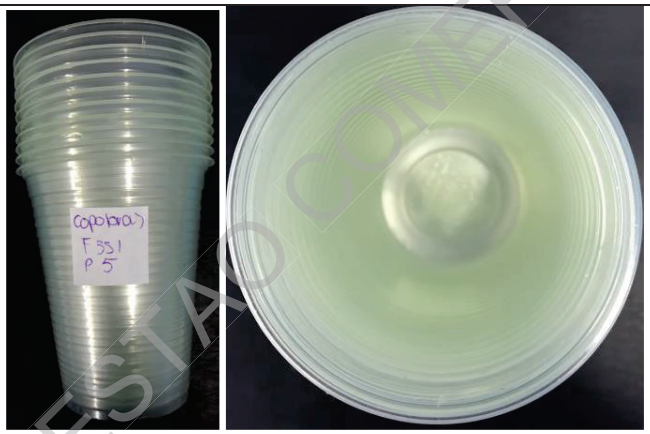
TEST REPORT

General information

Date: November 5, 2018

Number of report: Q-161018F351-2
Client: Copobras
Address: Brazil.
Analysis period: 16-10-2018/02-11-2018
Test Description: Determine the endpoint of degradation

I.- Sample Description:



M1. Disposal Cup SMC 100P – with Plife 1% Green Pigment Base PP

II.- Identification of the Method:

LAB-M001 "Standard practice for fluorescent ultraviolet exposure of photodegradable plastics" ASTM D5208–14. LAB-M002 "Standard practice ford determining degradation end point in degradable polyethylene and polypropylene using a tensile test" ASTM D3826–98 (2013).

III.- Laboratory Equipment:

a) Accelerated weathering tester "QUV"
Cycle C. Continues cycle of UV at 50°C. Irradiation de 0.89 W/(m^2 · nm) a 340 nm**.**

b) Universal Testing Machine "TESTER 1"
Grip for Stress Testing in plastic films 2 / in. Speed:300 mm/min.

IV.- Process:

The preparation of the test pieces is carried out as established in the instructions LAB-I002.

Dimensions of the test piece

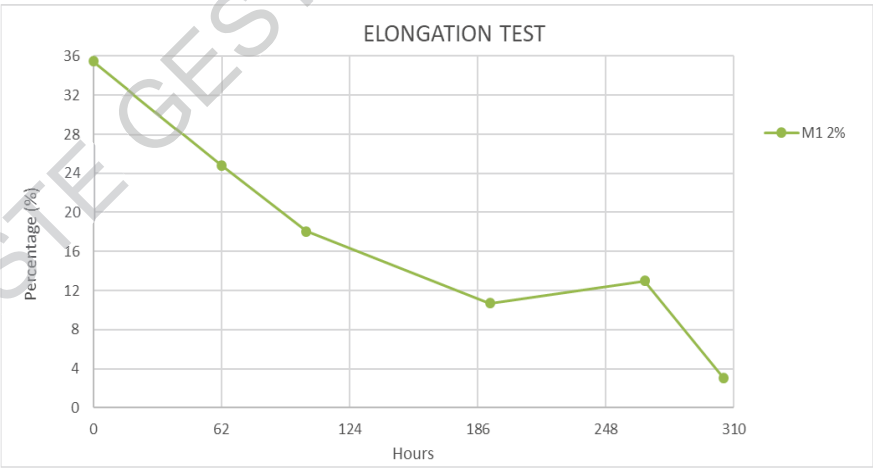
Width: 26 mm

Length: 106 mm

V.- Results:

In the following table are shown the values obtained during the evaluation of the elongation for each sample. Importantly, these results are specifically for these samples.

Table 1.- ELONGATION PERCENT (%)	
HOURS OF EXPOSITION	M1
0	35.45
62	24.82
103	18.05
192	10.70
267	12.97
305	3.05
Temperature	Humidity
23 °C	32%



Note:

1. *The separation between the grips at the start of the tests was 4 cm in each specimen.*
2. *In this test, 4 specimens were evaluated to determine their end point of degradation and more than 75% recorded less than 5% elongation, the average value is recorded in table 1.*

VI.- Conclusiones:

M1. Disposal Cup

After exposing the sample to the accelerated aging process, the change in mechanical and physical properties were also clearly observed.

It is considered that the period of useful life ends by losing more than 50% of the initial elongation, that took place after 192 hours of exposure. Therefore, it is determined a ***shelf life of 1 year and 8 months*** under 30°C warehouse environment.

Based on the ASTM D3826-98 standard, it is considered that the sample has reached its degradation when 75% or more of the samples recorded an elongation less than 5%, which happened after 305 hours, therefore we concluded that this sample has a ***degradation time of 2 years and 8 months.*** The disposal cup final molar mass after 305 hours is below than 5000 mols according to the SP Institute report.

Realizó
Ing. Karla Angelica Ventura Ramos
Ingeniero de Calidad

Aprobó
Ing. Martha Castillo Cruz
Directora de Operaciones

-Fin del Informe-

ANEX 1.-*SAMPLE DURING THE ELONGATION TEST.*

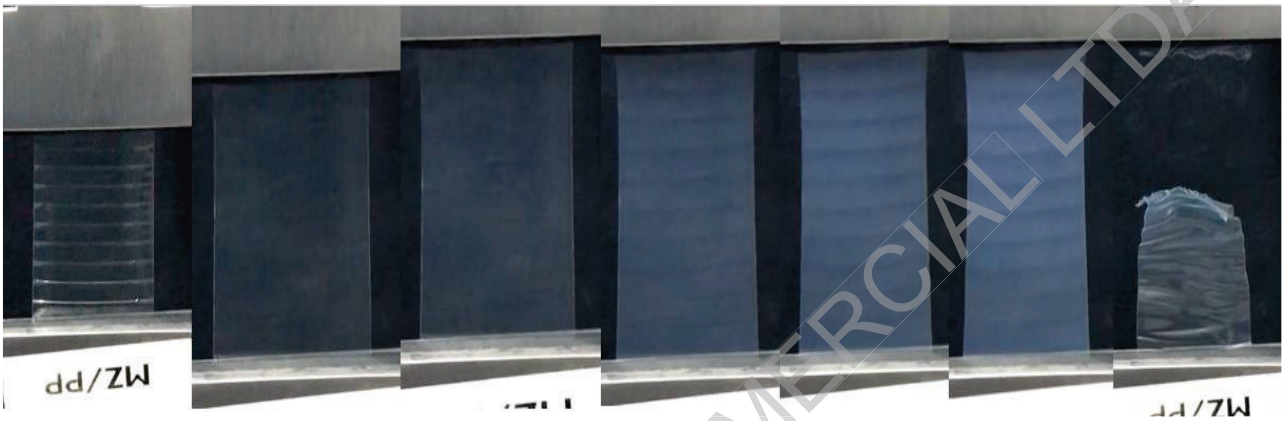


Image 1.-*Initial elongation test for the sample.*

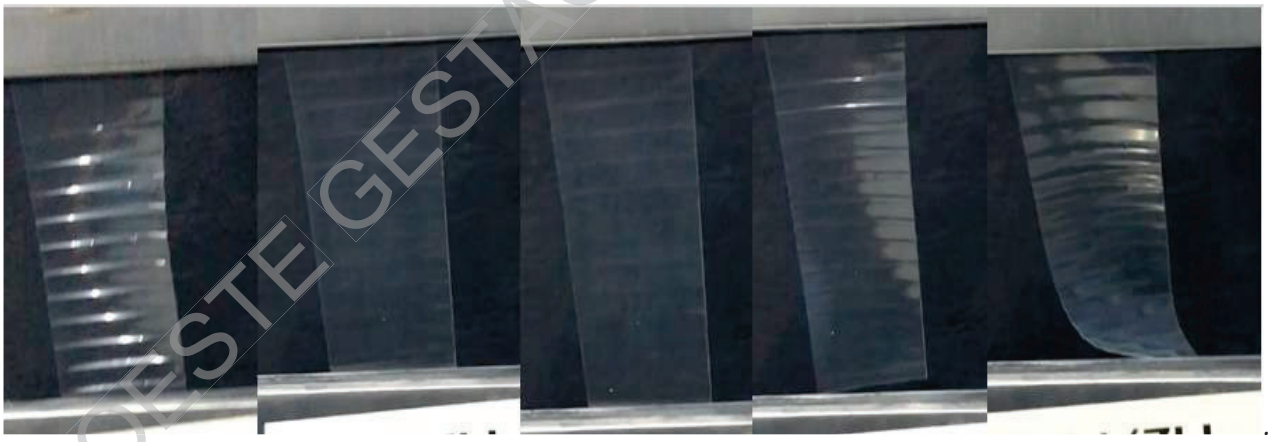


Image 2.-*Sample at 62 hours of exposition.*

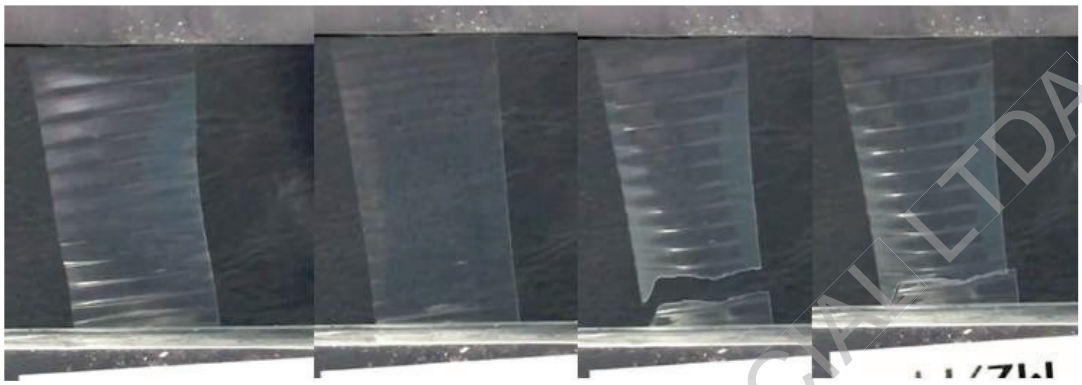


***Image 3.**-Sample at 192 hours of exposition.*

***Image 4.**-Final state of the sample at 305 hours of exposition.*

TEST REPORT

Job Number :	Project 10004971	**Date :**	31-12-18
Sample Description :	LDPE (50% Recycle +50% Virgin) with 0.2% P-life	**Page**	1 of 4
Sample Source :	Hong Kong Oxo-biodegradable Plastics Association Limited Unit F, 4/F, Southtex Building, 51 Tsun Yip Street, Kwun Tong, Kowloon, Hong Kong		
Sampling Done by :	The above company		
Receipt Date :	03-08-17		
Test Performing Date :	03-08-17 to 31-12-18		
Nature of Test :	Determining Anaerobic Biodegradation of Samples Under High-Solids Anaerobic-Digestion Conditions (In-house method with reference to ASTM D5511)		

Test Results :

I. Sample Description

Sample were submitted by the client. The sample information was supplied by the client and shown as follows:

Sample ID	Sample Description
1	LDPE (50% Recycle +50% Virgin) with 0.2% P-life

II. Objectives:

To determinate the anaerobic biodegradability of sample and reference materials under controlled composting conditions by measurement of the total amount of carbon dioxide and methane evolved.

III. Methods:

Determining Anaerobic Biodegradation of Plastic Materials Under High-Solids Anaerobic-Digestion Conditions (In-house method with reference to ASTM D5511)

IV. Instrumentation

ECHO respirometer

V. Reference Material

Cellulose, microcrystalline powder of 20 micron

For Enquiry Tel 查詢電話 : 27885076 / 27885505
Material Testing Laboratory, 5/F HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong.
香港九龍達之路 78 號生產力大樓材料測試實驗室 Tel:2788 5076 , Fax: 2788 5522

Job Number :	Project 10004971	**Date :**	31-12-18
Sample Description :	LDPE (50% Recycle +50% Virgin) with 0.2% P-life	**Page**	2 of 4
Sample Source :	Hong Kong Oxo-biodegradable Plastics Association Limited Unit F, 4/F, Southtex Building, 51 Tsun Yip Street, Kwun Tong, Kowloon, Hong Kong		
Sampling Done by :	The above company		
Receipt Date :	03-08-17		
Test Performing Date :	03-08-17 to 31-12-18		
Nature of Test :	Determining Anaerobic Biodegradation of Samples Under High-Solids Anaerobic-Digestion Conditions (In-house method with reference to ASTM D5511)		

Test Results :

VI. Soil and Sample Information

1. The information of the inoculum

Parameters	Reading
Volatile solids	17%
pH	8.3
Dry solid	45%

2. The amount of material in each testing vessel

Vessel	Weight of Inoculum (g)	Weight of sample (g)
Blank	180	0
Cellulose (Reference)	180	16
LDPE	180	8

VII. Results:

1. The basic information of the sample

Sample	Dry solids (%)	Total organic carbon (TOC) of dry solids (g/g)	Theoretical total gaseous carbon (CO_2 + CH_4) produced (g)
Cellulose	97.8	0.410	6.41
LDPE	99.9	0.623	4.98

For Enquiry Tel 查詢電話 : 27665073 / 27665522
Materials Testing Laboratory, 5/F HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong.
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TEST REPORT

Job Number :	Project 10004971	**Date :**	31-12-18
Sample Description :	LDPE (50% Recycle +50% Virgin) with 0.2% P-life	**Page**	3 of 4
Sample Source :	Hong Kong Oxo-biodegradable Plastics Association Limited Unit F, 4/F, Southtex Building, 51 Tsun Yip Street, Kwun Tong, Kowloon, Hong Kong		
Sampling Done by :	The above company		
Receipt Date :	03-08-17		
Test Performing Date :	03-08-17 to 31-12-18		
Nature of Test :	Determining Anaerobic Biodegradation of Samples Under High-Solids Anaerobic-Digestion Conditions (In-house method with reference to ASTM D5511)		

Test Results :

2. The testing condition of the Incubation period

Chamber temperature (°C)	Air flow (ml/min)	Incubation period (day)
52±2	50	120

3. The results of the percentage biodegradation
   The total gas evolved and the degree of biodegradation of each vessel were listed in Table 1 in annex A.

Sample	Degree of biodegradation (%)
Cellulose (Reference)	73.6
LDPE	30.3

4. The average value of the degree of biodegradation of the sample was 30.3% after 120 days incubation.

5. The relative biodegradation rate of the sample with reference to the biodegrading rate of the reference material (cellulose) is 41.2% for 120 days incubation.

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TEST REPORT

Job Number :	Project 10004971	**Date :**	31-12-18
Sample Description :	LDPE (50% Recycle +50% Virgin) with 0.2% P-life	**Page**	4 of 4
Sample Source :	Hong Kong Oxo-biodegradable Plastics Association Limited Unit F, 4/F, Southtex Building, 51 Tsun Yip Street, Kwun Tong, Kowloon, Hong Kong		
Sampling Done by :	The above company		
Receipt Date :	03-08-17		
Test Performing Date :	03-08-17 to 31-12-18		
Nature of Test :	Determining Anaerobic Biodegradation of Samples Under High-Solids Anaerobic-Digestion Conditions (In-house method with reference to ASTM D5511)		

Test Results :

VIII. Conclusion:

a. After 120 days of the biodegradable test, the degree of biodegradation of the sample is 30.3%.

b. After 120 days of the biodegradable test, the relative biodegradation rate of the sample to the reference materials (cellulose) is 41.2%.

Mr. CHU Ka-lap
Assistant Engineering Officer,
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Dr. LAM Chi-chung
B.Sc., Ph.D., C.Chem, MRSC
Principal Consultant,
Food & Materials Technology

-End of Report-

For Enquiry Tel 查詢電話：27665075 / 27665503
Material Testing Laboratory, 5/F HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong.
香港九龍達之路78號生產力大樓材料測試實驗室。 Tel:(852) 5076 Fax: 2799 5501

1. The data and the graph for the total gas produced (in term of Carbon (g))

Day	Cellulose (reference)	LDPE
0	0	0
1	140.9	119.66
2	718.81	167.99
3	1110.74	219.8
4	1503.14	257.85
5	1373.88	302.85
6	1570.28	332.58
7	1812.16	Data checking
8	1984.63	
9	2008.64	
10	2052	
11	2087.18	
12	2115.89	743.46
13	2136.75	785.37
14	Data checking	816.76
15		859.02
16		874.91
17		913.02
18		962.32
19	2367.53	992.39
20	2466.86	1018.02
21	2564.05	1042.7
22	2706.55	1059.61
23	2799.68	1071.48
24	2983.16	1090.09
25	3332.86	1111.84
26	3569.11	1123.7
27	3771.82	1136.73
28	3944.59	1149.07
29	4130.8	1161.82
30	4238.8	1168.64

Day	Cellulose (reference)	LDPE
31	4389.07	1176.82
32	4630.36	1190.73
33	4739.05	1200.27
34	4885.16	1209.27
35	5027.93	1218.55
36	5152.09	1227
37	5224.16	1230
38	5319.14	1238.18
39	5470.98	1248.27
40	5570.66	1255.36
41	5664.14	1258.36
42	5750.52	1268.45
43	5831.11	1272.55
44	5861.11	1279.09
45	5931.2	1284.27
46	6013.09	1290
47	6070.57	1298.73
48	6091.09	1304.18
49	6159.14	1309.64
50	6182.45	1315.09
51	6220.23	1318.36
52	6253.23	1322.18
53	6277.7	1328.73
54	6318.14	1333.36
55	6341.18	1337.73
56	6363.41	1340.18
57	6384.27	1343.73
58	6394.98	1347.82
59	6410.93	1351.91
60	6436.36	1357.36
61	6454.5	1362.2

Day	Cellulose (reference)	LDPE
62	6469.09	1365.48
63	6478.09	1369.3
64	6489.48	1371.2
65	6506.52	1374.75
66	6521.18	1377.48
67	6540.95	1380.75
68	6550.5	1384.02
69	6564.89	1387.57
70	6573.89	1390.3
71	6580.7	1393.57
72	6591.89	1396.3
73	6602.52	1399.57
74	6611.45	1400.32
75	6621.55	1407.14
76	6631.09	1410.95
77	6639	1413.14
78	6648.27	1415.59
79	6657.55	Data checking
80	6664.09	
81	6673.02	
82	6681.75	1424.05
83	6689.93	1425.41
84	6696.75	1428.95
85	6700.57	1431.41
86	Data checking	1433.59
87		1435.5
88		1439.86
89	6717.48	1441.77
90	6721.3	1443.41
91	6724.3	1445.59
92	6728.39	1447.77

Day	Cellulose (reference)	LDPE
93	6731.66	1450.5
94	6746.73	1452.68
95	6752.73	1455.68
96	6756.55	1457.59
97	6759.82	1459.5
98	6763.09	1463.59
99	6768.55	1463.93
100	6771.55	1466.66
101	6775.09	1468.57
102	6779.73	1471.57
103	6782.73	1474.57
104	6787.36	1476
105	6792	1478.73
106	6793.64	1480.53
107	6797.73	1483.35
108	6800.45	1485.67
109	6804.82	1488.52
110	6810	1491.03
111	6814.91	1493.6
112	6817.28	1495.69
113	6820.28	1497.7
114	6824.42	1499.51
115	6827.41	1501.49
116	6831.95	1502.87
117	6834.78	1504.64
118	6838.86	1506.55
119	6842.3	1507.91
120	6845.11	1509.55

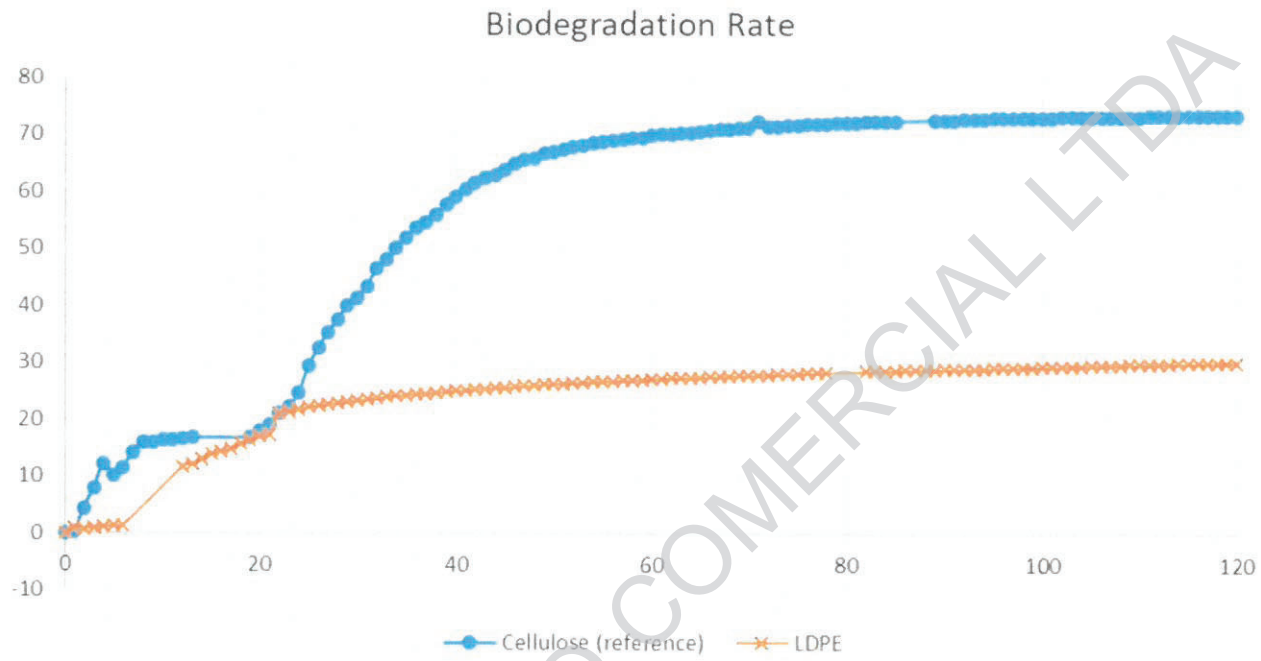
2. The data and the graph for the biodegradation rate of the cellulose and the LDPE

Day	Cellulose (reference) (%)	LDPE (%)
0	0	0
1	0.34	0.97
2	4.43	0.78
3	7.87	1.02
4	12.11	1.14
5	10.08	1.34
6	11.61	1.49
7	14.23	Data checking
8	15.93	
9	16.1	
10	16.41	
11	16.59	
12	16.71	11.82
13	16.84	12.25
14	Data checking	13.04
15		13.93
16		14.41
17		14.98
18		15.81
19	16.9	16.44
20	18.03	17.13
21	19.23	17.47
22	21.11	21.26
23	22.41	21.5
24	24.85	21.87
25	29.54	22.31
26	32.64	22.54
27	35.38	22.8
28	37.59	23.05
29	40.03	23.31
30	41.51	23.44

Day	Cellulose (reference) (%)	LDPE (%)
31	43.52	23.61
32	46.69	23.89
33	48.17	24.08
34	50.1	24.26
35	52.04	24.45
36	53.71	24.62
37	54.68	24.68
38	55.96	24.84
39	57.88	25.04
40	59.22	25.18
41	60.45	25.24
42	61.56	25.45
43	62.59	25.53
44	62.98	25.66
45	63.87	25.76
46	64.91	25.88
47	65.61	26.05
48	65.86	26.16
49	66.7	26.27
50	66.99	26.38
51	67.45	26.45
52	67.85	26.53
53	68.13	26.66
54	68.58	26.75
55	68.86	26.84
56	69.09	26.89
57	69.29	26.96
58	69.42	27.04
59	69.6	27.12
60	69.88	27.23
61	70.07	27.33

Day	Cellulose (reference) (%)	LDPE (%)
62	70.22	27.39
63	70.32	27.47
64	70.43	27.51
65	70.65	27.58
66	70.81	27.63
67	71.01	27.7
68	71.09	27.77
69	71.23	27.84
70	71.32	27.89
71	72.47	27.96
72	71.49	28.01
73	71.58	28.08
74	71.67	28.09
75	71.78	28.23
76	71.88	28.31
77	71.96	28.35
78	72.04	28.4
79	72.13	Data checking
80	72.2	
81	72.27	
82	72.35	28.57
83	72.43	28.6
84	72.49	28.67
85	72.53	28.72
86	Data checking	28.76
87		28.8
88		28.89
89	72.69	28.92
90	72.72	28.96
91	72.72	29
92	72.76	29.04
93	72.79	29.1
94	72.95	29.14

Day	Cellulose (reference) (%)	LDPE (%)
95	73.02	29.2
96	73.06	29.24
97	73.09	29.28
98	73.1	29.36
99	73.11	29.37
100	73.14	29.42
101	73.17	29.46
102	73.23	29.52
103	73.27	29.58
104	73.31	29.61
105	73.32	29.67
106	73.34	29.7
107	73.37	29.76
108	73.38	29.81
109	73.39	29.86
110	73.42	29.91
111	73.47	29.96
112	73.49	30.01
113	73.49	30.05
114	73.53	30.08
115	73.54	30.12
116	73.57	30.15
117	73.57	30.19
118	73.6	30.22
119	73.6	30.25
120	73.62	30.28



PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Plásticos y Derivados Country, S. de R.L. de C.V.

Calle San Miguel # 243 San Juan de Ocotán,
Zapopan, Jalisco, México C.P. 45019

(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:

ISO/IEC 17025:2017

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system
(as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

Mechanical and Chemical Testing
(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
May 5, 2018	April 13, 2022	June 30, 2024

Accreditation No.:	*Certificate No.:*
99219	L22-278

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

Plásticos y Derivados Country, S. de R.L. de C.V.
Calle San Miguel # 243 San Juan de Ocotán
Zapopan, Jalisco, México C.P. 45019
Contact Name: Martha Castillo Cruz Phone: 331-256-0620

Accreditation is granted to the facility to perform the following testing:

FIELD OF TEST	ITEMS, MATERIALS OR PRODUCTS TESTED	SPECIFIC TESTS OR PROPERTIES MEASURED	SPECIFICATION, STANDARD METHOD OR TECHNIQUE USED	RANGE (WHERE APPROPRIATE) AND DETECTION LIMIT
Mechanical[F]	Plastic Film	Determining Degradation end Point (Elongation)	ASTM D3826 Universal Machine	1 % to 750 %
	Thermoplastics	Melt Flow Rates	ASTM D1238	0.15 g/10 min to 50 g/10 min
Chemical[F]	Plastic Film	Fluorescent Ultraviolet (UV) Exposure	ASTM D5208	Visual

1. The presence of a superscript F means that the laboratory performs testing of the indicated parameter at its fixed location. Example: Outside Micrometer[F] would mean that the laboratory performs this testing at its fixed location.