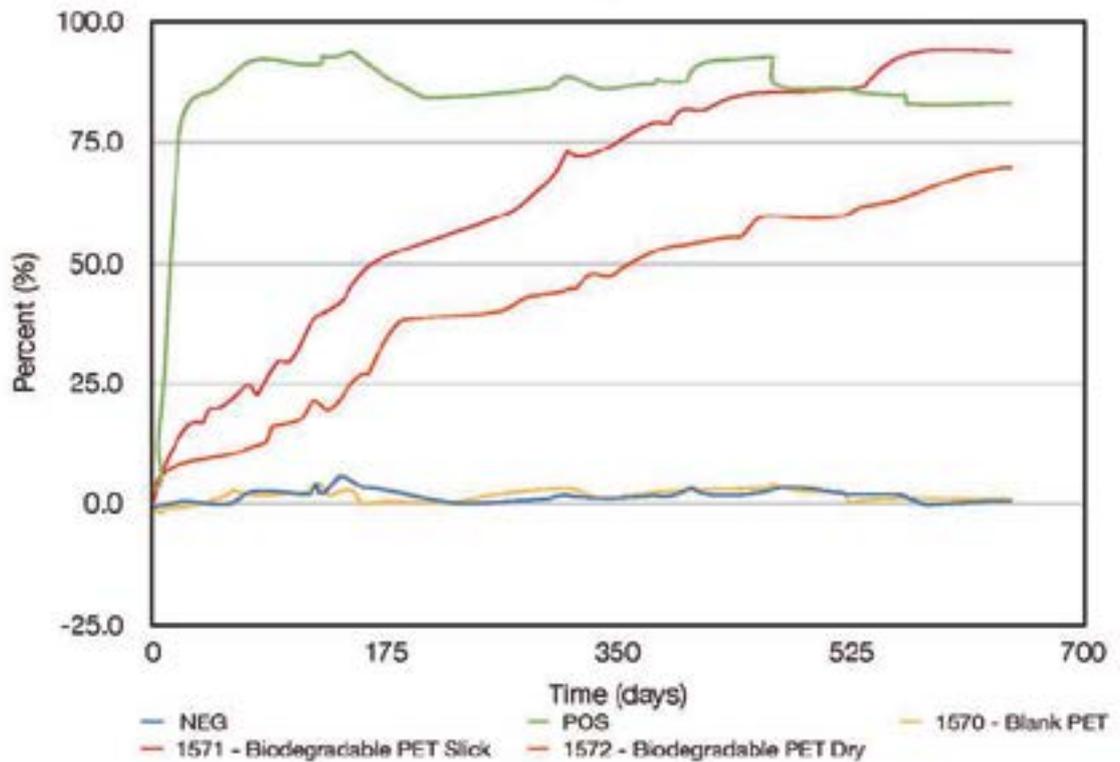
Date: June 19, 2019 Regarding:

Primaloft Samples (646 Days)

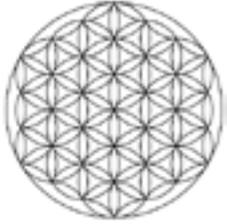
Update

	Inculum	Negative	Positive	1570 - Blank PET	1571 - Biodegradable PET Slick	1572 - Biodegradable PET Dry
Cumulative Gas Volume (mL)	5113.2	5270.5	12919.4	5292.1	29293.9	24021.9
Percent CH ₄ (%)	47.0	48.4	44.2	49.7	52.0	50.2
Volume CH ₄ (mL)	2405.1	2551.9	5704.0	2632.5	15225.8	12061.2
Mass CH ₄ (g)	1.72	1.82	4.07	1.88	10.88	8.62
Percent CO ₂ (%)	38.5	36.8	40.4	37.6	36.8	35.1
Volume CO ₂ (mL)	1967.7	1937.9	5215.2	1989.2	10790.7	8422.8
Mass CO ₂ (g)	3.87	3.81	10.24	3.91	21.20	16.54
Sample Mass (g)	10	10	10	20.0	20.0	20
Theoretical Sample Mass (g)	0.0	8.6	4.2	12.4	12.4	12.4
Biodegraded Mass (g)	2.34	2.41	5.85	2.48	13.94	10.97
Percent Biodegraded (%)		0.7	83.1	1.1	93.7	69.7

Biodegradation



NOTE: The above content has been provided by a third-party testing facility.



Eden Research Laboratory

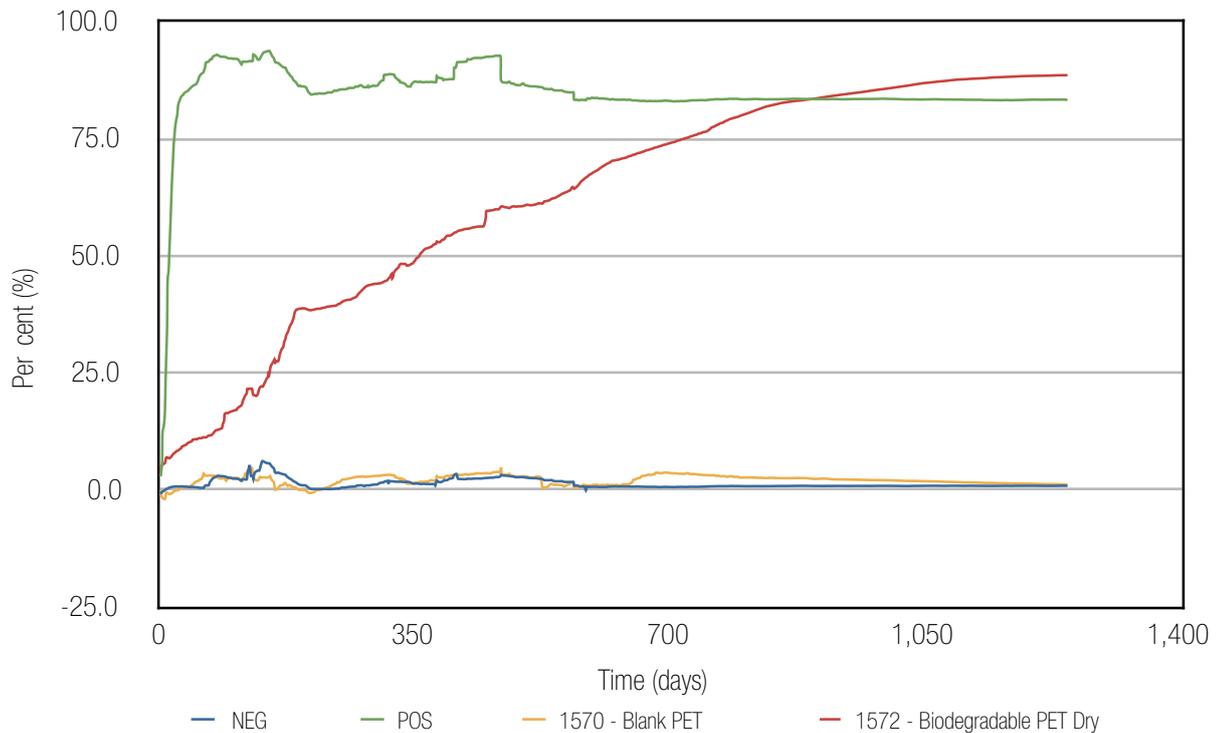
Date: February 4, 2021

Update

Regarding: ASTM D5511 Primaloft Samples (1242 Days)

	Inculum	Negative	Positive	1570 - Blank PET	1572 - Biodegradable PET Dry
Cumulative Gas Volume (mL)	5683.9	5867.4	13487.1	5850.5	29293.9
Per cent CH ₄ (%)	48.0	49.2	44.8	50.7	52.0
Volume CH ₄ (mL)	2727.4	2887.4	6036.9	2965.0	15225.8
Mass CH ₄ (g)	1.95	2.06	4.31	2.12	10.88
Per cent CO ₂ (%)	38.1	36.6	40.1	37.4	36.8
Volume CO ₂ (mL)	2164.4	2145.2	5411.7	2188.3	10790.7
Mass CO ₂ (g)	4.25	4.21	10.63	4.30	21.20
Sample Mass (g)	10	10	10	20.0	20.0
Theoretical Sample Mass (g)	0.0	8.6	4.2	12.4	12.4
Biodegraded Mass (g)	2.62	2.70	6.13	2.76	13.94
Per cent Biodegraded (%)		0.9	83.2	1.1	91.4

Biodegradation



NOTE: The above content has been provided by a third-party testing facility.

Marine Simulation

Test method ASTM D6691

Summary: Microplastics in the ocean is an ecological and environmental concern. The use of microfibers in clothing and other applications has garnered attention by environmentalists as one of the potential sources of microplastics in the ocean requiring immediate corrective action. It is important for there to be material solutions that address accidental leakage of microfibers into ocean environments. PrimaLoft® Bio™ utilizes a technology that enables polyester fibers to biodegrade in marine environments ultimately reducing the accumulation of microplastic waste in the ocean over time. The PrimaLoft® Bio™ fiber was tested according to ASTM D6691 Standard Test Method For Determining Aerobic Biodegradation Of Plastic Materials In The Marine Environment By A Defined Microbial Consortium Or Natural Sea Water Inoculum at Eden Research Laboratories in Albuquerque, New Mexico to determine the biodegradation rate of the fiber in natural sea water.

Test Procedure: The test method ASTM D6691 determines the degree and rate of aerobic biodegradation of synthetic plastic material exposed to marine microorganisms found in natural sea water. This is an accelerated test due to the elevated temperature of the sea water under laboratory conditions. A positive control and a negative control are included in the test for comparison purposes as well as to validate that the conditions of the test were accurately prepared. The plastic material is exposed to a natural sea water inoculum (containing marine microorganisms). The inoculum used by Eden Research Labs is a 50/50 mixture containing sea water from both the East and West coasts of the United States. The test was conducted at 30°C and the inoculum is consistently agitated to simulate water movement. The determination of the degree and rate of biodegradation is calculated based on the quantity of carbon dioxide that is generated from the biodegradation of the plastic materials.

Results: The PrimaLoft® Bio™ (siliconized) fiber biodegraded 87.9% at 1953 days compared to 3.5% biodegradation of the standard recycled polyester fiber (negative control) at the same time period. Similarly, the PrimaLoft® Bio™ (dry) fiber biodegraded 84% at 1563 days. Biogas continues to be observed on both fiber types and so the biodegradation process has been allowed to continue on the PrimaLoft® Bio™ fibers.

Conclusion: PrimaLoft® Bio™ polyester has been confirmed by an independent third-party laboratory using method ASTM D6691 to biodegrade in an aerobic sea water environment.

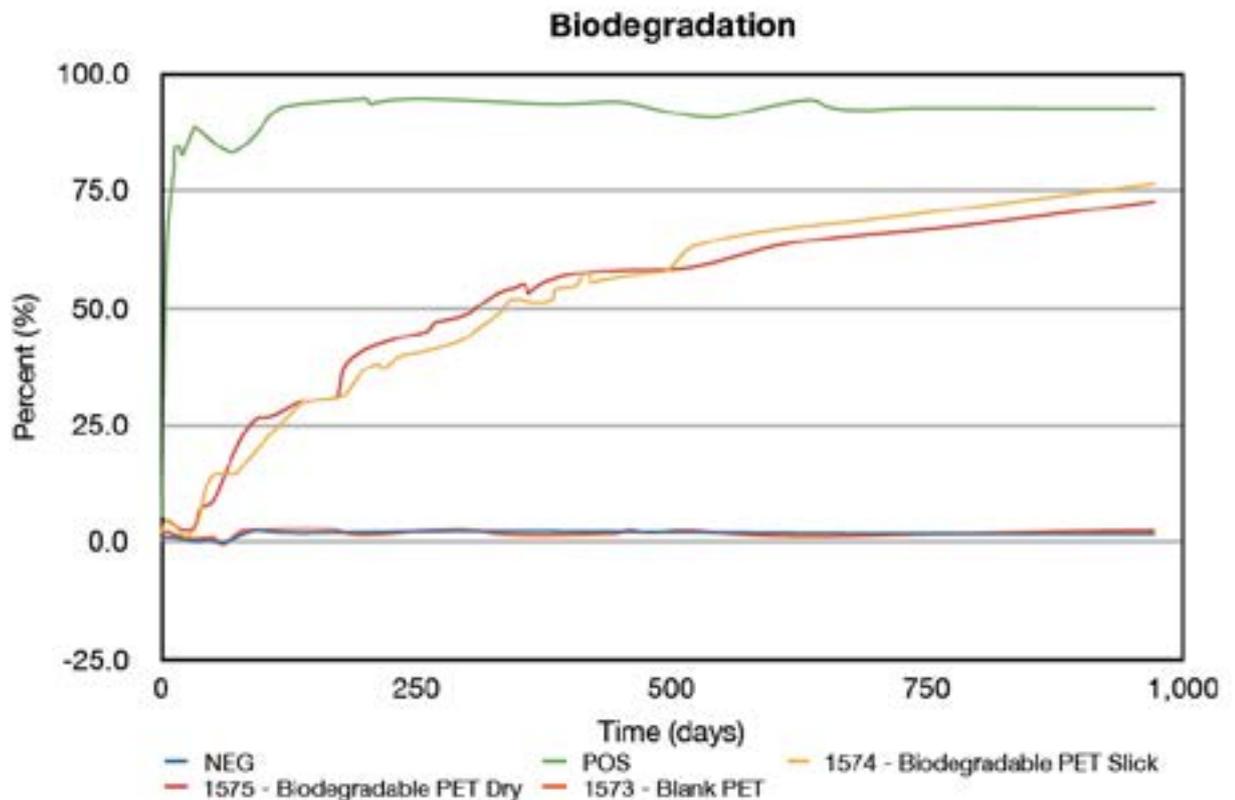
ASTM D6691

Standard test method for determining aerobic biodegradation of plastic materials in the marine environment by a defined microbial consortium or natural sea water inoculum.

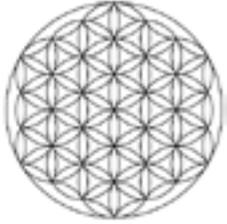


Regarding: Aerobic Research ASTM D6691 for Primaloft Samples in 973 days

	Inculum	Negative	Positive	1574 - Biodegradable PET Slick	1575 - Biodegradable PET Dry	1573 - Blank PET
Cumulative Gas Volume (mL)	24.8	29.2	91.4	118.4	114.5	30.0
Percent CO ₂ (%)	92.6	87.2	89.1	94.2	93.6	87.0
Volume CO ₂ (mL)	23.0	25.5	81.5	111.5	107.2	26.1
Mass CO ₂ (g)	0.045	0.050	0.160	0.219	0.211	0.05
Sample Mass (g)		0.080	0.080	0.100	0.100	0
Theoretical Sample Mass (g)		0.069	0.034	0.062	0.062	0.1
Biodegraded Mass (g)	0.012	0.014	0.044	0.060	0.057	0.014
Percent Biodegraded (%)		1.9	92.8	76.6	72.9	2.7
* Adjusted Percent Biodegraded (%)		2.1	100.0	82.5	78.5	2.9



NOTE: The above content has been provided by a third-party testing facility.



Eden Research Laboratory

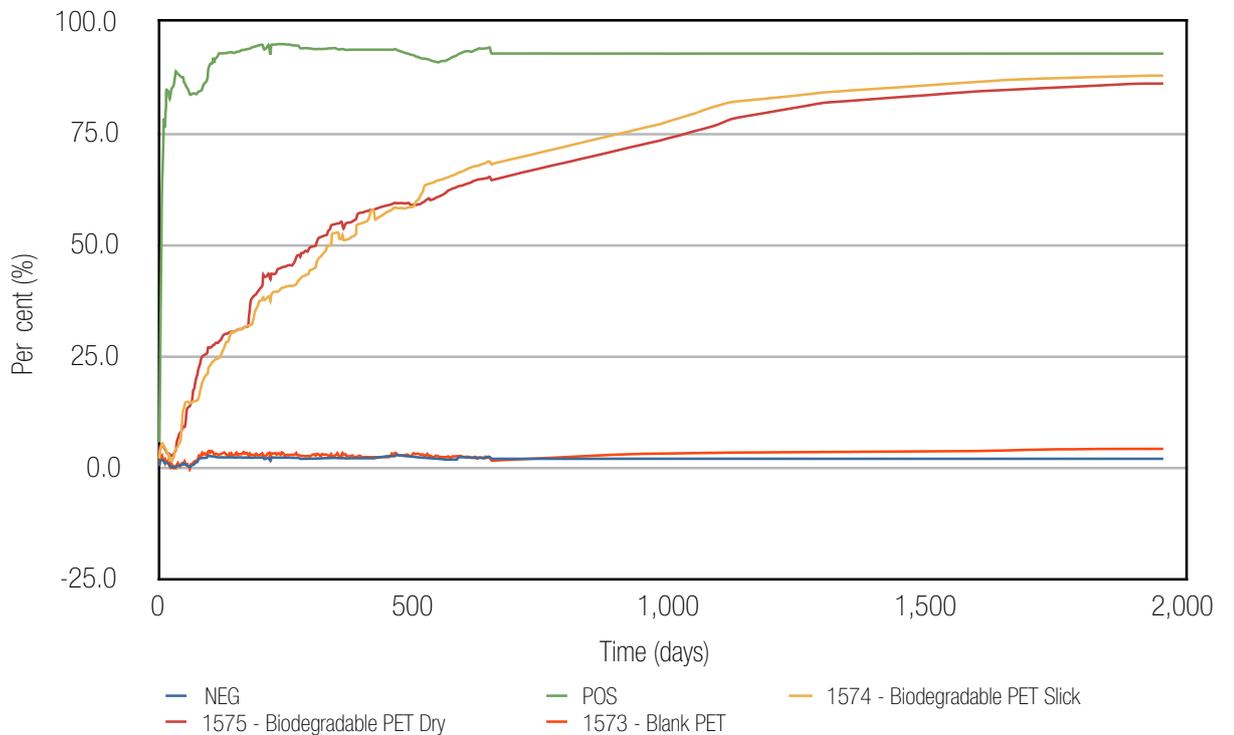
Date: January 27, 2023

Update

Regarding: Aerobic Research ASTM D6691 for Primaloft Samples in 1953 days

	Inoculum	Negative	Positive	1574 - Biodegradable PET Slick	1575 - Biodegradable PET Dry	1573 - Blank PET
Cumulative Gas Volume (mL)	26.4	30.7	92.9	133.2	131.6	33.3
Per cent CO ₂ (%)	92.9	87.7	89.3	94.6	94.2	88.1
Volume CO ₂ (mL)	24.5	27.0	83.0	126.0	124.0	29.3
Mass CO ₂ (g)	0.048	0.053	0.163	0.248	0.244	0.06
Sample Mass (g)		0.080	0.080	0.100	0.100	0
Theoretical Sample Mass (g)		0.069	0.034	0.062	0.062	0.1
Biodegraded Mass (g)	0.013	0.014	0.044	0.068	0.066	0.016
Per cent Biodegraded (%)		1.9	92.8	87.9	86.1	4.2

Biodegradation



NOTE: The above content has been provided by a third-party testing facility.

Sewage Sludge Simulation

Test method ASTM D5210

Summary: Textile apparel fibers in effluent water streams from residential washing machines and hygienic wipes containing textile fibers are frequently flushed into sewer systems that enter waste water treatment facilities. These textile fibers that enter waste water treatment facilities ultimately end up exposed in the surrounding environment. The PrimaLoft® Bio™ fiber (containing a silicone based finish) was tested according to ASTM D5210 Standard Test Method For Determining The Anaerobic Biodegradation of Plastic Materials In the Presence Of Municipal Sewage Sludge at Eden Research Laboratories in Albuquerque, New Mexico to determine the biodegradation rate of the fiber in sewage sludge typically found in wastewater treatment facilities.

Test Procedure: The test method ASTM D5210 determines the degree and rate of biodegradation of synthetic plastic materials when exposed to anaerobic-digester municipal sewage sludge from a wastewater treatment facility under laboratory conditions. The method simulates the environment of a wastewater treatment facility and is an accelerated test run at 35°C. A known positive control as well as a known negative control are included in the test parameters. The sample results are compared to the positive and negative control. The sample is exposed to an inoculum that was derived from sewage sludge from an anaerobic digester. Results are then calculated based on the production quantity of biogas (carbon dioxide and methane) given off over certain time periods.

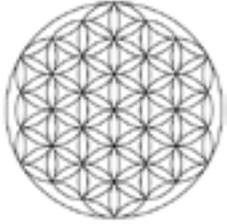
Results: After 14 days of testing according to ASTM D5210, the PrimaLoft® Bio™ fiber has biodegraded 11.5%, compared to 0.9% biodegradation of the standard recycled polyester fiber (negative control). The sample has shown a relatively consistent rate of biodegradation (biogas continues to be produced), demonstrating that it has not leveled off yet and that the sample is continuing to biodegrade.

Conclusion: PrimaLoft® Bio™ polyester has been confirmed by an independent third-party laboratory using method ASTM D5210 to biodegrade in a Municipal Wastewater Treatment facility.

ASTM D5210

Standard test method for determining the anaerobic biodegradation of plastic materials in the presence of municipal sewage sludge.





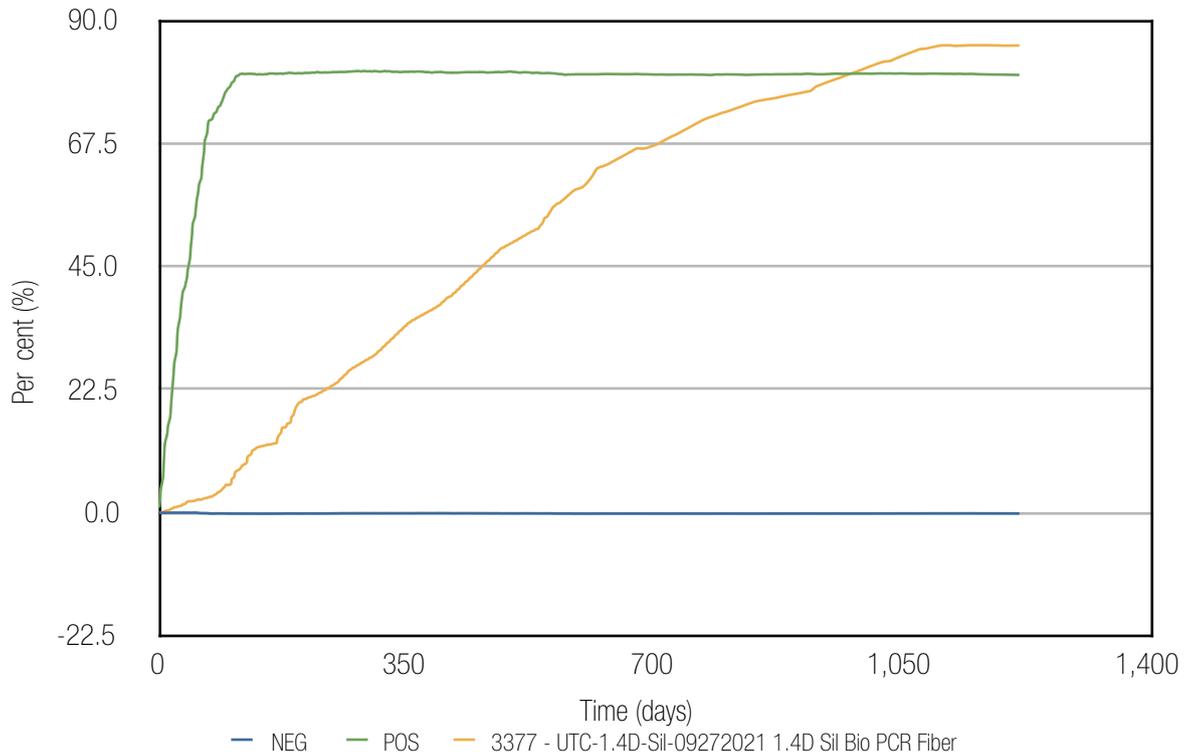
Eden Research Laboratory

Date: October 12, 2023

Regarding: ASTM D5210 Primaloft Study update (1213 days)

	Inoculum	Negative	Positive	3377 - UTC-1.4D-Sil-09272021 1.4D Sil Bio PCR Fiber
Cumulative Gas Volume (mL)	3704.9	3618.6	10719.9	25843.5
Per cent CH ₄ (%)	49.9	52.3	50.6	54.4
Volume CH ₄ (mL)	1847.2	1894.0	5420.4	14050.8
Mass CH ₄ (g)	1.32	1.35	3.87	10.04
Per cent CO ₂ (%)	37.6	36.7	38.5	35.1
Volume CO ₂ (mL)	1393.3	1327.2	4126.5	9064.7
Mass CO ₂ (g)	2.74	2.61	8.11	17.81
Sample Mass (g)	10	10	10	20.0
Theoretical Sample Mass (g)	0.0	8.6	4.2	12.5
Biodegraded Mass (g)	1.74	1.73	5.11	12.38
Per cent Biodegraded (%)		-0.1	80.1	85.5

Biodegradation



NOTE: The above content has been provided by a third-party testing facility.

Soil Simulation

Test method ASTM D5988

Summary: The degree and rate of aerobic biodegradability of a plastic material in the environment determines the extent to which and time period over which plastic materials are mineralized by soil microorganisms. Disposal is becoming a major issue with the increasing use of plastics, and the results of this test method permit an estimation of the degree of biodegradability and the time period over which plastics will remain in an aerobic soil environment. This test method determines the degree of aerobic biodegradation by measuring evolved carbon dioxide as a function of time that the plastic is exposed to soil.

This test method covers determination under laboratory conditions of the degree and rate of aerobic biodegradation of plastic materials, including formulation additives, in contact with soil. This test method is designed to measure the biodegradability of plastic materials relative to a reference material in an aerobic environment. This test method is designed to be applicable to all plastic materials that are not inhibitory to the bacteria and fungi present in soil.

Results: After 973 days of testing according to ASTM D5988, the PrimaLoft® Bio™ fiber has biodegraded 88.1%, compared to 0% biodegradation of the standard polyester fiber (negative control). The sample has shown a relatively consistent rate of biodegradation (biogas continues to be produced), demonstrating that it has not leveled off yet and that the sample is continuing to biodegrade.

Conclusion: PrimaLoft® Bio™ polyester has been confirmed by an independent third-party laboratory using method ASTM D5988 to biodegrade in contact with soil.

ASTM D5988

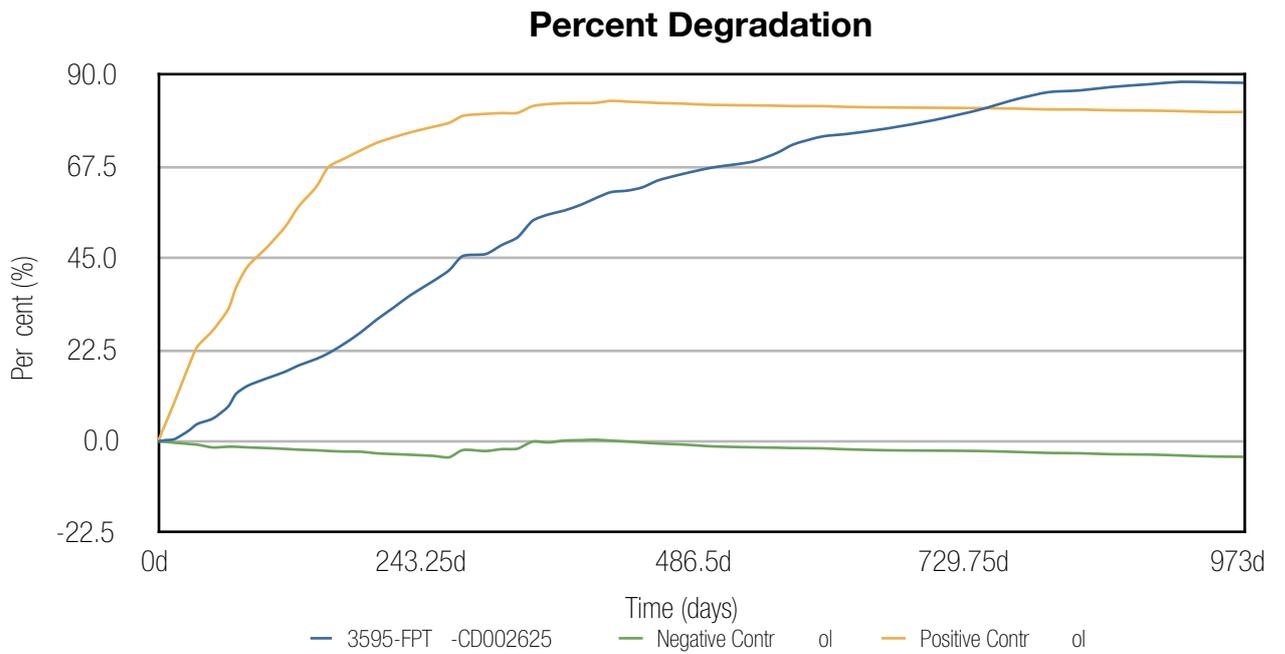
Standard test method for determining the anaerobic biodegradation of plastic materials in soil.

This ASTM test method is equivalent to ISO 17556.



Regarding: ASTM D5988 - Study Sample (973 Days)

	AVG Sample Weight (mg)	Total AVG C Recovered	Back-ground Corrected	Theoretical Carbon	% Biodegraded
Sample 3595	400.0	3,216.7	219.7	249.2	88.1
Negative Control	400.0	2,984.1	-13.0	342.8	-3.8
Positive Control	1,000.0	3,354.9	357.9	442.0	81.0
Inoculum Control	300.0	2,997.1			



NOTE: The above content has been provided by a third-party testing facility.

Pyrolysis Gas Chromatography Mass Spectrometry

Test method PYMS

Summary: PrimaLoft, Inc. tested the biodegradability of PrimaLoft® Bio™ polyester fiber according to ASTM D5511 (Determining Anaerobic Biodegradation of Plastic Materials) for 646 days at Eden Research Labs. Once the sample had achieved 93.7% biodegradation, the sample was determined to have achieved complete biodegradation. The PrimaLoft® Bio™ sample was considered spent and biodegradation testing was ceased. The spent inoculum was preserved for subsequent toxicology analysis in order to determine if there were any remaining substances of concern.

Toxicology Analysis: The chemical composition of the spent inoculum was tested according to Pyrolysis Gas Chromatography Mass Spectrometry (PYMS) at Jordi Labs located in Mansfield, MA. PYMS is a method of chemical analysis in which a sample is heated to decomposition to produce smaller molecules that are separated by gas chromatography and then detected by mass spectrometry. PYMS is an instrumental method that enables the characterization of the molecular complexes found in virtually all materials even at trace levels.

The spent inoculum as well as a blank inoculum control sample were screened by PYMS for the presence of residual PET as well as all degradation components of PET. The blank inoculum is of the same inoculum lot as the spent inoculum, was exposed to the same biodegradation testing conditions for the same period of time as the spent inoculum, but did not contain the bio fiber sample.

Results: No compounds, fragments, monomers, nor additives consistent with PET were found in the spent inoculum. Compounds consistent with the fiber finish were detected at trace levels.

Conclusion: PrimaLoft® Bio™ polyester has been confirmed by an independent third party laboratory using scientific methodology to have achieved near complete biodegradation. No substances of concern were detected. Based on the results of the chemical composition analysis, it is anticipated that a germination study should show there is no risk of soil pollution due to plastic degradation. Actual results of a germination study will be forthcoming.

PYMS

Pyrolysis Gas Chromatography Mass Spectrometry - toxicology analysis in order to determine if there were any remaining substances of concern.

September 27, 2019

Primaloft
Jon-Alan Minehardt
19 British American Blvd.
Latham, NY 12110

Phone: 518-213-4618
Email: jon.minehardt@primaloft.com

Dear Jon-Alan,

Please find enclosed the test results for your samples described as:

1. 1571 Inoculum
2. Inoculum
3. 1.4D PrimaLoft Bio

The following tests were performed:

1. Pyrolysis Gas Chromatography Mass Spectrometry (PYMS)

Objective

It was noted that biomass testing was being performed on Primaloft PET (polyethylene terephthalate) product. It was our understanding that during this testing the polymer (20 grams) was degraded to humus. It was further noted that other components present in the material pre-biodegradation are PLA, crosslinked silicone and uncrosslinked acrylic resin. *The goal of this analysis was to screen the material provided by Eden Labs for the presence of residual PET and other polymeric materials (see above).*

Summary of Results

No compound consistent with pyrolysis product of PET (polyethylene terephthalate) was found in *1571 Inoculum* at the 2% level. The bulk chemistry of *Inoculum with 50 mg Spike* is consistent with PET.

No compound consistent with pyrolysis product of PLA, crosslinked silicone (the PET solubility study suggested the solubility of this material may be very low in HFIP) and uncrosslinked acrylic resin was detected in *1571 Inoculum* and *Inoculum* extracts.

Individual Test Results

A summary of the individual test results is provided below. All accompanying data, including spectra, has been included in the data section of this report.

PYMS

Analysis by PYMS was conducted using a double shot technique. The double shot experiment consists of heating a sample to release volatiles which were then cryogenically trapped and then analyzed by GCMS. Following completion of the 1st pass analysis, the remaining portion of the sample was then heated above the decomposition temperature rapidly and pyrolyzed components were passed into a gas chromatography column and analyzed by mass spectroscopy.

Prominent peaks found in PYMS typically include fragments of the polymer as well as monomer, antioxidants and other additives. Sample peaks were compared with over 796,613 reference compounds using the NIST/EPA/NIH mass spectral search program.

PET Solubility Study

Dissolution of the PET standard was attempted in HFIP to confirm which species were expected to extract.

45.076 mg of *1.4D PrimaLoft Bio* was added to 5 mL of HFIP (hexafluoroisopropanol) and subjected to gentle agitation overnight. Insoluble material was noted, and 50 μ L of the supernatant was transferred to a clean PYMS cup prior to analysis (referred to as *dissolved 1.4D PrimaLoft Bio*). Approximately 0.5 mg of *1.4D PrimaLoft Bio* (referred to as *solid 1.4D PrimaLoft Bio*) was also weighed in a flame-cleaned PYMS cup and analyzed without further preparation.

The 1st heat (thermal desorption) and 2nd heat (pyrolysis) chromatograms of the *solid 1.4D PrimaLoft Bio* and *dissolved 1.4D PrimaLoft Bio* are presented in **Figure 1** and **Figure 2**, respectively. The chromatograms of *solid 1.4D PrimaLoft Bio* and *dissolved 1.4D PrimaLoft Bio* are consistent. The major components of them are also consistent. Database matches are provided in the data section of this report.

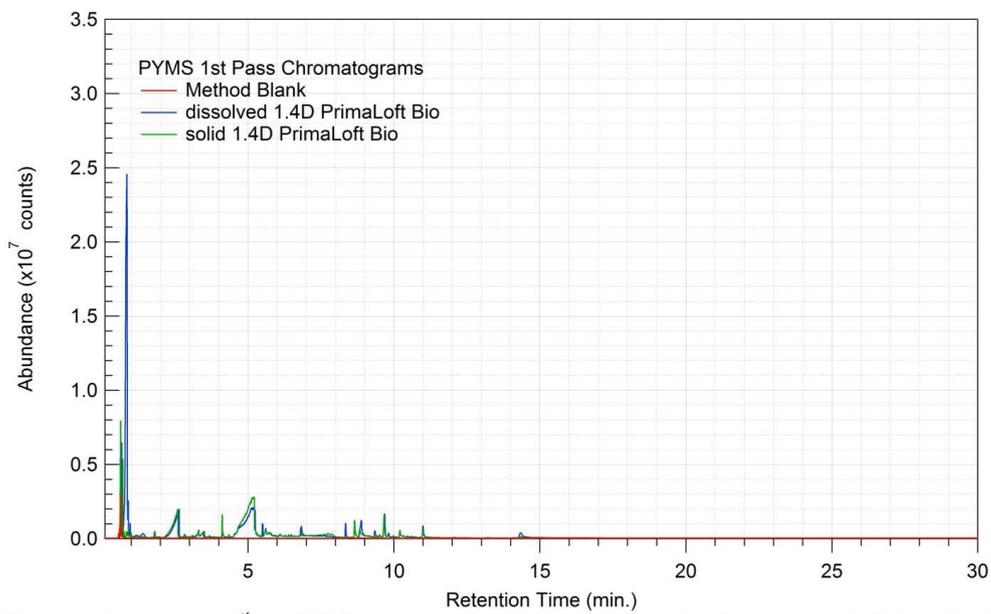


Figure 1. Overlay of the 1st heat PYMS chromatograms of *solid 1.4D PrimaLoft Bio*, *dissolved 1.4D PrimaLoft Bio* and method blank

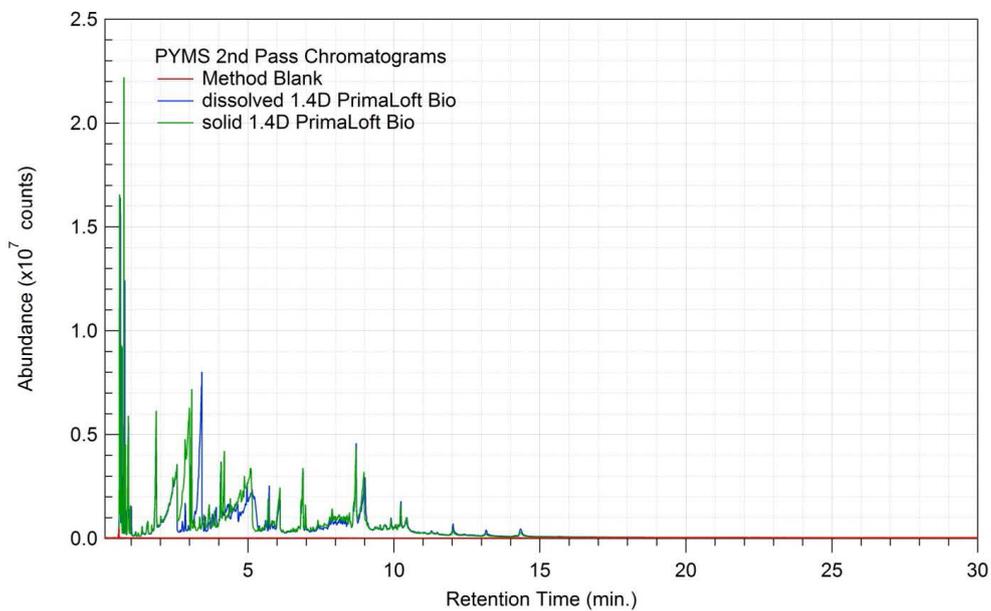


Figure 2. Overlay of the 2nd heat PYMS chromatograms of *solid 1.4D PrimaLoft Bio* and *dissolved 1.4D PrimaLoft Bio* and method blank

Sample Preparation

1571 Inoculum and *Inoculum* were analyzed via PYMS to probe for residual PET.

Approximately 2500 mg of *1571 Inoculum* was extracted with 5 mL of HFIP for an hour at room temperature. For *Inoculum*, 50.352 mg of *1.4D PrimaLoft Bio* was added to approximately 2500 mg of *Inoculum* (resulting in a 2% spike), and was extracted with 5 mL of HFIP for an hour at room temperature. The extract was referred to as *Inoculum with 50 mg Spike*. 100 μ L of each extract was placed into a flame-cleaned PYMS cup and dried at room temperature. The sample was analyzed without further preparation. The same HFIP was also brought through the same process to prepare a method blank.

Results

No compounds consistent with pyrolysis products of PET were found in *1571 Inoculum* at the 2% level.

The bulk chemistry of the *Inoculum with 50 mg Spike* is consistent with PET.

The 1st heat (thermal desorption) and 2nd heat (pyrolysis) chromatograms with highlighted desorption and pyrolysis products are presented in **Figure 3** and **Figure 4** respectively. The best database matches for the major peaks detected in the chromatograms are compiled in **Table 1**.

The compounds consistent with a fatty amide (9.34 min) and a fatty nitrile (8.34 min) are likely related (nitriles are pyrolysis products of amides) and fatty amides are commonly used slip agents.

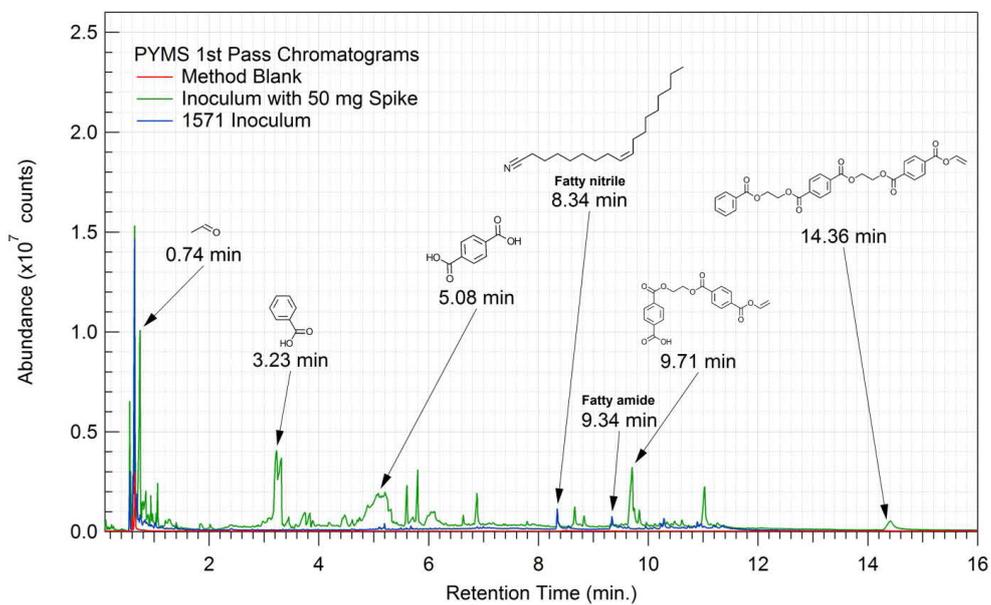


Figure 3. Overlay of the 1st heat PYMS chromatograms of *Inoculum with 50 mg Spike*, *1571 Inoculum* and method blank

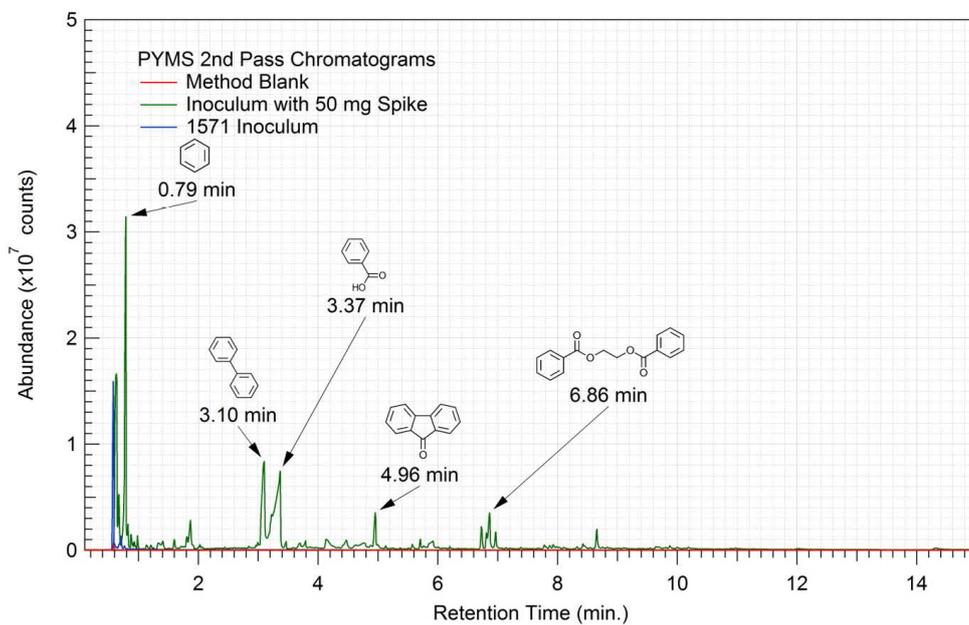
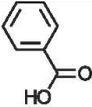
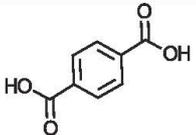
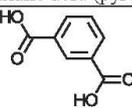
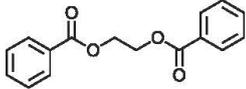
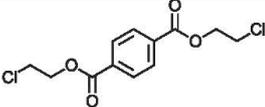
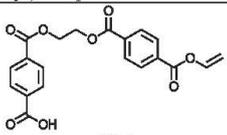
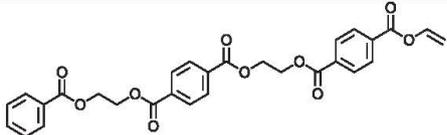


Figure 4. Overlay of the 2nd heat PYMS chromatograms of *Inoculum with 50 mg Spike*, *1571 Inoculum* and method blank

Table 1. Identification of PET related species detected by PYMS*				
CAS #	Probable ID	Comment/Common Source	Detected in Sample	
			1571 Inoculum	Inoculum with 50 mg Spike
0.744	 Acetaldehyde (pyrolyzate)	PET	N.D.	X
3.227	 Benzoic acid (pyrolyzate)	PET	N.D.	X
5.083	 Terephthalic acid (pyrolyzate)	PET	N.D.	X
6.102	 Isophthalic acid (pyrolyzate)	PET	N.D.	X
6.864	 Ethylene Glycol Dibenzoate (pyrolyzate)	PET	N.D.	X
6.879	 Di(2-chloroethyl) terephthalic acid ester (pyrolyzate)	PET	N.D.	X
9.709	 <i>p</i> -{2-[<i>p</i> -(Vinylloxycarbonyl)benzoyloxy]ethoxycarbonyl}benzoic acid (pyrolyzate)	PET	N.D.	X
11.029	Phthalate (m/z 76, 104, 149, 208, 296, 341, 385) (pyrolyzate)	PET	N.D.	X
14.402	 PET Oligomer (pyrolyzate)	PET	N.D.	X

X-Detected
N.D.-Not Detected

*Only PET related species have been reported. If other species detected are of interest then please contact your Jordi Labs representative for a revised report.

Analysis Conditions

PYMS

Sample was analyzed using a Agilent 6890 gas chromatograph in conjunction with a 5975B mass selective detector using a Frontier Laboratories double shot Pyrolyzer model PY3030D. Data acquisition was accomplished using MassHunter software. Sample peaks were compared with over 796,613 reference compounds using the NIST/EPA/NIH mass spectral search program.

The following run conditions were applied for gas chromatographic analysis:

Sample Size: Please see *Sample Preparation* section
Initial Delay: 0.5 minutes
Initial Temperature: 50 °C
Final Temperature: 350 °C
Temperature Ramp Rate: 20 °C per minute
Hold Time: 15 minutes
Pyrolysis Temperature: 1st pass =100-400 °C, 2nd pass = 700 °C
Detector Temperature: 315 °C
Injector Split: 80:1
Mass Range: Low Mass = 29 High Mass = 700
Column: Ultra Alloy –PBDE

Closing Comments

Jordi Labs' reports are issued solely for the use of the clients to whom they are addressed. No quotations from reports or use of the Jordi name is permitted except as authorized in writing. The liability of Jordi Labs with respect to the services rendered shall be limited to the amount of consideration paid for such services and do not include any consequential damages.

Jordi Labs specializes in polymer analysis and has more than 35 years' experience performing regulatory, quality control and failure testing. We are one of the few labs in the United States specialized in this type of testing. We will work closely with you to help explain your test results and complete your project goals. We appreciate your business and are looking forward to speaking with you concerning these results.

Sincerely,

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Terrestrial Plant Toxicity

Test method ASTM E1963

Summary: PrimaLoft, Inc. analyzed spent inoculum containing biodegraded PrimaLoft® Bio™ polyester fiber to determine if there was an environmental risk of soil pollution related to plastic biodegradation. The PrimaLoft® Bio™ fiber was biodegraded according to ASTM D5511 (Determining Anaerobic Biodegradation of Plastic Materials) for 646 days at Eden Research Labs, and the sample was determined to have achieved complete biodegradation once it reached 93.7% conversion into biogas. The spent inoculum sample was then tested according to ASTM E1963 (Standard Guide for Conducting Terrestrial Plant Toxicity Tests) to determine if there was any effect on germination and early plant growth.

Germination Study: The germination study analyzed the plant growth of three different seed varieties Bean, Corn, Pea planted in a general soil mixture combined with inoculum. The inoculum was combined with general soil at a mixture of 3 parts general soil and 2 parts inoculum. The study investigated plant growth in a general soil mixture with spent inoculum compared to a general soil mixture with the blank inoculum. The blank inoculum having not been exposed to PrimaLoft® Bio™ fiber. The study also included general soil contaminated with boric acid to represent a control with known inhibited plant growth to demonstrate adverse conditions.

Soil/Inoculum Mixture (3 parts general soil : 2 parts inoculum)

- Adverse Sample – General soil with boric acid added
- Blank Inoculum – 3 parts general soil : 2 parts blank inoculum
- Spent Inoculum – 3 parts general soil : 2 parts spent inoculum

The test is then measured as a percentage by how many seeds grew into plants, the epicotyl length (stalk of the plant above the seed leaves or cotyledons) and the hypocotyl length (stalk of the plant below the seed leaves or cotyledons and the roots) (Figure 1.). The test also measures the average weight of the plants that grew in each of the samples.

Terrestrial Plant Toxicity

ASTM E1963 (Standard Guide for Conducting Terrestrial Plant Toxicity Tests) to determine if there was any effect on germination and early plant growth.



Terrestrial Plant Toxicity

Test method ASTM E1963

Results: The growth and measurements of the plants showed that the boric acid did in fact hinder germination as well as the general quality of the plants that grew. The plants that grew in the blank inoculum mixed with general soil compared to the plants that grew in the spent inoculum that contained the biodegraded PrimaLoft® Bio™ fiber showed to be comparable to the blank inoculum in regards to the germination rate and general quality of plants. Also, if you compare the hypocotyl lengths and the epicotyl lengths, the adverse control sample showed lower growth compared to the blank inoculum and the spent inoculum. Lastly, the plant weights are also higher in the blank inoculum and the spent inoculum then the adverse control. When comparing the inoculum and sample the weights, and hypocotyl and epicotyl lengths are all similar.

Conclusion: PrimaLoft® Bio™ polyester has been confirmed by an independent third-party laboratory using method ASTM E1963, that there is no environmental risk of soil pollution associated with PrimaLoft biodegraded polyester fibers. The spent inoculum demonstrated no toxic pollution that would hinder plant growth.

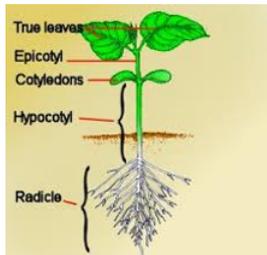


Figure 1. Source: Google Images

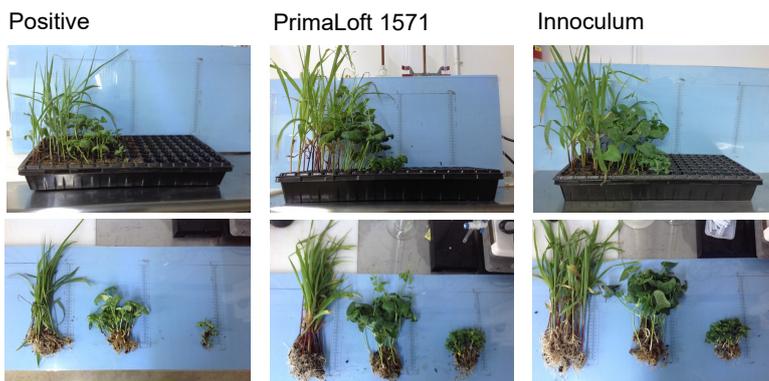
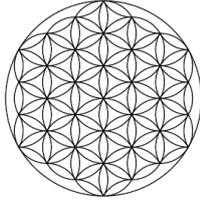


Figure 2

Terrestrial Plant Toxicity

ASTM E1963 (Standard Guide for Conducting Terrestrial Plant Toxicity Tests) to determine if there was any effect on germination and early plant growth.





Eden Research Laboratory

ASTM E1963 - Conducting Terrestrial Plant Toxicity Tests - 0828191014A

To: Primaloft

Report Number: 0828191014A

Date: August 28, 2019

Report

From: Eden Research Laboratory

Regarding: 15 days test of Primaloft Sample ERL# 1571

RESULTS

Following 20 months of biodegradation as per ASTM D5511, no retardation or mutations are apparent using the residual inoculum of exposed Primaloft Sample 1571 when compared to the inoculum alone.

METHOD

ASTM method E1963 measures the effect of substances on plant growth. The method details several measurements to determine the toxicity of test substances. Depending on the nature of the test substance the method allows for mixing of the test substance directly into the seedling mix or extraction of the substance and addition of this to the mix. The test stipulates that testing be done under controlled illumination and consistent temperature and humidity.

Evaluation of seedling emergence, epicotyl and hypocotyl length as well as epicotyl weight. Among the many species mentioned in the method bean, corn and pea give very good results. Boron positive control is employed to compare results from run to run.

Seeds are screened in advance to achieve a uniform size, then stored in a cool, dry place. Seeds are then planted, 2-4 per cell, depending on size to a depth of 1.5 to 2 times the seed diameter in a mixture of potting soil and perlite. The test is run in duplicate with from 5 to 20 seeds per duplicate. Flats are then placed under fluorescent lights with an illumination of 100-200 $\mu\text{M m}^{-1} \text{s}^{-1}$ for 12 to 16 hours per day. Two weeks later growth is terminated and data is collected. Temperature and humidity are kept within narrow limits and monitored constantly.

DATA

Four seed groupings are germinated. They are as follows:

GROUPING	DESCRIPTION
POSITIVE CONTROL	General Soil & 20mM Boric Acid
SAMPLE	3 Parts General Soil & 2 Parts Primaloft Sample 1571 Exposed Inoculum
INOCULUM	3 Parts General Soil & 2 Parts Inoculum

POSITIVE (in cm and g)

BEAN													
EP													
LENGTH	11.0	13.0	13.5	10.5	6.0	6.5	16.5	7.5	11.0	10.0	8.0	12.5	8.5
HY													
LENGTH	16.0	18.0	18.0	16.0	11.0	11.5	22.5	12.5	16.0	17.5	13.0	20.0	15.0
EP													
WEIGHT	0.9	1.1	1.1	1.2	0.7	0.8	1.0	1.4	1.9	0.9	0.8	1.0	0.9
CORN													
EP													
LENGTH	26.0	24.0	25.0	15.0	32.5	13.0	32.5	26.0	32.5	25.0	27.0	20.5	23.0

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