



TEST LOCATION TÜV SÜD China

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CLIENT NAME RONG HAO LIMITED COMPANY

CLIENT ADDRESS 9F.-2, No.286, Sec. 4, Meichuan W.Rd., Beitun Dist., Taichung City 406, Taiwan

TEST PERIOD 20-Jun-2024 ~ 26-Nov-2024

RESULT SUMMARY As per client's request, with reference to EN 13432:2000 Packaging - Requirements for Packaging Recoverable Through Composting and Biodegradation - Test Scheme and Evaluation Criteria for the Final Acceptance of Packaging; ASTM D6400-23 Standard Specification for Labeling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities

- Biodegradation

See details enclosed

Prepared By

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(4) Disclaimer Measurement Uncertainty:

Unless otherwise agreed upon, Pass or Fail verdicts are given based on the measured values without any considerations of measurement uncertainties.

Please note, every test method has a measurement uncertainty which has been evaluated by the laboratory according to ISO/IEC 17025 requirements.

By taking measurement uncertainties into account it might happen that measured values can neither be assessed as Pass nor as Fail.

(5) The testing report without CMA stamp is not legally binding and could only be used as internal reference material for the applicant. It shall not be provided as a notarial certification.

SAMPLE SOURCE/ RECEIPT DATE / TEST DATE

Logistics Express/ 20-Jun-2024/ 20-Jun-2024

THE FOLLOWING SAMPLE(S) WAS/WERE SUBMITTED

BY/ ON BEHALF OF THE CLIENTS AS

Sample Name: 60% Bio-based Degradable Particles
Sample Type/ Specification: KB9001
Batch No./Date: 2024.6.4
Manufacturer: Fujian Kristine Biotechnology Co., Ltd.

SAMPLE NO.	DESCRIPTION	PHOTOGRAPH
721692843	Plastic particle	

TEST RESULT(S)

- Test method: With reference to ASTM D5338-15 (2021) Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions. Incorporating Thermophilic Temperatures

Material name/ Number	Test Period (days)	Percentage biodegradation (%)	Relative percentage biodegradatio (%)
Positive control (TLC grade cellulose)	135	91.1	/
721692843 (OX240620-020)		48.1	52.7
Validity of results	(1) The degree of biodegradation of positive control is more than 70 % after 45 days: ☒ yes / ☐ no (2) The difference between the percentage biodegradation of the positive control in the different vessels is less than 20 % at the end of the test: ☒ yes / ☐ no (3) The inoculum in the blank has produced more than 50 mg but less than 150 mg of carbon dioxide per gram of volatile solids (mean values) after 10 days of incubation.: ☒ yes / ☐ no		

Note:

1. The relative percentage biodegradation is the rate of percentage biodegradation of test material to control.
2. The following attached page of test report listed more detailed information

1. Information of inoculum, test material and control

Table 1. Basic information sheet

Item	Inoculum	Positive control (TLC grade cellulose)	Test material/ 721692843 (OX240620-020)
pH	8.31	/	/
Moisture content (%)	19.1	2.7	0.5
Total dry solid content (%)	80.9	97.3	99.5
Volatile solids content (%)	11.8	100.0	97.1
Total organic carbon content (%)	4.76	44.40	60.59

2. Test system information

(1) The experiment was carried out at a constant temperature of $58^{\circ}\text{C} \pm 2^{\circ}\text{C}$, and free from vapours inhibitory to microorganisms. The volume of the reaction container is 2 liters.

(2) Source of inoculum: Lab self-made aerobic compost, the age of the compost: 3 months. Sieve the compost on a screen of 0.5 cm before used.

(3) Positive control/ TLC (thin-layer chromatography) grade cellulose.

(4) The test method determines the ultimate biodegradability and degree of disintegration of test material under

conditions simulating an intensive aerobic composting process. Determine the carbon dioxide by complete absorption in 4.0g/L $\text{Ba}(\text{OH})_2$, and determination of the dissolved inorganic carbon with 0.05mol/L hydrochloric acid.

The percentage biodegradation is given by the ratio of the gaseous-carbon produced from the test material to the maximum theoretical amount of carbon that can be produced from the test material. The maximum theoretical amount of carbon produced is calculated from the measured total organic carbon (TOC) content which is determined by element analyzer.

Table 2. Test system information sheet

Item	Inoculum			Positive control (TLC grade cellulose)			Test item/ 721692843 (OX240620-020)		
	1	2	3	1	2	3	1	2	3
Wet solids of inoculum, g	445.14	445.15	445.22	445.15	445.20	445.15	445.18	445.20	445.16
Total dry solids of inoculum, g	360.0	360.0	360.1	360.0	360.0	360.0	360.0	360.0	360.0
Volatile solids of inoculum, g	42.3	42.3	42.3	42.3	42.3	42.3	42.3	42.3	42.3
Wet solids of reference item or test item, g	/	/	/	61.76	61.70	61.70	60.30	60.30	60.27
Total dry solids of reference item or test item, g	/	/	/	60.1	60.0	60.0	60.0	60.0	60.0
Ci, g/vessel	/	/	/	97.8	97.7	97.7	133.3	133.3	133.3
The ratio of total dry solids to wet solids, %	48.3	48.3	48.3	52.1	52.1	52.1	52.2	52.2	52.1
The ratio of volatile solids to total dry solids, %	11.8	11.8	11.8	/	/	/	/	/	/
C/N	18.6	18.6	18.6	21.2	21.1	21.1	26.3	26.3	26.3
1. Note: Pictures of test item before test, and after 60 days of testing were shown in Figure 2-8, respectively									
2. Due to the inability to observe the sample after 60 days of the test, no follow-up photos will be taken									



3. Results

Table 3.Cumulative gaseous carbon production

Days	Cumulative gaseous carbon production (g)											
	Blank				Positive control				721692843 (OX240620-020)			
	1	2	3	average	1	2	3	average	1	2	3	average
1	0.44	0.44	0.44	0.44	0.90	0.96	0.88	0.91	0.35	0.42	0.39	0.39
2	0.86	0.88	0.83	0.86	2.57	2.44	2.49	2.50	0.80	0.89	0.82	0.84
3	1.17	1.28	1.18	1.21	4.93	4.71	4.85	4.83	1.46	1.49	1.49	1.48
4	1.47	1.68	1.53	1.56	7.25	6.99	7.34	7.19	2.16	2.09	2.19	2.15
5	1.82	2.02	1.83	1.89	11.19	10.95	11.48	11.21	2.72	2.63	2.79	2.71
6	2.15	2.35	2.15	2.21	15.06	15.74	15.21	15.34	3.46	3.34	3.47	3.42
7	2.49	2.68	2.44	2.54	18.34	17.94	17.59	17.96	3.99	3.91	4.07	3.99
8	2.80	2.97	2.72	2.83	21.04	20.68	20.09	20.60	4.72	4.58	4.78	4.70
9	3.10	3.26	3.02	3.13	23.63	23.23	22.55	23.14	5.48	5.36	5.55	5.46
10	3.40	3.52	3.32	3.41	27.31	26.95	25.62	26.63	6.07	5.92	6.17	6.05
11	3.64	3.78	3.51	3.65	29.71	29.40	27.78	28.96	6.72	6.53	6.78	6.68
12	3.91	4.04	3.69	3.88	31.55	31.01	29.67	30.74	7.33	7.08	7.42	7.28
13	4.16	4.29	3.92	4.12	33.34	32.68	31.39	32.47	7.95	7.67	8.02	7.88
14	4.47	4.61	4.20	4.43	35.35	34.69	33.65	34.56	8.68	8.46	8.73	8.63
15	4.75	4.92	4.51	4.73	37.05	36.69	35.84	36.53	9.38	9.18	9.44	9.33
16	4.91	5.10	4.67	4.89	38.72	38.34	37.41	38.16	10.08	9.85	10.14	10.02
17	5.07	5.27	4.83	5.06	40.70	39.97	39.13	39.93	10.70	10.59	10.77	10.68
18	5.22	5.44	4.97	5.21	42.50	41.46	40.66	41.54	11.33	11.20	11.43	11.32
19	5.38	5.61	5.11	5.36	44.11	43.19	42.35	43.22	11.89	11.80	12.03	11.91
20	5.52	5.77	5.25	5.51	45.55	44.75	43.88	44.73	12.54	12.39	12.59	12.51
21	5.67	5.94	5.41	5.67	47.32	47.87	46.24	47.15	13.26	13.07	13.21	13.18
22	5.85	6.13	5.60	5.86	48.81	49.44	47.91	48.72	14.25	14.00	14.01	14.09
23	6.04	6.33	5.79	6.05	50.44	51.01	49.50	50.32	15.03	14.81	14.75	14.86
24	6.20	6.50	5.97	6.22	52.24	52.59	51.38	52.07	15.93	15.77	15.57	15.76
25	6.35	6.62	6.12	6.37	53.47	54.11	52.69	53.42	16.77	16.68	16.41	16.62
26	6.45	6.76	6.26	6.49	54.96	55.53	54.17	54.88	17.58	17.52	17.31	17.47
27	6.57	6.90	6.40	6.63	56.43	56.97	55.57	56.32	18.45	18.41	18.20	18.35
28	6.82	7.08	6.56	6.82	58.11	58.70	57.25	58.02	19.38	19.27	19.11	19.25
29	6.99	7.25	6.72	6.99	59.90	60.44	59.05	59.80	20.34	20.13	20.01	20.16
30	7.19	7.41	6.93	7.18	61.78	62.06	60.91	61.58	21.27	21.04	20.97	21.09
31	7.37	7.57	7.11	7.35	63.62	63.69	62.56	63.29	22.27	21.95	21.92	22.05
32	7.79	8.03	7.54	7.79	65.32	65.13	64.29	64.91	23.01	22.74	22.70	22.82
33	7.92	8.17	7.68	7.92	66.84	66.49	65.66	66.33	23.82	23.54	23.55	23.64
34	8.06	8.26	7.79	8.04	68.10	67.84	67.17	67.70	24.63	24.28	24.35	24.42
35	8.29	8.52	8.01	8.27	70.07	70.00	69.18	69.75	25.96	25.61	25.84	25.80
36	8.41	8.66	8.13	8.40	71.15	71.01	70.16	70.78	26.63	26.28	26.56	26.49
37	8.79	9.08	8.52	8.80	72.47	72.33	71.49	72.10	27.29	27.05	27.26	27.20
38	8.91	9.19	8.67	8.92	73.82	73.41	72.76	73.33	28.02	27.71	28.02	27.92



Table 4.Cumulative gaseous carbon production (cont'd)

Days	Cumulative gaseous carbon production (g)											
	Blank				Positive control				721692843 (OX240620-020)			
	1	2	3	average	1	2	3	average	1	2	3	average
39	9.05	9.30	8.81	9.05	74.94	74.42	73.90	74.42	28.68	28.34	28.56	28.53
40	9.17	9.42	8.95	9.18	75.94	75.43	74.95	75.44	29.41	29.00	29.32	29.24
41	9.34	9.58	9.11	9.35	76.87	76.53	76.02	76.47	30.21	29.72	29.92	29.95
42	9.52	9.72	9.28	9.51	78.02	77.67	77.08	77.59	30.92	30.51	30.51	30.65
43	9.68	9.95	9.49	9.71	78.76	78.46	78.00	78.40	31.78	31.35	31.48	31.54
44	9.85	10.13	9.68	9.89	79.76	79.47	78.87	79.37	32.52	32.13	32.42	32.36
45	10.31	10.60	10.16	10.35	82.84	82.42	81.89	82.38	34.88	34.68	35.47	35.01
52	10.68	10.98	10.56	10.74	84.98	84.71	84.27	84.65	36.67	36.60	37.77	37.01
56	11.18	11.51	11.05	11.25	87.36	87.25	86.65	87.09	38.81	39.00	40.26	39.36
59	11.60	11.91	11.38	11.63	89.59	89.85	88.98	89.47	40.70	41.09	42.27	41.35
63	12.09	12.44	11.80	12.11	92.37	91.84	91.44	91.88	42.61	43.53	44.45	43.53
66	12.43	12.74	12.08	12.42	94.60	93.93	93.77	94.10	44.01	45.52	46.41	45.31
70	12.76	13.03	12.35	12.71	96.16	95.44	95.26	95.62	45.94	47.77	48.07	47.26
73	13.23	13.72	13.01	13.32	97.21	96.79	96.04	96.68	48.31	50.74	50.98	50.01
77	13.71	14.07	13.35	13.71	98.30	97.56	97.62	97.83	50.41	53.67	53.63	52.57
80	13.97	14.35	13.63	13.98	99.10	98.47	98.50	98.69	52.04	55.70	55.48	54.41
83	14.29	14.56	13.84	14.23	99.79	99.15	99.29	99.41	53.56	57.02	56.57	55.72
87	15.07	15.31	14.50	14.96	101.12	100.52	100.65	100.76	55.88	60.19	59.15	58.40
91	15.44	15.71	14.85	15.34	102.13	101.46	101.58	101.73	58.26	63.19	61.49	60.98
94	15.90	15.98	15.06	15.65	102.64	101.92	102.18	102.25	59.99	65.18	63.00	62.73
97	16.35	16.28	15.33	15.99	103.26	102.45	102.79	102.83	61.80	66.97	64.35	64.37
100	16.79	16.56	15.59	16.31	104.25	103.50	103.72	103.82	63.62	69.00	66.14	66.25
105	17.00	16.66	15.85	16.51	104.78	104.13	104.32	104.41	64.27	69.83	66.68	66.93
108	17.50	17.03	16.07	16.87	105.18	104.59	104.81	104.86	66.81	72.39	68.91	69.37
112	17.92	17.30	16.35	17.19	105.69	105.12	105.23	105.35	68.94	74.80	70.98	71.57
115	18.30	17.59	16.46	17.45	106.06	105.45	105.60	105.70	70.88	76.50	72.74	73.37
119	18.65	17.94	16.69	17.76	106.50	105.90	106.04	106.15	72.83	78.44	74.97	75.42
122	18.85	18.11	16.88	17.94	106.76	106.18	106.31	106.41	74.13	79.91	76.38	76.81
126	19.12	18.42	17.22	18.26	107.21	106.62	106.75	106.86	76.11	81.76	78.04	78.64
129	19.42	18.56	17.39	18.46	107.54	106.91	107.04	107.16	77.63	83.35	79.47	80.15
133	19.60	18.73	17.61	18.65	108.05	107.39	107.41	107.62	79.13	84.94	81.32	81.80
135	19.82	18.89	17.81	18.84	108.38	107.62	107.66	107.89	80.43	86.13	82.23	82.93

Table 5. Percentage biodegradation

Days	Percentage biodegradation(%)							
	Positive control				721692843 (OX240620-020)			
	1	2	3	average	1	2	3	average
1	0.5	0.5	0.4	0.5	0.0	0.0	0.0	0.0
2	1.7	1.6	1.7	1.7	0.0	0.0	0.0	0.0
3	3.8	3.6	3.7	3.7	0.2	0.2	0.2	0.2
4	5.8	5.6	5.9	5.8	0.5	0.4	0.5	0.4
5	9.5	9.3	9.8	9.5	0.6	0.6	0.7	0.6
6	13.1	13.8	13.3	13.4	0.9	0.8	0.9	0.9
7	16.1	15.8	15.4	15.8	1.1	1.0	1.1	1.1
8	18.6	18.3	17.7	18.2	1.4	1.3	1.5	1.4
9	21.0	20.6	19.9	20.5	1.8	1.7	1.8	1.8
10	24.4	24.1	22.7	23.7	2.0	1.9	2.1	2.0
11	26.6	26.4	24.7	25.9	2.3	2.2	2.4	2.3
12	28.3	27.8	26.4	27.5	2.6	2.4	2.7	2.5
13	29.9	29.2	27.9	29.0	2.9	2.7	2.9	2.8
14	31.6	31.0	29.9	30.8	3.2	3.0	3.2	3.1
15	33.0	32.7	31.8	32.5	3.5	3.3	3.5	3.5
16	34.6	34.2	33.3	34.0	3.9	3.7	3.9	3.8
17	36.4	35.7	34.9	35.7	4.2	4.1	4.3	4.2
18	38.1	37.1	36.3	37.2	4.6	4.5	4.7	4.6
19	39.6	38.7	37.9	38.7	4.9	4.8	5.0	4.9
20	40.9	40.2	39.3	40.1	5.3	5.2	5.3	5.2
21	42.6	43.2	41.5	42.4	5.7	5.6	5.7	5.6
22	43.9	44.6	43.0	43.8	6.3	6.1	6.1	6.2
23	45.4	46.0	44.5	45.3	6.7	6.6	6.5	6.6
24	47.0	47.4	46.2	46.9	7.3	7.2	7.0	7.2
25	48.2	48.9	47.4	48.1	7.8	7.7	7.5	7.7
26	49.5	50.2	48.8	49.5	8.3	8.3	8.1	8.2
27	50.9	51.5	50.1	50.8	8.9	8.8	8.7	8.8
28	52.4	53.1	51.6	52.4	9.4	9.3	9.2	9.3
29	54.1	54.7	53.3	54.0	10.0	9.9	9.8	9.9
30	55.8	56.2	55.0	55.7	10.6	10.4	10.3	10.4
31	57.5	57.7	56.5	57.2	11.2	10.9	10.9	11.0
32	58.8	58.7	57.8	58.4	11.4	11.2	11.2	11.3
33	60.2	59.9	59.1	59.7	11.9	11.7	11.7	11.8
34	61.4	61.2	60.5	61.0	12.4	12.2	12.2	12.3
35	63.2	63.2	62.3	62.9	13.3	13.0	13.2	13.2
36	64.2	64.1	63.2	63.8	13.7	13.4	13.6	13.6
37	65.1	65.0	64.2	64.8	13.9	13.7	13.9	13.8
38	66.3	66.0	65.3	65.9	14.3	14.1	14.3	14.2
39	67.4	66.9	66.4	66.9	14.7	14.5	14.6	14.6

Table 6. Percentage biodegradation (cnot'd)

Days	Percentage biodegradation(%)							
	Positive control				721692843 (OX240620-020)			
	1	2	3	average	1	2	3	average
40	68.2	67.8	67.3	67.8	15.2	14.9	15.1	15.0
41	69.0	68.7	68.2	68.7	15.6	15.3	15.4	15.5
42	70.0	69.7	69.1	69.6	16.1	15.7	15.8	15.9
43	70.6	70.4	69.9	70.3	16.6	16.2	16.3	16.4
44	71.4	71.2	70.6	71.1	17.0	16.7	16.9	16.9
45	74.1	73.7	73.2	73.7	18.4	18.2	18.8	18.5
52	75.9	75.7	75.2	75.6	19.4	19.4	20.3	19.7
56	77.8	77.8	77.2	77.6	20.7	20.8	21.8	21.1
59	79.7	80.0	79.1	79.6	21.8	22.1	23.0	22.3
63	82.0	81.6	81.2	81.6	22.9	23.6	24.3	23.6
66	84.0	83.4	83.2	83.6	23.7	24.8	25.5	24.7
70	85.3	84.6	84.5	84.8	24.9	26.3	26.5	25.9
73	85.8	85.4	84.6	85.3	26.2	28.1	28.3	27.5
77	86.5	85.8	85.9	86.0	27.5	30.0	30.0	29.1
80	87.0	86.5	86.5	86.6	28.5	31.3	31.1	30.3
83	87.5	86.9	87.0	87.1	29.5	32.1	31.8	31.1
87	88.1	87.5	87.7	87.8	30.7	33.9	33.1	32.6
91	88.7	88.1	88.3	88.4	32.2	35.9	34.6	34.2
94	88.9	88.3	88.5	88.6	33.3	37.1	35.5	35.3
97	89.2	88.5	88.8	88.8	34.4	38.2	36.3	36.3
100	89.9	89.2	89.4	89.5	35.5	39.5	37.4	37.5
105	90.2	89.7	89.9	89.9	35.8	40.0	37.6	37.8
108	90.3	89.8	90.0	90.0	37.5	41.6	39.1	39.4
112	90.5	90.0	90.1	90.2	38.8	43.2	40.4	40.8
115	90.6	90.0	90.2	90.3	40.1	44.3	41.5	41.9
119	90.7	90.2	90.3	90.4	41.3	45.5	42.9	43.2
122	90.8	90.3	90.4	90.5	42.1	46.5	43.8	44.1
126	90.9	90.4	90.6	90.6	43.4	47.6	44.9	45.3
129	91.1	90.5	90.6	90.7	44.4	48.7	45.8	46.3
133	91.4	90.8	90.8	91.0	45.4	49.7	47.0	47.4
135	91.5	90.8	90.9	91.1	46.2	50.5	47.6	48.1

Note: When the calculated result of percentage biodegradation is negative, denoted as "0".

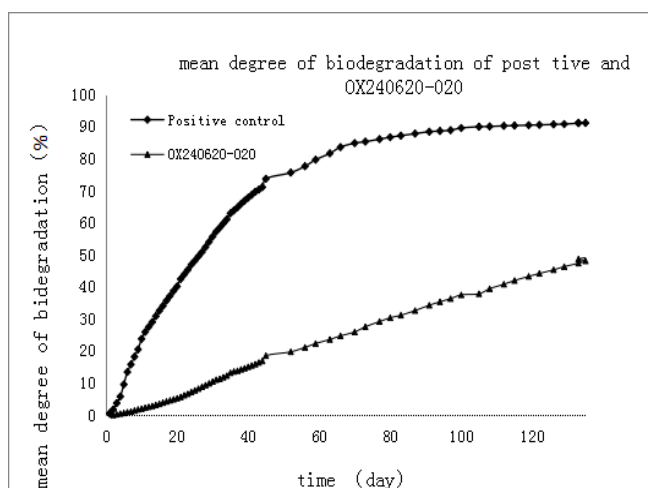


Fig 1. The mean percentage biodegradation curve

4. Validity of results

(1)Percentage biodegradation of three replicates of reference item was 74.1%、73.7% and 73.2% after 45 days of testing, respectively, and the mean value was 73.7%, greater than 70%。

(2)The differences between the individual values of three replicates of reference item were 0.5%、0.3% and 0.2% after 135 days of testing. All were less than 20%.

(3)During the first 10 days of testing, the compost inoculum produced 80.6 mg CO₂ per gram of volatile solids, within the range of 50 to 150 mg CO₂ per gram of volatile solids.

The testing is therefore considered to be valid.

5.Appendices: Test pictures (Note: The color of the sample may deviate from their pictures due to lighting and the use of different monitors.)



Fig 2.721692843 (OX240620-020)



Fig 3.The picture of 721692843 (OX240620-020) before test



Fig 4.The mixture of 721692843 (OX240620-020) and inoculum at the beginning of the test (Vessel 1)



Fig 5.The mixture of 721692843 (OX240620-020) and inoculum at the 5 days of the test (Vessel 1)



Fig 6.The mixture of 721692843 (OX240620-020) and inoculum at the 15 days of the test (Vessel 1)



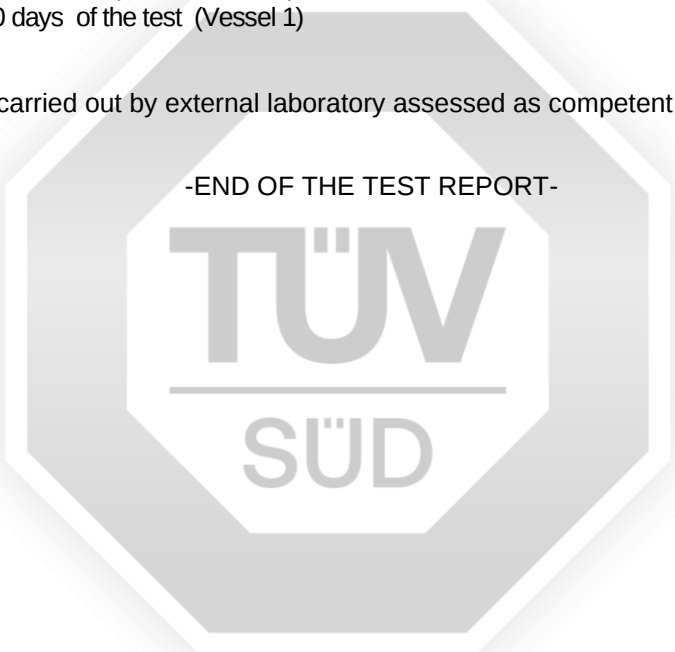
Fig 7.The mixture of 721692843 (OX240620-020) and inoculum at the 30 days of the test (Vessel 1)



Fig 8. The mixture of 721692843 (OX240620-020) and inoculum at the 60 days of the test (Vessel 1)

Note: This test was carried out by external laboratory assessed as competent

-END OF THE TEST REPORT-



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