

# TEST REPORT

**Requester:**

[REDACTED]

**Request date:**

14/05/2008

**Subject:**

Standard test for the evaluation of the ultimate biodegradability of a plastic

**Sample identification:**

- Plastic film

**Reference documents:**

- EN 14046 (2003): Packaging. Evaluation of the ultimate aerobic biodegradability and disintegration of packaging materials under controlled composting conditions – Method by analysis of released carbon dioxide.
- EN 13432 (2000): Packaging. Requirements for packaging recoverable through composting and biodegradation – Test scheme and evaluation criteria for the final acceptance of packaging.

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It has 9 pages.

## 1. DESCRIPTION OF SAMPLES

One batch of plastic:  
- Sample: plastic film.

A photograph of the sample is attached.

Submitted by the requester and received at the laboratory on 16 May 2008.

## 2. TEST CONDITIONS

The (ultimate) biodegradability of the plastic film material was evaluated in accordance with standard EN 14046, which is the method recommended by standard EN 13432 concerning the biodegradability and compostability of packaging materials.

The test method consists of monitoring the degradation of the organic carbon in the material into mineral carbon, when the material is placed under controlled composting conditions: the kinetics and the biodegradation rate are monitored by means of cumulative measurements of the carbon dioxide released under the action of the microorganisms provided by the compost and trapped in concentrated alkaline salt solutions.

### 2.1. PRELIMINARY INFORMATION AND ESTABLISHMENT OF DATA

#### Sourcing of the compost

The compost is a mature compost originating from a rottable household waste composting site (STE URBASYS, 91480 VARENNES-JARCY).

#### Preparation of the compost for testing

The compost was cleaned and then screened to 10 mm.

#### Establishment of the dry matter content of the compost and test materials

The dry matter content was calculated by weighing after drying of test portions at 105°C until a constant mass was reached.

#### Establishment of the C/N ratio of the compost

A C/N ratio of 16.7 was calculated from the data available; as this was satisfactory (between 10 and 40), no nitrogen was added to the compost.

#### Establishment of the pH of the compost

The measured pH is 8.7 (between 7 and 9 is acceptable).

□ **Preparation of the test materials**

The materials were cut into pieces with an area of approximately 2 cm x 2 cm.

□ **Biodegradable reference material**

The test was monitored using Avicel™ microcrystalline cellulose (< 20 µm).

□ **Organic carbon content of the test materials**

The organic carbon content (assumed to be equal to the total carbon) was established by gravimetric analysis after burning in oxygen.

**2.2. BIODEGRADATION TEST**

□ **Setting up of the test rig**

The test rig comprises:

- a compressed air supply with flow control,
- a device to capture the carbon dioxide present in the air and humidify it before entry to the test reactors,
- an air supply control valve for the various test lines,
- 6 x 3 l reactors: 2 for the material to be tested, 2 for the biodegradable reference material, 2 for the blank tests. These are placed in a temperature controlled cabinet at  $58 \pm 1$  °C,
- downstream of each reactor, 2 absorbers containing 100 ml of 5 mol/l (200g/l) sodium hydroxide.

□ **Preparation for the composting tests**

The reactors contain the following:

- Compost: 240 g (including 127.2 g of dry matter made up of 54.7 g of volatile matter and 72.5 g of non-volatile solids)
- Cut pieces of test material: 40 g
- Avicel reference material: 40 g
- Blank test: compost only
- Water added at the start: 68 g (test with material), 28 g (blank test).

□ **Carbon dioxide determination**

The carbon dioxide produced by the degradation of the samples was quantified in the sodium hydroxide solutions by carbon determination using an organic carbon analyzer (T.O.C.) operating in "inorganic carbon" (T.I.C.) measurement mode.

□ **Test duration**

The degradation was monitored for 147 days, from 9 July 2003 to 3 December 2008; the carbon analyses were carried out periodically, every week.

During the analysis, the reactors were shaken by hand in order to bring together the test medium, and water was added to it if necessary.

### **3. RESULTS**

#### **3.1. CHARACTERISTICS OF THE TEST MATERIALS**

**- Organic carbon content of the products:**

- Plastic film: 50.5% dry matter.

**- Organic carbon content of the Avicel reference material:**

- 41.9 % dry matter.

#### **3.2. EVALUATION OF THE ULTIMATE AEROBIC BIODEGRADABILITY IN A COMPOST ENVIRONMENT**

The tables below show the mass of carbon dioxide released, the percentage of biodegradation and the cumulative percentage of biodegradation by sampling day, for the tests on the products and the microcrystalline cellulose reference material.

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day	reference 1			reference 2		
	M CO <sub>2</sub> g	% bio	% cumulative bio	M CO <sub>2</sub> g	% bio	% cumulative bio
0	0	0	0	0	0	0
7	0.5	3	3	0	0	0
14	1.4	8	12	0.6	4	4
21	1.9	12	24	1.6	10	14
28	2.5	15	39	2.6	16	30
35	0.9	12	51	2.8	18	47
42	0.5	6	57	2	12	60
49	0.3	3	60	0.7	4	64
56	0.4	2	62	0.6	4	67
63	0.4	3	64	0.8	5	72
70	0.4	3	67	0.3	2	74
77	0.2	2	69	0.5	3	77
84	0.1	1	71	0.2	1	78
91	0	1	71	0.2	1	79
98	0	0	71	0.1	1	80
105	0	0	71	0.1	0	80
112	0	0	71	0	0	80
119	0	0	71	0	0	81
126	0	0	71	0.1	1	81
133	0	0	71	0	0	81
140	0	0	71	0	0	81
147	0	0	71	0	0	81

Biodegradability of the reference cellulose

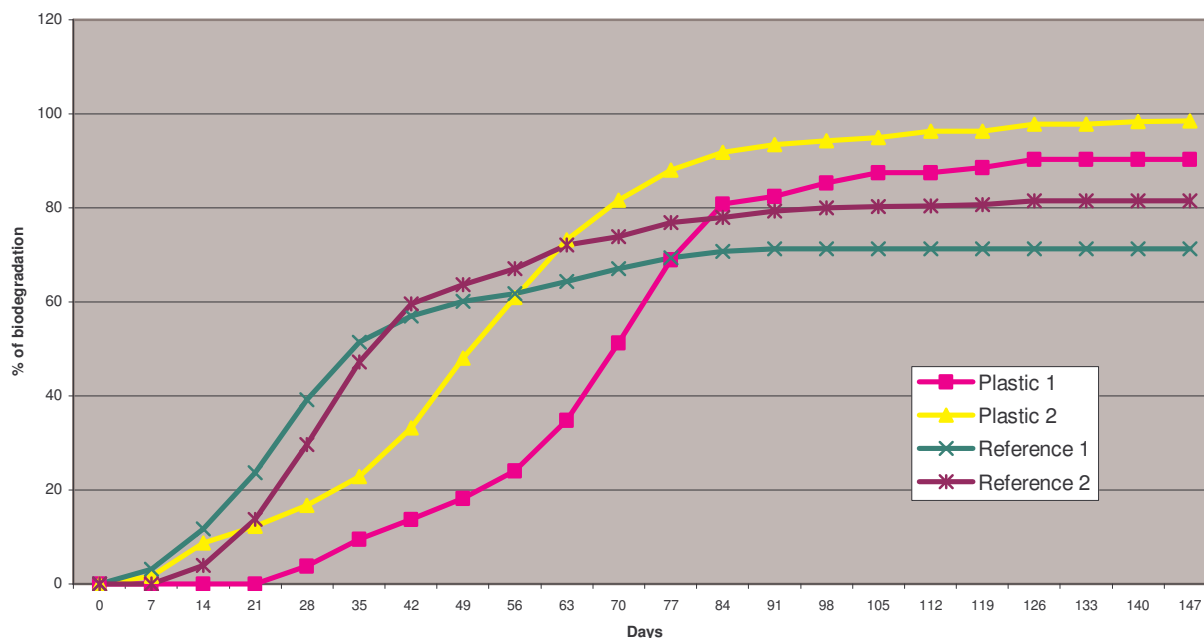
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day	plastic 1			plastic 2		
	M CO <sub>2</sub> g	% bio	% cumulative bio	M CO <sub>2</sub> g	% bio	% cumulative bio
0	0	0	0	0	0	0
7	0	0	0	0.3	2	2
14	0	0	0	1.4	7	9
21	0	0	0	0.7	3	12
28	0.8	4	4	0.9	5	17
35	1.1	6	9	1.2	6	23
42	0.9	4	14	2.1	10	33
49	0.9	4	18	3.0	15	48
56	1.2	6	24	2.6	13	61
63	2.1	11	35	2.4	12	73
70	3.3	16	51	1.7	8	82
77	3.5	18	69	1.3	6	88
84	2.3	12	81	0.8	4	92
91	0.4	2	83	0.3	2	93
98	0.6	3	85	0.2	1	94
105	0.4	2	87	0.1	1	95
112	0	0	87	0.3	1	96
119	0.2	1	89	0.5	0	96
126	0.4	2	90	0.3	2	98
133	0	0	90	1.3	0	98
140	0	0	90	0.1	1	98
147	0	0	90	0	0	99

Biodegradability of the material

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The graph below shows the biodegradation evolution curves for the test materials and the reference materials:



#### Biodegradability test validation criteria:

- The percentage of degradation of the reference substance is greater than 70% at the end of the test: **validated**.
- The difference between the percentages of biodegradation of the reference substance in the 2 reactors is less than 20% at the end of the test: **validated**.
- The difference between the percentages of biodegradation of the test material in the 2 reactors is less than 20% at the end of the test: **validated**.
- The percentage of biodegradation of the test material is at least 90% of the percentage of biodegradation of the reference substance at the end of the test: **validated**.

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4. CONCLUSION

The material in question meets the biodegradability requirements of standard EN 13432, applicable to packaging recoverable through composting and biodegradation.

Trappes, December 12, 2008

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APPENDIX



Plastic film