TECHNICAL REPORT 22311632 – FEBRUARY 29th, 2024

TECHNICAL REPORT FOR THE CERTIFICATION OF PRODUCT CONFORMING TO CRITERIA DEFINED BY:

EN 13432

Program "OK COMPOST INDUSTRIAL" PD-BA-TABE-CERT-BIO-CS-001_OKI_EN, Edition: F, Application Date: 2022-01-01

Test material	
Sample Code	22311632
Producer identification	PVA PRO JSC
Commercial name of the product	AQUAFLEX
Arrival date	August 24th 2023
Shape	Dimensions (average): Thickness of "30 µm sample": 32 ± 4 µm Thickness of "61 µm sample": 62 ± 5 µm Grammage of "30 µm sample": 42,5 ± 1,6 g/m^2 Grammage of "61 µm sample": 99,8 ± 4,2 g/m^2
Visual aspect	Light yellow granulates and modular film (nominal thickness 30 µm & 61 µm)
Starting date for tests	September 01st 2023

February 29th, 2024

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1 INTRODUCTION

This technical note describes the results obtained on the following sample:

Table 1. Test material information and identification.

Test material	
Sample Code	22311632
Producer identification	PVA PRO JSC
Commercial name of the product	AQUAFLEX
Arrival date	August 24th 2023
Shape	Dimensions (average): Thickness of "30 µm sample": 32 ± 4 µm Thickness of "61 µm sample": 62 ± 5 µm Grammage of "30 µm sample": 42,5 ± 1,6 g/m^2 Grammage of "61 µm sample": 99,8 ± 4,2 g/m^2
Visual aspect	Light yellow granulates and modular film (nominal thickness 30 µm & 61 µm)
Starting date for tests	September 01st 2023

According to the following Regulation and Programs:

- EN 13432;
- Program "OK COMPOST INDUSTRIAL" PD-BA-TABE-CERT-BIO-CS-001_OKI_EN, Edition: F, Application Date: 2022-01-01;
- TÜV Austria TS-OK-15e;
- TÜV Austria TS-OK-16e;

to verify the compliance with the **requirements for recoverable plastic material under industrial composting conditions** according to the above-mentioned schemes.

In particular, this technical report describes the overall results obtained by carrying on the experimental steps for the assessment of the conformity to the requirements as following listed:

1) Identification and characterization of the product
2) Biodegradability test under industrial composting conditions
3) Quantitative disintegration including effects on the biological treatment process on two different thicknesses (30 µm and 61 µm, as nominal values)
4) Effect on the final substrate quality and ecotoxicity test

according to the Producer's request (PVA PRO JSC).

2 IDENTIFICATION OF THE PRODUCT

The previous Table 1 summarises the main information for the description of the test material, in Figure 1, the pictures of the test material are presented.



Figure 1. Pictures of the "AQUAFLEX" samples: granulates, 61 µm film, 30 µm film (from left to right).

- Commercial name of the product: AQUAFLEX
- Material producer: PVA PRO JSC
- Production site: 89 Vinh Hoi, Q4, Ho Chi Minh City, Vietnam
- Material formulation: not available
- Color: light yellow granulates and films
- Thickness of "30 µm sample": 32 ± 4 µm
- Thickness of "61 µm sample": 62 ± 5 µm
- Grammage of "30 µm sample": 42,5 ± 1,6 g/m^2
- Grammage of "61 µm sample": 99,8 ± 4,2 g/m^2
- Other relevant information: none

According to the results related to the determination of the volatile solids content (expressed in percentage on dry matter, % dm, reference value > 50% dm), the sample complies with the requirements of EN 13432, as reported in ANNEX 1 - Test report n. 22311632/1.

Volatile solids contents = 96,04% w/w d.m.

2.1 HEAVY METALS AND FLUORINE CONCENTRATIONS

The results related to the quantification of the heavy metals and fluorine concentrations are reported in Table 2. and ANNEX 1 - Test Report n. 22311632/1: **the sample complies with the requirements of EN 13432 for all the below-mentioned parameters**.

Table 2. Heavy metals and fluorine concentrations compared to EN 13432 limits.

		22311632	EN 13432:2000
As	mg/kg dm	0,279	**5**
Cd	mg/kg dm	0,284	**0,5**
Cr tot	mg/kg dm	0,386	**50**
Hg	mg/kg dm	< 0,1	**0,5**
Mo	mg/kg dm	0,547	**1**
Ni	mg/kg dm	0,572	**25**
Pb	mg/kg dm	0,452	**50**
Cu	mg/kg dm	1,78	**50**
Se	mg/kg dm	0,353	**0,75**
Zn	mg/kg dm	26,8	**150**
Co	mg/kg dm	0,279	**-**
F	mg/kg dm	< 25	**100**

2.2 FTIR SPECTRUM

Infrared spectroscopic analysis (FTIR) is performed for the characterization of the main organic component. The determination is carried out by using the ATR (Total Attenuated Reflectance) technique on the material as it is. The spectrum is registered with 32 acquisitions and is shown in Figure 2.

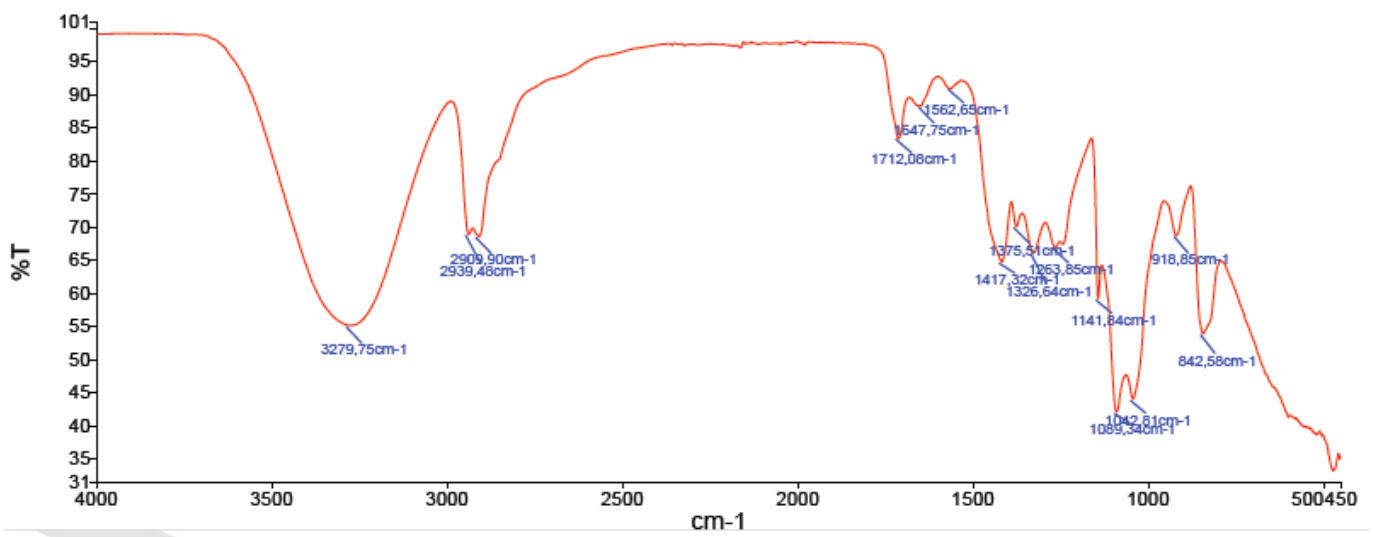


Figure 2. FTIR Spectrum of AQUAFLEX sample.

3 BIODEGRADABILITY TEST IN COMPOSTING CONDITION

Biodegradability is carried on test material is performed according to ISO 14855-1:2012 official method. In the Test Reports:

- n. 22311632/1 for TEST MATERIAL CHARACTERIZATION (see ANNEX 1),
- n. 22311632/2 for BIODEGRADABILITY TEST (see ANNEX 2)

the results of the characterizations are reported. The test started on September 13th 2023 and ended February 27th 2024.

3.1 INFORMATION ON INOCULUM AND REFERENCE MATERIAL (CELLULOSE)

The reference material is microcrystalline cellulose, average dimension of the particles is 20 µm, produced by ALDRICH, distributed by SIGMA ALDRICH SRL, Code number 310697-500G, Lot number MKCL9441, Expiration date September 28th, 2023. The characterizations of this reference material are provided in Test Report n. 22311632/2, ANNEX 2.

The used compost as inoculum and the microcrystalline cellulose used as reference material for the biodegradation test in composting conditions were characterized for the main parameters (Table 3).

Table 3. Main parameters and results for biodegradation test.

Substrate - Compost	
ARCHA REAGENT CODE	R02276001 (C2023003744)
Supplier identification	ENOMONDO
Arrival date	03/04/2023

Parameter	C (% dm)	Dry matter (%)	VS (% dm)	Water to add (g/kg DM) (for 50 - 55 % DM)	pH	N tot (% dm)	C/N	Compliance VS [VS > 30 %dm]	Compliance pH [7 < pH < 9]	Compliance C/N [10 < C/N < 40]
Substrate	20,7	54,5	37,5	38,5	7,92	1,52	13,6	Compliant	Compliant	Compliant
Reference material (Cellulose)	45,4	98,2	-		-	-	-	-	-	-
Test material	50,5	99,4	-		-	-	-	-	-	-

3.2 PREPARATION OF THE BIODEGRADABILITY TEST

In Table 4, the main information about the amount of materials and inoculum needed to start the biodegradation test are presented. The test material was used as it is, in granulates shape.

Table 4. Vessels preparation to start the Biodegradation test.

Vessel	Blank 1	Blank 4	Blank 7	Reference 10	Reference 13	Reference 16	Test 35	Test 37	Test 38
Substrate weight as it is (g)	600,0	605,3	600,2	603,6	611,0	600,0	601,4	607,3	603,6
Dry substrate weight (g)	327,1	330,0	327,2	329,1	333,1	327,1	327,9	331,1	329,1
Theoretical material weight as it is (g)	-	-	-	55,8582	56,5430	55,5250	54,9660	55,5053	55,1671
Actual material weight as it is (g)	-	-	-	75,6085	75,1105	75,0059	75,3527	74,8422	75,1123
Actual dry material weight (g)	-	-	-	74,2400	73,7510	73,6483	74,9157	74,4081	74,6766
Subs/dry mater ratio	-	-	-	4,43	4,52	4,44	4,38	4,45	4,41
Theoretical CO2 for test material (g)	-	-	-	123,6	122,8	122,6	138,7	137,8	138,3
VS load for blank (g)	122,7	123,8	122,7	-	-	-	-	-	-
Water to add (Humidity = 50 %) (g)	54,2	54,7	54,3	127,4	127,6	126,5	128,8	128,9	128,8

3.3 MAIN CHARACTERISTICS OF THE EQUIPMENT

The equipment for biodegradation test in composting conditions is listed below:

- Climatic chamber (Set-point Temperature at 58°C)
- Composting reactors: glass cans with gas inlet and outlet; 3-litres volume; 3 vessels for each sample.
- Glass jars, with gas inlet and outlet, for condensate collection, same number as the composting reactors.
- Air supply system, with a compressor, filtration and purification systems, flow regulation and humidification systems, capable of supplying water-saturated air to each composting reactor
- Carbon dioxide determination system: continuous infrared sensor
- Residual oxygen determination system with integrated temperature and pressure sensors: continuous UV sensor
- Flowmeter
- Pipes for the flow of gas, to connect the composting vessels to the air supply and to the carbon dioxide detector
- Temperature Datalogger
- Sieve (dimension 1 cm sieving)
- Technical balance



Figure 3. Picture of the vessels in the climatic chamber for the biodegradation test in composting condition.

3.4 TEST TEMPERATURE RANGE FOR THE BIODEGRADATION TEST IN COMPOSTING CONDITIONS

The biodegradability test in composting condition was carried on at fixed temperature (58 ± 2°C) in the climatic chamber, with temperature monitoring: in Figure 4, the acquired data for temperature monitoring during the biodegradability test are presented.

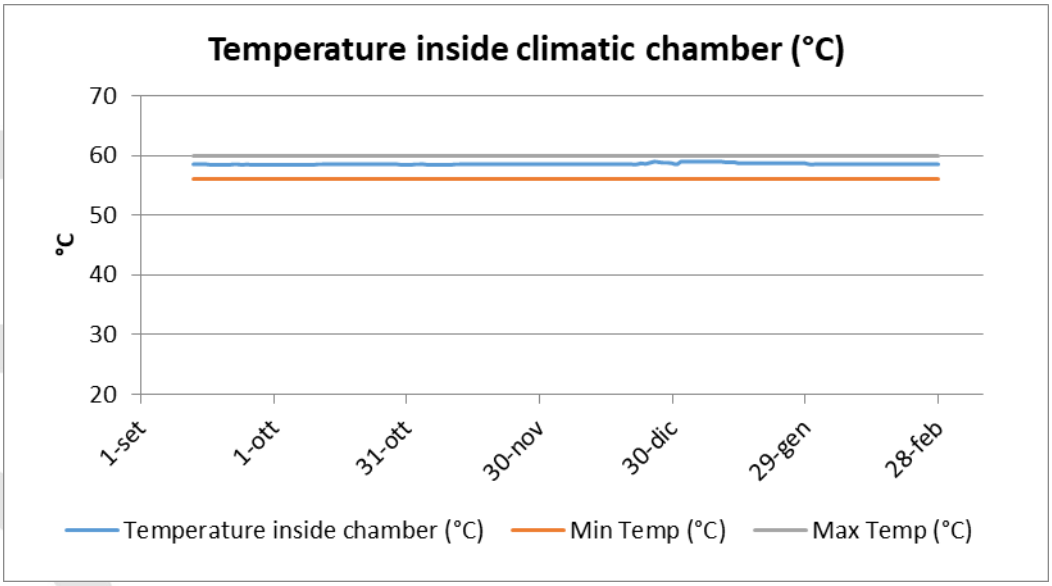


Figure 4. Temperature monitoring during biodegradability test in climatic chamber (58°C, temperature setting).

3.5 REQUIREMENTS FOR THE BIODEGRADATION TEST IN COMPOSTING CONDITIONS

The test met all the requirements for its validation, both for the "blank sample" (compost alone) and for the reference sample (cellulose), as detailed below and in Table 5:

1. after 10 days of incubation, the inoculum in the blank sample develops between 50 - 150 mg of carbon dioxide per gram of volatile solids (average values);
2. after 45 days of incubation, the degree of biodegradation of the reference material (cellulose) is more than 70%;
3. at the end of the test, the differences between the biodegradation percentage of the reference material in the different vessels is less than 20%.

Table 5. Compliance with the requirements for validity of the biodegradation test.

	Blank 1	Blank 4	Blank 7	Reference 10	Reference 13	Reference 16
CO2 after 10 days (mg)	147,7	149,7	146,2	-	-	-
Compliance [50 < CO2 < 150 mg]	Compliant	Compliant	Compliant	-	-	-
D after 45 days (%)	-	-	-	80,8	72,8	74,9
Compliance [D > 70%]	-	-	-	Compliant	Compliant	Compliant
Plateau reached?	-	-	-	YES	YES	YES
Plateau D (%)	-	-	-	91,9	90,6	91,3
Plateau time (days)	-	-	-	117,2	166,2	131,2
Final D (%) (all samples)	-	-	-	92,2	90,6	91,7
Final time (days)	-	-	-	167,0		
Compliance [Max - Min < 20]	-	-	-	Compliant		
D average (%)	-	-	-	91,5		
D definitive (%)	-	-	-	**Average**	**value**	**91,5**

3.6 EXPERIMENTAL RESULTS FOR BIODEGRADATION TEST

The most meaningful results are presented:

- CO_2 cumulative production for single vessel of blank inoculum, reference material and tested sample, see Figure 5,
- CO_2 evolved for single vessel of blank, reference material and tested sample (not subtracted by the blank compost and not cumulative, as raw data), see Table 6,
- Biodegradability percentages by each vessel for reference and test materials, in graphical and tabular form (Figure 6 and Figure 7, Table 7)
- Average Biodegradability percentages for reference and test materials, in graphical and tabular form (Figure 8, Table 7)
- Final degree of Biodegradation of the reference and test materials (Table 9).

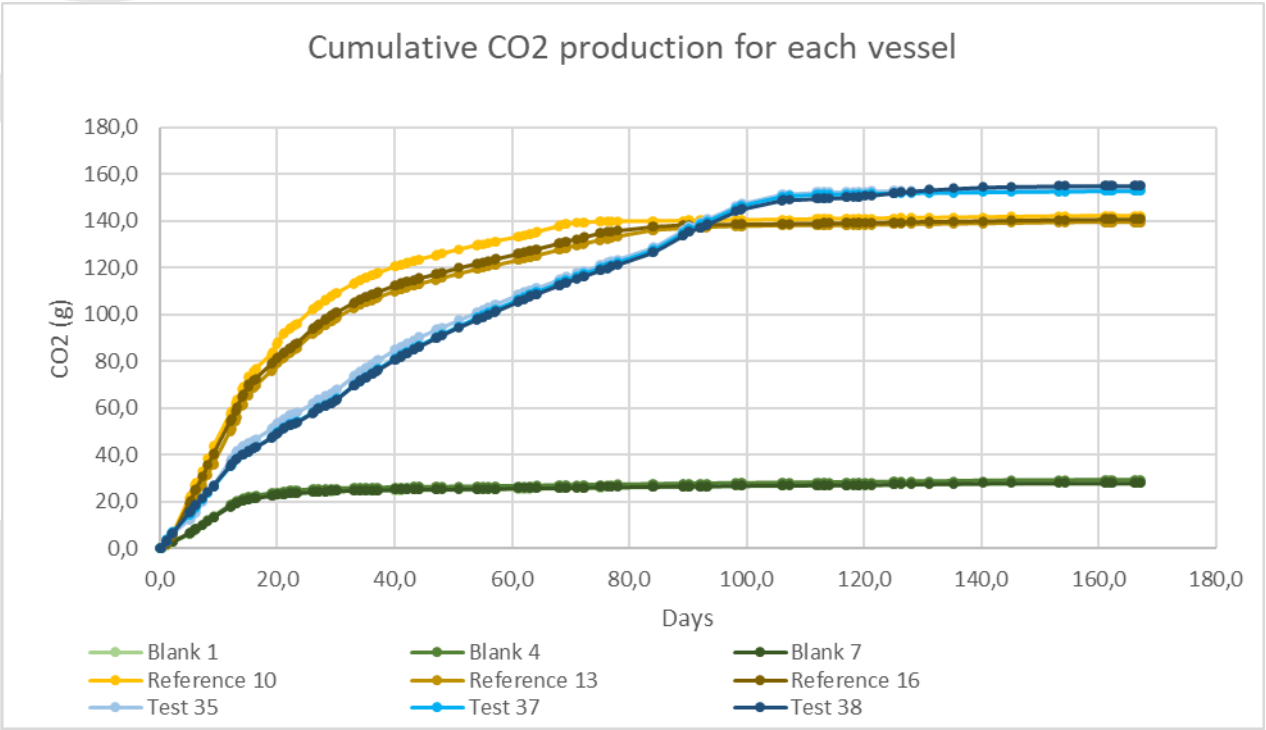


Figure 5. Cumulative CO2 production for single vessel.

Table 6. CO_2 evolved by each vessel for blank, reference and test materials and calculated average values.

TIME (days)	Blank 1	Blank 4	Blank 7	Average Blank	Reference 10	Reference 13	Reference 16	Average Reference	Test 35	Test 37	Test 38	Average Test
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,22	0,15	0,18	0,19	0,18	0,22	0,14	0,16	0,17	0,36	0,34	0,33	0,34
1,04	1,12	1,44	1,52	1,36	1,90	1,57	1,70	1,73	2,71	2,77	2,53	2,67
1,21	0,22	0,25	0,25	0,24	0,50	0,52	0,48	0,50	0,56	0,64	0,52	0,58
2,00	0,95	0,90	0,87	0,90	3,00	2,93	2,59	2,84	2,43	2,97	2,55	2,65
2,25	0,25	0,23	0,23	0,24	1,04	0,96	0,93	0,98	0,58	0,73	0,78	0,70
5,04	3,57	3,33	3,45	3,45	14,85	10,69	13,53	13,02	5,67	6,71	8,57	6,98
5,25	0,35	0,35	0,36	0,35	1,25	0,71	1,15	1,03	0,52	0,53	0,65	0,57
6,04	1,37	1,38	1,38	1,38	4,21	3,22	4,13	3,85	2,22	2,20	2,49	2,30
6,23	0,32	0,33	0,33	0,33	0,97	0,94	0,95	0,95	0,63	0,69	0,53	0,62
7,25	1,76	1,82	1,68	1,76	5,22	5,09	5,09	5,14	4,05	3,59	2,53	3,39
8,23	1,76	1,78	1,59	1,71	5,28	4,81	4,88	4,99	3,78	2,60	2,65	3,01
9,10	1,54	1,58	1,47	1,53	4,79	4,30	4,46	4,52	3,26	2,48	2,57	2,77
9,21	0,19	0,19	0,18	0,19	0,57	0,55	0,56	0,56	0,41	0,34	0,33	0,36
12,00	4,57	4,77	4,44	4,59	13,79	13,75	13,79	13,78	10,28	8,45	8,33	9,02
12,24	0,38	0,40	0,37	0,38	1,16	1,15	1,16	1,16	0,88	0,72	0,71	0,77
12,96	1,12	1,16	0,95	1,07	3,29	3,33	3,40	3,34	2,45	2,05	1,96	2,15
13,24	0,35	0,37	0,30	0,34	1,48	1,50	1,49	1,49	0,80	0,69	0,63	0,71
14,04	0,72	0,78	0,76	0,75	4,77	4,69	4,43	4,63	1,90	1,64	1,49	1,67
14,21	0,12	0,12	0,12	0,12	0,87	0,86	0,84	0,85	0,29	0,26	0,25	0,27
14,99	0,53	0,45	0,45	0,48	3,65	3,62	3,67	3,64	1,07	0,98	1,03	1,02
15,24	0,15	0,14	0,14	0,14	1,03	1,10	0,83	0,99	0,35	0,32	0,33	0,34
15,96	0,39	0,39	0,39	0,39	2,18	2,41	1,63	2,07	1,04	1,02	0,99	1,02
16,28	0,15	0,15	0,15	0,15	0,77	0,77	0,75	0,76	0,49	0,48	0,45	0,47
18,98	0,89	1,07	1,05	1,01	6,34	6,34	6,40	6,36	4,44	4,35	4,06	4,28
19,21	0,05	0,09	0,08	0,07	0,74	0,76	0,52	0,67	0,44	0,42	0,41	0,42
19,97	0,15	0,26	0,23	0,21	3,22	2,41	1,58	2,40	1,53	1,45	1,45	1,48
20,23	0,05	0,09	0,08	0,07	1,10	0,53	0,54	0,73	0,52	0,50	0,50	0,51
21,02	0,16	0,27	0,22	0,21	3,39	1,62	1,66	2,23	1,56	1,51	1,48	1,51
21,24	0,05	0,07	0,06	0,06	0,70	0,47	0,48	0,55	0,42	0,40	0,38	0,40
22,08	0,22	0,25	0,21	0,23	1,82	1,93	1,98	1,91	1,46	1,38	1,39	1,41
22,21	0,02	0,02	0,02	0,02	0,16	0,16	0,17	0,16	0,11	0,10	0,11	0,11
23,04	0,13	0,12	0,11	0,12	1,18	1,15	1,16	1,16	0,59	0,60	0,57	0,59
23,26	0,06	0,05	0,05	0,05	0,56	0,55	0,55	0,55	0,27	0,27	0,26	0,27
26,04	0,52	0,51	0,52	0,52	6,24	6,29	6,37	6,30	3,87	3,93	4,09	3,96
26,21	0,01	0,01	0,01	0,01	0,32	0,32	0,32	0,32	0,32	0,32	0,33	0,32
26,96	0,04	0,05	0,08	0,05	1,35	1,33	1,34	1,34	1,40	1,45	1,43	1,43
27,21	0,02	0,04	0,06	0,04	0,46	0,44	0,46	0,45	0,33	0,33	0,33	0,33
28,10	0,07	0,12	0,16	0,12	1,61	1,55	1,63	1,59	1,00	0,93	0,92	0,95
28,25	0,01	0,01	0,01	0,01	0,27	0,26	0,27	0,26	0,18	0,17	0,17	0,17
29,02	0,06	0,04	0,05	0,05	1,28	1,28	1,28	1,28	0,93	0,91	0,90	0,91
29,25	0,01	0,01	0,01	0,01	0,35	0,36	0,36	0,36	0,28	0,28	0,28	0,28

29,98	0,04	0,04	0,04	0,04	1,07	1,10	1,08	1,08	1,06	1,07	1,09	1,07
30,23	0,01	0,01	0,01	0,01	0,35	0,36	0,35	0,35	0,46	0,47	0,47	0,47
33,00	0,17	0,16	0,14	0,15	3,94	3,97	3,97	3,96	5,63	5,68	5,68	5,66
33,24	0,01	0,01	0,01	0,01	0,35	0,35	0,35	0,35	0,49	0,48	0,49	0,48
33,96	0,04	0,04	0,03	0,03	1,02	0,98	0,99	1,00	1,32	1,35	1,31	1,32
34,21	0,01	0,01	0,01	0,01	0,32	0,30	0,31	0,31	0,41	0,44	0,40	0,42
35,00	0,04	0,04	0,05	0,04	0,85	0,86	0,86	0,86	1,23	1,35	1,22	1,26
35,24	0,01	0,01	0,01	0,01	0,22	0,23	0,23	0,23	0,40	0,41	0,39	0,40
35,99	0,03	0,03	0,03	0,03	0,65	0,70	0,71	0,69	1,23	1,21	1,20	1,21
36,29	0,01	0,01	0,01	0,01	0,28	0,29	0,29	0,29	0,44	0,44	0,43	0,43
36,97	0,03	0,03	0,03	0,03	0,64	0,65	0,66	0,65	1,03	1,02	1,00	1,02
37,23	0,01	0,01	0,01	0,01	0,25	0,25	0,25	0,25	0,42	0,41	0,41	0,41
40,04	0,07	0,09	0,13	0,10	2,69	2,67	2,74	2,70	4,37	4,35	4,28	4,33
40,24	0,01	0,01	0,01	0,01	0,19	0,19	0,19	0,19	0,29	0,29	0,29	0,29
40,98	0,05	0,05	0,05	0,05	0,63	0,62	0,61	0,62	1,00	1,01	1,05	1,02
41,21	0,02	0,02	0,02	0,02	0,18	0,18	0,17	0,18	0,31	0,31	0,32	0,31
41,96	0,05	0,04	0,05	0,05	0,56	0,54	0,56	0,55	0,97	0,98	1,01	0,98
42,23	0,01	0,01	0,01	0,01	0,19	0,19	0,19	0,19	0,35	0,36	0,36	0,36
43,26	0,02	0,02	0,02	0,02	0,71	0,73	0,72	0,72	1,40	1,39	1,40	1,40
43,25	0,00	0,00	0,00	0,00	-0,01	-0,01	-0,01	-0,01	-0,02	-0,02	-0,02	-0,02
44,06	0,01	0,01	0,01	0,01	0,53	0,54	0,54	0,54	1,00	1,10	1,11	1,07
44,21	0,00	0,00	0,00	0,00	0,09	0,10	0,10	0,10	0,16	0,19	0,19	0,18
47,00	0,04	0,03	0,03	0,03	1,80	1,86	1,82	1,83	3,15	3,54	3,60	3,43
47,24	0,00	0,00	0,00	0,00	0,16	0,16	0,16	0,16	0,29	0,31	0,31	0,30
48,06	0,02	0,02	0,02	0,02	0,52	0,53	0,53	0,52	0,88	0,98	1,00	0,95
50,97	0,07	0,06	0,08	0,07	1,83	1,88	1,92	1,87	2,97	3,49	3,31	3,26
53,99	0,08	0,10	0,09	0,09	1,81	1,85	1,89	1,85	3,32	3,55	3,33	3,40
54,25	0,01	0,01	0,01	0,01	0,15	0,15	0,15	0,15	0,29	0,29	0,29	0,29
55,04	0,02	0,03	0,02	0,03	0,43	0,44	0,47	0,45	0,87	0,90	0,85	0,87
55,98	0,03	0,04	0,03	0,03	0,51	0,51	0,57	0,53	0,98	1,05	1,02	1,02
57,00	0,03	0,04	0,03	0,03	0,53	0,55	0,60	0,56	1,06	1,13	1,11	1,10
57,23	0,01	0,01	0,01	0,01	0,11	0,13	0,14	0,12	0,25	0,25	0,25	0,25
60,96	0,12	0,12	0,13	0,12	1,78	2,05	2,22	2,02	4,10	4,18	4,09	4,12
61,25	0,01	0,01	0,01	0,01	0,14	0,16	0,17	0,16	0,33	0,33	0,33	0,33
61,99	0,01	0,01	0,01	0,01	0,42	0,44	0,46	0,44	0,71	0,78	0,81	0,77
62,96	0,02	0,02	0,00	0,01	0,67	0,64	0,62	0,64	0,77	0,96	1,00	0,91
63,21	0,01	0,01	0,00	0,01	0,18	0,17	0,16	0,17	0,20	0,25	0,25	0,24
64,09	0,04	0,03	0,02	0,03	0,62	0,60	0,56	0,59	0,74	0,89	0,89	0,84
64,21	0,01	0,01	0,00	0,01	0,08	0,07	0,07	0,08	0,11	0,11	0,11	0,11
67,96	0,22	0,22	0,18	0,21	2,56	2,38	2,43	2,45	3,61	3,73	3,64	3,66
68,21	0,01	0,01	0,01	0,01	0,18	0,17	0,16	0,17	0,24	0,24	0,24	0,24
69,08	0,05	0,05	0,04	0,04	0,61	0,63	0,61	0,62	0,80	0,84	0,85	0,83
69,22	0,01	0,01	0,01	0,01	0,08	0,10	0,10	0,09	0,13	0,14	0,14	0,14
71,11	0,08	0,08	0,08	0,08	0,52	1,10	1,11	0,91	1,62	1,81	1,73	1,72
72,06	0,03	0,04	0,03	0,03	0,15	0,53	0,55	0,41	0,81	0,88	0,85	0,85
72,29	0,01	0,01	0,01	0,01	0,03	0,14	0,14	0,10	0,21	0,21	0,21	0,21

75,04	0,09	0,08	0,10	0,09	0,33	1,55	1,69	1,19	2,38	2,32	2,33	2,35
75,21	0,00	0,00	0,00	0,00	0,02	0,08	0,10	0,07	0,14	0,14	0,14	0,14
76,23	0,02	0,02	0,02	0,02	0,05	0,52	0,45	0,34	0,85	0,85	0,88	0,86
76,96	0,02	0,01	0,02	0,02	0,01	0,40	0,22	0,21	0,61	0,62	0,62	0,62
78,03	0,03	0,02	0,03	0,03	0,02	0,58	0,32	0,31	0,90	0,92	0,92	0,91
83,96	0,17	0,13	0,16	0,16	0,14	2,63	1,70	1,49	5,02	5,08	5,15	5,09
84,21	0,01	0,01	0,01	0,01	0,01	0,08	0,07	0,05	0,21	0,21	0,21	0,21
89,08	0,17	0,19	0,13	0,16	0,18	0,74	0,72	0,55	7,11	7,12	6,91	7,04
89,23	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,37	0,37	0,36	0,37
89,98	0,03	0,02	0,02	0,02	0,03	0,07	0,03	0,05	1,36	1,33	1,36	1,35
90,24	0,01	0,01	0,01	0,01	0,01	0,04	0,01	0,02	0,20	0,21	0,21	0,21
91,96	0,05	0,05	0,05	0,05	0,04	0,24	0,05	0,11	1,41	1,58	1,48	1,49
92,22	0,01	0,01	0,01	0,01	0,01	0,04	0,01	0,02	0,27	0,29	0,28	0,28
93,04	0,02	0,02	0,02	0,02	0,02	0,12	0,01	0,05	0,99	1,00	1,00	1,00
93,25	0,00	0,00	0,00	0,00	0,01	0,03	0,00	0,01	0,25	0,26	0,26	0,26
98,08	0,13	0,11	0,13	0,12	0,14	0,38	0,09	0,20	5,49	5,50	5,41	5,47
98,97	0,03	0,03	0,03	0,03	0,02	0,03	0,03	0,03	0,93	0,92	0,87	0,91
99,23	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,26	0,27	0,25	0,26
105,96	0,10	0,12	0,10	0,11	0,15	0,22	0,18	0,18	3,97	3,97	3,75	3,89
106,25	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,05	0,05	0,04	0,04
107,22	0,01	0,01	0,01	0,01	0,04	0,02	0,04	0,03	0,14	0,13	0,12	0,13
112,00	0,12	0,12	0,05	0,10	0,22	0,07	0,19	0,16	0,62	0,58	0,53	0,58
112,26	0,01	0,01	0,00	0,01	0,01	0,00	0,01	0,01	0,03	0,03	0,03	0,03
113,08	0,01	0,02	0,00	0,01	0,03	0,01	0,02	0,02	0,08	0,07	0,08	0,08
113,25	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01
113,97	0,00	0,01	0,01	0,01	0,01	0,01	0,02	0,01	0,05	0,03	0,05	0,04
117,00	0,03	0,03	0,05	0,04	0,06	0,04	0,09	0,07	0,20	0,12	0,32	0,21
117,21	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,01	0,01	0,03	0,02
118,28	0,01	0,02	0,03	0,02	0,03	0,02	0,03	0,03	0,03	0,03	0,16	0,07
118,96	0,01	0,02	0,02	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,11	0,05
119,21	0,01	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,05	0,02
120,10	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,04	0,24	0,11
121,21	0,05	0,06	0,05	0,05	0,05	0,06	0,06	0,06	0,07	0,08	0,32	0,16
124,99	0,13	0,16	0,16	0,15	0,13	0,17	0,18	0,16	0,18	0,17	1,03	0,46
125,22	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,06	0,03
126,25	0,03	0,02	0,03	0,03	0,02	0,04	0,05	0,04	0,03	0,04	0,27	0,12
128,10	0,04	0,03	0,04	0,04	0,05	0,07	0,08	0,07	0,04	0,06	0,42	0,17
131,24	0,08	0,06	0,07	0,07	0,10	0,09	0,10	0,10	0,08	0,08	0,57	0,24
135,22	0,13	0,13	0,13	0,13	0,12	0,11	0,13	0,12	0,11	0,11	0,57	0,26
140,24	0,16	0,18	0,16	0,17	0,13	0,14	0,16	0,14	0,13	0,14	0,55	0,28
145,13	0,09	0,09	0,08	0,09	0,14	0,14	0,17	0,15	0,14	0,09	0,30	0,18
153,23	0,09	0,07	0,02	0,06	0,27	0,27	0,30	0,28	0,25	0,21	0,25	0,24
154,28	0,01	0,01	0,00	0,01	0,03	0,03	0,03	0,03	0,03	0,03	0,02	0,03
161,05	0,01	0,08	0,03	0,04	0,12	0,08	0,17	0,12	0,15	0,14	0,09	0,13
161,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
162,03	0,00	0,01	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01

162,26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
166,08	0,00	0,03	0,01	0,02	0,03	0,05	0,05	0,04	0,04	0,03	0,02	0,03
166,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
166,96	0,01	0,02	0,00	0,01	0,00	0,01	0,01	0,01	0,01	0,01	0,00	0,01
167,21	0,01	0,01	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

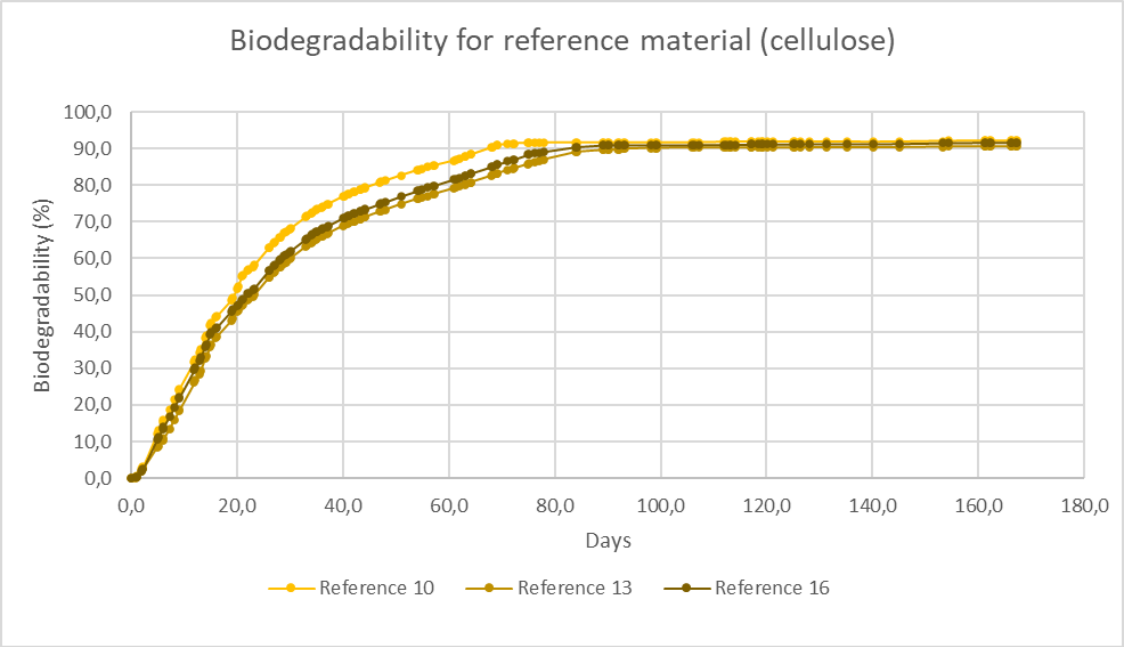


Figure 6. Biodegradation degree of reference material (each vessel).

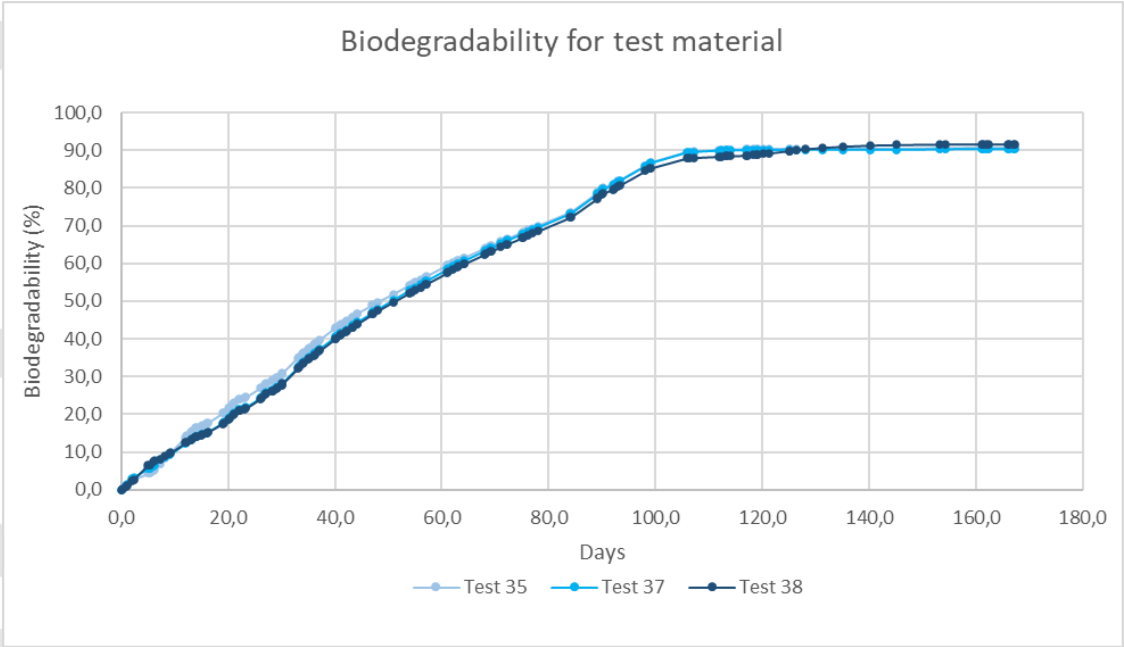


Figure 7. Biodegradation degree of test material (each vessel).

Table 7. Biodegradability percentages by each vessel for reference and test materials and calculated average values.

TIME (days)	Reference 10	Reference 13	Reference 16	Average Reference	Test 35	Test 37	Test 38	Average Test
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,22	0,03	-0,03	-0,01	0,00	0,13	0,12	0,11	0,12
1,04	0,48	0,14	0,27	0,30	1,11	1,14	0,96	1,07
1,21	0,69	0,37	0,46	0,51	1,34	1,43	1,17	1,31
2,00	2,39	2,02	1,84	2,08	2,44	2,93	2,36	2,58
2,25	3,03	2,61	2,40	2,68	2,68	3,29	2,75	2,91
5,04	12,26	8,50	10,63	10,46	4,29	5,66	6,45	5,47
5,25	12,98	8,79	11,28	11,02	4,41	5,79	6,67	5,62
6,04	15,28	10,29	13,52	13,03	5,01	6,38	7,47	6,29
6,23	15,79	10,79	14,03	13,54	5,23	6,64	7,62	6,50
7,25	18,60	13,51	16,75	16,29	6,88	7,98	8,18	7,68
8,23	21,49	16,04	19,34	18,96	8,38	8,63	8,86	8,62
9,10	24,12	18,29	21,73	21,38	9,63	9,32	9,62	9,52
9,21	24,43	18,59	22,03	21,69	9,79	9,42	9,73	9,65
12,00	31,88	26,05	29,54	29,16	13,89	12,23	12,43	12,85
12,24	32,51	26,68	30,17	29,79	14,25	12,47	12,67	13,13
12,96	34,30	28,51	32,07	31,63	15,24	13,18	13,30	13,91
13,24	35,22	29,45	33,00	32,56	15,57	13,43	13,51	14,17
14,04	38,47	32,66	36,01	35,71	16,39	14,07	14,04	14,84
14,21	39,08	33,26	36,59	36,31	16,52	14,17	14,13	14,94
14,99	41,64	35,81	39,19	38,88	16,94	14,54	14,53	15,34
15,24	42,37	36,60	39,76	39,57	17,09	14,67	14,66	15,48
15,96	43,81	38,24	40,77	40,94	17,56	15,13	15,10	15,93
16,28	44,31	38,75	41,26	41,44	17,81	15,36	15,32	16,16
18,98	48,63	43,09	45,65	45,79	20,29	17,79	17,53	18,53
19,21	49,18	43,65	46,02	46,28	20,55	18,04	17,77	18,79
19,97	51,61	45,44	47,13	48,06	21,50	18,94	18,66	19,70
20,23	52,44	45,82	47,52	48,59	21,82	19,25	18,97	20,01
21,02	55,02	46,97	48,70	50,23	22,79	20,18	19,89	20,95
21,24	55,54	47,30	49,05	50,63	23,04	20,43	20,12	21,20
22,08	56,82	48,69	50,47	51,99	23,93	21,26	20,96	22,05
22,21	56,94	48,80	50,59	52,11	23,99	21,33	21,03	22,12
23,04	57,79	49,64	51,44	52,96	24,34	21,67	21,35	22,46
23,26	58,20	50,05	51,85	53,37	24,49	21,83	21,51	22,61
26,04	62,83	54,75	56,62	58,07	26,91	24,31	24,09	25,10
26,21	63,08	55,00	56,87	58,32	27,13	24,53	24,32	25,33
26,96	64,13	56,04	57,92	59,36	28,11	25,54	25,31	26,32
27,21	64,47	56,36	58,26	59,70	28,31	25,76	25,52	26,53
28,10	65,67	57,52	59,49	60,90	28,95	26,35	26,10	27,13
28,25	65,88	57,73	59,70	61,10	29,07	26,46	26,22	27,25
29,02	66,88	58,73	60,70	62,10	29,71	27,09	26,84	27,88
29,25	67,15	59,02	60,99	62,39	29,90	27,28	27,03	28,07

29,98	67,99	59,88	61,84	63,24	30,65	28,03	27,79	28,82
30,23	68,26	60,16	62,12	63,51	30,97	28,36	28,12	29,15
33,00	71,32	63,27	65,23	66,61	34,91	32,37	32,11	33,13
33,24	71,59	63,54	65,51	66,88	35,26	32,71	32,46	33,48
33,96	72,40	64,31	66,29	67,67	36,18	33,67	33,38	34,41
34,21	72,64	64,55	66,53	67,91	36,47	33,98	33,66	34,70
35,00	73,30	65,21	67,20	68,57	37,32	34,92	34,50	35,58
35,24	73,47	65,39	67,38	68,74	37,60	35,21	34,78	35,87
35,99	73,97	65,93	67,93	69,28	38,47	36,07	35,62	36,72
36,29	74,18	66,16	68,16	69,50	38,77	36,38	35,92	37,02
36,97	74,68	66,67	68,67	70,01	39,50	37,10	36,62	37,74
37,23	74,87	66,86	68,87	70,20	39,79	37,39	36,91	38,03
40,04	76,97	68,96	71,03	72,32	42,87	40,48	39,94	41,10
40,24	77,12	69,10	71,17	72,46	43,07	40,68	40,14	41,30
40,98	77,59	69,57	71,63	72,93	43,76	41,38	40,87	42,00
41,21	77,71	69,70	71,76	73,06	43,97	41,59	41,09	42,21
41,96	78,13	70,10	72,18	73,47	44,63	42,26	41,78	42,89
42,23	78,28	70,25	72,33	73,62	44,88	42,52	42,03	43,14
43,26	78,84	70,83	72,90	74,19	45,88	43,51	43,04	44,14
43,25	78,83	70,82	72,90	74,18	45,86	43,50	43,02	44,13
44,06	79,25	71,26	73,33	74,61	46,58	44,29	43,82	44,90
44,21	79,33	71,33	73,41	74,69	46,70	44,43	43,96	45,03
47,00	80,76	72,82	74,87	76,15	48,95	46,97	46,54	47,48
47,24	80,88	72,95	75,00	76,28	49,16	47,19	46,76	47,70
48,06	81,29	73,36	75,41	76,69	49,78	47,89	47,46	48,38
50,97	82,71	74,84	76,92	78,15	51,87	50,37	49,81	50,68
53,99	84,10	76,27	78,39	79,59	54,20	52,88	52,15	53,08
54,25	84,21	76,38	78,51	79,70	54,40	53,09	52,35	53,28
55,04	84,54	76,72	78,87	80,04	55,01	53,72	52,95	53,89
55,98	84,92	77,11	79,30	80,45	55,69	54,46	53,66	54,60
57,00	85,32	77,53	79,77	80,87	56,44	55,25	54,45	55,38
57,23	85,40	77,63	79,87	80,97	56,61	55,43	54,62	55,55
60,96	86,75	79,20	81,59	82,51	59,48	58,37	57,49	58,44
61,25	86,86	79,32	81,72	82,63	59,70	58,61	57,72	58,68
61,99	87,19	79,67	82,08	82,98	60,21	59,17	58,29	59,22
62,96	87,72	80,19	82,58	83,49	60,75	59,85	59,01	59,87
63,21	87,86	80,32	82,70	83,63	60,89	60,03	59,19	60,04
64,09	88,34	80,78	83,14	84,09	61,40	60,65	59,81	60,62
64,21	88,40	80,84	83,19	84,14	61,47	60,73	59,89	60,70
67,96	90,30	82,61	85,00	85,97	63,92	63,29	62,37	63,19
68,21	90,43	82,73	85,12	86,10	64,08	63,46	62,54	63,36
69,08	90,89	83,21	85,59	86,56	64,63	64,03	63,12	63,93
69,22	90,94	83,28	85,66	86,63	64,72	64,13	63,21	64,02
71,11	91,30	84,11	86,51	87,31	65,83	65,39	64,40	65,20
72,06	91,39	84,52	86,93	87,61	66,38	66,00	65,00	65,79
72,29	91,41	84,63	87,04	87,69	66,53	66,14	65,14	65,94

75,04	91,61	85,82	88,34	88,59	68,18	67,76	66,76	67,57
75,21	91,62	85,88	88,42	88,64	68,28	67,86	66,86	67,67
76,23	91,64	86,29	88,76	88,90	68,88	68,46	67,48	68,27
76,96	91,64	86,60	88,93	89,06	69,30	68,90	67,92	68,71
78,03	91,64	87,04	89,17	89,28	69,94	69,55	68,56	69,35
83,96	91,62	89,06	90,43	90,37	73,45	73,12	72,18	72,92
84,21	91,62	89,12	90,48	90,41	73,59	73,27	72,33	73,06
89,08	91,64	89,59	90,94	90,72	78,60	78,32	77,21	78,04
89,23	91,64	89,59	90,94	90,72	78,86	78,58	77,47	78,30
89,98	91,65	89,64	90,94	90,74	79,83	79,53	78,43	79,26
90,24	91,65	89,66	90,94	90,75	79,97	79,68	78,58	79,41
91,96	91,65	89,82	90,94	90,80	80,96	80,79	79,62	80,45
92,22	91,64	89,85	90,94	90,81	81,14	81,00	79,81	80,65
93,04	91,65	89,92	90,94	90,84	81,84	81,71	80,52	81,36
93,25	91,65	89,94	90,94	90,84	82,02	81,90	80,71	81,54
98,08	91,66	90,16	90,91	90,91	85,89	85,80	84,53	85,41
98,97	91,66	90,16	90,91	90,91	86,54	86,45	85,14	86,04
99,23	91,66	90,16	90,91	90,91	86,73	86,64	85,32	86,23
105,96	91,69	90,25	90,97	90,97	89,51	89,44	87,95	88,97
106,25	91,69	90,25	90,97	90,97	89,54	89,47	87,98	89,00
107,22	91,71	90,26	90,99	90,99	89,63	89,56	88,05	89,08
112,00	91,82	90,24	91,07	91,04	90,01	89,91	88,37	89,43
112,26	91,82	90,24	91,08	91,04	90,03	89,93	88,39	89,45
113,08	91,83	90,24	91,08	91,05	90,08	89,97	88,43	89,50
113,25	91,84	90,24	91,08	91,05	90,09	89,98	88,44	89,50
113,97	91,84	90,24	91,09	91,06	90,12	90,00	88,47	89,53
117,00	91,86	90,24	91,14	91,08	90,24	90,06	88,67	89,66
117,21	91,86	90,24	91,14	91,08	90,24	90,06	88,69	89,66
118,28	91,87	90,24	91,15	91,09	90,25	90,07	88,79	89,70
118,96	91,87	90,25	91,16	91,09	90,25	90,07	88,86	89,73
119,21	91,87	90,25	91,16	91,09	90,25	90,07	88,89	89,74
120,10	91,87	90,25	91,17	91,10	90,26	90,08	89,04	89,80
121,21	91,87	90,26	91,17	91,10	90,28	90,10	89,24	89,87
124,99	91,85	90,27	91,19	91,11	90,30	90,12	89,87	90,10
125,22	91,85	90,27	91,20	91,11	90,30	90,12	89,91	90,11
126,25	91,85	90,29	91,22	91,12	90,30	90,13	90,09	90,17
128,10	91,86	90,31	91,25	91,14	90,31	90,15	90,37	90,27
131,24	91,89	90,32	91,28	91,16	90,31	90,15	90,73	90,40
135,22	91,88	90,31	91,28	91,15	90,30	90,14	91,05	90,50
140,24	91,85	90,29	91,27	91,14	90,28	90,12	91,33	90,58
145,13	91,89	90,33	91,34	91,19	90,32	90,12	91,48	90,64
153,23	92,06	90,51	91,53	91,36	90,45	90,23	91,62	90,77
154,28	92,07	90,52	91,55	91,38	90,47	90,25	91,63	90,78
161,05	92,14	90,55	91,65	91,45	90,55	90,32	91,67	90,85
161,24	92,14	90,55	91,66	91,45	90,55	90,32	91,67	90,85
162,03	92,15	90,55	91,66	91,45	90,56	90,32	91,67	90,85

162,26	92,15	90,56	91,66	91,46	90,56	90,32	91,67	90,85
166,08	92,16	90,58	91,69	91,48	90,58	90,34	91,67	90,86
166,24	92,16	90,58	91,69	91,48	90,58	90,34	91,67	90,86
166,96	92,15	90,58	91,69	91,47	90,57	90,33	91,67	90,86
167,21	92,15	90,58	91,68	91,47	90,57	90,33	91,67	90,86

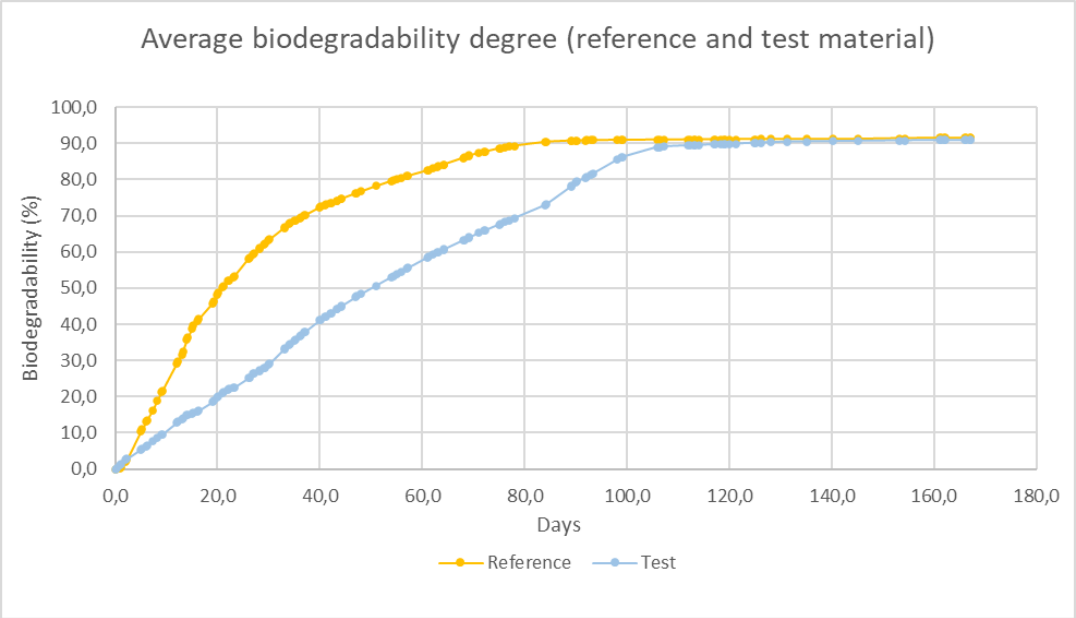


Figure 8. Average Biodegradation degrees for reference and test materials.

The weights of the single composting vessel, estimated at the beginning and at the end of the biodegradation test is provided in next Table 8.

Table 8. Weight of each vessel for biodegradation test.

	Initial weight (kg)	Final weight (kg)
Blank 1	2,55	1,91
Blank 4	2,68	1,89
Blank 7	2,51	1,77
Reference 10	2,48	1,82
Reference 13	2,50	1,77
Reference 16	2,47	1,59
Test 35	2,47	1,63
Test 37	2,45	1,75
Test 38	2,51	1,61

Table 9. Main meaningful results for biodegradability test in composting conditions.

	Blank 1	Blank 4	Blank 7	Reference 10	Reference 13	Reference 16	Test 35	Test 37	Test 38
CO2 after 10 days (mg)	147,7	149,7	146,2	-	-	-	-	-	-
Compliance [50 < CO2 < 150 mg]	Compliant	Compliant	Compliant	-	-	-	-	-	-
D after 45 days (%)	-	-	-	80,8	72,8	74,9	-	-	-
Compliance [D > 70%]	-	-	-	Compliant	Compliant	Compliant	-	-	-
Plateau reached?	-	-	-	YES	YES	YES	YES	YES	YES
Plateau D (%)	-	-	-	91,9	90,6	91,3	90,6	90,3	91,7
Plateau time (days)	-	-	-	117,2	166,2	131,2	166,1	166,1	167,0
Final D (%) (all samples)	-	-	-	92,2	90,6	91,7	90,6	90,3	91,7
Final time (days)	-	-	-	167,0			167,0		
Compliance [Max - Min < 20]	-	-	-	Compliant			-	-	-
D average (%)	-	-	-	91,5			90,9		
D definitive (%)	-	-	-	**Average**	**value**	**91,5**	**Average**	**value**	**90,9**

3.7 VISUAL OBSERVATION, pH AND MOISTURE CONTENT DURING THE OVERALL TEST

The visual observation on inoculum, reference and test materials during the overall biodegradation test, such as moisture content, fungal development, structure, color, odor and physical measurements are provided in Table 10, Table 11 and Table 12, respectively.

Table 10. Visual observation and measurement on blank samples (Blank 1, 4 and 7).

Date	Blank 1							Blank 4							Blank 7						
	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	pH	Compliance pH	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	pH	Compliance pH	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	pH	Compliance pH
20/09/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,15	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,03	Compliant
27/09/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,15	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,1	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,09	Compliant
04/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,21	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,12	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,11	Compliant
11/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,14	Compliant
17/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,19	Compliant
25/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,15	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,21	Compliant
31/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,09	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,11	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,15	Compliant
08/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,23	Compliant
14/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,24	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,19	Compliant
22/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,26	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,17	Compliant
29/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,24	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,19	Compliant
04/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,29	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,26	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,23	Compliant
11/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,29	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,25	Compliant
18/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,26	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,3	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,17	Compliant
27/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,32	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,19	Compliant
04/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,3	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant
11/12/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,3	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,24	Compliant
18/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,25	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,26	Compliant
22/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,28	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,27	Compliant
29/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,24	Compliant
05/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,26	Compliant
12/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,1	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,13	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,21	Compliant
23/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,12	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,1	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	8,19	Compliant

Table 11. Visual observation and measurement on reference materials (Reference10, 13 and 16).

Date	Reference 10								Reference 13								Reference 16							
	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	test material disintegration	pH	Compliance pH	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	test material disintegration	pH	Compliance pH	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	test material disintegration	pH	Compliance pH
20/09/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	7,97	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,07	Compliant
27/09/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,05	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,11	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant
04/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,1	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,08	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,08	Compliant
11/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,11	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant
17/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,18	Compliant
25/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,24	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,16	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,15	Compliant
31/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,11	Compliant
08/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant
14/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,28	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant
22/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,26	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant
29/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,23	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant
04/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,29	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant
11/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,29	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,3	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant
18/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,25	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,29	Compliant
27/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,25	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,23	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant
04/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant
11/12/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant
18/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,26	Compliant
22/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,24	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,24	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,28	Compliant
29/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,23	Compliant
05/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,24	Compliant
12/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant
23/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,13	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant

Table 12. Visual observation and measurement on test materials (Test 35, 37 and 38).

Date	Test 35								Test 37								Test 38							
	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	test material disintegration	pH	Compliance pH	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	test material disintegration	pH	Compliance pH	Compost structure	Moisture content of the compost	Compost colour	Mold and mildew development	Smell of exhaust air	test material disintegration	pH	Compliance pH
20/09/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,06	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	7,99	Compliant
27/09/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,03	Compliant
04/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,05	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,15	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant
11/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,08	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,1	Compliant
17/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,11	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant
25/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,04	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,08	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,15	Compliant
31/10/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,11	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,16	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,02	Compliant
08/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,06	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,1	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant
14/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,09	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant
22/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,11	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,1	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant
29/11/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,12	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,27	Compliant
04/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,15	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant
11/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,18	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,26	Compliant
18/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant
27/12/2023	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,23	Compliant
04/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant
11/12/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,24	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,23	Compliant
18/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,26	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,28	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,3	Compliant
22/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,27	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,24	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,25	Compliant
29/01/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,26	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant
05/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,22	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant
12/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,21	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,19	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,23	Compliant
23/02/2024	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,2	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,17	Compliant	Homogeneous	Rightly so, without free water	Dark brown	no	Undergrowth	-	8,14	Compliant

3.8 CONCLUSION ON BIODEGRADABILITY TEST ON COMPOSTING CONDITION

The biodegradation test has run properly, according to the validity criteria, as follow:

1. after 10 days of incubation, the inoculum in the blank sample develops between 50 - 150 mg of carbon dioxide per gram of volatile solids (average values);
2. after 45 days of incubation, the degree of biodegradation of the reference material (cellulose) is more than 70%;
3. at the end of the test, the differences between the biodegradation percentage of the reference material in the different vessels is less than 20%.

The test material complies with the requirements of EN 13432 for the biodegradability degree in composting conditions, providing an average biodegradation degree 91 ± 12 % after 167 days (at the plateau value).

4 DISINTEGRATION AND EFFECTS ON THE BIOLOGICAL TREATMENT PROCESS (IF ANY)

The disintegration test procedure is according to **ISO 16929:2021** (quantitative sieving test) and it is considered sufficient for the compliance to disintegration requirements (> 90% within 12 weeks, as defined in EN13432). The disintegration test started on November 10th, 2023 and ended on February 02nd, 2024. The test is performed on two different thicknesses of the film samples:

- Thickness of "30 µm sample": 32 ± 4 µm (experimental measurement) [ANNEX 5 – Test report n. 22311632/5]
- Thickness of "61 µm sample": 62 ± 5 µm (experimental measurement) [ANNEX 4 – Test report n. 22311632/4]

4.1 TEST MATERIAL IDENTIFICATION

See Test Report n. 22311632/1 – ANNEX 1, Table 1 and Table 14 in the present Report.

4.2 INOCULUM DESCRIPTION (SOURCE AND PRELIMINARY CHARACTERISATION)

Inoculum is prepared as follow (Table 13):

− Fruit / vegetable (50 %, made by 12 % banana, 28 % apple, 12 % pear, 12 % carrot, 24 % potato, 12 % leek)

− Mature Compost (5 %)

− Rabbit feed pellets (30 %)

− Bulking material (wood bark) (15 %)

Separately, the compost and the bark are sieved at 5 cm and sieved material is mixed. Fruits and vegetables are cut into pieces smaller than 5 cm. The compost is stored at refrigerated temperature (4 ± 1 ° C) for 1 month (maximum).

Table 13. Inoculum identification and composition for disintegration test.

Inoculum (weight per test material, divided in 2 vessels)			
ARCHA REAGENT CODE			R50045001 (P2023000199)
Ratio	Soil		-
	Mature compost		1,5
	Rabbit feed in pellets		9
	Wood bark - bulking agent		4,5
	Fruit/ vegetable	Banana	1,8
		Apple	4,2
		Pear	1,8
		Carrot	1,8
		Potato	3,6
		Leek	1,8

Results from the analyses carried on for the characterisation of the inoculum are presented in Test Report n. 22311632/3 – ANNEX 3 and in Table 14.

Table 14. Characterization of the inoculum and test material for disintegration test.

Parameters	C (% dm)	N tot (% dm)	Humidity (%)	Volatile solids 550°C (% dm)	pH	C/N substrate	Compliance pH [pH > 5]	Compliance C/N [20 < C/N < 30]	Compliance volatile solids [VS > 50 % s.s.]	Compliance humidity [U > 50 %]
Inoculum	44,6	1,97	78,82	90,46	6,9	22,6	Compliant	Compliant	Compliant	Compliant
Test material	50,5	-	0,58	96,04	-	-	-	-	-	-

4.3 PREPARATION OF THE TEST MATERIAL

The test material was prepared by using both film samples reduced to 10 x 10 cm pieces for the disintegration test. The granulates sample was used for the ecotoxicity test and the assessment of the quality of the final compost.

The composting vessels were:

- 2 for control (inoculum alone – vessels n. 1 and n. 2)
- 2 for the test material disintegration (inoculum + 30 µm-film, vessels n. 5 and 6)
- 2 for the test material disintegration (inoculum + 61 µm-film) + test material for the ecotoxicity test (inoculum + granulates sample - vessels n. 7 and 8)

The amount of test material added in each vessel were:

- 1% on wet basis of the film (for disintegration)
- 9% on wet basis of the granulates (for ecotoxicity).

Each vessel was filled with the same amount of inoculum in each container (15 kg). The actual test material and inoculum weights for disintegration and ecotoxicity tests are presented in Table 15.

Carefully, the inoculum and test material were mixed, the containers were closed and the test started in the incubation chamber at a controlled temperature.

Table 15. Information related to disintegration and preparative for ecotoxicity test conditions.

Vessel	Control sample 1	Control sample 2	Test 5 (30 µm)	Test 6 (30 µm)
Amount inoculum as it is (Kg)	15,0	15,0	15,0	15,0
Theoretical material weight for disintegration test (g)	-	-	150,00	150,00
Actual material weight for disintegration test (g)	-	-	155,20	159,50
Actual material weight for disintegration test (g dm)	-	-	154,30	158,57

Vessel	Control sample 1	Control sample 2	Test 7 (61 µm)	Test 8 (61 µm)
Amount inoculum as it is (Kg)	15,0	15,0	15,0	15,0
Theoretical material weight for disintegration test (g)	-	-	150,00	150,00
Theoretical material weight for ecotoxicity test (g)	-	-	1350,00	1350,00
Actual material weight for disintegration test (g)	-	-	156,30	152,90
Actual material weight for ecotoxicity test (g)	-	-	1349,70	1351,20
Actual material weight for disintegration test (g dm)	-	-	155,39	152,01

4.4 DESCRIPTION OF EQUIPMENT FOR DISINTEGRATION TEST

The equipment (Figure 9) is made by:

- Composting vessel made by not-biodegradable and heat-resistant plastic, 40 liters volume, with sealing closure with holes for air inlet and outlet and temperature probe and equipped with drainage system consisting of a drainage layer (gravel) with a height of at least 5 cm from the bottom of the container
- Probes for measuring temperature
- Data logger for temperature
- Residual oxygen determination system with integrated temperature sensor: continuous analyzer with UV sensor.
- Climatic chamber
- Various sieves (2 mm, 10 mm and 5 cm mesh)
- Technical Balance (maximum 100 kg)
- Analytical Balance
- Dewar vessel (1.5 L volume)



Figure 9. Pictures of the equipment for disintegration test.

4.5 TEST TEMPERATURE RANGE

The disintegration test was carried in a overshadowed incubation chamber, with temperature monitoring (in Figure 10 and Table 16) for the acquired data of temperature monitoring during the disintegration test inside vessels.

Table 16. pH and Temperature inside each vessel compliance during the disintegration test.

	Control sample 1	Control sample 2	Test 5 (30 µm)	Test 6 (30 µm)	Test 7 (61 µm)	Test 8 (61 µm)
Compliance pH [Max > 7]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 2-7: 60 < T < 75]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 8-28: 55 (±5) < T < 65 (±5)]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 29-56: 50 (±5) < T < 60 (±5)]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 57-70: T < 50]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 71-84: T < 45]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant

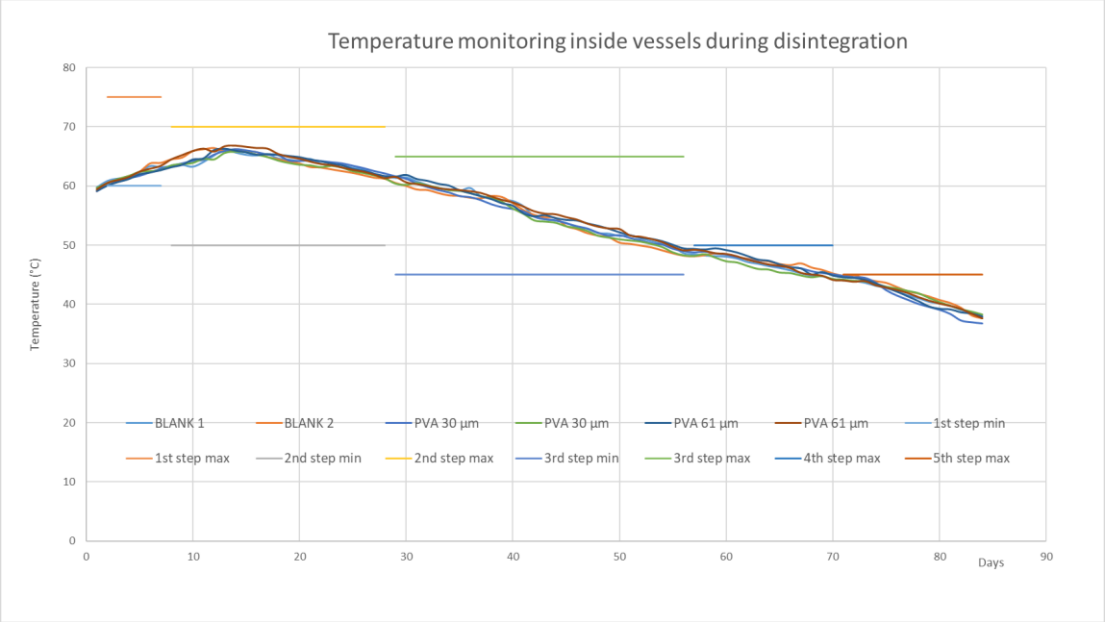


Figure 10. Temperature monitoring during disintegration test in climatic chamber.

4.6 COMPOSTING PROCESS PROFILE OF MAIN PARAMETERS (OXYGEN, PH AND MOISTURE)

In the following graphs (from Figure 11 to Figure 13). The Oxygen concentration in exhausted air is always above 10% in compliance with the requirements of the ISO 16929:2021. The pH values are more than 5 (according to the best composting environment) for all samples. The humidity content of the materials inside each vessel is more than 40% as recommended for a good composting process to occur (and no need to add water).

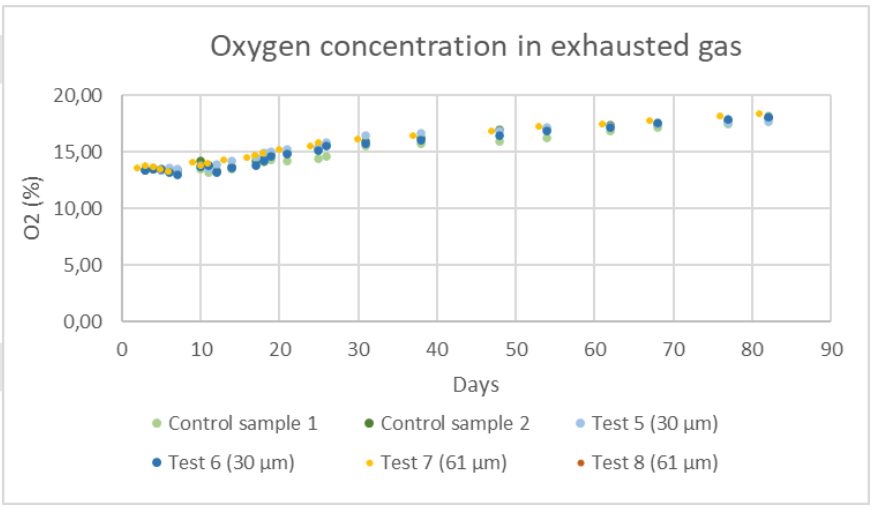


Figure 11. Oxygen concentration in exhausted air from each reactor, during disintegration test.

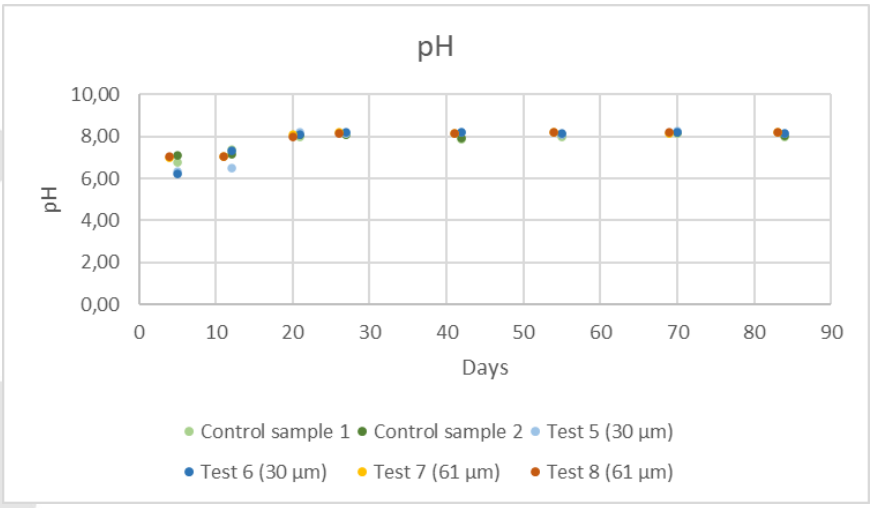


Figure 12. pH of substrate in each reactor, during disintegration test.

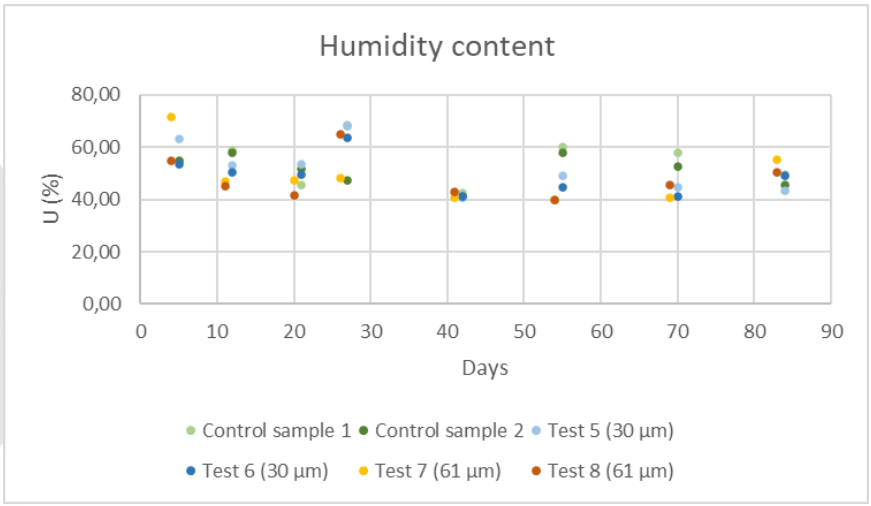


Figure 13. Moisture content of substrate in each reactor, during disintegration test.

4.7 FINAL RESULTS FROM BLANK

The maturity level of the blank samples is checked by using the "Rottegrad" scale. The "Rottegrad" scale is evaluated on 1 cm sieved sample and the maximum reached temperature (T max) is recorded in a self-heating test carried on in a Dewar vessel (see Methods Book for the Analysis of Compost 3rd Ed. - Federal Compost Quality). The self-heating capacity of the fresh compost in the Dewar vessels provides an estimation of the maturity degree of the compost. The obtained results are presented in Table 17.

Table 17. Blank samples – Rottegrad degree

	Maximum temperature (°C)	Rottegrad degree
Blank 1	37,6	4
Blank 2	37,4	4

4.8 AMOUNTS OF RESIDUAL MATERIALS AFTER COMPOSTING AND SIEVING PROCESSES

Homogenised material is taken from each sample reactor from disintegration test. After cooling to room temperature, a sieving treatment is made firstly at 1 cm, breaking the agglomerates manually and then sieved at 2 mm. The obtained results are shown in Table 18 and the conformity criteria are inserted in Table 19.

Table 18. Test material – disintegration degree and volatile solids content of not disintegrated residues.

	Starting test material weight (g dm)	Final test material weight (g dm)	Disintegration degree (%)	Volatile solids (% dm)
Test 5	154,30	0	100	NA
Test 6	158,57	0	100	NA
Test 7	155,39	0	100	NA
Test 8	152,01	0	100	NA

Table 19. Conformity criteria for the final disintegration results.

	Control sample 1	Control sample 2	Test 5 (30 µm)	Test 6 (30 µm)	Test 7 (61 µm)	Test 8 (61 µm)
Compliance pH [Max > 7]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 2-7: 60 < T < 75]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 8-28: 55 (±5) < T < 65 (±5)]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 29-56: 50 (±5) < T < 60 (±5)]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 57-70: T < 50]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Temperature compliance [days 71-84: T < 45]	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
Test material dry weight end of test > 2mm (g)	-	-	0	0	0	0
Disintegration degree (%)	-	-	**100,00**	**100,00**	**100,00**	**100,00**
VS on remaining material at the end of the test (% dm)	-	-	NA	NA	NA	NA
Max Rottegrad temperature (°C)	37,6	37,4	-	-	-	-
Rottegrad degree after 12 weeks	4	4	-	-	-	-
Compliance Rottegrad degree	Compliant	Compliant	-	-	-	-

NA = not available

4.9 VISUAL OBSERVATION (OPTIONAL)

In ANNEX 7, the pictures of the material over 2 mm sieve and the residual composted material (passed sieving at 2 mm) are presented for the analysed samples. Nothing to point out.

4.10 CONCLUSION ON DISINTEGRATION TEST

Both the analysed 30 µm and 61 µm film samples comply with the requirements of EN 13432 Standard for the disintegration test with 100% as final average disintegration degree.

5 EVALUATION OF NEGATIVE EFFECTS ON DEGRADATION PROCESS (IF ANY)

The following parameters (see Table 20) are evaluated on the substrate provided by the disintegration test with and without the test material.

Table 20. Main parameters for the assessment of the final residues quality

Parameter	Method
General appearance (eg structure, color, fungi and/or molds growth...)	Visual observation
pH (soil)	ASTM D4972-13
Dry matter (105°C)	APHA Standard Methods 2540 G 1997
Volatile solids (550°C)	APHA Standard Methods 2540 G 1997
Total Organic Carbon	DM 21/12/2000 GU n 21 26/01/2001 supp 6
Total Nitrogen	UNI 10780:1998 APP J1
Salinity	UNI 10780:1998 APP D
Volumetric mass	UNI EN 1097-3:1999
Ammonium nitrogen	UNI 10780:1998 APP J3
Phosphorus / Magnesium / Potassium	UNI EN 13657:2004 + UNI EN ISO 11885:2009

The evaluation deals with the observation of any significant differences of the parameters indicated in Table 20 above.

All obtained results are presented in Test Report n. 22311632/3 (ANNEX 3) and n. 22311632/4 (ANNEX 4) and the main significant parameters for agronomic values are in the next Table 21: for these main parameters, the compliance with the regulation limits is verified. **The sample complies with the requirements of the legislation for the main characteristics of fertilizers.**

Table 21. Regulation limits for mixed fertilizer.

	Blank sample (22311632/3)	Test material final compost (22311632/4)	Optimal values for agronomic application
Dry matter (105°C) (%)	54,8	23,3	≥ 50%
pH	8,05	8,18	6 - 8,5
Organic Carbon	23,7	29,9	≥ 20% dm
C/N ratio	6,4	11,1	≤ 25

6 FINAL SUBSTRATE QUALITY – CHEMICAL- PHYSICAL PARAMETERS

The assessment of any related environmental risks is carried out by quantifying the concentration of the following parameters on the final substrate deriving from the disintegration test, with and without the test material. The obtained results are evaluated on the criteria described in the following paragraph.

Table 22. Main parameters for the final composted material

Parameter	Method
Heavy metals (Cd, Cr, Cu, Hg, Ni, Pb, Zn)	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Cr VI	EPA 3060A 2007 + EPA 7196A 1992

6.1 FINAL SUBSTRATE QUALITY–EUROPEAN REQUIREMENTS

The heavy metals concentrations (i.e. Cd, Cr, Cu, Hg, Ni, Pb, Zn and CrVI) are evaluated by comparing the results of the substrates deriving from the disintegration test, with and without the test material, according to the following criteria (where L is the reference regulatory Limit):

Table 23. Criteria for the evaluation of the final composted residue.

	Substrate alone (A)	Substrate and test material (B)	Criteria	Judgment
Case 1	≤ L	≤ L	-	Accepted
Case 2	≤ L o > L	> L	[(B) – (A)] ≤ L?	Yes: Accepted No: Not Accepted

The obtained results are presented in Table 24 and compared with the limits provided by the fertilizers Regulation.

The final composted residue for test material complies with the “Case 1 – Criteria” for all the heavy metal concentrations: accordingly, the final substrate obtained from the test material can be accepted for the Regulation. The obtained results are presented in Test Report n. 22311632/4 – ANNEX 4.

Table 24. Final composted residues and comparison with Regulation requirements.

		FINAL COMPOSTED RESIDUES		
	UM	Control sample (22311632/3)	Test material final compost (22311632/4)	Limits for Fertilisers
Cd	mg/kg dm	0,208	0,225	1,5
Cr VI	mg/kg dm	< 1	< 1	absent
Cr tot	mg/kg dm	7,6	5,91	-
Cu	mg/kg dm	32,7	36,9	230
Hg	mg/kg dm	< 0,1	< 0,1	1,5
Ni	mg/kg dm	8,2	6,31	100
Pb	mg/kg dm	9,0	5,08	140
Zn	mg/kg dm	139	130	500

6.2 CONCLUSION ON FINAL COMPOST QUALITY

In conclusion, **the analysed final residues from test material disintegration complies with the requirements of Regulation for fertilizers.**

7 ECOTOXICITY ASSESSMENT

7.1 TEST METHOD

Evaluation of the toxicity of the biodegradation residuals by means of higher plants was performed in line with:

- OECD 208:2006 - Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test
- the principles of Annex E of UNI EN 13432:2002 - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging
- disposition 8.1.3 from document Program "OK COMPOST INDUSTRIAL" PD-BA-TABE-CERT-BIO-CS-001_OKI_EN, Edition: F, Application Date: 2022-01-01, developed by TÜV Austria.

7.2 TEST MATERIAL

The sample subjected to ecotoxicity test is **AQUAFLEX**, sample number **22311632/6**.

7.3 STUDY SCHEDULE

Starting date of toxicity test: 06 February 2024

Completion date of toxicity test: 26 February 2024

Duration of incubation: 20 days

Experimental completion date: 27 February 2024

Study completion date: 28 February 2024

7.4 TEST PLANTS

Plant toxicity was evaluated by means of barley (*Hordeum vulgare*) and cress (*Lepidium sativum*). Table 25 reports an exhaustive description of seeds employed for ecotoxicity evaluation.

Table 25. Standard Soil characteristics.

Common Name	Scientific Name	Supplier	Lot #	Growing Season	Last Date of Germination Rating Evaluation	Germination Rate	Number of seeds needed for 100 plants
Barley	Hordeum vulgare	Bavicchi	211197	2021	01/2024	98%	103
Cress	Lepidium sativum	Franchi Sementi	88/XS	n.a.	01/2024	98%	103

7.5 TEST SUBSTRATE

EN 13432 standard indicates as suitable substrates "*all the substrates defined by the national standards for the analysis of the quality of the compost*", for example: the reference substrate *Einheits Erde Type Null* (EE0), mixtures of culture substrate with clay granules (ONORM S2023) or mixtures of peat and siliceous sand. The laboratory opted for the R*eference Substrate EE0*. Table 26 summarizes the chemical and physical characteristics of substrate EE0.

Table 26. Substrate EE0 characteristics.

Type of substrate	pH	Organic matter (% d.m.)	Water retention capacity (% w/w)
Substrate EE0	6.4	18.4	31.9

7.6 TEST MATERIAL PREPARATION FOR SUBSEQUENT PLANT TOXICITY TEST

Test materials were prepared according to ISO 16929 specifications. Briefly, two parallel tests were prepared, one containing 10% of the material to be tested and the other, as a control, set up under the same conditions but without such material. The test material must be in the form of powder or granules; it should be recommended as a powder with particles < 500 µm in size. Sample was added to an artificial bio-waste and incubated in composting condition for 12 weeks. At the end of incubation period the material was sieved with a 10 mm sieve and employed in phytotoxicity tests.

7.7 EXPERIMENTAL PROTOCOL

An overview of the start-up is given in Table 27; weights are expressed per replicate.

Table 27. Test set-up of soil preparation for subsequent phytotoxicity tests in standard soil.

Plant Species	Pot material	Pot dimension (diameter x height; mm)	Substrate EE0 (g per pot)
Barley	Non-porous plastic	160x160	450
Cress	Non-porous plastic	140x130	240

Control and Test Material compost were mixed to substrate EE0 at 25 and 50% w/w. Each pot was sown with a number of seeds to guarantee the germination of 100 plants. Three replicates were set up for each series of tests.

Pots were incubated in a growth chamber in these conditions:

- lighting for 16 hours a day at 3000 lx minimum (with light at a wavelength suitable for photosynthesis) at 25°C
- dark phase of 8 hours a day at 20°C
- incubation period: 14-21 days from the time that 50% of the control plants are germinated.

Crops were kept at the right level of humidity, gently spraying them when necessary. To verify the variation in water content, tests were visually monitored every day and, periodically, some vessels were weighted randomly: the weight variation did not exceed 10%.

At the end of the test plants were harvested and was determined:

- the number of plants per pot (germination)
- the fresh (wet) weight of biomass per pot
- the dry weight of biomass per pot (after a drying period of 1 day at 60°C)

7.8 EVALUATION CRITERIA

According to point A4 of Annex A of UNI EN 13432 standard, the germination rate and the plant biomass of both plant species, at each dilution tested, must be 90% greater than or equal to that of the control test.

For test validity, in control cultures the following criteria must be respected:

- at least 70% of the seeds must be germinated
- at least 90% of these must survive for the duration of the test
- grown plants show no phytotoxic effects (necrosis, chlorosis, rot, etc.)

7.9 EXPERIMENTAL RAW DATA

Test began on 06 February 2024 and ended on 26 February 2024. More in detail, the barley test was stopped after 20 days of incubation (15 days from 50% control plants germination), while the cress test was stopped after 20 days of incubation (16 days from 50% control plants germination). No visual injury was detected in any of the ecotoxicological tests. The experimental data of the toxicity tests performed on barley are given in Table 28. Figure 14 and Figure 15 show, respectively, Barley plants grown on control compost and test compost at 25 and 50% dilution. Average values of germinated plants, fresh biomass of the plants and relative standard deviation calculated for barley are reported in Table 29.

Table 28. Experimental data – Barley.

Sample	Sample %	Sample (g)	Substrate (g)	Germination (number)	Fresh Weight (g)
Control compost	25	112.5	337.5	97	41.2
	25	112.5	337.5	99	43.0
	25	112.5	337.5	96	40.9
	50	225	225	98	38.9
	50	225	225	99	39.3
	50	225	225	96	37.4
Test compost 22311632/6	25	112.5	337.5	96	40.3
	25	112.5	337.5	99	40.8
	25	112.5	337.5	96	38.6
	50	225	225	99	36.9
	50	225	225	98	35.6
	50	225	225	98	37.0

Table 29. Average values - Barley

Test compost dilution	Germination (number)		Fresh Weight (g)	
	AVG	STD	AVG	STD
25%	97.0	1.7	39.9	1.2
50%	98.3	0.6	36.5	0.8



25% Control 50% Control

Figure 14. Visual presentation of Barley plants (Control compost)



25% Sample 50% Sample

Figure 15. Visual presentation of Barley plants (Test Compost).

Results for cress are reported in Table 30. Figure 16 and Figure 17 show, respectively, Cress plants grown on control compost and test compost at 25 and 50% dilution. Average values of germinated plants, fresh biomass of the plants and relative standard deviation calculated for cress are reported in Table 31.

Table 30. Experimental data – Cress.

Sample	Sample %	Sample (g)	Substrate (g)	Germination (number)	Fresh Weight (g)
Control compost	25	60	180	97	14.4
	25	60	180	98	15.2
	25	60	180	97	14.6
	50	120	120	93	11.7
	50	120	120	96	13.1
	50	120	120	94	12.4
Test compost 22311632/6	25	60	180	95	13.9
	25	60	180	98	15.5
	25	60	180	98	14.2
	50	120	120	95	11.8
	50	120	120	93	10.9
	50	120	120	96	12.6

Table 31. Average values – Cress.

Test compost dilution	Germination (number)		Fresh Weight (g)	
	AVG	STD	AVG	STD
25%	97.0	1.7	14.5	0.9
50%	94.7	1.5	11.8	0.9





25% Control 50% Control

Figure 16. Visual presentation of Cress plants (Control compost)





25% Sample 50% Sample

Figure 17. Visual presentation of Cress plants (Test Compost)

Figure 18 and Figure 19 represent graphically germination averages for barley and cress at both dilutions investigated, where Figure 20 and Figure 21 represent graphically fresh biomass averages for barley and cress.

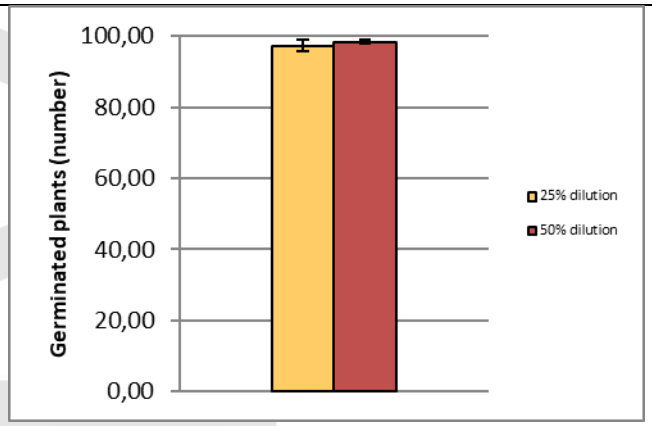


Figure 18. Average germination - Barley

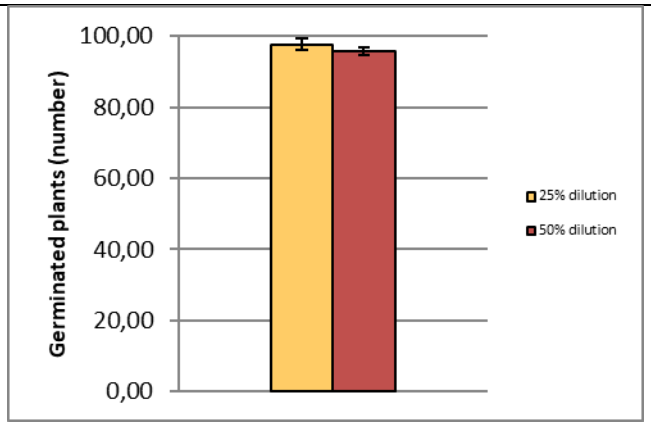


Figure 19. Average germination - Cress

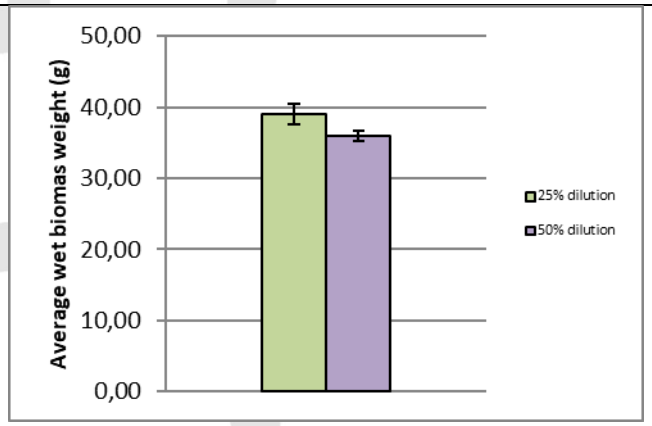


Figure 20. Average wet biomass weight - Barley

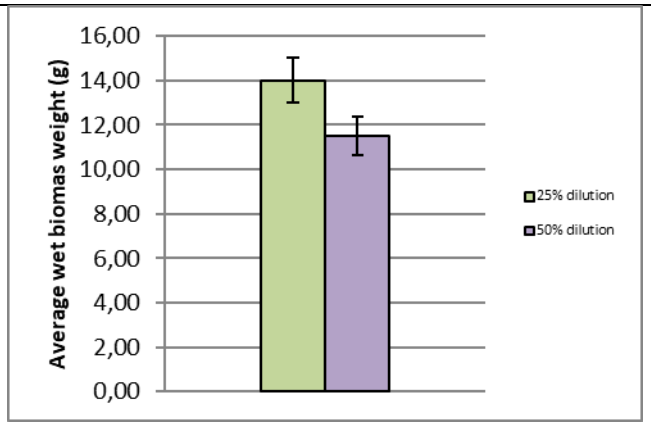


Figure 21. Average wet biomass weight – Cress.

7.10 FINAL RESULTS

Percent emergence as compared to controls (germination rate) calculated for barley and cress are reported in Table 32 and Table 33. In the same tables is reported fresh biomass measurement of the plants as percentage of the controls.

Table 32. Final Results – Barley.

Test compost dilution	Germination rate (%)	Fresh Weight (%)
25%	99.7	95.7
50%	101	94.7

Table 33. Final Results – Cress.

Test compost dilution	Germination rate (%)	Fresh Weight (%)
25%	99.7	98.6
50%	100	94.9

7.11 VALIDITY OF RESULTS

Table 34 and Table 35 report the results relating to the validity criteria described in Paragraph 7.8. In the tables it is possible to observe that the control cultures passed all the evaluation criteria, therefore **the test can be considered valid**.

Table 34. Validity criteria – Barley.

Ctrl compost dilution	Germination rate (>70%)	Surviving rate (>90%)	Phytotoxic effects (none)
25%	94.5	100	none
50%	94.8	100	none

Table 35. Validity criteria – Cress.

Ctrl compost dilution	Germination rate (>70%)	Surviving rate (>90%)	Phytotoxic effects (none)
25%	94.5	100	none
50%	91.6	100	none

7.12 MEASUREMENT UNCERTAINTY

The method does not report any data about uncertainty.

The laboratory decided to calculate the extended uncertainty (U) using the reproducibility standard deviation (S_R; obtained by applying a holistic approach) multiplied by a factor K (= 2, having been carried out 10 pairs of tests).

Table 36 reports extended uncertainty (expressed as percentage) calculated for germination of the 2 vegetable species on substrate EE0, Lepidium fresh biomass and Hordeum fresh biomass.

Table 36. Extended uncertainty.

Parameter	U (%)
Germination on substrate EE0	4.29
Lepidium fresh biomass	11.06
Hordeum fresh biomass	6.38

7.13 CONCLUSIONS

No significant difference was observed regarding the germination and biomass production between the control compost and the test compost. Sample called **AQUAFLEX (Sample number n°22311632/6) showed no phytotoxic effect** on test plants.

8 NOT AVAILABLE DOCUMENTATION (FOR THIS SAMPLE)

For this specific analyzed material, dealing with the following documentation:

- In the case of several internal production sites: OCO nomination document (OCO: OK compost industrial manager), description of the traceability system and agreement of the manufacturers for each production site.
  NOT FORESEEN
- In the case of several external production sites (third-party companies): description of the traceability system and contract of the manufacturers for each production site
  NOT FORESEEN
- In case of sublicense certification: authorization of the original certificate holder
  NOT FORESEEN
- In case of use of recycled sources: adequate documentation of origin, recycling flows and production of recycled sources
  NOT FORESEEN
- MSDS of AQUAFLEX is not provided nor inserted in this report. The producer has provided to Certification Body, directly.

A representative sample of AQUAFLEX to be certified will be sent from the Producer to Certification Body for the certification procedure.

9 CHECK LIST FOR THE FINAL ASSESSMENT OF THE COMPLIANCE WITH EN 13432

The check list for the final assessment of the compliance with EN 13432 is presented below:

Overall result of the evaluation		
Code number	Acceptance	Rejected
22311632	X	

	Parameters		Official method to verify the compliance	*Judgement*	Test report n.
Characterization	Volatile solids		APHA Standard Methods 2540 G 1997	*COMPLIANT*	22311632/1
	Heavy metals	Cu, Zn, Ni, Cd, Pb, Hg, Cr, Mo, Se, As, Co	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016	*COMPLIANT*	22311632/1
	Fluorine		UNI EN 14582:2016 + UNI EN ISO 10304-1:2009	*COMPLIANT*	22311632/1
Biodegradability			ISO 14855-1:2012	*COMPLIANT*	22311632/2
Disintegration			ISO 16929:2021	*COMPLIANT*	22311632/4 & /5 (61 & 30 µm thick)
Substrate quality	Chemical - physical parameters	Moisture content	APHA Standard Methods 2540 G 1997	*COMPLIANT*	22311632/3 & /4 (final blank and sample composted residues)
		pH	ISO 10390:2021	*COMPLIANT*	
		Total Organic Carbon	UNI EN 15936:2022 Met B	*COMPLIANT*	
		C/N ratio	UNI EN 15936:2022 Met B + UNI 10780:1998 App J1	*COMPLIANT*	
	Heavy metals	Cd, Cr, Cu, Hg, Ni, Pb, Zn	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016	*COMPLIANT*	
		Cr (VI)	EPA 3060A 2007 + EPA 7196A 1992	*COMPLIANT*	
	Phytotoxicity and Ecotoxicity		UNI EN 13432:2002 + OECD 208:2006	*COMPLIANT*	22311632/6

The material has previously been tested with a higher mass / surface ratio	NO
Minor changes have been made that do not affect the compliance with the EN 13432 standard	NO
Changes type	NO
Comment (if any)	NO
Signature of the person responsible for this evaluation	
Qualification of the person responsible for this assessment	Dr. Francesca Braca (LABORATORY ANALYSES SUPERVISOR)

Sample code: 22311632

ANNEXES

TEST REPORT

SAMPLE CODE

22311632

ARCHA S.r.l.
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C.F. P.IVA Iscr. Reg. Impr. di Pisa n. 01115340505 – Rep. Econ. Amm. di Pisa n° 101169 – Capitale Sociale 101.400 i.v.

ANNEX 1

TEST REPORT

SAMPLE CODE:

22311632/1

ARCHA S.r.l.
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PVA PRO JSC
Sede Legale
89 Vinh Hoi, Q4
00000 Ho Chi Minh City

1. General Data - Sample Description

Description: **AquaFlex (MATERIAL CHARACTERIZATION)**
Sample N°: 22311632/1 *Received on:* 24/08/2023
Type of material: PLASTIC MATERIALS *Appearance:* SOLID
Batch N°: -

2. Sampling Data

Site Address: Sede Legale, 89 Vinh Hoi, Q4 00000 Ho Chi Minh City

Sampling Date: 21/08/2023 *Sampling Report:*
Sampling:

3. Other Informations

Customer N°: 051985 *Order:* S23/0146

4. Warnings and Legends

The reproduction of the present Test Report is not allowed without authorization of ARCHA S.r.l.. The content of the present Report refers exclusively to the submitted samples and not to the batch that they want to represent. A portion of the sample is kept for 60 days if the nature and the quantity of the sample allow this. The data and the files are saved in laboratory for ten years. The report is made solely on the basis of the instructions and/or informations and materials supplied by the Applicant. If not indicated on report uncertainty data are available for every single test.
Unless otherwise stated, when they are present: "Description", "Batch N°", "Process conditions", "Sampling date" (if the sample was sampled by the Customer), are data provided by the Customer and the Laboratory disclaims all responsibility.
U = Expanded uncertainty of the test expressed with the same measurement unit as the result and calculated with a coverage factor k = 2.26 (k = 2 where indicated by the symbol §) corresponding to a probability level of approximately 95% or as a confidence interval calculated at a probability level of approximately 95% ; U.M. = Unit of Measurement.
(*) not accreditated by ACCREDIA

5. Additional Notes

None

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Dott. Yuri Pelosi
Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

6. Test Results (Start measurements: 01/09/2023 - End measurements: 02/10/2023)

Test	UM	Result	LQ	U	Method Description
FEATURES AND INFORMATION		Note (1)			
THICKNESS	µm	Note (2)			* ASTM F2251-13
MASS / SURFACE RATIO	g/m²	Note (3)			* M.I. 2493 rev 0 2017
TOTAL ORGANIC CARBON	% w/w (d.m.)	50,5		± 7,2	UNI EN 15936:2022 Met B
TOTAL NITROGEN	% w/w (d.m.)	< LQ	0,05		UNI 10780:1998 App J1
TOTAL FLUORINE	mg/kg (d.m.)	< LQ	25		* UNI EN 14582:2016 + UNI EN ISO 10304-1:2009
VOLATILE SOLIDS	% w/w (d.m.)	96,04		± 0,91	* APHA Standard Methods 2540 G 1997
DRY MATTER	% w/w	99,42		± 0,33	* APHA Standard Methods 2540 G 1997
FT/IR SPECTROSCOPY		Note (4)			-
ACID DIGESTION	-	Note (5)			* UNI EN 13657:2004
ARSENIC	mg/kg (d.m.)	0,279		± 0,045	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
CADMIUM	mg/kg (d.m.)	0,284		± 0,045	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
COBALT	mg/kg (d.m.)	0,279		±	* UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
TOTAL CHROMIUM	mg/kg (d.m.)	0,386		± 0,061	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
COPPER	mg/kg (d.m.)	1,78		± 0,28	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
MERCURY	mg/kg (d.m.)	< LQ	0,1	±	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
MOLYBDENUM	mg/kg (d.m.)	0,547		± 0,087	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
NICKEL	mg/kg (d.m.)	0,572		± 0,09	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
LEAD	mg/kg (d.m.)	0,452		± 0,069	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
SELENIUM	mg/kg (d.m.)	0,353		± 0,054	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
ZINC	mg/kg (d.m.)	26,8		± 4,1	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016

(1) The test material is described in detail in the TECHNICAL REPORT 22311632, providing the composition, the main constituents, the additives.

(2) Micrometer: RS PRO Mod. 705-1229
Number of replicates for the quantification of the thickness: 10

Film 1 (61 µm): 62 ± 5 µm
Film 2 (30 µm): 32 ± 4 µm

(3) Number of replicates for the quantification of the mass/surface ratio: 10

Film 1 (61 µm): 99,8 ± 4,2 g/m2
Film 2 (30 µm): 42,5 ± 1,6 g/m2

(4) The IR spectrum is provided in the TECHNICAL REPORT 22311632

(5) Amount of sample: 0,5 ± 0,3 g
Pre-treatment: air drying, granulometric reduction and homogenization.
Digestion equipment: microwave digestor in closed vessel, temperature 180 °C gained within 13 minutes and keep constant for 2 minutes, with aqua regia.
Separation after digestion made by: filtration

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Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

7. Opinions and interpretations (not accreditated by ACCREDIA)

None

End of Test Report

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Dott. Yuri Pelosi
Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

Sample code: 22311632

ANNEX 2

TEST REPORT

SAMPLE CODE:

22311632/2

ARCHA S.r.l.
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C.F. P.IVA Iscr. Reg. Impr. di Pisa n. 01115340505 – Rep. Econ. Amm. di Pisa n° 101169 – Capitale Sociale 101.400 i.v.

PVA PRO JSC
Sede Legale
89 Vinh Hoi, Q4
00000 Ho Chi Minh City

1. General Data - Sample Description

Description: **AquaFlex (BIODEGRADABILITY TEST - INDUSTRIAL COMPOSTING CONDITIONS)**
Sample N°: 22311632/2 *Received on:* 24/08/2023
Type of material: PLASTIC MATERIALS *Appearance:* SOLID
Batch N°: -

2. Sampling Data

Site Address: Sede Legale, 89 Vinh Hoi, Q4 00000 Ho Chi Minh City

Sampling Date: 21/08/2023 *Sampling Report:*
Sampling:

3. Other Informations

Customer N°: 051985 *Order:* S23/0146

4. Warnings and Legends

The reproduction of the present Test Report is not allowed without authorization of ARCHA S.r.l.. The content of the present Report refers exclusively to the submitted samples and not to the batch that they want to represent. A portion of the sample is kept for 60 days if the nature and the quantity of the sample allow this. The data and the files are saved in laboratory for ten years. The report is made solely on the basis of the instructions and/or informations and materials supplied by the Applicant. If not indicated on report uncertainty data are available for every single test.
Unless otherwise stated, when they are present: "Description", "Batch N°", "Process conditions", "Sampling date" (if the sample was sampled by the Customer), are data provided by the Customer and the Laboratory disclaims all responsibility.
U = Expanded uncertainty of the test expressed with the same measurement unit as the result and calculated with a coverage factor k = 2.26 (k = 2 where indicated by the symbol §) corresponding to a probability level of approximately 95% or as a confidence interval calculated at a probability level of approximately 95% ; U.M. = Unit of Measurement.
(*) not accreditated by ACCREDIA

5. Additional Notes

None

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Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

Date 28/02/2024 **Test Report 22311632/2** **PVA PRO JSC**

6. Test Results (Start measurements: 13/09/2023 - End measurements: 28/02/2024)

Test	UM	Result	LQ	U	Method Description
COMPOST CHARACTERIZATION					
TOTAL ORGANIC CARBON	% w/w (d.m.)	20,7		± 2,9	UNI EN 15936:2022 Met B
DRY MATTER	% w/w	54,52		± 0,44	* APHA Standard Methods 2540 G 1997
VOLATILE SOLIDS	% w/w (d.m.)	37,5		± 1,1	* APHA Standard Methods 2540 G 1997
pH	-	7,92		± 0,52	* ISO 10390:2021
TOTAL NITROGEN	% w/w (d.m.)	1,52		± 0,25	UNI 10780:1998 App J1
		-			
BIODEGRADABILITY TEST - SINGLE TESTS					
BIODEGRADATION DEGREE	%	91		± 12	* UNI EN ISO 14855-1:2013
BIODEGRADATION DEGREE	%	90		± 12	* UNI EN ISO 14855-1:2013
BIODEGRADATION DEGREE	%	92		± 12	* UNI EN ISO 14855-1:2013
		-			
BIODEGRADABILITY TEST - AVERAGE VALUE					
BIODEGRADATION DEGREE	%	91		± 12	* UNI EN ISO 14855-1:2013

The characterization data of reference (cellulose) lot number MKCL9441, expiration date September 28th 2023 are:
TOC = 45,4 % w/w (d.m.) determination on 20/03/2023
Dry residue = 98,19 % w/w determination on 17/03/2023

7. Opinions and interpretations (not accreditated by ACCREDIA)

None

End of Test Report

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Dott. Yuri Pelosi
Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

ANNEX 3

TEST REPORT

SAMPLE CODE:

22311632/3

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PVA PRO JSC
Sede Legale
89 Vinh Hoi, Q4
00000 Ho Chi Minh City

1. General Data - Sample Description

Description: **AquaFlex - (DISINTEGRATION TEST - INDUSTRIAL COMPOSTING CONDITIONS - CONTROL SAMPLE)**
Sample N°: 22311632/3 *Received on:* 24/08/2023
Type of material: PLASTIC MATERIALS *Appearance:* SOLID
Batch N°: -

2. Sampling Data

Site Address: Sede Legale, 89 Vinh Hoi, Q4 00000 Ho Chi Minh City

Sampling Date: 21/08/2023 *Sampling Report:*
Sampling:

3. Other Informations

Customer N°: 051985 *Order:* S23/0146

4. Warnings and Legends

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Unless otherwise stated, when they are present: "Description", "Batch N°", "Process conditions", "Sampling date" (if the sample was sampled by the Customer), are data provided by the Customer and the Laboratory disclaims all responsibility.
U = Expanded uncertainty of the test expressed with the same measurement unit as the result and calculated with a coverage factor k = 2.26 (k = 2 where indicated by the symbol §) corresponding to a probability level of approximately 95% or as a confidence interval calculated at a probability level of approximately 95% ; U.M. = Unit of Measurement.
(*) not accreditated by ACCREDIA

5. Additional Notes

None

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Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

6. Test Results (Start measurements: 10/11/2023 - End measurements: 13/02/2024)

Test	UM	Result	LQ	U	Method Description
COMPOST CHARACTERIZATION START TEST					
TOTAL ORGANIC CARBON	% w/w (d.m.)	44,6		± 6,3	UNI EN 15936:2022 Met B
TOTAL NITROGEN	% w/w (d.m.)	1,97		± 0,31	UNI 10780:1998 App J1
DRY MATTER	% w/w	21,18		± 0,52	* APHA Standard Methods 2540 G 1997
VOLATILE SOLIDS	% w/w (d.m.)	90,46		± 0,92	* APHA Standard Methods 2540 G 1997
pH	-	6,90		± 0,56	* ISO 10390:2021
		-			
FINAL SUBSTRATE CHARACTERIZATION (CONTROL) - TEST 1					
GENERAL APPEARANCE		Note (1)			
MATURITY DEGREE (ROTTEGRAD)		4			* Methods Book for the Analysis of Compost 3rd ed. - Federal Compost Quality Cap II Par 4
		-			
FINAL SUBSTRATE CHARACTERIZATION (CONTROL) - TEST 2					
GENERAL APPEARANCE		Note (1)			
MATURITY DEGREE (ROTTEGRAD)		4			* Methods Book for the Analysis of Compost 3rd ed. - Federal Compost Quality Cap II Par 4
		-			
FINAL SUBSTRATE CHARACTERIZATION (CONTROL) - MEDIUM SAMPLE					
pH	-	8,05		± 0,51	* ISO 10390:2021
DRY MATTER	% w/w	54,80		± 0,44	* APHA Standard Methods 2540 G 1997
VOLATILE SOLIDS	% w/w (d.m.)	71,84		± 0,97	* APHA Standard Methods 2540 G 1997
TOTAL ORGANIC CARBON	% w/w (d.m.)	23,7		± 3,4	UNI EN 15936:2022 Met B
TOTAL NITROGEN	% w/w (d.m.)	3,69		± 0,52	UNI 10780:1998 App J1
AMMONIACAL NITROGEN	mg/kg N (d.m.)	2570		± 450	* UNI 10780:1998 App J3.1
SALINITY	meq/100g	57400			* UNI 10780:1998 App D
VOLUME MASS	kg/dm³	0,352		± 0,082	* UNI EN 1097-3:1999
HEXAVALENT CHROMIUM	mg/kg (d.m.)	< LQ	1		* EPA 3060A 2007 + EPA 7196A 1992
ACID DIGESTION	-	Note (2)			* UNI EN 13657:2004
PHOSPHORUS	mg/kg (d.m.)	7800		± 1200	UNI EN 13657:2004 + UNI EN ISO 11885:2009
CADMIUM	mg/kg (d.m.)	0,208		± 0,033	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
TOTAL CHROMIUM	mg/kg (d.m.)	7,6		± 1,2	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
COPPER	mg/kg (d.m.)	32,7		± 5,2	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
MERCURY	mg/kg (d.m.)	< LQ	0,1		UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
POTASSIUM	mg/kg (d.m.)	14400		± 2400	UNI EN 13657:2004 + UNI EN ISO 11885:2009

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Dott. Yuri Pelosi
Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

Date 28/02/2024 **Test Report 22311632/3** **PVA PRO JSC**

Test	UM	Result	LQ	U	Method Description
MAGNESIUM	mg/kg (d.m.)	4210		± 700	UNI EN 13657:2004 + UNI EN ISO 11885:2009
NICKEL	mg/kg (d.m.)	8,2		± 1,3	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
LEAD	mg/kg (d.m.)	9,0		± 1,4	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
ZINC	mg/kg (d.m.)	139		± 21	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016

(1) Blank material with sample numbers: 1 - 2 (blank vessels)
- Structure: homogeneous
- Color: brown
- Fungi and molds: absent
- Other: nothing to point out

(2) Amount of sample: 0,5 ± 0,3 g
Pre-treatment: air drying, granulometric reduction and homogenization.
Digestion equipment: microwave digestor in closed vessel, temperature 180 °C gained within 13 minutes and keep constant for 2 minutes, with aqua regia.
Separation after digestion made by: filtration

7. Opinions and interpretations (not accreditated by ACCREDIA)

None

End of Test Report

Rapporto di Prova firmato digitalmente
Dott. Yuri Pelosi
Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

ANNEX 4

TEST REPORT

SAMPLE CODE:

22311632/4

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C.F. P.IVA Iscr. Reg. Impr. di Pisa n. 01115340505 – Rep. Econ. Amm. di Pisa n° 101169 – Capitale Sociale 101.400 i.v.

PVA PRO JSC
Sede Legale
89 Vinh Hoi, Q4
00000 Ho Chi Minh City

1. General Data - Sample Description

Description: **AquaFlex - Film 61 µm (DISINTEGRATION TEST - INDUSTRIAL COMPOSTING CONDITIONS - TEST MATERIAL)**
Sample N°: 22311632/4 *Received on:* 24/08/2023
Type of material: PLASTIC MATERIALS *Appearance:* SOLID
Batch N°: -

2. Sampling Data

Site Address: Sede Legale, 89 Vinh Hoi, Q4 00000 Ho Chi Minh City

Sampling Date: 21/08/2023 *Sampling Report:*
Sampling:

3. Other Informations

Customer N°: 051985 *Order:* S23/0146

4. Warnings and Legends

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Unless otherwise stated, when they are present: "Description", "Batch N°", "Process conditions", "Sampling date" (if the sample was sampled by the Customer), are data provided by the Customer and the Laboratory disclaims all responsibility.
U = Expanded uncertainty of the test expressed with the same measurement unit as the result and calculated with a coverage factor k = 2.26 (k = 2 where indicated by the symbol §) corresponding to a probability level of approximately 95% or as a confidence interval calculated at a probability level of approximately 95% ; U.M. = Unit of Measurement.
(*) not accreditated by ACCREDIA

5. Additional Notes

None

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Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

6. Test Results (Start measurements: 10/11/2023 - End measurements: 13/02/2024)

Test	UM	Result	LQ	U	Method Description
DISINTEGRATION TEST- SINGLE TESTS					
DISINTEGRATION DEGREE	%	100		± 13	* ISO 16929:2021
DISINTEGRATION DEGREE	%	100		± 13	* ISO 16929:2021
		-			
DISINTEGRATION TEST - AVERAGE VALUE					
DISINTEGRATION DEGREE	%	100		± 13	* ISO 16929:2021
		-			
FINAL SUBSTRATE CHARACTERIZATION (TEST MATERIAL) - SINGLE TESTS					
GENERAL APPEARANCE		Note (1)			
		-			
FINAL SUBSTRATE CHARACTERIZATION (TEST MATERIAL) - MEDIUM SAMPLE					
pH	-	8,18		± 0,51	* ISO 10390:2021
DRY MATTER	% w/w	53,30		± 0,44	* APHA Standard Methods 2540 G 1997
VOLATILE SOLIDS	% w/w (d.m.)	74,18		± 0,96	* APHA Standard Methods 2540 G 1997
TOTAL ORGANIC CARBON	% w/w (d.m.)	29,9		± 4,2	UNI EN 15936:2022 Met B
TOTAL NITROGEN	% w/w (d.m.)	2,70		± 0,40	UNI 10780:1998 App J1
AMMONIACAL NITROGEN	mg/kg N (d.m.)	2600		± 450	* UNI 10780:1998 App J3.1
SALINITY	meq/100g	57600			* UNI 10780:1998 App D
VOLUME MASS	kg/dm³	0,430		± 0,094	* UNI EN 1097-3:1999
HEXAVALENT CHROMIUM	mg/kg (d.m.)	< LQ	1		* EPA 3060A 2007 + EPA 7196A 1992
ACID DIGESTION	-	Note (2)			* UNI EN 13657:2004
PHOSPHORUS	mg/kg (d.m.)	7900		± 1200	UNI EN 13657:2004 + UNI EN ISO 11885:2009
CADMIUM	mg/kg (d.m.)	0,225		± 0,036	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
TOTAL CHROMIUM	mg/kg (d.m.)	5,91		± 0,93	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
COPPER	mg/kg (d.m.)	36,9		± 5,9	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
MERCURY	mg/kg (d.m.)	< LQ	0,1		UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
POTASSIUM	mg/kg (d.m.)	14700		± 2400	UNI EN 13657:2004 + UNI EN ISO 11885:2009
MAGNESIUM	mg/kg (d.m.)	3980		± 660	UNI EN 13657:2004 + UNI EN ISO 11885:2009
NICKEL	mg/kg (d.m.)	6,31		± 0,99	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
LEAD	mg/kg (d.m.)	5,08		± 0,78	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
ZINC	mg/kg (d.m.)	130		± 20	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016

(1) Test material with sample numbers: 7 - 8 (disintegration vessels)
- Structure: homogeneous
- Color: brown
- Fungi and molds: absent

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Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

Test	UM	Result	LQ	U	Method Description

- Other: nothing to point out

(2) Amount of sample: 0,5 ± 0,3 g
Pre-treatment: air drying, granulometric reduction and homogenization.
Digestion equipment: microwave digestor in closed vessel, temperature 180 °C gained within 13 minutes and keep constant for 2 minutes, with aqua regia.
Separation after digestion made by: filtration

7. Opinions and interpretations (not accreditated by ACCREDIA)

None

End of Test Report

Rapporto di Prova firmato digitalmente
Dott. Yuri Pelosi
Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

ANNEX 5

TEST REPORT

SAMPLE CODE:

22311632/5

ARCHA S.r.l.
Via di Tegulaia 10/a – 56121 – PISA – ph. +39 050 985165 – www.archa.it – archainf@archa.it
C.F. P.IVA Iscr. Reg. Impr. di Pisa n. 01115340505 – Rep. Econ. Amm. di Pisa n° 101169 – Capitale Sociale 101.400 i.v.

PVA PRO JSC
Sede Legale
89 Vinh Hoi, Q4
00000 Ho Chi Minh City

1. General Data - Sample Description

Description: **AquaFlex - Film 30 µm (DISINTEGRATION TEST - INDUSTRIAL COMPOSTING CONDITIONS - TEST MATERIAL)**
Sample N°: 22311632/5 *Received on:* 24/08/2023
Type of material: PLASTIC MATERIALS *Appearance:* SOLID
Batch N°: -

2. Sampling Data

Site Address: Sede Legale, 89 Vinh Hoi, Q4 00000 Ho Chi Minh City

Sampling Date: 21/08/2023 *Sampling Report:*
Sampling:

3. Other Informations

Customer N°: 051985 *Order:* S23/0146

4. Warnings and Legends

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5. Additional Notes

None

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Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

6. Test Results (Start measurements: 10/11/2023 - End measurements: 07/02/2024)

Test	UM	Result	LQ	U	Method Description
DISINTEGRATION TEST- SINGLE TESTS					
DISINTEGRATION DEGREE	%	100		± 13	ISO 16929:2021
DISINTEGRATION DEGREE	%	100		± 13	ISO 16929:2021
		-			
DISINTEGRATION TEST - AVERAGE VALUE					
DISINTEGRATION DEGREE	%	100		± 13	ISO 16929:2021
		-			
FINAL SUBSTRATE CHARACTERIZATION (TEST MATERIAL) - SINGLE TESTS					
GENERAL APPEARANCE		Note (1)			

(1) Test material with sample numbers: 5 - 6 (disintegration vessels)
- Structure: homogeneous
- Color: brown
- Fungi and molds: absent
- Other: nothing to point out

7. Opinions and interpretations

None

End of Test Report

Rapporto di Prova firmato digitalmente
Dott. Yuri Pelosi
Ordine dei Chimici della Toscana
N. 1680 SEZIONE A

ANNEX 6

TEST REPORT

SAMPLE CODE:

22311632/6

ARCHA S.r.l.
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C.F. P.IVA Iscr. Reg. Impr. di Pisa n. 01115340505 – Rep. Econ. Amm. di Pisa n° 101169 – Capitale Sociale 101.400 i.v.

PVA PRO JSC
Sede Legale
89 Vinh Hoi, Q4
00000 Ho Chi Minh City

1. General Data - Sample Description

Description: **AquaFlex (ECOTOXICITY TEST)**
Sample N°: 22311632/6 *Received on:* 24/08/2023
Type of material: PLASTIC MATERIALS *Appearance:* SOLID
Batch N°: -

2. Sampling Data

Site Address: Sede Legale, 89 Vinh Hoi, Q4 00000 Ho Chi Minh City

Sampling Date: 21/08/2023 *Sampling Report:*
Sampling: -

3. Other Informations

Customer N°: 051985 *Order:* S23/0146

4. Warnings and Legends

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5. Additional Notes

None

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Dott. Agostino Bazzichi
Ordine dei Biologi Toscana-Umbria
N. ToU_A0939

6. Test Results (Start measurements: 06/02/2024 - End measurements: 26/02/2024)

Test	UM	Result	LQ	U	Method Description
SAMPLE DILUTION 25%		-			
LEPIDIUM SATIVUM: GERMINATION AS PERCENTAGE OF THE CONTROL	%	99.7			UNI EN 13432:2002 + OECD 208:2006
LEPIDIUM SATIVUM: BIOMASS (SHOOT FRESH WEIGHT) AS PERCENTAGE OF THE CONTROL	%	98.6			UNI EN 13432:2002 + OECD 208:2006
HORDEUM VULGARE: GERMINATION AS PERCENTAGE OF THE CONTROL	%	99.7			UNI EN 13432:2002 + OECD 208:2006
HORDEUM VULGARE: BIOMASS (SHOOT FRESH WEIGHT) AS PERCENTAGE OF THE CONTROL	%	95.7			UNI EN 13432:2002 + OECD 208:2006
SAMPLE DILUTION 50%		-			
LEPIDIUM SATIVUM: GERMINATION AS PERCENTAGE OF THE CONTROL	%	100			UNI EN 13432:2002 + OECD 208:2006
LEPIDIUM SATIVUM: BIOMASS (SHOOT FRESH WEIGHT) AS PERCENTAGE OF THE CONTROL	%	94.9			UNI EN 13432:2002 + OECD 208:2006
HORDEUM VULGARE: GERMINATION AS PERCENTAGE OF THE CONTROL	%	101			UNI EN 13432:2002 + OECD 208:2006
HORDEUM VULGARE: BIOMASS (SHOOT FRESH WEIGHT) AS PERCENTAGE OF THE CONTROL	%	94.7			UNI EN 13432:2002 + OECD 208:2006

7. Opinions and interpretations

None

End of Test Report

Rapporto di Prova firmato digitalmente
Dott. Agostino Bazzichi
Ordine dei Biologi Toscana-Umbria
N. ToU_A0939

ANNEX 7

Photographic documentation of disintegration test

SAMPLE CODE:

22311632

ARCHA S.r.l.
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As example, some pictures of the sample of plastic material after different elapsed times from the beginning of the disintegration test are presented below.

	30 µm film (22311632/5)	61 µm (22311632/4)
Starting of test		
AFTER 7 days		
AFTER 15 days		
AFTER 28 days		

AFTER 45 days		
AFTER 60 days		
AFTER 75 days		
AFTER 84 days		
Pieces of material over 2 mm dimension	Not Available	Not Available

Finally, the pictures of residual substrate at the end of the disintegration test after sieving with 1 cm-sieve related to the control sample (Figure 22) and test material sample with the test materials (Figure 23) to observe the absence of visual contamination.



Figure 22. Sieved substrate of the sample with blank compost at the end of the disintegration test



30 µm FILM 61 µm FILM

Figure 23. Sieved substrates of the samples with test materials at the end of the disintegration test.