


Prüfbericht - Nr.: Q00224110-1R1 <i>Test Report No.:</i>		Seite 1 von 14 <i>Page 1 of 14</i>	
Auftraggeber: <i>Client:</i>	LIEN SHENG PLASTIC INDUSTRY CO.,LTD NO.111, LN.840.SEC.1, ZHONGZHENG E.RD DAYUAN TOWNSHIP,TAOYUAN COUNTY,TAIWAN		
Gegenstand der Prüfung: <i>Test Item:</i>	BLS PLA BB BULLET		
Bezeichnung: <i>Identification:</i>	PLA 0.25g		
Anlieferungszustand: <i>Delivery condition:</i>	Good	Eingangsdatum: <i>Date of Receipt:</i>	2013-04-15
Prüfört: <i>Testing location:</i>	Tested at TÜV Rheinland Shanghai		
Prüfgrundlage: <i>Test specification:</i>	Testing in reference to: DIN EN 13432:2000 Controlled Aerobic Composting Test (ISO 14855-1:2012)		
Prüfergebnis: <i>Test result:</i>	PASS		
			
2014-03-21	Sven Posselt	Technical Manager	
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	
Sonstiges / Other Aspects: Test period: 2013-11-05 – 2014-01-20			
Abkürzungen:	ok / P = entspricht Prüfgrundlage fail / F = entspricht nicht Prüfgrundlage n.a. / N = nicht anwendbar	Abbreviations:	ok / P = passed fail / F = failed n.a. / N = not applicable
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</p> <p><i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i></p>			

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Picture and detailed description of the test sample



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1. Biodegradation

1.1 General test information

Reference material: Cellulose

Test vessels: 2000ml, the vessel used for biodegradation test is a high pressure conical flask, volume: 2000 ml. It was provided by Pyrex Co. Ltd.

CO₂-determination: Determination of the amount of carbon dioxide evolved by weighing the carbon dioxide absorbing system. The amount of carbon dioxide is calculated via the difference in the weight of the carbon dioxide absorbing trap in the beginning and in the end of the test.

Thermostat controlled oven: The biodegradation test is proceeded in a temperature controlled oven for maintaining the temperature needed.

1.2 Summary of test results

	Test material	Reference material
45 days biodegradation rate	81%	84%
Overall biodegradation rate	90%	96%
Test duration	66 days	76 days
Observation	No abnormal findings	No abnormal findings

Validity Criteria

- Degree of biodegradation of reference material after 45 days > 70% ?
 Yes No
- Difference between percentage biodegradation of reference material in the different vessels at the end of test <20% ?
 Yes No
- Average CO₂ production in the blank vessels after 10 days in the range 50mg to 150mg CO₂/g volatile solids ?
 Yes No

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1.3 Flow chart of experiment

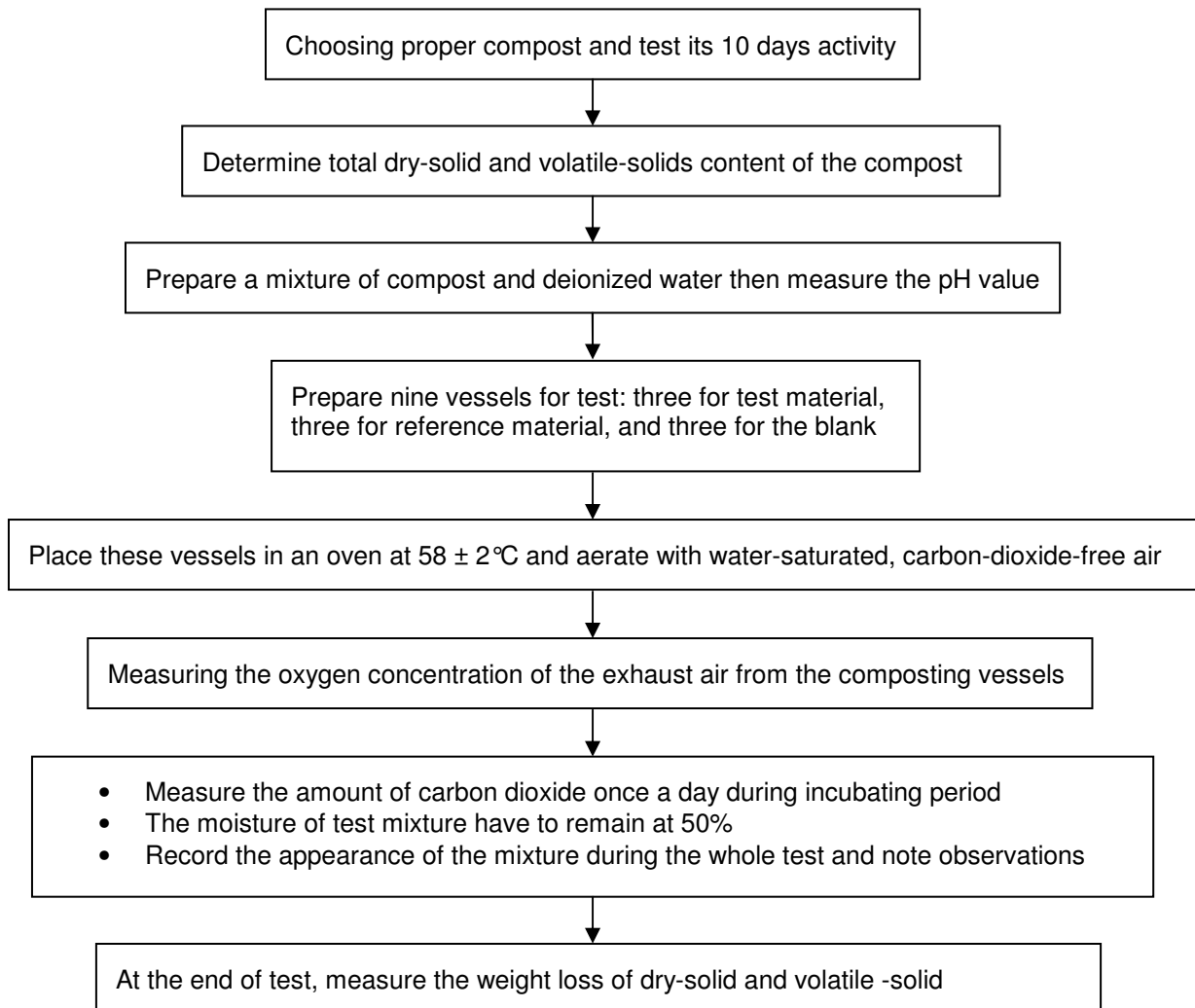


Fig 2 : Flow chart of experiment

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1.4 RESULTS

1.4.1 Appearance of compost and sample



Before test



After test

Compost (blank)



Before test



After test

Compost (reference)

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Before test



After test

Compost (Test material)

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1.4.2 Properties of compost
Table 1 Properties of compost

Total dry solids (%)	Moisture content (%)	Volatile solids (%)	Ash (%)	Compost Activity Test (mg - CO ₂ / g - volatile solid)	Carbon/Nitrogen ratio (%)
45	55	52	48	142	22

1.4.3 Activity of the compost
Table 2 The amount of CO₂ for the first 10 days

Days	Amount of carbon dioxide (mg)
1	1720
2	2170
3	2250
4	1357
5	1357
6	1357
7	2920
8	2720
9	1720
10	2360
Total	19,950

$$142 = \text{mg - CO}_2 / \text{g - volatile solid}$$

1.4.4 Total Amount of Organic Carbon for Test and Reference Samples
Table 3 Total amount of organic carbon

	Total organic carbon (%)	Amount of organic carbon (TOC) in test vessel, (g)	Theoretical amount of evolved carbon dioxide, (ThCO ₂), (g)	Size (cm × cm)	Thickness (mm)	Shape	Total dry solids (%)	Moisture content (%)
Reference material	42.63	20	73.3	-	-	powder	95	5
Test material	17.83	20	73.3	-	-	powder	99	1

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1.4.5 The amount of sample and compost in the test vessel
Table 4 The amount of sample and compost in the test vessel

	Compost		Sample	
	Weight (g)	Total dry solids (g)	Weight (g)	Total dry solids (g)
Blank	600	270	None	None
Reference	600	228	None	None
Sample	600	270	112	111

1.5 pH Value
Table 5 The pH values before and after test

	Blank 1	Blank 2	Blank 3
Before Test	6.8	6.5	7.0
After Test	7.9	7.5	8.0

Table 6 The pH values before and after test

	Reference material 1	Reference material 2	Reference material 3
Before Test	6.7	6.7	7.0
After Test	7.5	7.2	7.7

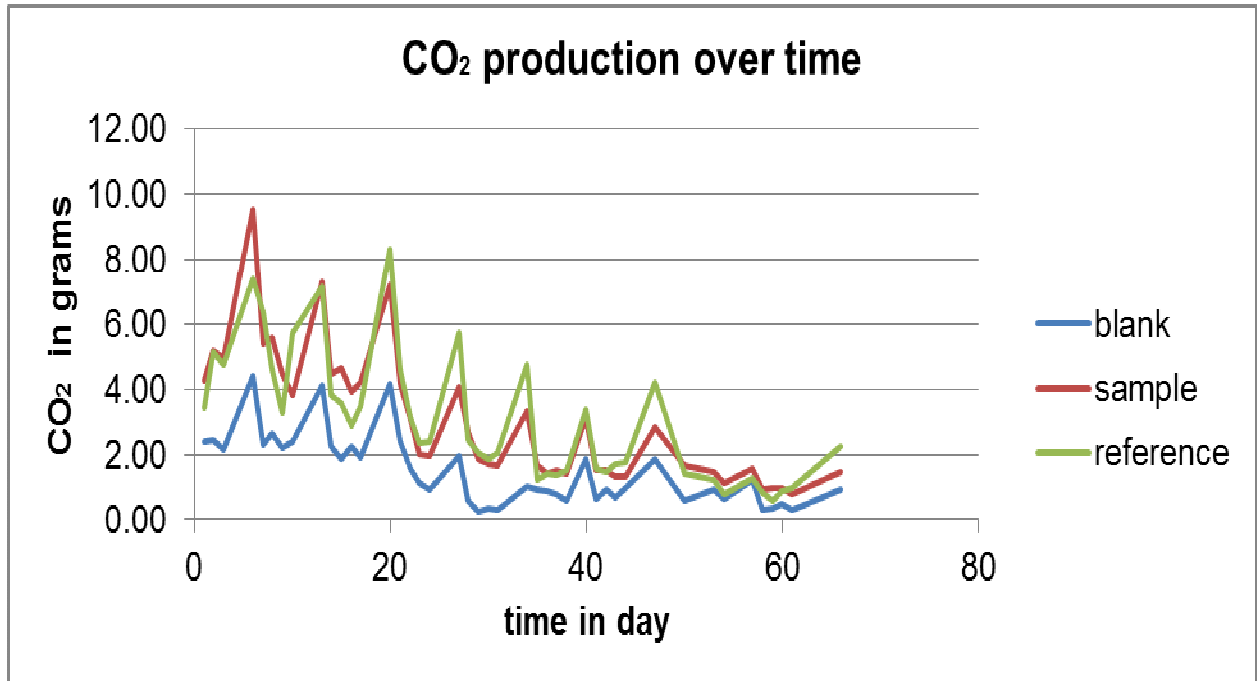
Table 7 The pH values before and after test

	Test material 1	Test material 2	Test material 3
Before Test	7.2	6.6	7.0
After Test	8.0	7.5	6.8

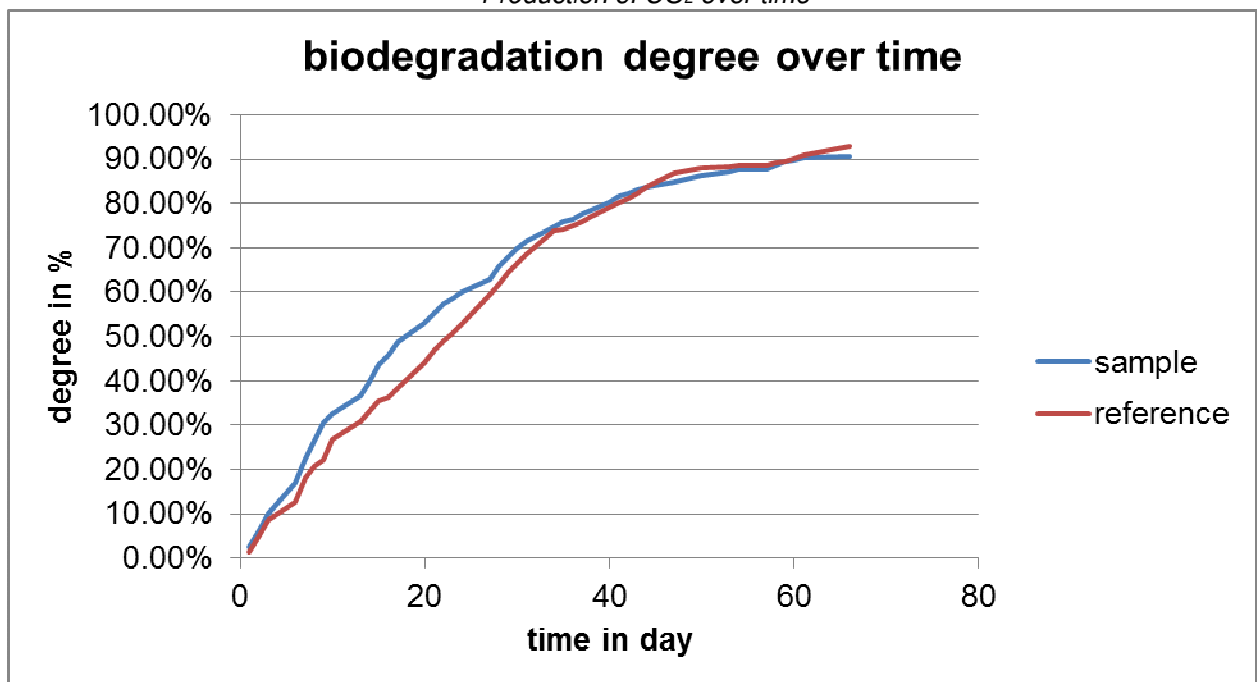
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1.6 Controlled Aerobic Composting Test (Mass of Organic Matter)

(1) Test Material

Amount of total organic carbon (TOC) of the test material placed in each vessel: 20g
 This TOC leads to a theoretical amount of evolved carbon dioxide (ThCO₂), caused by the degradation of the test material: 73.3g



CO₂:Evolution curve of test material
Production of CO₂ over time



Biodegradation curve of test material
Degree of degradation over time

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Table 8 **Controlled aerobic composting test data of test material**

Day	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	D	D	D	D
	B1	B2	B3	B _{mean}	t1	t2	t3	t _{mean}	t1	t2	t3	t _{mean}
	g/vessel	g/vessel	g/vessel	g/Vessel	g/Vessel	g/Vessel	g/Vessel	g/Vessel	%	%	%	%
1	2.52	1.72	3.09	2.44	4.10	4.57	4.13	4.27	2.26%	2.90%	2.30%	2.49%
2	2.17	2.98	2.31	2.49	5.94	5.04	4.71	5.23	4.71%	3.48%	3.03%	3.74%
3	2.25	1.64	2.68	2.19	3.19	5.20	6.44	4.94	1.36%	4.10%	5.80%	3.75%
6	4.07	4.25	4.97	4.43	9.88	8.81	9.95	9.55	7.43%	5.97%	7.53%	6.98%
7	2.92	2.00	2.03	2.32	3.26	4.71	8.24	5.40	1.29%	3.26%	8.08%	4.21%
8	2.72	2.08	3.18	2.66	5.55	6.60	4.69	5.61	3.94%	5.37%	2.77%	4.03%
9	1.72	2.70	2.34	2.25	6.00	4.80	2.65	4.48	5.11%	3.47%	0.54%	3.04%
10	2.36	2.58	2.39	2.44	3.22	3.74	4.58	3.85	1.06%	1.77%	2.91%	1.91%
13	4.53	3.23	4.69	4.15	6.69	8.05	7.17	7.30	3.46%	5.32%	4.12%	4.30%
14	1.55	2.76	2.61	2.31	4.05	5.07	4.24	4.45	2.38%	3.77%	2.64%	2.93%
15	1.93	2.35	1.42	1.90	5.26	4.94	3.80	4.67	4.58%	4.15%	2.59%	3.77%
16	1.72	2.71	2.35	2.26	4.36	4.24	3.23	3.94	2.86%	2.70%	1.32%	2.30%
17	2.21	1.63	2.03	1.96	4.49	4.33	3.84	4.22	3.45%	3.24%	2.57%	3.09%
20	4.25	4.17	4.13	4.18	8.45	6.40	6.77	7.21	5.82%	3.02%	3.53%	4.12%
21	2.19	2.35	2.73	2.42	3.85	5.39	3.38	4.21	1.95%	4.05%	1.30%	2.43%
22	1.00	1.88	1.93	1.60	3.27	3.29	2.83	3.13	2.27%	2.30%	1.67%	2.08%
23	1.04	1.36	1.12	1.17	2.23	2.13	1.76	2.04	1.44%	1.30%	0.80%	1.18%
24	1.02	0.99	0.90	0.97	2.44	2.05	1.45	1.98	2.00%	1.47%	0.65%	1.38%
27	1.95	2.19	1.76	1.97	3.03	4.20	5.08	4.10	1.45%	3.05%	4.25%	2.91%
28	0.67	1.02	0.23	0.64	1.91	3.23	3.02	2.72	1.73%	3.53%	3.25%	2.84%
29	0.62	0.04	0.24	0.30	2.14	1.24	2.25	1.88	2.51%	1.28%	2.66%	2.15%
30	0.63	0.14	0.41	0.39	1.1	1.78	2.4	1.76	0.96%	1.89%	2.74%	1.86%
31	0.57	0.14	0.25	0.32	0.97	1.63	2.52	1.71	0.89%	1.79%	3.00%	1.89%
34	0.89	1	1.32	1.07	3.19	3.58	3.31	3.36	2.89%	3.42%	3.05%	3.12%
35	1.24	0.97	0.75	0.99	2.05	1.32	1.72	1.70	1.45%	0.45%	1.00%	0.97%
36	1.02	0.8	0.95	0.92	2.1	0.96	1.32	1.46	1.60%	0.05%	0.54%	0.73%
37	1.03	0.84	0.6	0.82	2.05	1.07	1.56	1.56	1.67%	0.34%	1.00%	1.00%
38	0.98	0.87	0.06	0.64	1.05	1.63	1.61	1.43	0.56%	1.35%	1.33%	1.08%
40	1.99	2.67	0.95	1.87	3.05	3.47	2.95	3.16	1.61%	2.18%	1.47%	1.75%
41	0.69	0.95	0.34	0.66	1.25	1.48	1.99	1.57	0.80%	1.12%	1.81%	1.25%
42	0.83	1.12	0.96	0.97	1.65	1.46	1.5	1.54	0.93%	0.67%	0.72%	0.77%
43	0.82	0.78	0.55	0.72	1.11	1.46	1.5	1.36	0.54%	1.01%	1.07%	0.87%
44	0.63	1.44	1.01	1.03	1.04	1.46	1.5	1.33	0.02%	0.59%	0.65%	0.42%
after 45 days	56.73	58.35	57.28	57.45	113.92	119.33	118.09	117.11	77.00%	84.38%	82.69%	81.36%

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47	1.83	2.7	1.14	1.89	2.63	3.46	2.5	2.86	1.01%	2.14%	0.83%	1.33%
50	0.83	0.21	0.87	0.64	2.11	1.77	1.2	1.69	2.01%	1.55%	0.77%	1.44%
53	0.64	1.01	1.25	0.97	1.71	1.77	1.1	1.53	1.01%	1.10%	0.18%	0.76%
54	0.74	0.57	0.77	0.69	1.34	1.26	0.82	1.14	0.88%	0.77%	0.17%	0.61%
57	1.56	1.25	0.99	1.27	1.57	1.24	1.93	1.58	0.41%	-0.04%	0.90%	0.43%
58	0.51	0.28	0.24	0.34	0.99	0.87	0.97	0.94	0.88%	0.72%	0.85%	0.82%
59	0.62	0.42	0.12	0.39	1.01	0.98	1	1.00	0.85%	0.81%	0.84%	0.83%
60	0.78	0.25	0.54	0.52	1.21	0.75	1.04	1.00	0.94%	0.31%	0.70%	0.65%
61	0.54	0.23	0.24	0.34	0.89	0.77	0.87	0.84	0.75%	0.59%	0.73%	0.69%
66	0.99	0.87	1.01	0.96	1.25	1.31	1.95	1.50	0.40%	0.48%	1.35%	0.75%
total	65.77	66.14	64.45	65.453	128.6	133.51	131.47	131.203	86.15%	92.81%	90.03%	89.66%

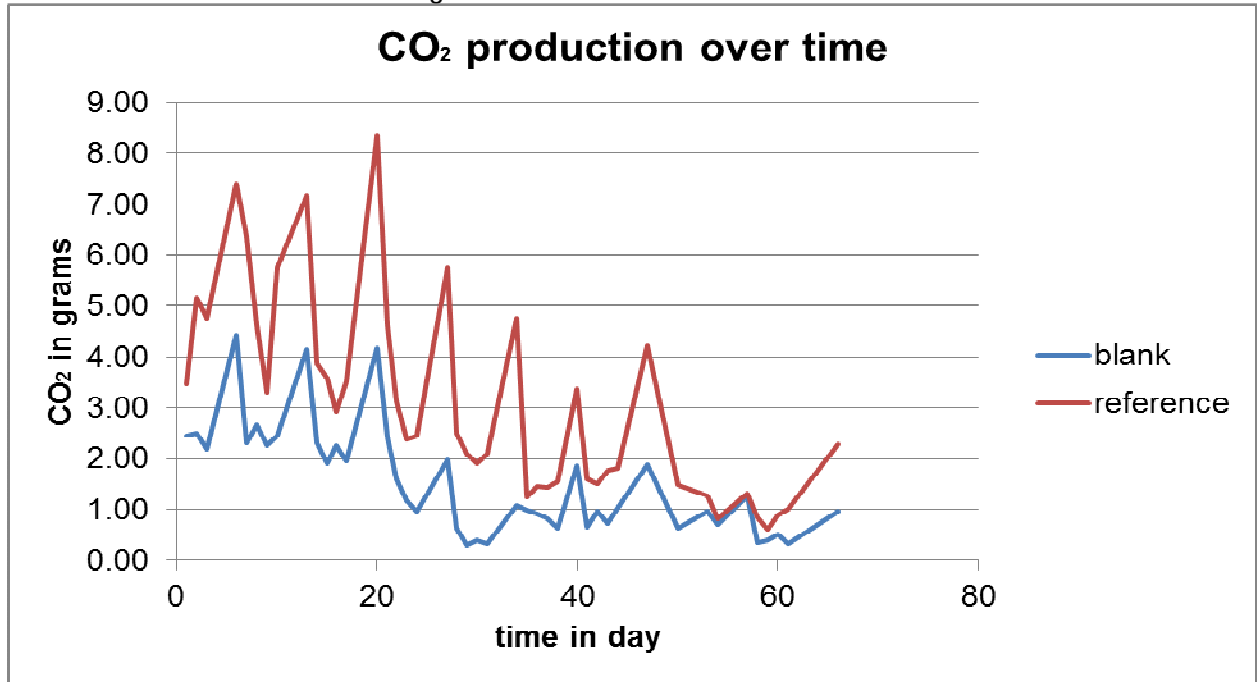
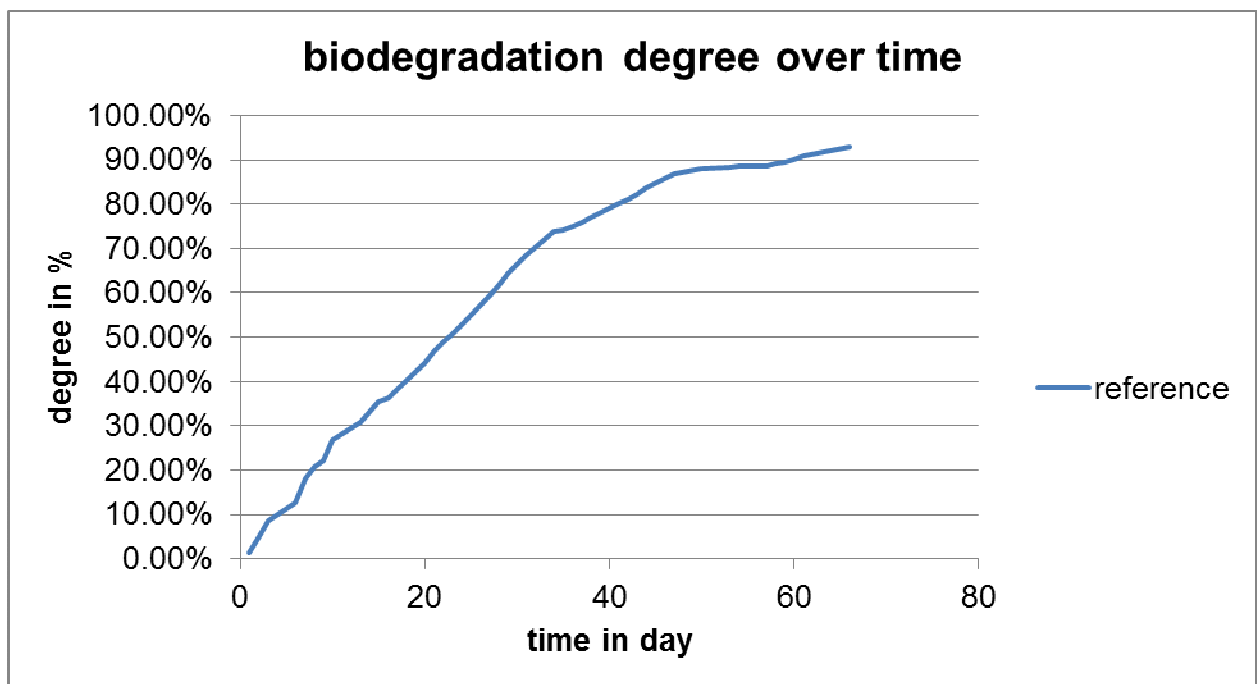
 $(CO_2)_B$ = Measured cumulative CO₂ production by blank

 $(CO_2)_t$ = Measured cumulative CO₂ production by test or reference material

 $(CO_2)_{Bmean}$ = $[(CO_2)_{B1} + (CO_2)_{B2} + (CO_2)_{B3}] / 3$
 D = $[(CO_2)_t - (CO_2)_{Bmean}] / ThCO_2$
 D_{mean} = $(D_{t1} + D_{t2} + D_{t3}) / 3$

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(2) Reference Material

 Amount of total organic carbon (TOC) of the reference material placed in each vessel: 20 g
 This TOC leads to a theoretical amount of evolved carbon dioxide (ThCO₂), caused by the degradation of the reference material: 73.3 g

 CO₂ Evolution Curve of Reference Material
Production of CO₂ over time

 Biodegradation Curve of Reference Material
Degree of degradation over time

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Table 9 Controlled aerobic composting test data of reference material

Day	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	(CO ₂)	D	D	D	D
	B1	B2	B3	B _{mean}	t1	t2	t3	t _{mean}	t1	t2	t3	t _{mean}
	g/vessel	g/vessel	g/vessel	g/Vessel	g/Vessel	g/Vessel	g/Vessel	g/Vessel	%	%	%	%
1	2.52	1.72	3.09	2.44	1.15	4.55	4.68	3.46	-1.76%	2.87%	3.05%	1.39%
2	2.17	2.98	2.31	2.49	3.38	5.47	6.64	5.16	1.22%	4.07%	5.66%	3.65%
3	2.25	1.64	2.68	2.19	4.57	4.78	4.94	4.76	3.25%	3.53%	3.75%	3.51%
6	4.07	4.25	4.97	4.43	6.66	8.68	6.89	7.41	3.04%	5.80%	3.35%	4.06%
7	2.92	2.00	2.03	2.32	8.87	6.92	3.31	6.37	8.94%	6.28%	1.35%	5.52%
8	2.72	2.08	3.18	2.66	4.65	5.60	3.59	4.61	2.71%	4.01%	1.27%	2.66%
9	1.72	2.70	2.34	2.25	3.25	4.06	2.61	3.31	1.36%	2.46%	0.49%	1.44%
10	2.36	2.58	2.39	2.44	7.15	3.90	6.22	5.76	6.42%	1.99%	5.15%	4.52%
13	4.53	3.23	4.69	4.15	7.22	6.06	8.25	7.18	4.19%	2.60%	5.59%	4.13%
14	1.55	2.76	2.61	2.31	3.15	3.39	5.05	3.86	1.15%	1.48%	3.74%	2.12%
15	1.93	2.35	1.42	1.90	3.15	3.53	4.08	3.59	1.70%	2.22%	2.97%	2.30%
16	1.72	2.71	2.35	2.26	2.87	2.95	2.94	2.92	0.83%	0.94%	0.93%	0.90%
17	2.21	1.63	2.03	1.96	2.47	3.67	4.40	3.51	0.70%	2.34%	3.33%	2.12%
20	4.25	4.17	4.13	4.18	9.43	6.02	9.58	8.34	7.15%	2.50%	7.36%	5.67%
21	2.19	2.35	2.73	2.42	3.67	4.43	5.75	4.62	1.70%	2.74%	4.54%	2.99%
22	1.00	1.88	1.93	1.60	3.10	3.80	2.52	3.14	2.04%	3.00%	1.25%	2.10%
23	1.04	1.36	1.12	1.17	2.55	2.82	1.77	2.38	1.88%	2.25%	0.81%	1.65%
24	1.02	0.99	0.90	0.97	2.93	2.15	2.27	2.45	2.67%	1.61%	1.77%	2.02%
27	1.95	2.19	1.76	1.97	6.96	5.81	7.51	6.76	6.81%	5.24%	7.56%	6.54%
28	0.67	1.02	0.23	0.64	2.60	2.37	2.52	2.50	2.67%	2.36%	2.56%	2.53%
29	0.62	0.04	0.24	0.30	2.7	1.92	1.68	2.10	3.27%	2.21%	1.88%	2.45%
30	0.63	0.14	0.41	0.39	2.37	2.43	0.94	1.91	2.70%	2.78%	0.75%	2.07%
31	0.57	0.14	0.25	0.32	2.26	2.16	1.9	2.11	2.65%	2.51%	2.15%	2.44%
34	0.89	1	1.32	1.07	4.97	4.23	5.09	4.76	5.32%	4.31%	5.48%	5.04%
35	1.24	0.97	0.75	0.99	1.58	0.73	1.45	1.25	0.81%	-0.35%	0.63%	0.36%
36	1.02	0.8	0.95	0.92	1.93	1.26	1.2	1.46	1.37%	0.46%	0.38%	0.74%
37	1.03	0.84	0.6	0.82	1.98	1.16	1.14	1.43	1.58%	0.46%	0.43%	0.82%
38	0.98	0.87	0.06	0.64	2.07	1.28	1.3	1.55	1.95%	0.88%	0.90%	1.25%
40	1.99	2.67	0.95	1.87	2.49	3.7	3.95	3.38	0.85%	2.50%	2.84%	2.06%
41	0.69	0.95	0.34	0.66	1.88	1.65	1.3	1.61	1.66%	1.35%	0.87%	1.30%
42	0.83	1.12	0.96	0.97	1.05	1.93	1.3	1.43	0.11%	1.31%	0.45%	0.62%
43	0.82	0.78	0.55	0.72	1.67	1.92	1.3	1.63	1.30%	1.64%	0.80%	1.25%
44	0.63	1.44	1.01	1.03	2	2.88	1.3	2.06	1.33%	2.53%	0.37%	1.41%
after 45 days	56.73	58.35	57.28	57.45	118.73	118.21	119.37	118.77	83.56%	82.85%	84.44%	83.62%

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47	1.83	2.7	1.14	1.89	4.75	4.58	3.3	4.21	3.90%	3.67%	1.92%	3.16%
50	0.83	0.21	0.87	0.64	1.2	1.82	1.4	1.47	0.77%	1.61%	1.04%	1.14%
53	0.64	1.01	1.25	0.97	1.03	1.52	1.24	1.26	0.09%	0.75%	0.37%	0.40%
54	0.74	0.57	0.77	0.69	0.7	0.85	0.94	0.83	0.01%	0.21%	0.34%	0.19%
57	1.56	1.25	0.99	1.27	1.16	1.73	1.06	1.32	-0.15%	0.63%	-0.28%	0.07%
58	0.51	0.28	0.24	0.34	0.71	0.85	0.99	0.85	0.50%	0.69%	0.88%	0.69%
59	0.62	0.42	0.12	0.39	0.39	0.54	0.89	0.61	0.00%	0.21%	0.69%	0.30%
60	0.78	0.25	0.54	0.52	0.89	0.87	0.94	0.90	0.50%	0.47%	0.57%	0.51%
61	0.54	0.23	0.24	0.34	1.02	0.99	1.04	1.02	0.93%	0.89%	0.96%	0.93%
66	0.99	0.87	1.01	0.96	2.14	2.47	2.23	2.28	1.61%	2.06%	1.74%	1.80%
69	0.81	0.56	0.91	0.76	1.21	1.06	1.12	1.13	0.61%	0.41%	0.49%	0.50%
70	0.57	0.41	0.24	0.41	0.97	0.51	0.94	0.81	0.77%	0.14%	0.73%	0.55%
71	0.49	0.67	0.84	0.67	1	1.03	1.45	1.16	0.45%	0.50%	1.07%	0.67%
72	0.87	1.01	0.49	0.79	0.59	1.24	0.58	0.80	-0.27%	0.61%	-0.29%	0.02%
73	0.65	0.27	0.74	0.55	1.11	1.52	1.25	1.29	0.76%	1.32%	0.95%	1.01%
76	0.54	0.84	0.84	0.74	1.04	0.98	0.23	0.75	0.41%	0.33%	-0.70%	0.01%
<i>total</i>	<i>69.7</i>	<i>69.9</i>	<i>68.51</i>	<i>69.37</i>	<i>138.6</i>	<i>140.77</i>	<i>138.97</i>	<i>139.46</i>	<i>94.46%</i>	<i>97.37%</i>	<i>94.91%</i>	<i>95.58%</i>

$(CO_2)_B$ = Measured cumulative CO₂ production by blank
 $(CO_2)_t$ = Measured cumulative CO₂ production by test or reference material
 $(CO_2)_{Bmean}$ = $[(CO_2)_{B1} + (CO_2)_{B2} + (CO_2)_{B3}] / 3$
 D = $[(CO_2)_t - (CO_2)_{Bmean}] / ThCO_2$
 D_{mean} = $(D_{t1} + D_{t2} + D_{t3}) / 3$

1.7 Additional information (observations, reasons for rejection of test results and others)

This test report proves that the sample can be degraded by microorganisms according to the EN 13432 in combination with EN 14855.. After 66 days 90% of the test material have been degraded to carbon dioxide, so the test was stopped after that time, as the requirement already was fulfilled.

--END--