



# Certyfikat

## BIODEGRADOWALNOŚCI

/ certificate of biodegradability

w oparciu o raport nr 2016C0098

**Standard: ASTM D5338-92** /based on report no.

Nazwa próbki: biodegradowalna folia

(B4025GMX, B4033GMX, B2010GMX, B2012GMX, B2015GMX, B2020GMX)

Ilość próbek: 750g /quantity of samples

/sample name

Opis próbki: próbka to biała półprzezroczysta folia /description of sample

Materiał referencyjny: Celuloza /reference material

Sporządzono: 17 lut/feb 2016 /date of report

No.	Item(s) Tested	Requirement(s)	Test Result(s)	Conclusion
01	The final degree of biodegradation after 180 days, % (the biodegradation procedure and curve, were given in annex) (No text below this column)	$\geq 15$	39.9	Passed

Sample: Biodegradable filmReference material: CelluloseAge of compost: 3 MonthsVolume of test vessels: 3LMethod of CO<sub>2</sub> determination: The CO<sub>2</sub> in the exhaust air was measured directly with a continuous infrared analyser.

Result of the test

	45d degree of biodegradation %	180d final degree of biodegradation %
Sample	22.8	39.9
Reference material	73.4	94.6

Table 1 Basic Properties of samples

Samples	Appearance	Dry solids (%)	Moisture (%)	TOC in dry solid (%)	ThCO <sub>2</sub> (CO <sub>2</sub> g/100g sample)
Test material	film	99.23	0.77	49.03	179.78
Reference material	powder	99.04	0.96	43.27	158.66

Table 2 Volume of evolved CO<sub>2</sub> and rate of biodegradation

Day	(CO <sub>2</sub> ) <sub>B1</sub> g	(CO <sub>2</sub> ) <sub>B2</sub> g	D <sub>1</sub> %	(CO <sub>2</sub> ) <sub>B3</sub> g	D <sub>2</sub> %
180	56.6	150.1	94.6	71.7	39.9

(CO<sub>2</sub>)<sub>B1</sub> volume of CO<sub>2</sub> evolved from blank vessel

(CO<sub>2</sub>)<sub>B2</sub> volume of CO<sub>2</sub> evolved from reference material

(CO<sub>2</sub>)<sub>B3</sub> volume of CO<sub>2</sub> evolved from sample

D<sub>1</sub> reference material's rate of biodegradation

D<sub>2</sub> sample's rate of biodegradation

Table 3 Volume of evolved CO<sub>2</sub> and rate of biodegradation

Day	Evolved CO <sub>2</sub> , g					Degree of biodegradation, %	
	Blank	Cellulose	2015E0235	Cellulose(actual)	2015E0235(actual)	Cellulose	2015E0235
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	2.97	3.76	3.49	0.79	0.52	0.50	0.29
2	3.84	6.51	5.23	2.67	1.39	1.68	0.77
3	7.02	9.86	9.30	2.84	2.28	1.79	1.27
4	8.84	12.76	11.59	3.92	2.75	2.47	1.53
5	10.05	15.86	13.14	5.81	3.09	3.66	1.72
6	10.39	18.95	13.66	8.56	3.27	5.40	1.82
7	11.07	21.09	14.65	10.02	3.58	6.32	1.99
8	12.44	25.43	16.59	12.99	4.15	8.19	2.31
9	13.59	29.27	18.20	15.68	4.61	9.88	2.56
10	15.09	32.88	20.17	17.79	5.08	11.21	2.83
11	17.28	36.63	23.10	19.35	5.82	12.20	3.24
12	19.92	40.35	26.46	20.43	6.54	12.88	3.64
13	23.07	44.06	30.62	20.99	7.55	13.23	4.20
14	24.81	47.79	33.01	22.98	8.20	14.48	4.56
15	28.07	51.49	37.13	23.42	9.06	14.76	5.04

Day	Evolved CO <sub>2</sub> , g					Degree of biodegradation, %	
	Blank	Cellulose	2015E0235	Cellulose(actual)	2015E0235(actual)	Cellulose	2015E0235
16	30.34	55.22	39.97	24.88	9.63	15.68	5.36
17	34.31	59.89	45.21	25.58	10.90	16.12	6.06
18	36.49	63.11	47.92	26.62	11.43	16.78	6.36
19	38.65	65.49	50.71	26.84	12.06	16.92	6.71
20	40.80	69.08	53.44	28.28	12.64	17.82	7.03
21	41.77	72.33	56.01	30.56	14.24	19.26	7.92
22	42.85	75.62	57.48	32.77	14.63	20.65	8.14
23	43.83	78.91	58.98	35.08	15.15	22.11	8.43
24	45.00	82.20	60.53	37.20	15.53	23.45	8.64
25	46.14	85.45	62.07	39.31	15.93	24.78	8.86
26	47.29	88.76	63.50	41.47	16.21	26.14	9.02
27	47.97	93.74	64.50	45.77	16.53	28.85	9.19
28	48.67	100.50	65.68	51.83	17.01	32.67	9.46
29	49.58	107.69	66.96	58.11	17.38	36.63	9.67
30	50.48	114.58	68.20	64.10	17.72	40.40	9.86
31	50.92	119.45	68.96	68.53	18.04	43.19	10.03
32	51.14	124.68	69.51	73.54	18.37	46.35	10.22
33	51.39	128.70	70.47	77.31	19.08	48.73	10.61
34	51.54	132.97	72.09	81.43	20.55	51.32	11.43
35	51.61	137.76	73.57	86.15	21.96	54.30	12.21
36	51.66	143.84	74.79	92.18	23.13	58.10	12.87
37	51.92	147.98	75.86	96.06	23.94	60.54	13.32
38	52.07	152.90	78.40	100.83	26.33	63.55	14.65
39	52.10	155.91	79.93	103.81	27.83	65.43	15.48
40	52.11	158.80	82.42	106.69	30.31	67.24	16.86
41	52.14	162.61	84.40	110.47	32.26	69.63	17.94
42	52.18	163.74	85.99	111.56	33.81	70.31	18.81
43	52.20	164.88	88.50	112.68	36.30	71.02	20.19
44	52.23	167.07	90.27	114.84	38.04	72.38	21.16
45	52.26	168.74	93.29	116.48	41.03	73.41	22.82
46	52.29	170.04	94.24	117.75	41.95	74.22	23.33
47	52.33	171.79	96.58	119.46	44.25	75.29	24.61
48	52.35	172.52	97.17	120.17	44.82	75.74	24.93
49	52.38	173.68	98.25	121.30	45.87	76.45	25.51

Day	Evolved CO <sub>2</sub> , g					Degree of biodegradation, %	
	Blank	Cellulose	2015E0235	Cellulose(actual)	2015E0235(actual)	Cellulose	2015E0235
50	52.40	174.81	99.40	122.41	47.00	77.15	26.14
51	52.43	175.63	99.97	123.20	47.54	77.65	26.44
52	52.46	176.22	100.98	123.76	48.52	78.00	26.99
53	52.49	177.31	102.37	124.82	49.88	78.67	27.75
54	52.51	177.80	103.23	125.29	50.72	78.97	28.21
55	52.54	178.22	104.24	125.68	51.70	79.21	28.76
56	52.58	178.61	105.36	126.03	52.78	79.43	29.36
57	52.62	179.10	105.98	126.48	53.36	79.72	29.68
58	52.65	179.58	107.01	126.93	54.36	80.00	30.24
59	52.67	179.92	107.53	127.25	54.86	80.20	30.52
60	52.70	180.15	108.04	127.45	55.34	80.33	30.78
61	52.73	180.37	108.58	127.64	55.85	80.45	31.07
62	52.77	180.57	109.14	127.80	56.37	80.55	31.35
63	52.79	180.80	109.82	128.01	57.03	80.68	31.72
64	52.82	181.36	110.17	128.54	57.35	81.02	31.90
65	52.84	181.65	110.78	128.81	57.94	81.19	32.23
66	52.87	181.97	111.06	129.10	58.19	81.37	32.37
67	52.90	182.35	111.71	129.45	58.81	81.59	32.71
68	52.93	182.92	112.20	129.99	59.27	81.93	32.97
69	52.96	183.35	112.53	130.39	59.57	82.18	33.13
70	52.99	184.28	113.20	131.29	60.21	82.75	33.49
71	53.01	185.21	113.71	132.20	60.70	83.32	33.76
72	53.04	186.14	114.13	133.10	61.09	83.89	33.98
73	53.08	187.08	114.86	134.00	61.78	84.46	34.36
74	53.10	188.01	115.40	134.91	62.30	85.03	34.65
75	53.13	188.95	115.92	135.82	62.79	85.60	34.93
76	53.16	189.89	116.00	136.73	62.84	86.18	34.95
77	53.19	190.82	116.42	137.63	63.23	86.75	35.17
78	53.23	191.76	116.79	138.53	63.56	87.31	35.35
79	53.26	192.69	117.06	139.43	63.80	87.88	35.49
80	53.30	193.62	117.34	140.32	64.04	88.44	35.62
81	53.33	194.54	117.41	141.21	64.08	89.00	35.64
82	53.36	195.21	117.68	141.85	64.32	89.41	35.78
83	53.38	195.66	117.89	142.28	64.51	89.68	35.88

Day	Evolved CO <sub>2</sub> , g					Degree of biodegradation, %	
	Blank	Cellulose	2015E0235	Cellulose(actual)	2015E0235(actual)	Cellulose	2015E0235
84	53.41	195.97	118.04	142.56	64.63	89.85	35.95
85	53.44	196.31	118.16	142.87	64.72	90.05	36.00
86	53.47	196.80	118.26	143.33	64.79	90.34	36.04
87	53.51	197.25	118.35	143.74	64.84	90.60	36.07
88	53.54	197.49	118.48	143.95	64.94	90.73	36.12
89	53.57	197.73	118.56	144.16	64.99	90.86	36.15
90	53.61	197.96	118.65	144.35	65.04	90.98	36.18
91	53.64	198.17	118.74	144.53	65.10	91.09	36.21
92	53.68	198.59	118.85	144.91	65.17	91.33	36.25
93	53.71	198.71	118.96	145.00	65.25	91.39	36.29
94	53.74	198.92	119.09	145.18	65.35	91.50	36.35
95	53.78	199.04	119.18	145.26	65.40	91.55	36.38
96	53.81	199.34	119.30	145.53	65.49	91.72	36.43
97	53.84	199.52	119.39	145.68	65.55	91.82	36.46
98	53.88	199.69	119.50	145.81	65.62	91.90	36.50
99	53.91	199.81	119.60	145.90	65.69	91.96	36.54
100	53.94	199.93	119.72	145.99	65.78	92.01	36.59
101	53.98	200.05	119.83	146.07	65.85	92.06	36.63
102	54.01	200.12	119.94	146.11	65.93	92.09	36.67
103	54.05	200.19	120.05	146.14	66.00	92.11	36.71
104	54.08	200.29	120.15	146.21	66.07	92.15	36.75
105	54.11	200.37	120.26	146.26	66.15	92.18	36.79
106	54.15	200.46	120.37	146.31	66.22	92.22	36.83
107	54.18	200.54	120.47	146.36	66.29	92.25	36.87
108	54.21	200.63	120.58	146.42	66.37	92.29	36.92
109	54.25	200.71	120.69	146.46	66.44	92.31	36.96
110	54.28	200.80	120.81	146.52	66.53	92.35	37.01
111	54.32	200.88	120.90	146.56	66.58	92.37	37.03
112	54.35	200.97	121.03	146.62	66.68	92.41	37.09
113	54.38	201.05	121.12	146.67	66.74	92.44	37.12
114	54.42	201.14	121.24	146.72	66.82	92.47	37.17
115	54.45	201.22	121.33	146.77	66.88	92.51	37.20
116	54.48	201.31	121.44	146.83	66.96	92.54	37.25
117	54.52	201.39	121.54	146.87	67.02	92.57	37.28

Day	Evolved CO <sub>2</sub> , g					Degree of biodegradation, %	
	Blank	Cellulose	2015E0235	Cellulose(actual)	2015E0235(actual)	Cellulose	2015E0235
118	54.55	201.48	121.65	146.93	67.10	92.61	37.32
119	54.59	201.56	121.75	146.97	67.16	92.63	37.36
120	54.62	201.65	121.87	147.03	67.25	92.67	37.41
121	54.65	201.73	121.97	147.08	67.32	92.70	37.45
122	54.69	201.82	122.08	147.13	67.39	92.73	37.48
123	54.72	201.90	122.20	147.18	67.48	92.76	37.53
124	54.75	201.99	122.30	147.24	67.55	92.80	37.57
125	54.79	202.07	122.43	147.28	67.64	92.83	37.62
126	54.82	202.16	122.52	147.34	67.70	92.87	37.66
127	54.86	202.24	122.65	147.38	67.79	92.89	37.71
128	54.89	202.33	122.73	147.44	67.84	92.93	37.74
129	54.92	202.41	122.85	147.49	67.93	92.96	37.79
130	54.96	202.50	122.94	147.54	67.98	92.99	37.81
131	54.99	202.58	123.07	147.59	68.08	93.02	37.87
132	55.03	202.67	123.16	147.64	68.13	93.05	37.90
133	55.06	202.75	123.28	147.69	68.22	93.09	37.95
134	55.10	202.84	123.38	147.74	68.28	93.12	37.98
135	55.13	202.92	123.48	147.79	68.35	93.15	38.02
136	55.16	203.01	123.60	147.85	68.44	93.19	38.07
137	55.20	203.09	123.70	147.89	68.50	93.21	38.10
138	55.23	203.18	123.82	147.95	68.59	93.25	38.15
139	55.27	203.26	123.91	147.99	68.64	93.27	38.18
140	55.30	203.35	124.03	148.05	68.73	93.31	38.23
141	55.33	203.43	124.12	148.10	68.79	93.34	38.26
142	55.37	203.52	124.24	148.15	68.87	93.38	38.31
143	55.40	203.60	124.34	148.20	68.94	93.41	38.35
144	55.44	203.69	124.46	148.25	69.02	93.44	38.39
145	55.47	203.77	124.57	148.30	69.10	93.47	38.44
146	55.50	203.86	124.68	148.36	69.18	93.51	38.48
147	55.54	203.94	124.79	148.40	69.25	93.53	38.52
148	55.57	204.03	124.89	148.46	69.32	93.57	38.56
149	55.60	204.11	125.01	148.51	69.41	93.60	38.61
150	55.64	204.20	125.10	148.56	69.46	93.63	38.64
151	55.67	204.28	125.22	148.61	69.55	93.67	38.69

Day	Evolved CO <sub>2</sub> , g					Degree of biodegradation, %	
	Blank	Cellulose	2015E0235	Cellulose(actual)	2015E0235(actual)	Cellulose	2015E0235
152	55.71	204.37	125.31	148.66	69.60	93.70	38.71
153	55.74	204.45	125.42	148.71	69.68	93.73	38.76
154	55.77	204.54	125.52	148.77	69.75	93.77	38.80
155	55.81	204.62	125.64	148.81	69.83	93.79	38.84
156	55.84	204.71	125.73	148.87	69.89	93.83	38.88
157	55.88	204.79	125.86	148.91	69.98	93.85	38.93
158	55.91	204.88	125.98	148.97	70.07	93.89	38.98
159	55.94	204.96	126.07	149.02	70.13	93.92	39.01
160	55.98	205.05	126.19	149.07	70.21	93.96	39.05
161	56.01	205.13	126.28	149.12	70.27	93.99	39.09
162	56.04	205.22	126.40	149.18	70.36	94.02	39.14
163	56.08	205.30	126.50	149.22	70.42	94.05	39.17
164	56.11	205.39	126.62	149.28	70.51	94.09	39.22
165	56.15	205.47	126.71	149.32	70.56	94.11	39.25
166	56.18	205.56	126.83	149.38	70.65	94.15	39.30
167	56.21	205.64	126.93	149.43	70.72	94.18	39.34
168	56.25	205.73	127.05	149.48	70.80	94.21	39.38
169	56.28	205.81	127.17	149.53	70.89	94.25	39.43
170	56.32	205.90	127.27	149.58	70.95	94.28	39.46
171	56.35	205.98	127.37	149.63	71.02	94.31	39.50
172	56.38	206.07	127.46	149.69	71.08	94.35	39.54
173	56.42	206.15	127.57	149.73	71.15	94.37	39.58
174	56.45	206.24	127.68	149.79	71.23	94.41	39.62
175	56.48	206.32	127.79	149.84	71.31	94.44	39.67
176	56.52	206.41	127.90	149.89	71.38	94.47	39.70
177	56.55	206.49	128.01	149.94	71.46	94.50	39.75
178	56.59	206.58	128.11	149.99	71.52	94.54	39.78
179	56.62	206.66	128.22	150.04	71.60	94.57	39.83
180	56.65	206.75	128.35	150.10	71.70	94.60	39.88

*Bublaki*