TÜVRheinland®
Precisely Right.

Test Report No.: 326031590a 001

Client:	**Leetha Pack Pvt Ltd.**
Contact Information:	MAJOR INDUSTRIAL ESTATE, KALAMASSERY , ERNAKULAM, KERALA-683104, INDIA sales@leetha.com
Identification/Model No(s):	Aqueous coated paper and paper cups
Sample Receiving Date:	2024-06-05
Sample Obtaining Method:	Sending by customer
Condition at Delivery:	Test item complete and undamaged
Testing Period:	2024-06-17 to 2024-12-20
Place of Testing:	Chemical laboratory Shanghai& Kunshan

Test Specification:	***Test Result:***
With reference to EN 13432: 2000, Testing according to customer's specification for the following parameters:	
Heavy Metals and Other Toxic Substances	Pass
Qualitative Identification by Fourier Transform Infrared Spectroscopy	Please refer to page 5-6
Thickness Check	Please refer to page 7
Mass per Unit Area	Please refer to page 8
Aerobic Biodegradation Test	Pass
Quantitative Aerobic Disintegration Test	Pass
Plant Test	Pass

For and on behalf of
TÜV Rheinland (Shanghai) Co., Ltd.

2025-01-15 *Lucy Lu/Assistant Technical Manager*

Date *Name/Position*

Sample information is provided by customer. Test result is drawn according to the kind and extent of tests performed. This test report relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products. "Decision Rule" document announced in our website (https://www.tuv.com/landingpage/en/qm-gcn/) describes the statement of conformity and its rule of enforcement for test results are applicable throughout this test report.

Picture and Detailed Description of the Test Sample

M001

Material List:

Material No.	Material	Color	Location	Remark
M001	Paper + coating	White	-	-

1 Heavy Metals and Other Toxic Substances

Test Method: For Fluorine (F) content, according to EN 15408: 2011.
For other contents, according to ISO 17294-2: 2016.

Test Result:

			Test No. T001
			Material No. M001
Test Parameter	**Unit**	**Reporting Limit**	**Test Result**
Zn	mg/kg	5	<RL
Cu	mg/kg	5	<RL
Ni	mg/kg	5	<RL
Cd	mg/kg	0.25	<RL
Pb	mg/kg	5	<RL
Hg	mg/kg	0.20	<RL
Cr	mg/kg	5	<RL
Mo	mg/kg	0.25	<RL
Se	mg/kg	0.25	<RL
As	mg/kg	0.25	<RL
F	mg/kg	50	<RL
Co	mg/kg	3	<RL

Abbreviation: mg/kg = Milligram per kilogram
<RL = Less than reporting limit

Remark:

1. The requirement is following EN 13432: 2000.
2. The concentrations of regulated metals and other toxic substances in the plastic product or material refer to below Table 1 for examples.

Table 1 — Examples of maximum concentrations of regulated metals and other toxic substances

Values given in mg/kg of dry material

Element	US [a]	Canada [b]		EN13432 [c] / AS4736 [d] /AS5810 [d]	NF T51-800 [e]	China [f]	Japan [g]
		CCME	Ontario				
Zn	1400	350	250	150	150	150	180
Cu	750	200	50	50	50	50	60
Ni	210	31	31	25	25	25	30
Cd	19.5	1.5	1.5	0.5	0.5	0.5	0.5
Pb	150	75	75	50	50	50	10
Hg	8.5	0.4	0.4	0.5	0.5	0.5	0.2
Cr	—	105	105	50	50	50	50
Mo	—	2.5	2.5	1	1	1	—
Se	50	1	1	0.75	0.75	0.75	—
As	20.5	6.5	6.5	5	5	5	5
F	—	—	—	100	100	100	—
Co	—	17	17	—	38	38	—

[a] The maximum metal concentrations given here for the US are 50 % of those prescribed by 40 CFR 503.13, Table 3 (as per ASTM D6400 and ASTM D6868 requirements).

[b] The maximum metal concentrations for Canada are 50 % of those prescribed in Table 1 for Compost Category A in Guidelines for Compost Quality published by the Canadian Council of Ministers of the Environment (CCME), and Category AA of the Ontario Compost Quality Standards, published by Ontario Ministry of the Environment (as per ASTM D6400 requirements).

[c] The maximum metal concentrations for the EC are 50 % of those prescribed in ecological criteria for the award of the Community eco-label to soil improvers (EC OJ L 219, 7.8.1998, p. 39).

[d] The maximum metal concentrations given here for Australia refers to EN 13432, Table A.1.

[e] The maximum metal concentrations given here for France refers to EN 13432, Table A.1. except for Co, and the maximum concentration for Co is prescribed in BNQ 9011-911-l/2007.

[f]. The maximum metal and other toxic substances concentrations given here for People's Republic of China refers to GB/T 41010-2021 Degradability and identification requirements of biodegradable plastics and products, Table 1.

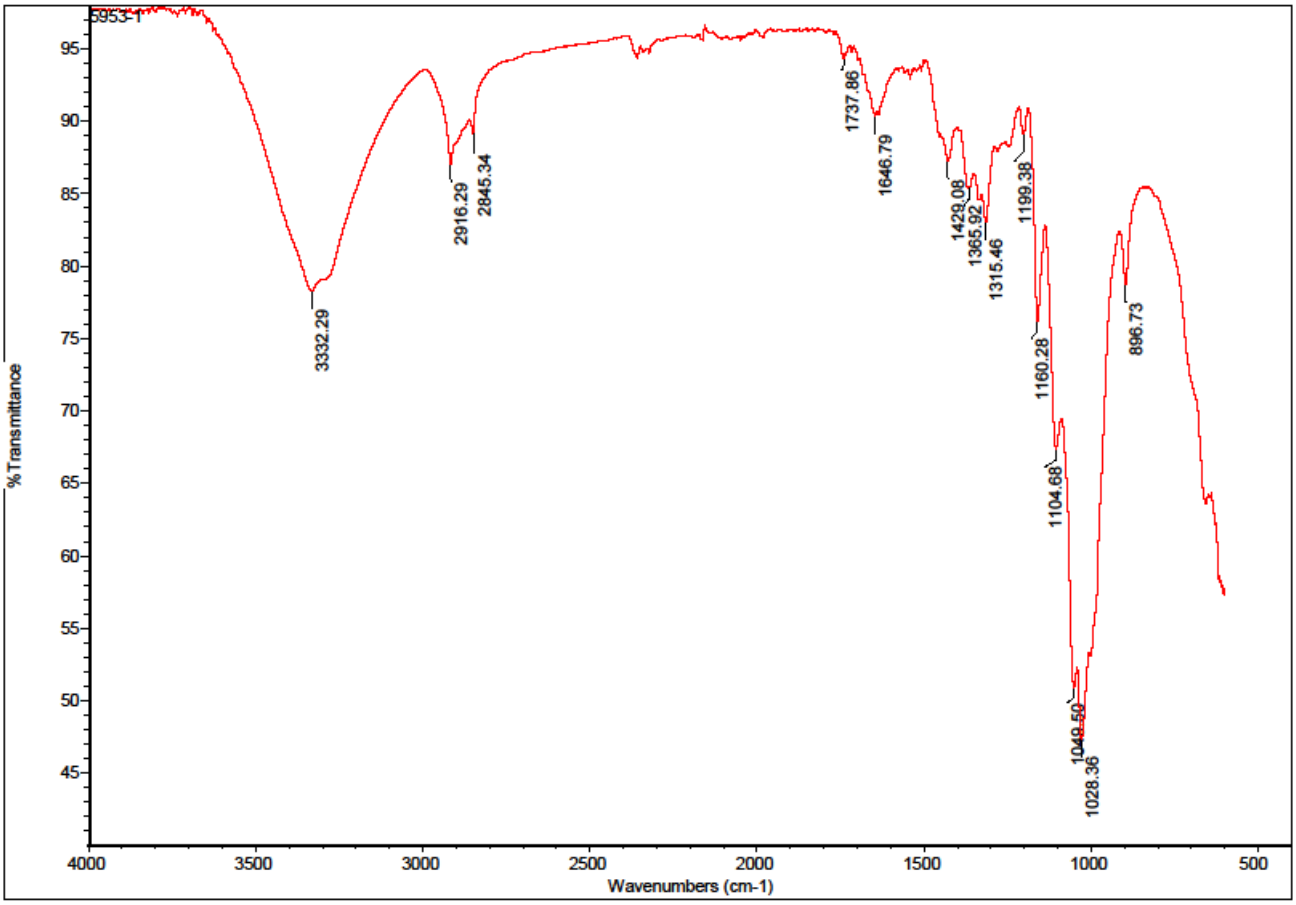
[g] The maximum metal concentrations for Japan are 10 % of those prescribed in the Fertilizer Control Law (Ministry of Agriculture, Forestry and Fisheries) and Guidelines for Quality of Composts (Central Union of Agricultural Co-operatives).

2 Qualitative Identification by Fourier Transform Infrared Spectroscopy

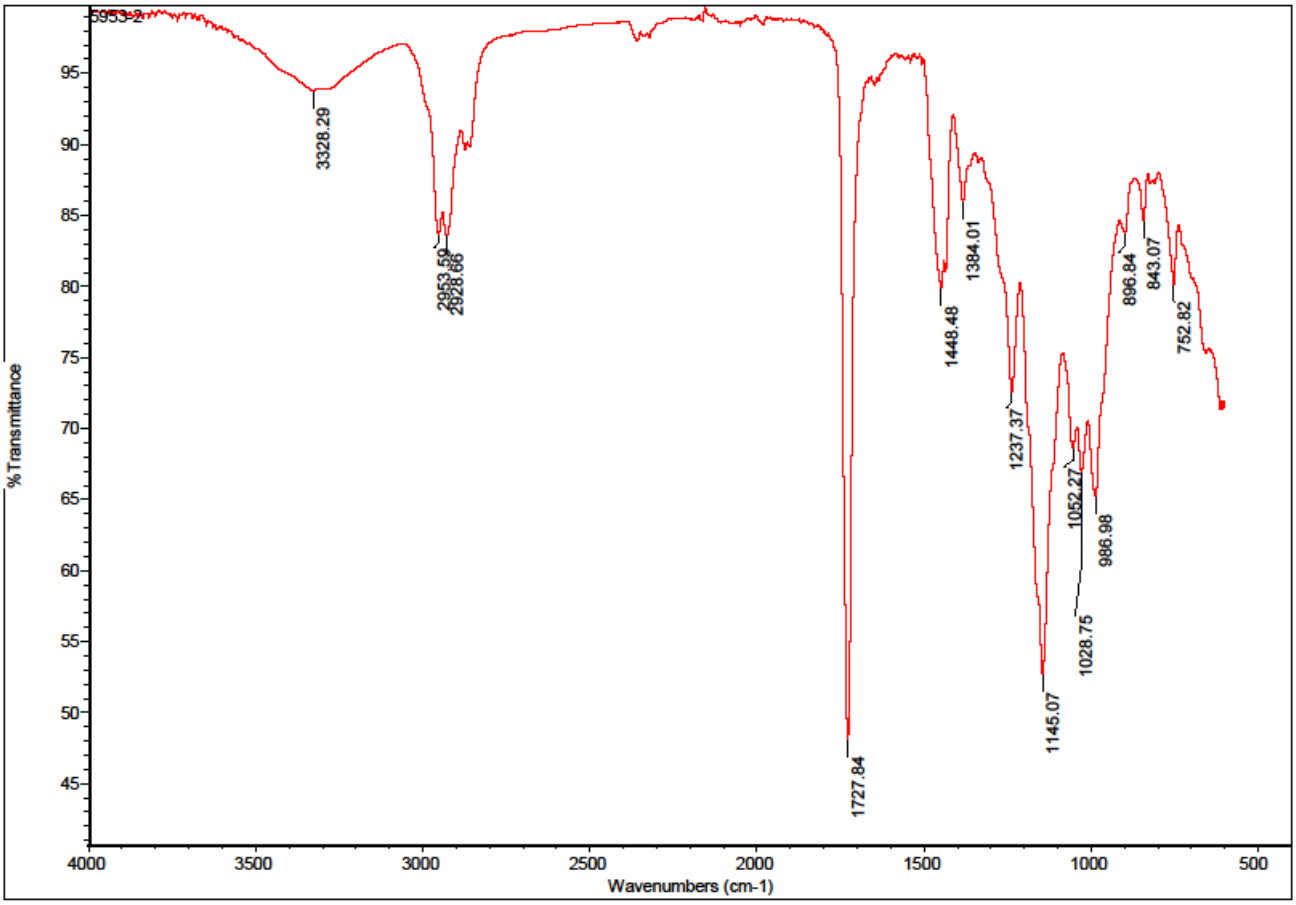
Test Method: Determination by Fourier Transform Infrared Spectroscopy ATR mode according to GB/T 6040-2019.

Test Result:

Picture of IR Spectrometry for M001 one side



Picture of IR Spectrometry for M001 another side



3 Thickness Check

Test Method: In-house method, the thickness of 10 samples have been measured in the same position by micrometer

Test Result:

Test No.:	T001
Material No.:	M001

Trial	Unit	Test Result
1	mm	0.430
2	mm	0.432
3	mm	0.429
4	mm	0.436
5	mm	0.432
6	mm	0.432
7	mm	0.429
8	mm	0.440
9	mm	0.436
10	mm	0.440
Average	mm	0.434
SD	mm	0.0042

Abbreviation: mm = Millimeter

SD = Standard deviation, $S = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Remark:

Equipment	Equipment Uncertainty	Foot Size	Foot force
Micrometer	0.001mm (k = 2)	Diameter 6.3mm	5.6N

4 Mass per Unit Area#

Test Method: ISO 536: 2019, Measured by balance and caliper.

Test Result:

Test No.:	T001
Material No.:	M001

Trial	Unit	Test Result
1	g/m^2	333
2	g/m^2	332
3	g/m^2	333
4	g/m^2	333
5	g/m^2	332
6	g/m^2	333
7	g/m^2	334
8	g/m^2	332
9	g/m^2	328
10	g/m^2	333
Average	g/m^2	332
SD	g/m^2	1.64

Abbreviation: g/m^2 = Gram per square meter.

SD = Standard deviation, $S = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Remark:

Equipment Uncertainty:

Balance: U = 0.0003g (k = 2)

Caliper: U = 0.01mm (k = 2)

#The test is subcontracted to an external lab which is accredited in accordance with ISO/IEC 17025:2017.

5 Biodegradation

5.1 General Test Information

Test Method : ISO 14855-1: 2012

Reference Material : Microcrystalline cellulose

Test Vessels : The vessel used for biodegradation test is a high pressure conical flask, volume: 3000 ml. It was provided by Pyrex Co. Ltd.

CO_2-determination : Determination of the amount of carbon dioxide evolved by weighing the carbon dioxide absorbing system. The amount of carbon dioxide is calculated via the difference in the weight of the carbon dioxide absorbing trap in the beginning and in the end of the test.

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

5.2 Summary of Test Results

	Test Material	Reference Material
45 days biodegradation rate (%)	>47.62	>72.63
Overall biodegradation rate (%)	92.53	99.77
Final relative biodegradation rate (test material/ reference material) (%)	92.74	
Test duration (days)	156	156
Observation	No abnormal findings	No abnormal findings

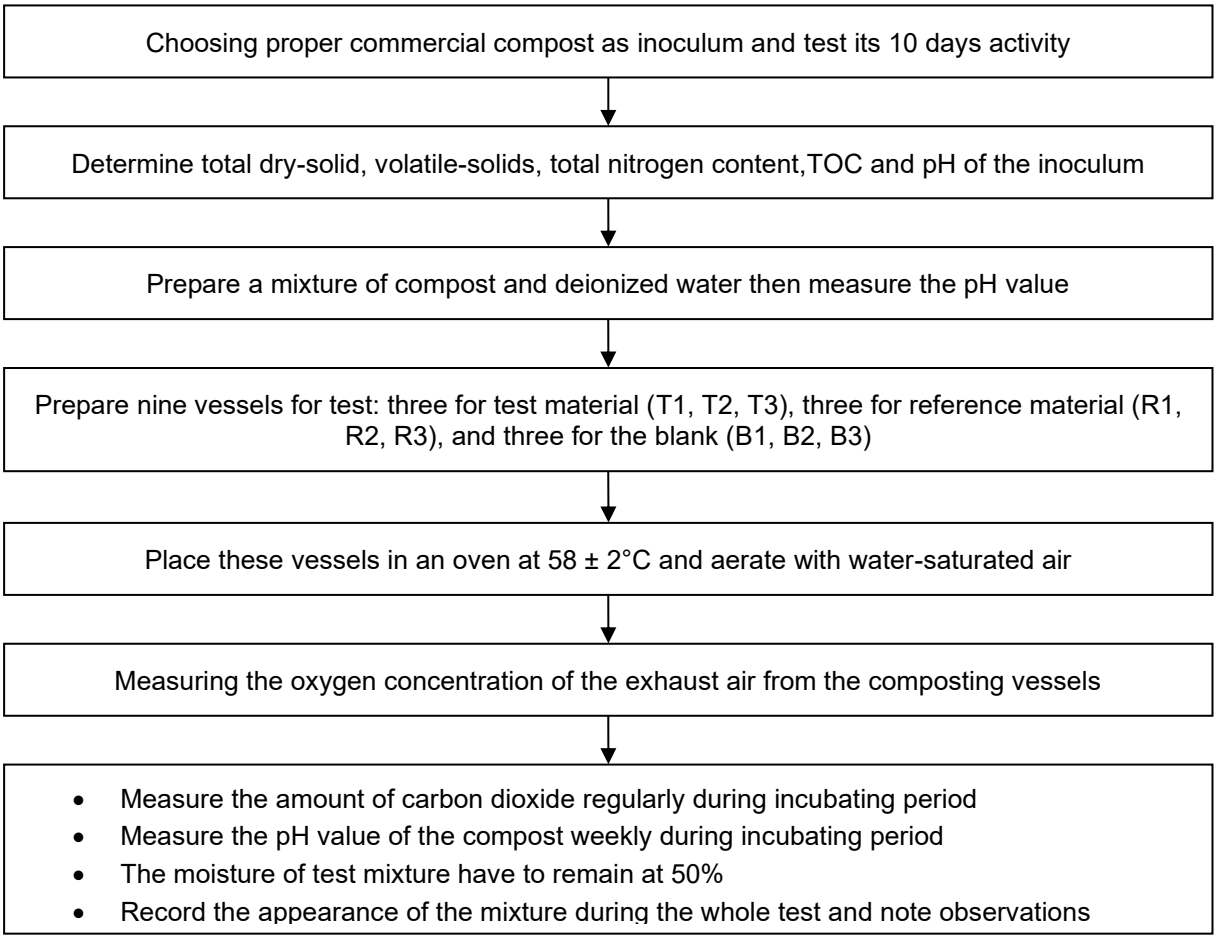
Validity Criteria :

Degree of biodegradation of reference material after 45 days > 70%.	☑ Yes	☐ No
Difference between percentage biodegradation of reference material in the different vessels at the end of test < 20%.	☑ Yes	☐ No
Average CO_2 production in the blank vessels after 10 days in the range 50 mg to 150 mg CO_2 /g volatile solids.	☑ Yes	☐ No

As the three criteria above have been fulfilled, the test is considered to be valid.

For detailed information, please see the following pages.

5.3 Flow Chart of Experiment



5.4 Results

5.4.1 Appearance of Compost and Sample

Before test

After test

Compost without any material before and after test

Before test

After test

Compost with reference material before and after test

Before test

After test

Compost with test material before and after test

5.4.2 Properties of inoculum

A commercial compost (Peilei) is used as the inoculum. The properties of inoculum are listed in the table below.

Properties	Data and description
Age	2 months
Storage condition	dry and room temperature
Handling	sieved through 10 mm
Total dry solids (%)	53.8
Moisture content (%)	46.8
Volatile solids (%)	36.3
Ash (%)	63.7
Compost Activity Test (mg CO_2 /g volatile solid)	130.6
Total organic carbon (%)	20.3
Total nitrogen content (g/kg)	9.68
Carbon/ Nitrogen ratio	21.0
pH of suspension	7.12

5.4.3 Activity of inoculum

The amount of CO_2 for the first 10 days

Days	Amount of Carbon Dioxide (mg)
1~2	4970.0
3~4	7630.0
5~7	9750.0
8~9	6790.0
10	1470.0
Total	30610.0

Compost Activity = 130.6 (mg CO_2 /g volatile solid)

Calculation:

Amount of CO_2 evolved during the first 10 days (mg) / (1200.0g * total dry solids * volatile solids)

1200.0g is the amount of compost used for each vessel.

5.4.4 Properties of Test and Reference Materials

The contents of organic carbon in test and reference material (microcrystalline cellulose) are determined. Results are used for calculation of amount of test material necessary to have an amount of 20.0g organic carbon in each vessel.

For reference material: m = amount of organic carbon each vessel / TOC

m = 20.0g / 0.434g/g = 46.1g

20.0g of organic carbon lead to a theoretical amount of 73.3g CO_2 evolved by microorganisms when the rate of biodegradation reaches 100%.

Parameter	Unit	Reference Material	Test Material
Total organic carbon (TOC)	(%)	43.4	43.6
Amount of organic carbon (TOC) in test vessel	(g)	20.0	20.0
Theoretical amount of evolved carbon dioxide	($ThCO_2$), (g)	73.3	73.3
Size	(cm × cm)	—	—
Shape	—	powder	paper shred
Volatile solids	(%)	100.0	99.0
Requirement for volatile solids	(%)	—	≥ 50
Total dry solids	(%)	94.7	91.9
Moisture content	(%)	5.3	8.1

5.4.5 The Amount of Material and Compost in Vessels

	Compost		Material	
	Weight (g)	Total Dry Solids (g)	Weight (g)	Total Dry Solids (g)
Blank	1200.0	645.6	None	None
Reference	1200.0	645.6	46.1	43.7
Test	1200.0	645.6	45.9	42.2

5.5 pH Value

The pH value of the compost is checked regularly during the test. It is determined by diluting compost with distillated water by 1:5 and measuring the value with an electrical pH-meter.

pH values during test

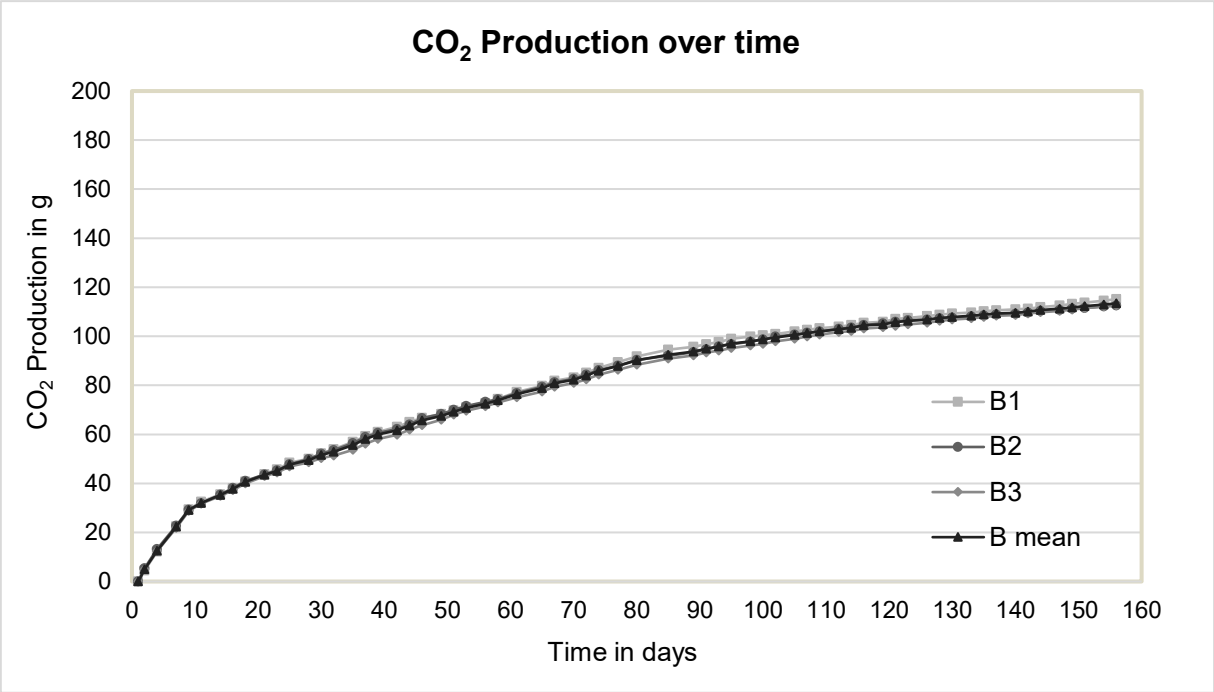
Day	B1	B2	B3	R1	R2	R3	T1	T2	T3
1	7.12	7.09	7.05	7.14	7.08	7.12	7.12	7.08	7.20
9	7.25	7.13	7.13	7.19	7.22	7.20	7.22	7.13	7.23
16	7.31	7.26	7.29	7.23	7.16	7.19	7.16	7.23	7.14
23	7.26	7.14	7.31	7.17	7.2	7.25	7.03	7.30	7.23
30	7.07	7.20	7.20	7.12	7.16	7.17	7.23	7.12	7.12
37	7.12	7.19	7.15	7.15	7.2	7.20	7.29	7.23	7.25
44	7.20	7.16	7.24	7.19	7.11	7.18	7.26	7.18	7.18
51	7.14	7.23	7.16	7.22	7.14	7.22	7.17	7.23	7.23
58	7.20	7.20	7.23	7.26	7.19	7.29	7.26	7.31	7.25
65	7.26	7.15	7.15	7.14	7.17	7.23	7.30	7.26	7.16
72	7.13	7.19	7.10	7.25	7.20	7.14	7.26	7.11	7.11

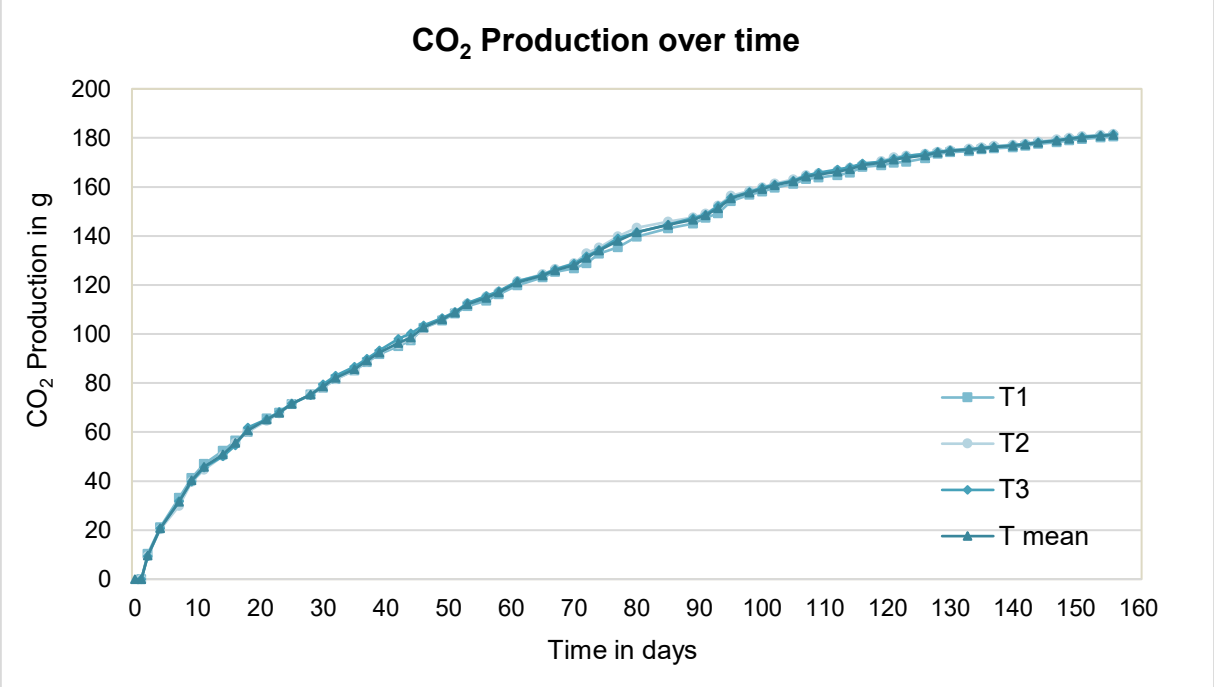
77	7.20	7.26	7.16	7.11	7.18	7.17	7.17	7.08	7.14
89	7.18	7.21	7.22	7.26	7.24	7.18	7.13	7.16	7.23
93	7.23	7.20	7.27	7.21	7.27	7.22	7.25	7.28	7.28
100	7.09	7.19	7.31	7.29	7.15	7.13	7.18	7.14	7.20
107	7.23	7.07	7.27	7.26	7.23	7.17	7.23	7.19	7.17
114	7.17	7.15	7.19	7.17	7.29	7.13	7.21	7.22	7.22
121	7.25	7.17	7.25	7.13	7.11	7.25	7.18	7.19	7.27
128	7.18	7.20	7.19	7.18	7.14	7.21	7.20	7.26	7.23
135	7.25	7.18	7.26	7.22	7.23	7.13	7.16	7.33	7.19
142	7.39	7.26	7.17	7.13	7.14	7.20	7.30	7.20	7.23
149	7.23	7.25	7.24	7.23	7.36	7.12	7.27	7.31	7.18
156	7.33	7.13	7.11	7.36	7.24	7.26	7.11	7.28	7.23

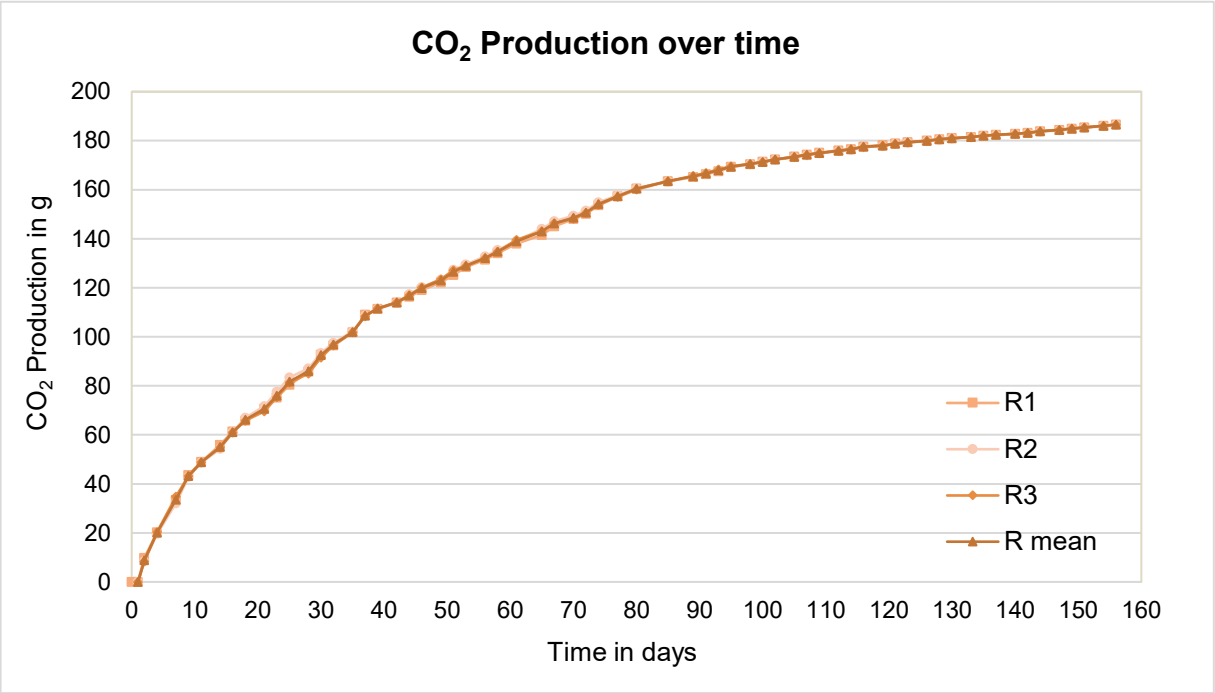
The pH values of the vessels do not show any obvious differences to the other vessels. Big differences in the pH value could ask for rejecting single values.

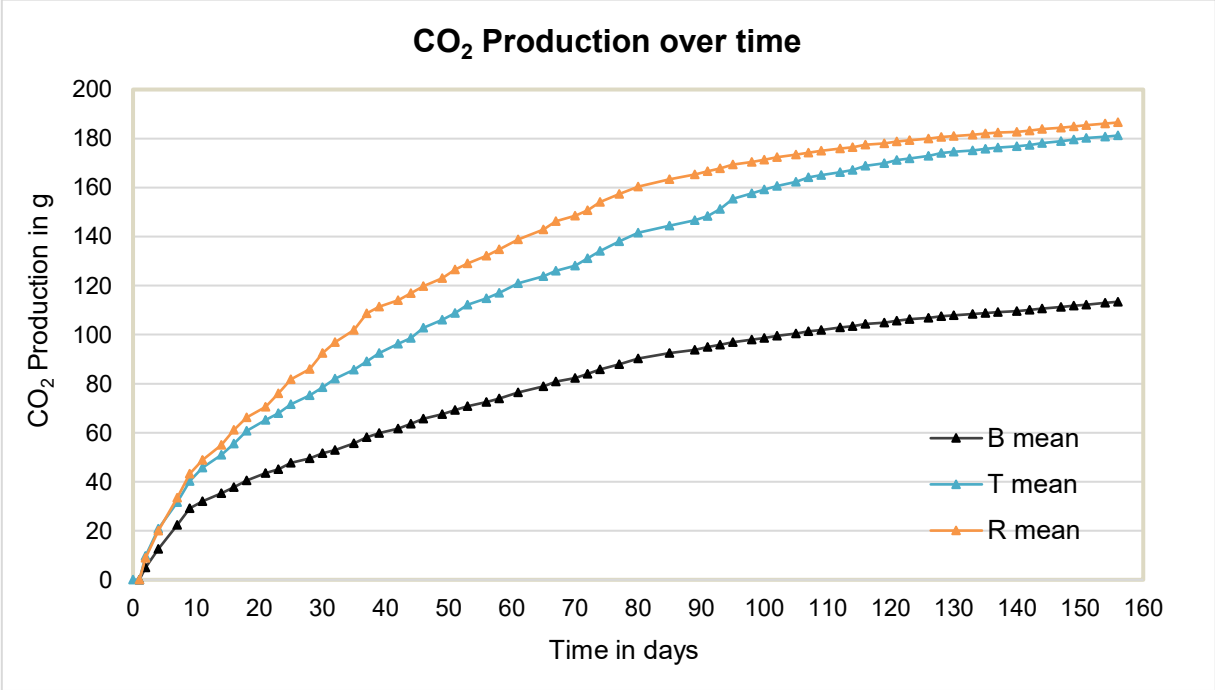
5.6 Controlled Aerobic Biodegradation Test

5.6.1 CO_2 Evolution Curve

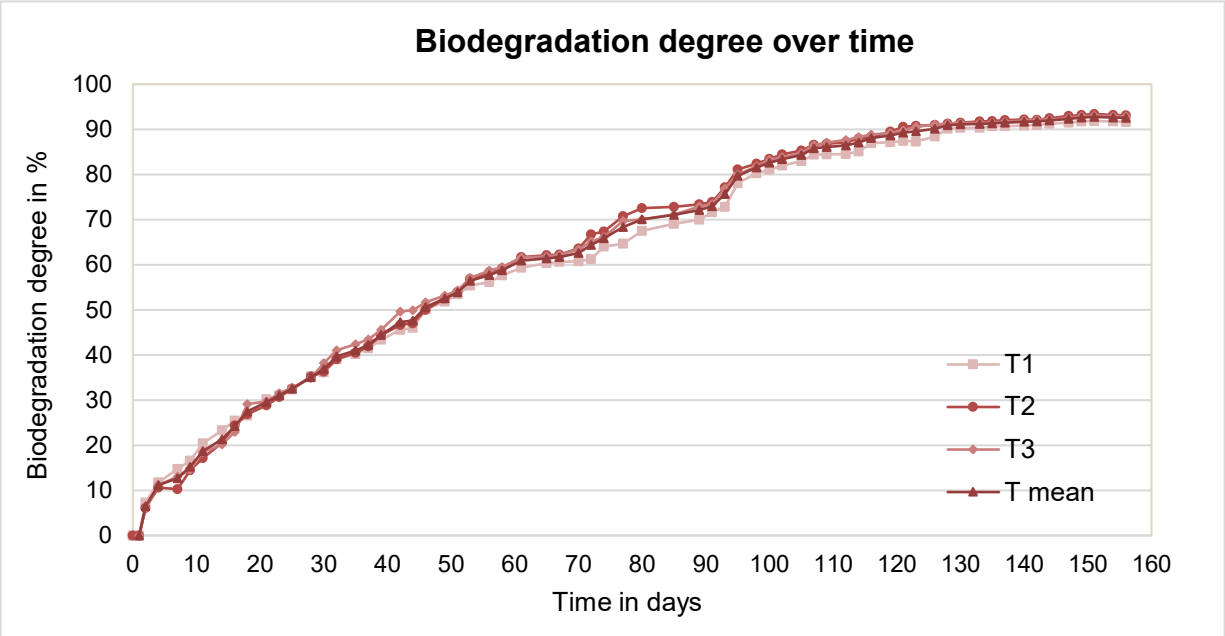


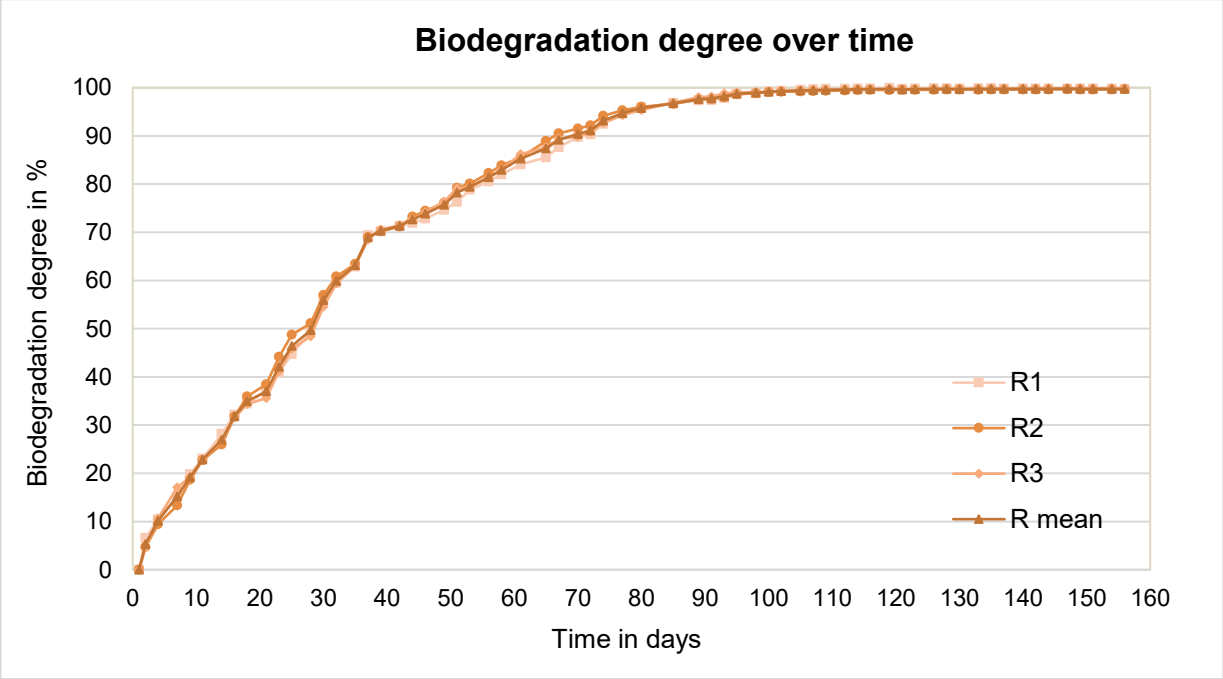


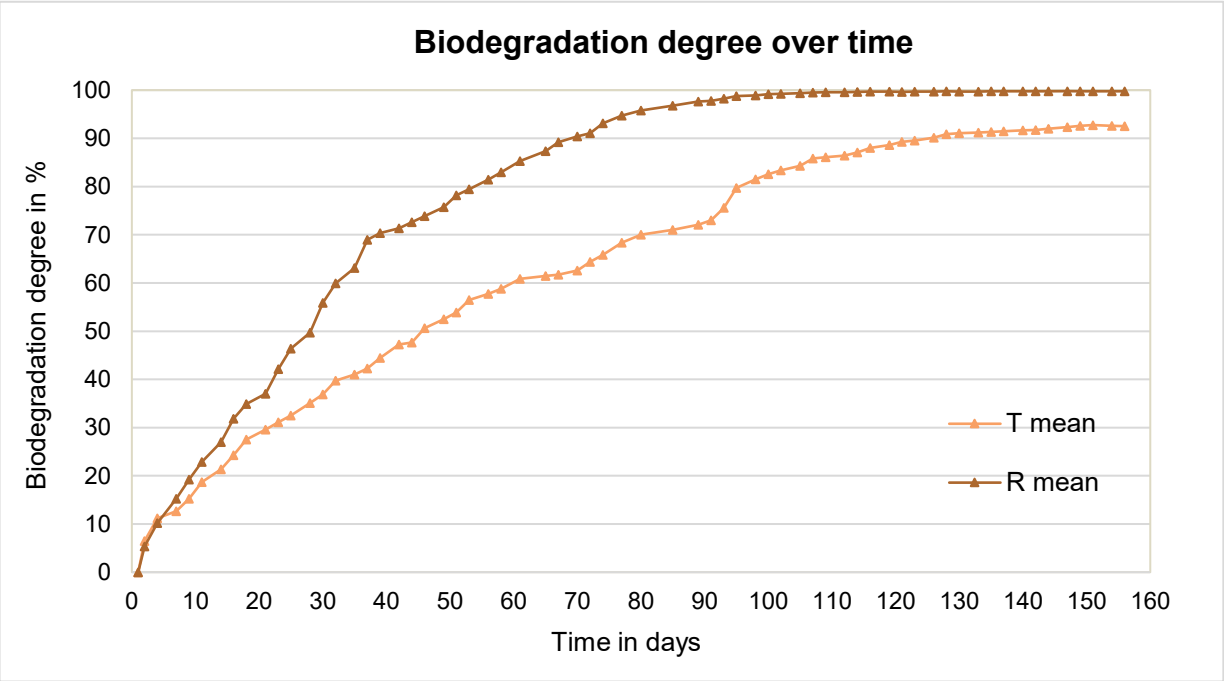

CO_2 Production over time
CO_2 Production in g
Time in days
R1
R2
R3
R mean


CO_2 Production over time
CO_2 Production in g
Time in days
B mean
T mean
R mean

5.6.2 Biodegradation curve







5.6.3 Controlled Aerobic Biodegradation Test Data of Test Material

Day	CO_2 (g/vessel)								D* (%)			
	B1	B2	B3	B_{mean}	T1	T2	T3	T_{mean}	T1	T2	T3	T_{mean}
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.51	5.41	4.98	4.97	10.32	9.42	9.41	9.72	7.30	6.07	6.06	6.48
4	7.70	7.80	7.40	7.63	10.87	10.98	11.37	11.07	4.42	4.57	5.10	4.70
7	10.25	9.58	9.42	9.75	11.98	9.46	11.10	10.85	3.04	-0.40	1.84	1.49
9	6.92	6.53	6.92	6.79	8.11	9.89	7.96	8.65	1.80	4.23	1.60	2.54
11	3.14	2.60	3.08	2.94	5.78	4.89	5.78	5.48	3.87	2.66	3.87	3.47
14	3.01	3.47	3.08	3.19	5.32	5.67	4.46	5.15	2.91	3.38	1.73	2.67
16	2.48	2.81	2.31	2.53	4.09	5.37	4.55	4.67	2.13	3.87	2.76	2.92
18	2.73	2.85	2.74	2.77	3.57	4.57	7.29	5.14	1.09	2.46	6.17	3.24
21	3.07	2.61	2.99	2.89	5.53	4.36	3.30	4.40	3.60	2.01	0.56	2.06
23	1.94	1.61	1.44	1.66	2.30	2.99	3.02	2.77	0.87	1.81	1.86	1.51
25	2.70	2.49	2.58	2.59	3.51	3.96	3.46	3.64	1.26	1.87	1.19	1.44
28	1.61	2.19	1.69	1.83	3.99	3.79	3.42	3.73	2.95	2.67	2.17	2.60
30	2.21	2.20	1.61	2.01	2.69	2.78	4.42	3.30	0.93	1.05	3.29	1.76
32	1.67	1.36	1.16	1.40	3.50	3.46	3.51	3.49	2.86	2.81	2.88	2.85
35	2.99	2.88	2.25	2.71	3.56	3.73	3.66	3.65	1.16	1.39	1.30	1.28

37	2.38	2.46	2.58	2.47	3.42	3.50	3.29	3.40	1.30	1.41	1.12	1.28
39	1.73	1.70	1.88	1.77	3.18	3.61	3.31	3.37	1.92	2.51	2.10	2.18
42	1.99	1.68	1.66	1.78	3.35	3.42	4.73	3.83	2.14	2.24	4.02	2.80
44	2.03	1.79	2.12	1.98	2.30	2.26	2.18	2.25	0.44	0.38	0.27	0.36
46	1.64	2.53	1.91	2.03	5.08	4.21	3.36	4.22	4.16	2.97	1.81	2.98
49	1.65	1.72	2.10	1.82	3.04	3.72	2.91	3.22	1.66	2.59	1.49	1.91
51	1.39	1.73	2.11	1.74	2.94	2.75	2.55	2.75	1.64	1.38	1.11	1.38
53	1.37	1.60	1.60	1.52	2.95	3.68	3.58	3.40	1.95	2.95	2.81	2.57
56	1.60	1.66	1.85	1.70	2.25	2.77	2.88	2.63	0.75	1.46	1.61	1.27
58	1.76	1.07	1.51	1.45	2.54	2.05	2.04	2.21	1.49	0.82	0.80	1.04
61	2.80	2.40	2.11	2.44	3.67	4.30	3.98	3.98	1.68	2.54	2.10	2.11
65	2.55	2.66	2.30	2.50	3.26	2.79	2.66	2.90	1.04	0.40	0.22	0.55
67	2.03	1.89	2.03	1.98	2.18	2.09	2.24	2.17	0.27	0.15	0.35	0.26
70	1.38	1.38	1.52	1.43	1.51	2.42	2.31	2.08	0.11	1.35	1.20	0.89
72	1.87	1.69	1.49	1.68	2.06	3.97	2.98	3.00	0.52	3.12	1.77	1.80
74	2.04	1.85	1.88	1.92	3.93	2.41	2.65	3.00	2.74	0.67	1.00	1.47
77	2.27	1.86	2.08	2.07	2.58	4.53	4.65	3.92	0.70	3.36	3.52	2.53
80	2.43	2.32	2.03	2.26	4.34	3.54	2.55	3.48	2.84	1.75	0.40	1.66
85	2.68	1.69	2.42	2.26	3.37	2.52	3.04	2.98	1.51	0.35	1.06	0.97
89	1.23	1.39	1.33	1.32	2.01	1.73	2.63	2.12	0.94	0.56	1.79	1.10
91	1.07	1.17	1.18	1.14	2.35	1.47	1.52	1.78	1.65	0.45	0.52	0.87
93	0.89	1.21	0.78	0.96	1.85	3.37	3.48	2.90	1.21	3.29	3.44	2.65
95	1.30	0.91	1.06	1.09	4.90	3.99	3.35	4.08	5.20	3.96	3.08	4.08
98	0.85	1.04	1.03	0.97	2.61	1.93	2.35	2.30	2.24	1.31	1.88	1.81
100	0.53	0.92	0.69	0.71	1.28	1.50	1.73	1.50	0.78	1.08	1.39	1.08
102	0.50	1.13	1.08	0.90	1.55	1.59	1.34	1.49	0.89	0.94	0.60	0.81
105	1.04	0.83	1.00	0.96	1.69	1.61	1.61	1.64	1.00	0.89	0.89	0.93
107	0.67	0.84	0.92	0.81	1.88	1.74	2.09	1.90	1.46	1.27	1.75	1.49
109	0.63	0.48	0.75	0.62	0.63	0.76	1.06	0.82	0.01	0.19	0.60	0.27
112	0.76	1.00	1.02	0.93	1.01	1.18	1.34	1.18	0.11	0.34	0.56	0.34
114	0.58	0.56	0.45	0.53	0.95	1.11	1.00	1.02	0.57	0.79	0.64	0.67
116	0.99	1.06	0.97	1.01	2.36	1.29	1.45	1.70	1.84	0.38	0.60	0.94
119	0.39	0.57	0.52	0.49	0.65	1.36	0.74	0.92	0.22	1.19	0.34	0.58
121	1.14	0.74	0.62	0.83	1.05	1.61	1.26	1.31	0.30	1.06	0.59	0.65
123	0.32	0.59	0.68	0.53	0.42	0.70	1.09	0.74	-0.15	0.23	0.76	0.28
126	0.84	0.25	0.64	0.58	1.38	0.70	0.94	1.01	1.09	0.16	0.49	0.58

128	0.53	0.51	0.76	0.60	1.84	0.85	0.77	1.15	1.69	0.34	0.23	0.75
130	0.50	0.35	0.55	0.47	0.65	0.62	0.57	0.61	0.25	0.20	0.14	0.20
133	0.35	0.44	0.53	0.44	0.44	0.64	0.45	0.51	0.00	0.27	0.01	0.09
135	0.52	0.46	0.51	0.50	0.74	0.54	0.54	0.61	0.33	0.05	0.05	0.14
137	0.47	0.32	0.45	0.41	0.42	0.58	0.54	0.51	0.01	0.23	0.18	0.14
140	0.37	0.36	0.33	0.35	0.44	0.47	0.57	0.49	0.12	0.16	0.30	0.19
142	0.29	0.46	0.63	0.46	0.57	0.40	0.57	0.51	0.15	-0.08	0.15	0.07
144	0.68	0.64	0.54	0.62	0.86	0.86	0.69	0.80	0.33	0.33	0.10	0.25
147	0.60	0.45	0.53	0.53	0.66	0.88	0.76	0.77	0.18	0.48	0.31	0.32
149	0.70	0.48	0.47	0.55	0.74	0.70	0.81	0.75	0.26	0.20	0.35	0.27
151	0.49	0.33	0.62	0.48	0.57	0.67	0.60	0.61	0.12	0.26	0.16	0.18
154	0.79	0.61	0.64	0.68	0.60	0.51	0.57	0.56	-0.11	-0.23	-0.15	-0.16
156	0.60	0.44	0.39	0.48	0.38	0.44	0.48	0.43	-0.14	-0.05	0.00	-0.06
After 44 days	**65.06**	**64.02**	**61.89**	**63.66**	**97.37**	**98.11**	**100.22**	**98.56**	**45.99**	**47.00**	**49.88**	**47.62**
Total	**115.14**	**112.61**	**112.50**	**113.41**	**180.55**	**181.66**	**181.50**	**181.22**	**91.60**	**93.11**	**92.89**	**92.53**

Remark:* D = Degree of degradation calculated from CO_2 evolution.

Equation:

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

$(CO_2)_T$ = Measured cumulative CO_2 production by test material

$(CO_2)_{Bmean}$ = $[(CO_2)_{B1}+(CO_2)_{B2}+(CO_2)_{B3}] / 3$

D = $[(CO_2)_T – (CO_2)_{Bmean}] / ThCO_2$

D_{Tmean} = $(D_{T1}+D_{T2}+D_{T3}) / 3$

5.6.4 Controlled Aerobic Biodegradation Test Data of Reference Material

Day	CO_2 (g/vessel)								D (%)			
	B1	B2	B3	B_{mean}	R1	R2	R3	R_{mean}	R1	R2	R3	R_{mean}
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.51	5.41	4.98	4.97	9.80	8.45	8.41	8.89	6.59	4.75	4.69	5.34
4	7.70	7.80	7.40	7.63	10.47	11.09	11.98	11.18	3.87	4.72	5.93	4.84
7	10.25	9.58	9.42	9.75	13.21	12.61	14.47	13.43	4.72	3.90	6.44	5.02
9	6.92	6.53	6.92	6.79	10.16	10.69	8.35	9.73	4.60	5.32	2.13	4.02
11	3.14	2.60	3.08	2.94	5.36	5.91	5.58	5.62	3.30	4.05	3.60	3.65
14	3.01	3.47	3.08	3.19	6.94	5.56	6.09	6.20	5.12	3.23	3.96	4.10
16	2.48	2.81	2.31	2.53	5.44	6.75	6.07	6.09	3.97	5.76	4.83	4.85
18	2.73	2.85	2.74	2.77	4.46	5.87	4.79	5.04	2.31	4.23	2.76	3.10
21	3.07	2.61	2.99	2.89	4.76	4.71	3.80	4.42	2.55	2.48	1.24	2.09
23	1.94	1.61	1.44	1.66	4.56	5.88	5.77	5.40	3.96	5.76	5.61	5.11
25	2.70	2.49	2.58	2.59	5.30	5.91	5.98	5.73	3.70	4.53	4.62	4.28
28	1.61	2.19	1.69	1.83	5.36	3.62	3.76	4.25	4.82	2.44	2.63	3.30
30	2.21	2.20	1.61	2.01	6.86	6.27	6.53	6.55	6.62	5.81	6.17	6.20
32	1.67	1.36	1.16	1.40	3.87	4.24	4.90	4.34	3.37	3.87	4.77	4.00
35	2.99	2.88	2.25	2.71	5.23	4.60	5.37	5.07	3.44	2.58	3.63	3.22
37	2.38	2.46	2.58	2.47	7.22	6.53	6.47	6.74	6.48	5.54	5.46	5.83
39	1.73	1.70	1.88	1.77	2.36	2.65	3.33	2.78	0.80	1.20	2.13	1.38
42	1.99	1.68	1.66	1.78	2.62	2.51	2.41	2.51	1.15	1.00	0.86	1.00
44	2.03	1.79	2.12	1.98	2.40	3.48	2.92	2.93	0.57	2.05	1.28	1.30
46	1.64	2.53	1.91	2.03	2.72	2.95	3.10	2.92	0.94	1.26	1.46	1.22
49	1.65	1.72	2.10	1.82	3.14	3.03	3.39	3.19	1.80	1.65	2.14	1.86
51	1.39	1.73	2.11	1.74	2.93	4.04	3.74	3.57	1.62	3.14	2.73	2.50
53	1.37	1.60	1.60	1.52	3.36	2.15	1.72	2.41	2.51	0.86	0.27	1.21
56	1.60	1.66	1.85	1.70	3.00	3.28	3.19	3.16	1.77	2.16	2.03	1.99
58	1.76	1.07	1.51	1.45	2.51	2.62	2.65	2.59	1.45	1.60	1.64	1.56
61	2.80	2.40	2.11	2.44	3.96	3.65	4.77	4.13	2.07	1.65	3.18	2.30
65	2.55	2.66	2.30	2.50	3.57	4.98	3.56	4.04	1.46	3.38	1.45	2.10
67	2.03	1.89	2.03	1.98	3.52	3.15	3.28	3.32	2.10	1.60	1.77	1.82
70	1.38	1.38	1.52	1.43	2.98	2.19	1.77	2.31	2.11	1.04	0.46	1.20
72	1.87	1.69	1.49	1.68	2.09	2.15	2.34	2.19	0.56	0.64	0.90	0.70
74	2.04	1.85	1.88	1.92	3.53	3.37	3.35	3.42	2.20	1.98	1.95	2.04
77	2.27	1.86	2.08	2.07	3.60	2.89	3.22	3.24	2.09	1.12	1.57	1.59

80	2.43	2.32	2.03	2.26	3.21	2.81	3.04	3.02	1.30	0.75	1.06	1.04
85	2.68	1.69	2.42	2.26	2.93	2.70	3.36	3.00	0.91	0.60	1.50	1.00
89	1.23	1.39	1.33	1.32	1.70	2.01	2.19	1.97	0.52	0.94	1.19	0.88
91	1.07	1.17	1.18	1.14	1.22	1.23	1.22	1.22	0.11	0.12	0.11	0.11
93	0.89	1.21	0.78	0.96	1.22	1.19	1.44	1.28	0.35	0.31	0.65	0.44
95	1.30	0.91	1.06	1.09	1.72	1.55	1.24	1.50	0.86	0.63	0.20	0.56
98	0.85	1.04	1.03	0.97	1.10	1.14	1.02	1.09	0.18	0.23	0.07	0.16
100	0.53	0.92	0.69	0.71	0.98	0.89	0.76	0.88	0.37	0.25	0.07	0.23
102	0.50	1.13	1.08	0.90	1.02	0.92	0.99	0.98	0.16	0.03	0.12	0.10
105	1.04	0.83	1.00	0.96	1.08	1.03	1.06	1.06	0.16	0.10	0.14	0.13
107	0.67	0.84	0.92	0.81	0.89	0.85	0.86	0.87	0.11	0.05	0.07	0.08
109	0.63	0.48	0.75	0.62	0.69	0.67	0.67	0.68	0.10	0.07	0.07	0.08
112	0.76	1.00	1.02	0.93	0.93	0.97	0.95	0.95	0.00	0.05	0.03	0.03
114	0.58	0.56	0.45	0.53	0.59	0.57	0.61	0.59	0.08	0.05	0.11	0.08
116	0.99	1.06	0.97	1.01	1.02	1.05	1.02	1.03	0.01	0.05	0.01	0.02
119	0.39	0.57	0.52	0.49	0.58	0.47	0.48	0.51	0.12	-0.03	-0.01	0.03
121	1.14	0.74	0.62	0.83	0.69	0.87	0.76	0.77	-0.19	0.05	-0.10	-0.08
123	0.32	0.59	0.68	0.53	0.57	0.53	0.60	0.57	0.05	0.00	0.10	0.05
126	0.84	0.25	0.64	0.58	0.64	0.59	0.62	0.62	0.08	0.01	0.05	0.05
128	0.53	0.51	0.76	0.60	0.56	0.64	0.61	0.60	-0.05	0.05	0.01	0.00
130	0.50	0.35	0.55	0.47	0.42	0.45	0.43	0.43	-0.07	-0.03	-0.05	-0.05
133	0.35	0.44	0.53	0.44	0.49	0.42	0.48	0.46	0.07	-0.03	0.05	0.03
135	0.52	0.46	0.51	0.50	0.51	0.51	0.53	0.52	0.01	0.01	0.04	0.02
137	0.47	0.32	0.45	0.41	0.39	0.43	0.40	0.41	-0.03	0.03	-0.01	0.00
140	0.37	0.36	0.33	0.35	0.32	0.36	0.37	0.35	-0.04	0.01	0.03	0.00
142	0.29	0.46	0.63	0.46	0.46	0.47	0.46	0.46	0.00	0.01	0.00	0.00
144	0.68	0.64	0.54	0.62	0.64	0.60	0.66	0.63	0.03	-0.03	0.05	0.02
147	0.60	0.45	0.53	0.53	0.51	0.58	0.55	0.55	-0.03	0.07	0.03	0.02
149	0.70	0.48	0.47	0.55	0.55	0.51	0.54	0.53	0.00	-0.05	-0.01	-0.02
151	0.49	0.33	0.62	0.48	0.49	0.47	0.49	0.48	0.01	-0.01	0.01	0.00
154	0.79	0.61	0.64	0.68	0.67	0.68	0.65	0.67	-0.01	0.00	-0.04	-0.02
156	0.60	0.44	0.39	0.48	0.46	0.52	0.51	0.50	-0.03	0.05	0.04	0.02
After 44 days	**65.06**	**64.02**	**61.89**	**63.66**	**116.38**	**117.33**	**116.98**	**116.90**	**71.92**	**73.22**	**72.74**	**72.63**
Total	**115.14**	**112.61**	**112.50**	**113.41**	**186.54**	**186.46**	**186.63**	**186.57**	**99.77**	**99.66**	**99.89**	**99.77**

Equation:

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

$(CO_2)_R$ = Measured cumulative CO_2 production by reference material

$(CO_2)_{Bmean}$ = $[(CO_2)_{B1}+(CO_2)_{B2}+(CO_2)_{B3}] / 3$

D = $[(CO_2)_R – (CO_2)_{Bmean}] / ThCO_2$

D_{Rmean} = $(D_{R1}+D_{R2}+D_{R3}) / 3$

5.7 Additional Information

For adjusting humidity in the composting vessels water was carefully added to the vessel once a week.

The concentration of oxygen was checked every day during the first week of the test and once a week afterwards. For aerobic conditions the concentration of oxygen shall be higher than 6%. The concentration did not fall below 18% during the test.

Control and cellulose reactors and the test item reactors showed a good structure. The soil is soft and unconsolidated, moisture content is suitable. Touch the soil, feel somewhat sticky and have some free water available when gently pressed by hand. No fungal growth was observed.

6 Disintegration

6.1 General Test Information

Test Method: ISO 16929: 2021

Ovens: The ovens used for this test contain of a heating system and a flow-rate adjustable air providing system. The temperature of the compost can be determined at any time. The volume of the composting oven is 70 liters.

O_2-determination: An instrument (CY-C12) is used for determining the concentration of oxygen in the exhaust gas directly.

6.2 Blank Compost

6.2.1 Composition of Blank Compost

The biowaste contains of a mixture of 7.0kg soil (peilei), 1.2kg onions, 1.2kg carrots, 1.2kg pepper, 1.5kg sawdust, 1.9kg rice and 1.0kg soybeans.

Mass for rice and soybeans is wet mass after soaking the rice and the soybeans in water for 12 hours.

6.2.2 Conditions of Blank Compost in Beginning of Test

Conditions	
Water content (%)	68.1
Volatile solids of total dry mass (%)	56.6
C-N-ratio	28.2
pH-Value	6.98

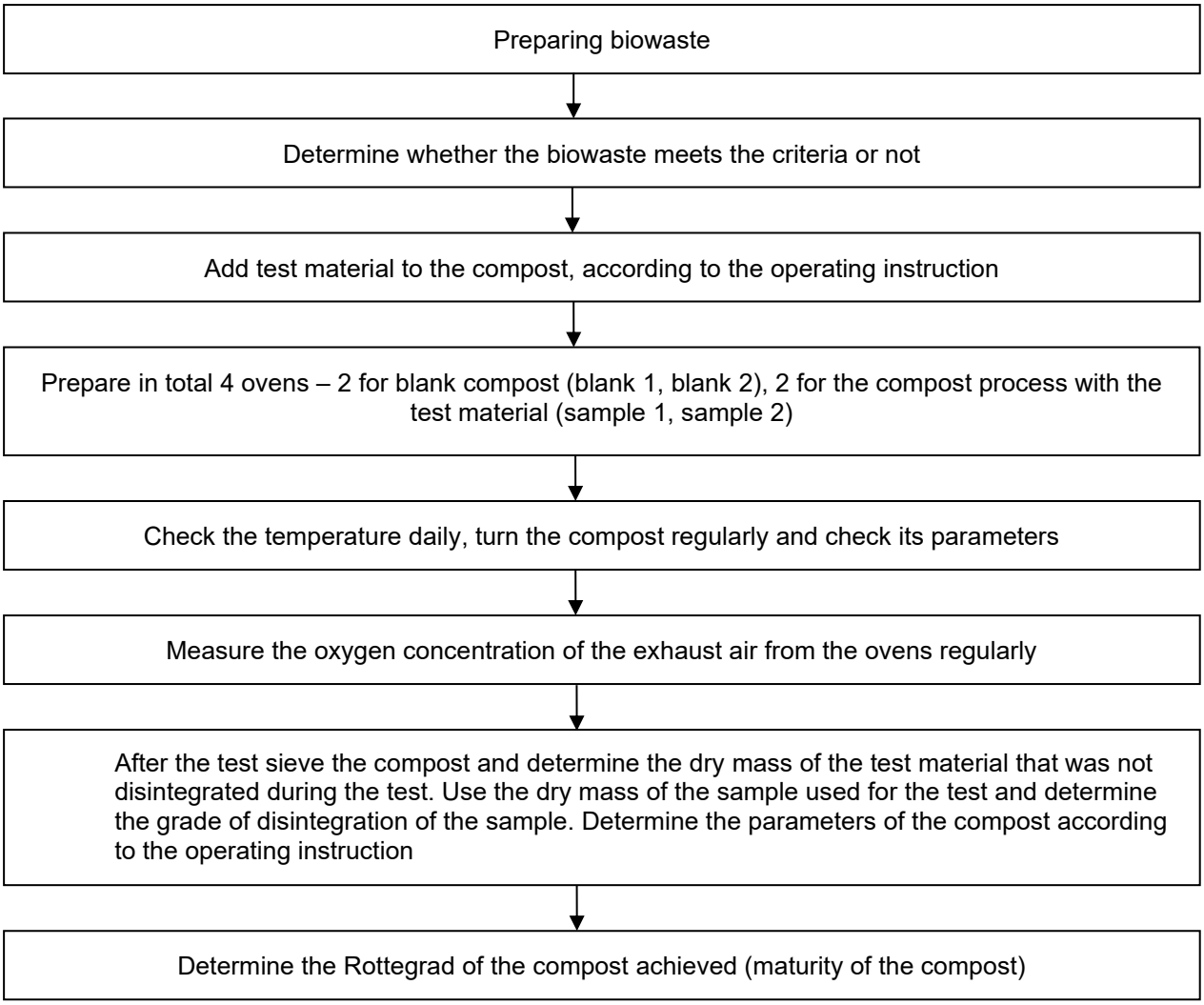
6.3 Set Up of the Testing

The whole mixture is composted in the oven. No nets are used during this test.

Wet mass of the blank compost: 15.0kg

Sample compost: paperboard (M001) pieces in around 5cm*5cm size + shreds(M001) are added to the blank compost to make the sample compost.

6.4 Flow Chart of Experiment



6.5 Results

6.5.1 Properties of Test Material

Parameter	M001
Total organic carbon (%)	43.6
Total nitrogen content (g/kg)	0.10
Total dry solids (%)	91.9
Volatile solids of total dry mass (%)	99.0
Requirement for volatile solids (%)	≥ 50
Moisture content (%)	9.1

6.5.2 Amount of Test Material and Biowaste in Ovens before Disintegration

	Biowaste	Test Material	
	Wet mass (kg)	Wet mass in final form (g) M001	Wet mass in fine form (g) M001
Blank 1	15.0	None	None
Blank 2	15.0	None	None
Sample 1	15.0	167.6	1356.8
Sample 2	15.0	164.7	1361.6

6.5.3 Amount of Test Material after the Process of Disintegration

Sample 1

Parameter	Unit	Result
Total dry mass of the sample used for the test	g	154.0
Total dry mass of sample (>2mm-fraction) after the test:	g	0
Degree of disintegration	%	100

Sample 2

Parameter	Unit	Result
Total dry mass of the sample used for the test	g	151.4
Total dry mass of sample (>2mm-fraction) after the test:	g	0
Degree of disintegration	%	100

The amount of sample found after sieving the final compost through a 2mm sieve, washing and drying the material, is less than 10% of the sample amount placed in the biowaste at the beginning of the test. The physical breakdown during the composting process was successful.

6.5.4 Test Results of the Compost after Disintegration

6.5.4.1 Wet Mass of the Compost Achieved after Disintegration

Parameter	Unit	Result
Wet mass of the compost (blank 1)	kg	9.6
Wet mass of the compost (blank 2)	kg	9.8
Wet mass of the compost (sample 1)	kg	9.8
Wet mass of the compost (sample 2)	kg	9.8

6.5.4.2 Parameters of the Compost Achieved after Disintegration by Analyzing the <10mm Fraction

Parameter	Unit	Blank 1	Blank 2	Sample 1	Sample 2
Total dry solids	%	95.3	95.4	94.5	94.5
Volatile solids	%	31.9	31.7	37.0	37.2
pH	-	7.22	7.16	7.18	7.13
Phosphorus	mg/kg	5470	5250	5920	5840
Nitrite as N	mg/kg	<0.60	<0.60	<0.60	<0.60
Electrical conductivity	mS/m	148	167	217	237
Total nitrogen as N	g/kg	8.72	9.17	10.9	10.9
Nitrate as N	mg/kg	33.7	35.2	170	169
Ammonium nitrogen as N	mg/kg	57.3	53.8	81.8	88.4
Potassium	mg/kg	24500	24300	22500	22400
Magnesium	mg/kg	10100	9960	10500	10400
Volumetric density	Kg/L	0.78	0.80	0.80	0.80
Total organic carbon	%	23.5	25.8	30.2	26.7

There is no obvious deviation on the tested parameters between the composts obtained after the test on disintegration.

6.5.4.3 Rottegrad of the Compost Achieved after Disintegration

The Rottegrad is a parameter for determining the maturity of the compost obtained after the test on disintegration. After 84 days the final compost is placed in Dewar vessels for 72 hours. The highest temperature during these 72 hours is used for comparing with the limits for the different Rottegrads (see table below).

As mature compost does not undergo a significant self-heating process anymore, the temperature shall be below 30°C.

Parameter	Amount of Compost (kg)	Temperature after 72 h (°C)	Rottegrad
Blank 1	1.0	34.7	IV
Blank 2	1.0	34.9	IV
Sample 1	1.0	34.1	IV
Sample 2	1.0	35.2	IV

Reference:

Maximum Temperature	> 60°C	50.1°C to 60°C	40.1°C to 50°C	30.1°C to 40°C	≤ 30°C
Rottegrad	I	II	III	IV	V

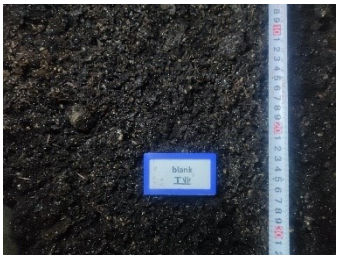
Validity parameter: The compost shall have a Rottegrad of IV to V after 12 weeks. This validity parameter has been fulfilled.

6.5.5 Appearance of Blank and Sample Compost

6.5.5.1 Appearance of Blank Compost

Before test

After 1 week



After 2 weeks

After 3 weeks

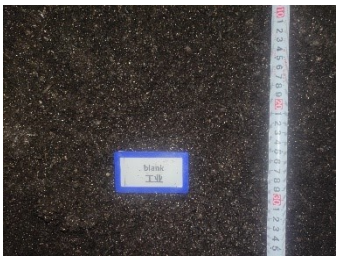
After 4 weeks

After 5 weeks

After 6 weeks

After 7 weeks

After 8 weeks



After 9 weeks

After 10 weeks

After 11 weeks

After test (After 12 weeks)

6.5.5.2 Appearance of Sample Compost

Before test

After 1 week

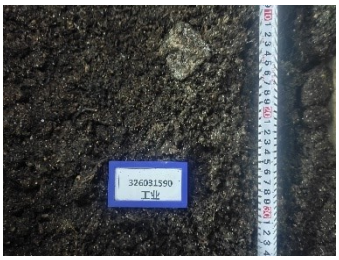
After 2 weeks

After 3 weeks

After 4 weeks

After 5 weeks

After 6 weeks



After 7 weeks

After 8 weeks

After 9 weeks

After 10 weeks

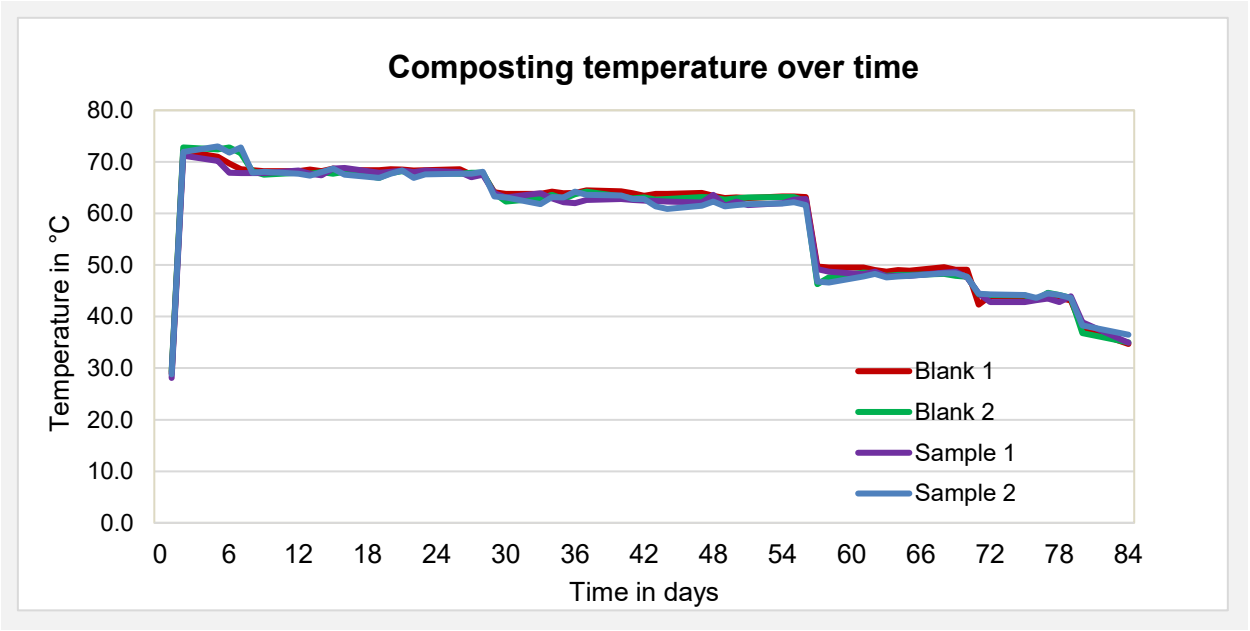
After 11 weeks

After test (After 12 weeks)

Remark: After test, no sample residues are distinguished to the naked eye from the other matter in the compost at a distance of 500 mm. No suspicion of visual contamination can be seen at the end of the test. The final interpretation is to be assessed by the certification body as the presence of visual contamination will render this test result uncompliant with the standard/certification scheme.

6.6 Diagrams

6.6.1 Course of the Temperature during the Test



Temperature over time

Validity parameter: Following minimum and maximum temperatures shall be respected in the ovens during the test.

— Days 2–7: between 60 °C and 75 °C

— Days 8–28: between 55 (±5) °C and 70 (±5) °C

— Days 29–56: between 50 (±5) °C and 65 (±5) °C

— Days 57–70: below 55 °C

— Days 71–84: below 45 °C

This requirement has been fulfilled. For single values please see below table.

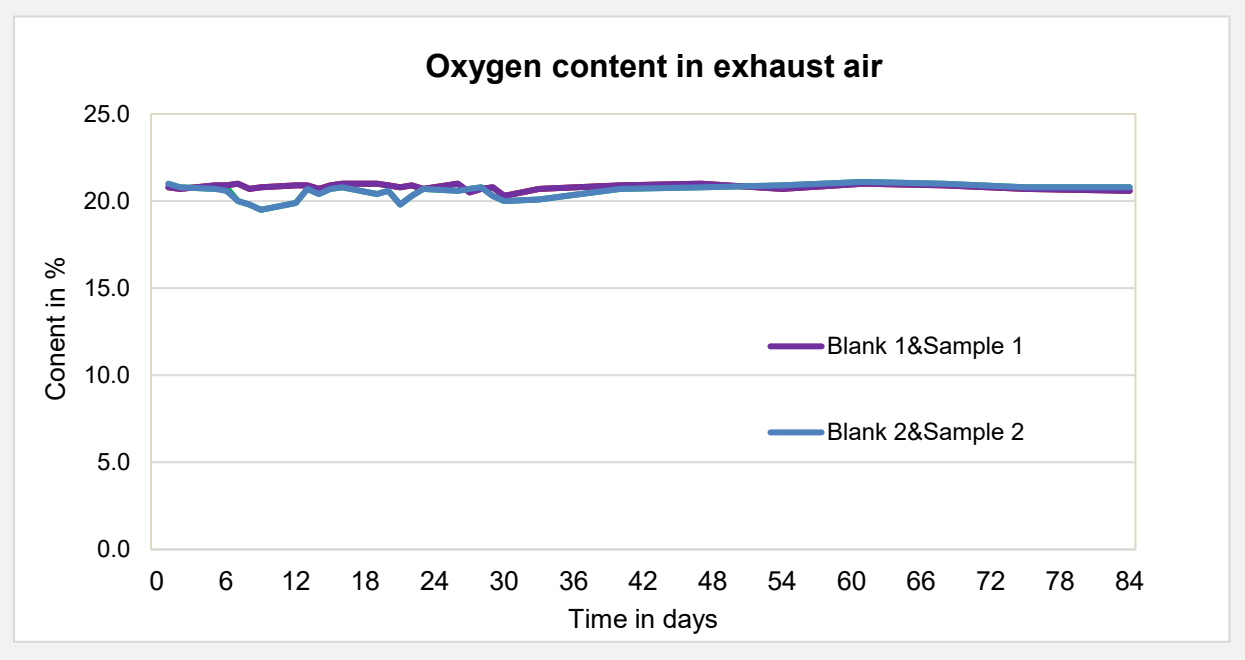
Temperature of the compost during the test (°C)

Day	Blank 1	Blank 2	Sample 1	Sample 2
1	29.0	29.4	28.1	28.8
2	72.1	72.8	71.2	71.9
5	71.0	72.4	70.2	73.0
6	69.7	72.8	67.9	71.8
7	68.6	71.7	67.8	72.8
8	68.4	68.2	67.8	67.9
9	68.2	67.5	67.8	68.1
12	68.2	67.9	68.3	67.7
13	68.5	67.7	67.7	67.3
14	68.2	68.0	67.4	68.0
15	68.7	67.7	68.7	68.7
16	68.4	68.1	68.8	67.5
19	68.4	66.9	67.9	66.9
20	68.6	67.8	68.1	67.7
21	68.5	68.2	68.3	68.3
22	68.3	67.7	68.0	66.9
23	68.4	67.9	68.3	67.6
26	68.6	67.7	68.0	67.7
27	67.5	67.9	67.0	67.7
28	67.7	67.9	67.5	68.1
29	64.1	63.9	63.9	63.3
30	63.8	62.3	63.1	63.1
33	63.8	62.9	63.9	61.8
34	64.2	63.6	62.9	63.2
35	63.9	62.8	62.2	63.1
36	64.0	63.7	62.0	64.2
37	64.5	64.2	62.6	63.6
40	64.3	63.3	62.8	63.5
41	63.9	62.9	62.6	62.8
42	63.4	63.1	62.5	62.8
43	63.8	62.7	62.4	61.4
44	63.8	62.8	62.3	60.9
47	64.0	63.2	62.1	61.5
48	63.4	63.1	63.6	62.3

49	63.0	62.7	61.5	61.4
50	63.1	62.9	62.3	61.6
51	63.0	63.1	61.6	61.8
54	63.3	63.2	62.0	61.9
55	63.3	63.2	62.7	62.2
56	63.2	62.4	62.8	61.6
57	49.7	46.3	49.2	46.8
58	49.5	47.6	48.7	46.6
61	49.5	48.5	48.2	47.8
62	49.0	48.4	48.7	48.3
63	48.7	47.9	47.8	47.6
64	49.0	48.1	47.9	47.8
65	48.9	48.1	47.9	47.9
68	49.6	48.3	48.5	48.4
69	49.1	47.9	48.7	48.4
70	49.1	47.7	47.6	47.7
71	42.3	44.3	44.5	44.4
72	44.0	44.2	42.8	44.3
75	43.8	44.1	42.8	44.2
76	43.3	43.3	43.2	43.6
77	44.2	44.6	43.5	44.5
78	43.6	44.2	42.8	44.2
79	43.1	43.6	43.9	43.6
80	37.8	36.8	38.9	38.3
84	34.7	35.0	34.9	36.5

5 days before the test was finished the heating function of the ovens was switched off. This caused the decreasing temperature after 79 days. The reason for switching off the heating function is, that the final compost will be used for determining the Rottegrad. Here the self-heating process of the final compost is determined, so we need to allow the compost to cool down to its natural temperature.

6.6.2 Course of the Concentration of Oxygen in the Exhaust Gas during the Test



Concentration of oxygen over time

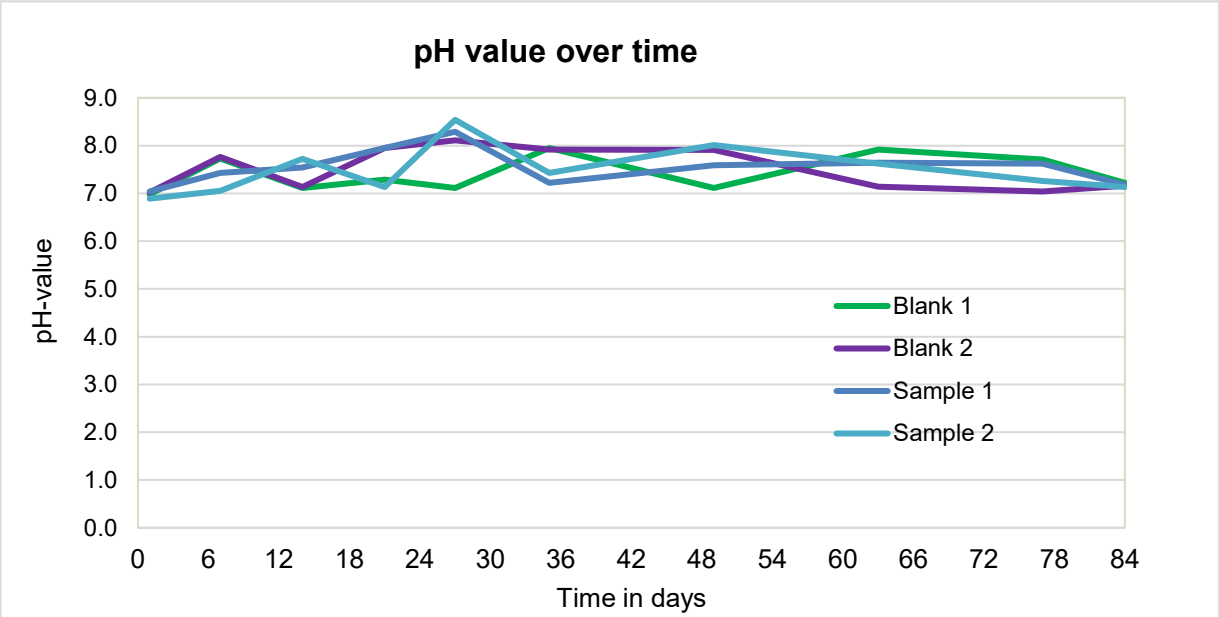
Validity parameter: For ensuring aerobic conditions, the concentration of oxygen in the exhaust gas never falls below 10%. This requirement has been fulfilled. For single values please see below table.

Concentration of oxygen in the exhaust gas (%)

Day	Blank 1	Blank 2	Sample 1	Sample 2
1	20.8	21.0	20.8	21.0
2	20.7	20.8	20.7	20.8
5	20.9	20.7	20.9	20.7
6	20.9	20.8	20.9	20.6
7	21.0	20.0	21.0	20.0
8	20.7	19.8	20.7	19.8
9	20.8	19.5	20.8	19.5
12	20.9	19.9	20.9	19.9
13	20.9	20.7	20.9	20.7
14	20.7	20.4	20.7	20.4
15	20.9	20.7	20.9	20.7
16	21.0	20.8	21.0	20.8
19	21.0	20.4	21.0	20.4
20	20.9	20.6	20.9	20.6
21	20.8	19.8	20.8	19.8

22	20.9	20.3	20.9	20.3
23	20.7	20.7	20.7	20.7
26	21.0	20.6	21.0	20.6
27	20.5	20.7	20.5	20.7
28	20.7	20.8	20.7	20.8
29	20.8	20.3	20.8	20.3
30	20.3	20.0	20.3	20.0
33	20.7	20.1	20.7	20.1
40	20.9	20.7	20.9	20.7
47	21.0	20.8	21.0	20.8
54	20.7	20.9	20.7	20.9
61	21.0	21.1	21.0	21.1
68	20.9	21.0	20.9	21.0
75	20.7	20.8	20.7	20.8
84	20.6	20.8	20.6	20.8

6.6.3 Graph of Development of pH Value of the Compost during Composting Process



pH Value over time

Validity parameter: The pH-value never falls below 5 and raises to a value above 7 during the test. This requirement has been fulfilled. For single values please see below table.

pH value of the compost during the test

Day	Blank 1	Blank 2	Sample 1	Sample 2
1	6.98	7.02	7.04	6.89
7	7.73	7.76	7.43	7.05
14	7.11	7.13	7.54	7.72
21	7.29	7.95	7.95	7.13
27	7.11	8.11	8.29	8.54
35	7.95	7.92	7.22	7.43
49	7.11	7.91	7.59	8.01
63	7.92	7.14	7.64	7.62
77	7.71	7.04	7.62	7.26
84	7.22	7.16	7.18	7.13

7 Plant test

7.1 General test information

Test Method : EN 13432: 2000 Annex E and OECD 208: 2006

Plants : For this test seeds for corn and soybean are used. Seeds are stored in dry room at home temperature for no more than 2 months.

Common name	Soybean	Corn
Class	di-cotyledonae	mono-cotyledonae
Family	Fabaceae (Leguminosae)	Poaceae (Gramineae)
Species	*Glycine max (G. soja)*	*Zea mays*
percentage germination	> 85%	
seed size	6-9mm	6-10mm

Plant Pots : Plants grow in pots made of PP in volumes of 10L.

Reference Substrate : A mixture of commercial potting soil as substrate (peat soil) and siliceous sand has been used.

Soil particle distribution: < 6mm; Total organic carbon: 25.4%; Volatile solids content: 38.5%; Total dry solids: 64.7%; pH value: 7.17

Compost: Use the composts < 10mm fraction including sample compost and blank compost obtained after 12 weeks composting and sieving with 10mm sieve according to ISO 16929: 2021.

7.2 Set up of the plant test

Prepare 24 pots and fill them with mixtures of the reference substrate with 25% or 50% (w/w) of blank compost or sample compost.

The total soil in each pot is 1400.0g, and peat soil is mixed with siliceous sand in a ratio of 1:1(w/w) to prepare the reference substrate.

In a plant test after complete disintegration, weight setup of each pot is shown in table below.

Mix ratio	Weight (g/pot)		
	Blank compost/Sample compost	Reference substrate	Total
25%	350.0	1050.0	1400.0
50%	700.0	700.0	1400.0

3 parallels were set for each mix ratio and the pots numbers are listed as below:

Plant	Mix ratio	Pot No.	
		Blank compost	Sample compost
Soybean	25 %	Parallel 1~3	Parallel 1~3
	50 %	Parallel 1~3	Parallel 1~3

Corn	25 %	Parallel 1~3	Parallel 1~3
	50 %	Parallel 1~3	Parallel 1~3

Evenly add 100 seeds of soybean or corn in each pot and add water. After watering, the pots are set in a warm house which staying dark all days during the germination period. For ensuring identical conditions the pots are stored in a greenhouse. The plants are watered daily and no additional fertilization is used.

Temperature: 22°C ± 10°C;

Relative humidity: 70% ± 25%;

Photoperiod: 16hours/day;

Light: luminance of 25900 lx ± 3700 lx (350 ± 50 μE/ m^2/s), no less than 14800 lx (200 μE/ m^2/s), measured at the top of the canopy.

After 50% of the seeds in the pots with a mixture of blank compost has been emerged, the plant growth test was kept running for 14 ~ 21 days.

7.3 Summary of test results

Parameters	Results			Requirement	Conclusion
	Plant	Mix ratio 25%	Mix ratio 50%		
Mean Germination Rate (%)	Soybean	99.0	98.3	≥ 90	Pass
	Corn	98.2	97.9		
Mean Dry Biomass / plant (%)	Soybean	100.5	104.0	≥ 90	Pass
	Corn	101.8	100.5		
Alternatively, Mean Wet Biomass / plant (%)	Soybean	100.7	100.5	≥ 90	Pass
	Corn	102.4	100.4		

Validity Criteria :

The seedling emergence is at least 70%.	☑ Yes	☐ No
The seedlings do not exhibit visible phytotoxic effects (e.g. chlorosis, necrosis, wilting, leaf and stem deformations) and the plants exhibit only normal variation in growth and morphology for that particular species.	☑ Yes	☐ No
The mean survival of emerged control seedlings is at least 90% for the duration of the study.	☑ Yes	☐ No
Environmental conditions for a particular species are identical and growing media contain the same amount of soil matrix, support media, or substrate from the same source.	☑ Yes	☐ No

As the four criteria above for the blank have been fulfilled, the test is considered to be valid.

For detailed information, please see the following pages.

7.4 Results

7.4.1 Germination rate

The pots were placed in the green room. It was 5 days after start, over 50% seeds each pot have been emerged.

Mix ratio	Test No.	Germination of Soybean (numbers)		Germination Rate (%) sample compost as percentage of blank compost	Mean Germination Rate (%)
		Blank compost	Sample compost		
25%	Parallel 1	95	93	97.9	99.0
	Parallel 2	93	95	102.2	
	Parallel 3	96	93	96.9	
50%	Parallel 1	96	95	99.0	98.3
	Parallel 2	94	92	97.9	
	Parallel 3	95	93	97.9	

Mix ratio	Test No.	Germination of Corn (numbers)		Germination Rate (%) sample compost as percentage of blank compost	Mean Germination Rate (%)
		Blank compost	Sample compost		
25%	Parallel 1	94	94	100.0	98.2
	Parallel 2	94	93	98.9	
	Parallel 3	96	92	95.8	
50%	Parallel 1	97	92	94.8	97.9
	Parallel 2	95	95	100.0	
	Parallel 3	94	93	98.9	

7.4.2 Wet Biomass of the Plants

14 days after the germination rate of the blank mixtures has reached 50%, the test was stopped. The plants were cut right above the soil. Some plants was removed which was attached to the soil. The wet biomass has been determined after then. By comparing the wet mass of plants growing on mixture blank and mixture sample it is checked whether the sample has a negative effect on the plant growth or not.

Mix ratio	Test No.	Total Wet Biomass of Soybean (g)		Wet Biomass of Soybean / plant (g)		Wet Biomass / plant (%)	Mean Wet Biomass / plant (%)
		Blank compost	Sample compost	Blank compost	Sample compost	Sample compost as percentage of blank compost	
25%	Parallel 1	371.4	361.5	3.951	3.973	100.6	100.7
	Parallel 2	365.2	372.6	3.927	3.964	100.9	
	Parallel 3	377.6	368.1	3.975	4.001	100.7	
50%	Parallel 1	368.9	366.2	3.924	3.896	99.3	100.5
	Parallel 2	370.9	364.5	3.988	4.005	100.4	
	Parallel 3	379.4	369.5	3.994	4.060	101.7	

Mix ratio	Test No.	Total Wet Biomass of Corn (g)		Wet Biomass of Corn / plant (g)		Wet Biomass / plant (%)	Mean Wet Biomass / plant (%)
		Blank compost	Sample compost	Blank compost	Sample compost	Sample compost as percentage of blank compost	
25%	Parallel 1	168.9	172.5	1.816	1.855	102.1	102.4
	Parallel 2	172.3	174.1	1.833	1.892	103.2	
	Parallel 3	175.4	169.1	1.846	1.879	101.8	
50%	Parallel 1	178.1	173.6	1.875	1.908	101.8	100.4
	Parallel 2	171.4	171.4	1.823	1.843	101.1	
	Parallel 3	173.3	168.4	1.863	1.830	98.2	

7.4.3 Dry Biomass of the Plants

After the plants were dried at 60°C for 12 hours and cooling down, the dry biomass has been determined. By comparing the dry mass of plants growing on mixture blank and mixture sample it is checked whether the sample has a negative effect on the plant growth or not.

Mix ratio	Test No.	Total Dry Biomass of Soybean (g)		Dry Biomass of Soybean / plant (g)		Dry Biomass / plant (%) Sample compost as percentage of blank compost	Mean Dry Biomass / plant (%)
		Blank compost	Sample compost	Blank compost	Sample compost		
25%	Parallel 1	38.2	37.2	0.406	0.409	100.7	100.5
	Parallel 2	37.1	36.9	0.399	0.393	98.5	
	Parallel 3	38.5	38.1	0.405	0.414	102.2	
50%	Parallel 1	37.0	39.1	0.394	0.416	105.6	104.0
	Parallel 2	37.7	37.9	0.405	0.416	102.7	
	Parallel 3	38.6	38.3	0.406	0.421	103.7	

Mix ratio	Test No.	Total Dry Biomass of Corn (g)		Dry Biomass of Corn / plant (g)		Dry Biomass / plant (%) Sample compost as percentage of blank compost	Mean Dry Biomass / plant (%)
		Blank compost	Sample compost	Blank compost	Sample compost		
25%	Parallel 1	16.5	17.8	0.177	0.191	107.9	101.8
	Parallel 2	17.3	16.9	0.184	0.184	100.0	
	Parallel 3	18.1	16.7	0.191	0.186	97.4	
50%	Parallel 1	17.8	16.8	0.187	0.185	98.9	100.5
	Parallel 2	17.3	17.8	0.184	0.191	103.8	
	Parallel 3	16.9	16.6	0.182	0.180	98.9	

7.4.4 Survival Rate of Blank Compost

Plant	Mix ratio	Test No.	Survival Numbers	Germination Numbers	Survival Rate (%)	Mean Survival Rate (%)
Soybean	25%	Parallel 1	94	95	98.9	99.3
		Parallel 2	93	93	100.0	
		Parallel 3	95	96	99.0	
	50%	Parallel 1	94	96	97.9	98.9
		Parallel 2	93	94	98.9	
		Parallel 3	95	95	100.0	
Corn	25%	Parallel 1	93	94	98.9	99.3
		Parallel 2	94	94	100.0	
		Parallel 3	95	96	99.0	
	50%	Parallel 1	95	97	97.9	98.6
		Parallel 2	94	95	98.9	
		Parallel 3	93	94	98.9	

Remark: Mean Survival rate (%) = mean survival numbers/mean germination numbers*100%

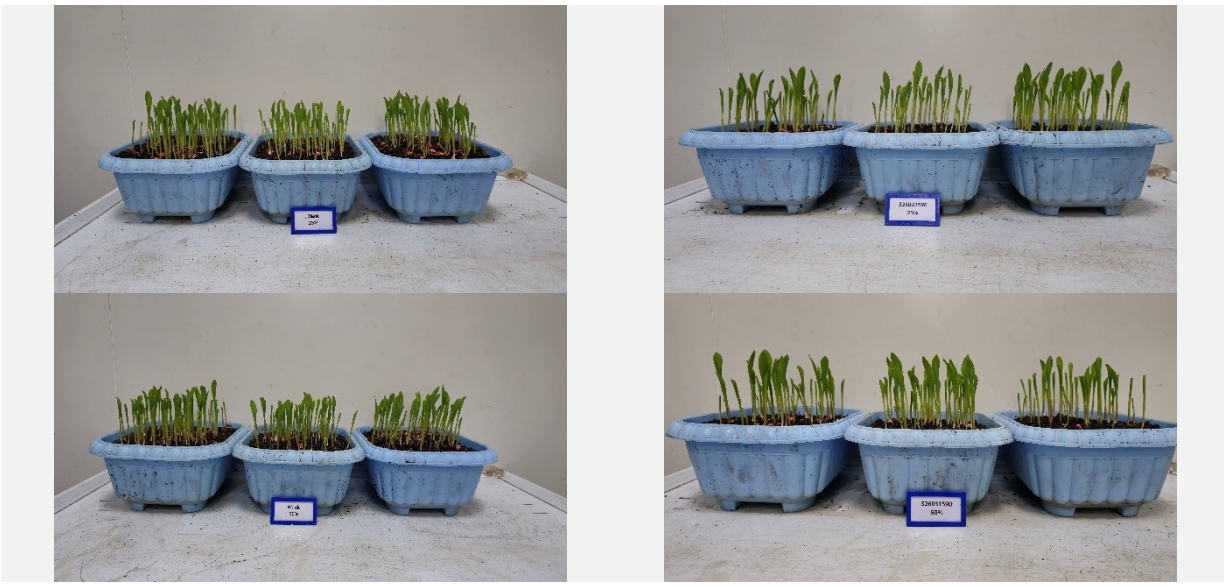
7.4.5 Appearance of plants during the test

Blank compost **Sample compost**

Soybean growth, during test
25% Mix on the top，50% Mix on the bottom

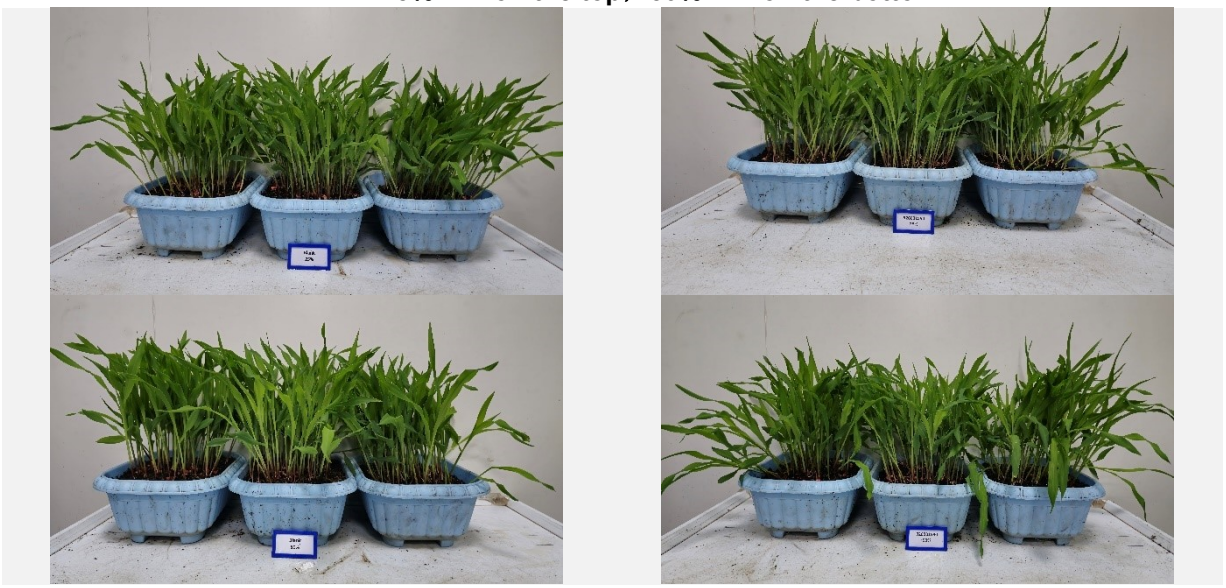
Blank compost **Sample compost**

Soybean growth, after test
25% Mix on the top，50% Mix on the bottom



Blank compost **Sample compost**

Corn growth, during test
25% Mix on the top，50% Mix on the bottom



Blank compost **Sample compost**

Corn growth, after test
25% Mix on the top，50% Mix on the bottom

7.4.6 Additional information

No abnormal observations. The seedlings do not exhibit visible phytotoxic effects (e.g. chlorosis, necrosis, wilting, leaf and stem deformations) and the plants exhibit only normal variation in growth and morphology for soybean and corn.

-End-

General Terms and Conditions of Business of TÜV Rheinland in Greater China

1. Scope

1.1 These General Terms and Conditions of Business of TÜV Rheinland in Greater China ("GTCB") is made between the client and one or more member entities of TÜV Rheinland in Greater China as applicable as the case may be ("TÜV Rheinland"). The Greater China hereof refers to the regions within the territories of China.The client hereof includes：

(i) a natural person capable to form legally binding contracts under the applicable laws who concludes the contract not for the purpose of a daily use;

(ii) the incorporated or unincorporated entity duly organized, validly existing and capable to form legally binding contracts under the applicable law.

1.2 The following terms and conditions apply to agreed services including consultancy services, information, deliveries and similar services as well as ancillary services and other secondary obligations provided within the scope of contract performance.

1.3 Any standard terms and conditions of the client of any nature shall not apply and shall hereby be expressly excluded. No standard contractual terms and conditions of the client shall form part of the contract even if TÜV Rheinland does not explicitly object to them.

1.4 In the context of an ongoing business relationship with the client, this GTCB shall also apply to future contracts with the client without TÜV Rheinland having to refer to them separately in each individual case.

2. Quotations

Unless otherwise agreed, all quotations submitted by TÜV Rheinland can be changed by TÜV Rheinland without notice prior to its acceptance and confirmation by the other party.

3. Coming into effect and duration of contracts

3.1 The contract shall come into effect for the agreed terms upon the quotation letter of TÜV Rheinland or a separate contractual document being signed by both contracting parties, or upon the works requested by the client being carried out by TÜV Rheinland. If the client instructs TÜV Rheinland without receiving a quotation from TÜV Rheinland (quotation), TÜV Rheinland is, in its sole discretion, entitled to accept the order by giving written notice of such acceptance (including notice sent via electronic means) or by performing the requested services.

3.2 The contract term starts upon the coming into effect of the contract in accordance with article 3.1 and shall continue for the term agreed in the contract.

3.3 If the contract provides for an extension of the contract term, the contract term will be extended by the term provided for in the contract unless terminated in writing by either party with a three-month notice prior to the end of the contractual term.

4. Scope of services

4.1 The scope and type of the services to be provided by TÜV Rheinland shall be specified in the contractually agreed service scope of TÜV Rheinland by both parties. If no such separate service scope of TÜV Rheinland exists, then the written confirmation of order by TÜV Rheinland shall be decisive for the service to be provided. Unless otherwise agreed, services beyond the scope of the service description (e.g. checking the correctness and functionality of parts, products, processes, installations, organizations not listed in the service description, as well as the intended use and application of such) are not owed. In particular, no responsibility is assumed for the design, selection of materials, construction or intended use of an examined part, product, process or plant, unless this is expressly stated in the order.

4.2 The agreed services shall be performed in compliance with the regulations in force at the time the contract is entered into.

4.3 TÜV Rheinland is entitled to determine, in its sole discretion, the method and nature of the assessment unless otherwise agreed in writing or if mandatory provisions require a specific procedure to be followed.

4.4 On execution of the tests there shall be no simultaneous assumption of any guarantee of the correctness (proper quality) and working order of either tested or examined parts nor of the installation as a whole and its upstream and/or downstream processes, organisations, use and application in accordance with regulations, nor of the systems on which the installation is based. In particular, TÜV Rheinland shall assume no responsibility for the construction, selection of materials and assembly of installations examined, nor for the use and application in accordance with regulations, unless these questions are expressly covered by the contract.

4.5 In the case of inspection work, TÜV Rheinland shall not be responsible for the accuracy or checking of the safety programmes or safety regulations on which the inspections are based, unless otherwise expressly agreed in writing.

4.6 If mandatory legal regulations and standards or official requirements for the agreed service scope change after conclusion of the contract, with a written notice to the client, TÜV Rheinland shall be entitled to additional remuneration for resulting additional expenses.

4.7 The services to be provided by TÜV Rheinland under the contract are agreed exclusively with the client. A contract of third parties with the services of TÜV Rheinland, as well as making available of and justifying confidence in the work results (test reports, test results, expert reports, etc.) is not part of the agreed services. This also applies if the client passes on work results - in full or in extracts - to third parties in accordance with clause 11.4.

4.8 The client understands and agrees that in order to perform the contract with TÜV Rheinland, the client may need to sign one or more contracts/ agreements with a/more third party(ies) and establish legal relationships with that/those third party(ies) according to such contracts/agreements. TÜV Rheinland will merely bears the corresponding legal liability according to this contract and the direct services actually to be provided by our company in the service process. If the relevant services are not directly provided by TÜV Rheinland (including but not limited to any testing and certification services to be provided by third testing and certification bodies), TÜV Rheinland will provide the client as agent for such relevant services. In order to achieve the purpose of the contract, the client hereby agrees that TÜV Rheinland can also sub-entrust to a third party to provide agency services, but TÜV Rheinland shall not bear any responsibility and/or risk for any services to be provided by any third parties (including but not limited to the testing and/or certification services to be entrusted and/or applied for by our company on behalf of the client to other third testing and/or certification bodies, agency services provided by any other third agent(s), etc.). Besides, the client shall be liable in accordance with the relevant laws and regulations and/or the terms under the contract. If the client is required to conduct any annual review/surveillance of the relevant testing and/or certification service results and pay additional fees in accordance with the relevant laws and regulations or the testing and certification rules, such fees are not within the scope of the contract price, the client shall timely perform the obligation of such annual review/surveillance and pay the corresponding fees. If the client fails to perform such obligations of the annual review/surveillance or fees payment, it may lead to adverse consequences such as failure/ suspending/cancellation/invalidity of testing and/or certification results, which shall not be borne/liable by TÜV Rheinland.

4.9 For the service content agreed in the contract, if the client requires TÜV Rheinland to deliver relevant test samples, data, etc. to any overseas laboratory or other places or sites to be designated by the client, TÜV Rheinland shall not take any responsibilities or risks for any problems during such delivery and the transportation process (including but not limited to any loss or damages of the samples and/or the materials, etc.). Besides, the relevant freight fees shall be borne by the client.

5. Performance periods/dates

5.1 The contractually agreed periods/dates of performance are based on estimates of the work involved which are prepared in line with the details provided by the client. They shall only be binding if being confirmed as binding by TÜV Rheinland in writing.

5.2 If binding periods of performance have been agreed, these periods shall not commence until the client has submitted all required documents to TÜV Rheinland.

5.3 Articles 5.1 and 5.2 also apply, even without express approval by the client, to all extensions of agreed periods/dates of performance not caused by TÜV Rheinland.

5.4 TÜV Rheinland is not responsible for a delay in performance, in particular if the client has not fulfilled his duties to cooperate in accordance with clause 6.1 or has not done so in time and, in particular, has not provided TÜV Rheinland with all documents and information required for the performance of the service as specified in the contract.

5.5 If the performance of TÜV Rheinland is delayed due to unforeseeable circumstances such as force majeure, strikes, business disruptions, governmental regulations, transport obstacles, etc., TÜV Rheinland is entitled to postpone performance for a reasonable period of time which corresponds at least to the duration of the hindrance plus any time period which may be required to resume performance.

5.6 If the client is obliged to comply with legal, officially prescribed and/or by the accreditor prescribed deadlines, it is the client's responsibility to agree on performance dates with TÜV Rheinland, which enable the client to comply with the legal and/or officially prescribed deadlines. TÜV Rheinland assumes no responsibility in this respect unless TÜV Rheinland expressly agreed in writing specifically stating that ensuring the deadlines is the contractual obligation of TÜV Rheinland.

6. The client's obligation to cooperate

6.1 The client shall guarantee that all cooperation required on its part, its agents or third parties will be provided in good time and at no cost to TÜV Rheinland.

6.2 Design documents, supplies, auxiliary staff, etc. necessary for performance of the services shall be made available free of charge by the client. Moreover, collaborative action of the client must be undertaken in accordance with legal provisions, standards, safety regulations and accident prevention instructions. And the client represents and warrants that:

a) it has required statutory qualifications;

b) the product, service or management system to be certified complies with applicable laws and regulations; and

c) it doesn't have any illegal and dishonest behaviours or is not included in the list of Enterprises with Serious Illegal and Dishonest Acts of People's Republic of China.

If the client breaches the aforesaid representations and warranties, TÜV Rheinland is entitled to i) immediately terminate the contract/order without prior notice; and ii) withdraw the issued testing report/certificates if any.

6.3 The client shall bear any additional cost incurred on account of work having to be redone or being delayed as a result of late, incorrect or incomplete information provided by or lack of proper cooperation from the client. Even where a fixed or maximum price is agreed, TÜV Rheinland shall be entitled to charge extra fees for such additional expense.

7. Prices

7.1 If the scope of performance is not laid down in writing when the order is placed, invoicing shall be based on costs actually incurred. If no price is agreed in writing, invoicing shall be made in accordance with the price list of TÜV Rheinland valid at the time of performance.

7.2 Unless otherwise agreed, work shall be invoiced according to the progress of the work.

7.3 If the execution of an order extends over more than one month and the value of the contract or the agreed fixed price exceeds €2,500.00 or equivalent value in local currency, TÜV Rheinland may demand payments on account or in instalments.

8. Payment terms

8.1 All invoice amounts shall be due for payment within 30 days of the invoice date without deduction on receipt of the invoice. No discounts and rebates shall be granted.

8.2 Payments shall be made to the bank account of TÜV Rheinland as indicated on the invoice, stating the invoice and client numbers.

8.3 In cases of default of payment, TÜV Rheinland shall be entitled to claim default interest at the applicable short term loan interest rate publicly announced by a reputable commercial bank in the country where TÜV Rheinland is located. At the same time, TÜV Rheinland reserves the right to claim further damages.

8.4 Should the client default in payment of the invoice despite being granted a reasonable grace period, TÜV Rheinland shall be entitled to cancel the contract, withdraw the certificate, claim damages for non-performance and refuse to continue performance of the contract.

8.5 The provisions set forth in article 8.4 shall also apply in cases involving returned cheques, cessation of payment, commencement of insolvency proceedings against the client's assets or cases in which the commencement of insolvency proceedings has been dismissed due to lack of assets.

8.6 Objections to the invoices of TÜV Rheinland shall be submitted in writing within two weeks of receipt of the invoice.

8.7 TÜV Rheinland shall be entitled to demand appropriate advance payments.

8.8 TÜV Rheinland shall be entitled to raise its fees at the beginning of a month if overheads and/or purchase costs have increased. In this case, TÜV Rheinland shall notify the client in writing of the rise in fees. This notification shall be issued one month prior to the date on which the rise in fees shall come into effect (period of notice of changes in fees). If the rise in fees remains under 5% per contractual year, the client shall not have the right to terminate the contract. If the rise in fees exceeds 5% per contractual year, the client shall be entitled to terminate the contract by the end of the period of notice of changes in fees. If the contract is not terminated, the changed fees shall be deemed to have been agreed upon by the time of the expiry of the notice period.

8.9 Only legally established and undisputed claims may be offset against claims by TÜV Rheinland.

8.10 TÜV Rheinland shall have the right at all times to setoff any amount due or payable by the client, including but not limited to setoff against any fees paid by the client under any contracts, agreement and/or orders/quotations reached with TÜV Rheinland.

9. Acceptance of work

9.1 Any part of the work result ordered which is complete in itself may be presented by TÜV Rheinland for acceptance as an instalment. The client shall be obliged to accept it immediately.

9.2 If acceptance is required or contractually agreed in an individual case, this shall be deemed to have taken place two (2) weeks after completion and handover of the work, unless the client refuses acceptance within this period stating at least one fundmental breach of contract by TÜV Rheinland.

9.3 The client is not entitled to refuse acceptance due to insignificant breach of contract by TÜV Rheinland.

9.4 If acceptance is excluded according to the nature of the work performance of TÜV Rheinland, the completion of the work shall take its place.

9.5 During the Follow-Audit stage, if the client was unable to make use of the time windows provided for within the scope of a certification procedure for auditing/performance by TÜV Rheinland and the certificate is therefore to be withdrawn (e.g. performance of surveillance audits), or if the client cancels or postpones a confirmed audit date within two (2) weeks before the agreed date, TÜV Rheinland is entitled to immediately charge a lump-sum compensation of 10% of the order amount as compensation for expenses. The client reserves the right to prove that the TÜV Rheinland has incurred no damage whatsoever or only a considerably lower damage than the above lump sum.

9.6Insofar as the client has undertaken in the contract to accept services, TÜV Rheinland shall also be entitled to charge lump-sum damages in the amount of 10% of the order amount as compensation for expenses if the service is not called within one year after the order has been placed. The client reserves the right to prove that the TÜV Rheinland has incurred no damage whatsoever or only a considerably lower damage than the above mentioned lump sum.

10. Confidentiality

10.1 For the purpose of these terms and conditions, "confidential information" means all know-how, trade secrets, documents, images, drawings, expertise, information, data, test results, reports, samples, project documents, pricing and financial information, customer and supplier information, and marketing techniques and materials, tangible or intangible, that are supplied, transferred or otherwise disclosed by one Party (the "disclosing party") to the other Party (the "receiving party"), in writing or orally, in printed or electronic format. Confidential information is expressly not the data and know-how collected, compiled or otherwise obtained by TÜV Rheinland (non-personal and not proprietary to the client) within the scope of the provision of services by TÜV Rheinland. TÜV Rheinland is entitled to store, use, further develop and pass on the data obtained in connection with the provision of services for the purposes of developing new services, improving services and analysing the provision of services.10.2 The disclosing party shall mark all confidential information disclosed in written form as confidential before passing it onto the receiving party. The same applies to confidential information transmitted by e-mail. If confidential information is disclosed orally, the receiving party shall be appropriately informed in advance and the disclosing party shall confirm in writing the confidentiality nature of the information within five working days of oral disclosure. Where the disclosing party fails to do so within the stipulated period, the receiving party shall not take any confidentiality obligations hereunder towards such information. The client shall avoid using any third party platform and/or system (e.g. Wechat, etc. Unauthorized by TÜV Rheinland) to send any confidential information to TÜV Rheinland. Instead, the client shall send any confidential information to company email of TÜV Rheinland employees through its company email. If the client suffers from any losses or damages due to any theft or leakages to be caused by the adoption of any unauthorized confidential information sharing methods mentioned above, TÜV Rheinland shall be waived for any compensation liabilities.

10.3 All confidential information which the disclosing party transmits or otherwise discloses to the receiving party and which is created during performance of work by TÜV Rheinland:

a) may only be used by the receiving party for the purposes of performing the contract, unless expressly otherwise agreed in writing by the disclosing party;

b) may not be copied, distributed, published or otherwise disclosed by the receiving party, unless this is necessary for fulfilling the purpose of the contract or TÜV Rheinland is required to pass on confidential information, inspection reports or documentation to the government authorities, judicial court, accreditation bodies or third parties (including but not limited to the relevant direct and/or indirect proposed purchasers, vehicle manufacturers/whole equipment manufacturers, test standards or test requirements providers of the client's test products and/or certified products, etc.) that are involved in the performance of the contract;

c) must be treated by the receiving party with the same level of confidentiality as the receiving party uses to protect its own confidential information, but never with a lesser level of confidentiality than that which is reasonably required.

10.4 The receiving party may disclose any confidential information received from the disclosing party only to those of its employees who need this information to perform the services required for the contract. The receiving party undertakes to oblige these employees to observe the same level of secrecy as set forth in this confidentiality clause.

10.5 Information for which the receiving party can furnish proof that:

a) it was generally known at the time of disclosure or has become general knowledge without violation of this confidentiality clause by the receiving party; or

b) it was disclosed to the receiving party by a third party entitled to disclose this information; or

c) the receiving party already possessed this information prior to disclosure by the disclosing party; or

d) the receiving party developed it itself, irrespective of disclosure by the disclosing party, shall not be deemed to constitute "confidential information" as defined in this confidentiality clause.

10.6 All confidential information shall remain the property of the disclosing party. The receiving party hereby agrees to immediately (i) return all confidential information, including all copies, to the disclosing party, and/or (ii) on request by the disclosing party, to destroy all confidential information, including all copies, and confirm the destruction of this confidential information to the disclosing party in writing, at any time if so requested by the disclosing party but in the latest and without special request after termination or expiry of the contract. This does not extend to include reports and certificates prepared for the client solely for the purpose of fulfilling the obligations under the contract, which shall remain with the client. However, TÜV Rheinland is entitled to make file copies of such reports, certificates and confidential information that forms the basis for preparing these reports and certificates in order to evidence the correctness of its results and for general documentation purposes required by laws, regulations and the requirements of working procedures of TÜV Rheinland.

10.7 From the start of the contract and for a period of three years after termination or expiry of the contract, the receiving party shall maintain strict secrecy of all confidential information and shall not disclose this information to any third parties or use it for itself.

11. Copyrights and rights of use, publications

11.1 TÜV Rheinland shall retain all exclusive copyrights in the reports, expert reports/opinions, test reports/results, results, calculations, presentations etc. prepared by TÜV Rheinland, unless otherwise agreed by the parties in a separate agreement. As the owner of the copyrights, TÜV Rheinland is free to grant others the right to use the work results for individual or all types of use ("right of use")

11.2 The client receives a simple, unlimited, non-transferable, non-sublicensable right of use to the contents of the work results produced within the scope of the contract, unless otherwise agreed by the parties in a separate agreement. The client may only use such reports, expert reports/opinions, test reports/results, results calculations, presentations etc. prepared within the scope of the contract for the contractually agreed purpose.

11.3 The transfer of right of use of the generated work results regulated in clause 11.2. of the GTCB is subject to full payment of the remuneration agreed in favour of TÜV Rheinland.

11.4 The client may use work results only complete and unshortened. The client may only pass on the work results in full unless TÜV Rheinland has given its prior written consent to the partial passing on of work results.

11.5 Any publication or duplication of the work results for advertising purposes or any further use of the work results beyond the scope regulaed in clause 11.2, and any quotaion of the introduction of TÜV Rheinland need the prior written approval of TÜV Rheinland in each individual case. Besides, the client ensures that the aforesaid use shall comply with relevant applicable laws, regulations and relevant rules (including but not limited to specific applicable testing and certification rules, etc.).

11.6 TÜV Rheinland may revoke a once given approval according to clause 11.5 at any time without stating reasons. In this case, the client is obliged to stop the transfer of the work results immediately at his own expense and, as far as possible, to withdraw publications.

11.7 The consent of TÜV Rheinland to publication or duplication of the work results does not entitle the client to use the corporate logo, corporate design or test/certification mark of TÜV Rheinland.

12. Liability of TÜV Rheinland

12.1 Irrespective of the legal basis, to the fullest extent permitted by applicable law, in the event of a breach of contractual obligations or tort, the liability of TÜV Rheinland for all damages, losses and reimbursement of expenses caused by TÜV Rheinland, its legal representatives and/or employees shall be limited to: (i) in the case of a contract with a fixed overall fee, three times the overall fee for the entire contract; (ii) in the case of a contract for annually recurring services, the agreed annual fee; (iii) in the case of a contract expressly charged on a time and material basis, a maximum of 20,000 Euro or equivalent amount in local currency; and (iv) in the case of a framework agreement that provides for the possibility of placing individual orders, three times of the fee for the individual order under which the damages or losses have occurred. Notwithstanding the above, in the event that the total and accumulated liability calculated according to the foregoing provisions exceeds 2.5 Million Euro or equivalent amount in local currency, the total and accumulated liability of TÜV Rheinland shall be only limited to and shall not exceed the said 2.5 Million Euro or equivalent amount in local currency.

12.2 The limitation of liability according to article 12.1 above shall not apply to damages and/or losses caused by malice, intent or gross negligence on the part of TÜV Rheinland or its vicarious agents. Such limitation shall not apply to damages for a person's death, physical injury or illness.

12.3 In cases involving a fundamental breach of contract, TÜV Rheinland will be liable even where minor negligence is involved. For this purpose, a "fundamental breach" is breach of a material contractual obligation, the performance of which permits the due performance of the contract. Any claim for damages for a fundamental breach of contract shall be limited to the amount of damages previously foreseen as a possible consequence of such breach of contract at the time of the breach (reasonably foreseeable damages), unless any of the circumstances described in article 12.2 applies.

12.4 TÜV Rheinland shall not be liable for the acts of the personnel made available by the client to support TÜV Rheinland in the performance of its services under the contract, unless such personnel made available is regarded as vicarious agent of TÜV Rheinland. If TÜV Rheinland is not liable for the acts of the personnel made available by the client under the foregoing provision, the client shall indemnify TÜV Rheinland against any claims made by third parties arising from or in connection with such personnel's acts.

12.5 Unless otherwise contractually agreed in writing, TÜV Rheinland shall only be liable under the contract to the client.

12.6 The limitation periods for claims for damages shall be based on statutory provisions.

12.7 None of the provisions of this article 12 changes the burden of proof to the disadvantage of the client.

13. Export control

13.1 When passing on the services provided by TÜV Rheinland or parts thereof to third parties in Greater China or other regions, the client must comply with the respectively applicable regulations of national and international export control law.

13.2 The performance of a contract with the client is subject to the proviso that there are no obstacles to performance due to national or international foreign trade legislations or embargos and/or sanctions.

In the event of a violation, TÜV Rheinland shall be entitled to terminate the contract with immediate effect and the client shall compensate for the losses incured thereof by TÜV Rheinland.

14. Data protection notice

The client understands and agrees that TÜV Rheinland processes personal data (including but not limited to personal information) of the client and its related parties (including but not limited to the supplier of the client) for the purpose of fulfilling this contract. The client confirms that it has obtained the prior consent of the data subject, which entitles TÜV Rheinland to access, use, or process the personal data that the client collected or processed by itself and transferred to TÜV Rheinland. For certain services, we may also process sensitive personal data. TÜV Rheinland will use and process the data in accordance with the relevant legal basis. If any personal data has to be disclosed or transferred to any third party or any overseas party outside of the district in which the personal data was collected, the client also confirms that it has obtained the prior consent of the data subject. TÜV Rheinland will carry out cross-border data transmission and protect the data in compliance with the privacy and personal data security related laws and regulations in China and the local country. TÜV Rheinland will take measures to avoid any leakage, abuse, manipulation, damage or unauthorized access of personal data. The personal data will be deleted immediately as soon as a corresponding reason for deletion arises. Data subjects may exercise the following rights: right of information, right of decision, right of rectification, right of deletion, right of processing limitation, right of objection, right of data transferability. In addition, persons concerned by the data processing have the right to revoke their consent at any time with effect for the future, as well as the right to file a complaint with the competent data protection supervisory authority. For further details on the processing of personal data by TÜV Rheinland as the person responsible or contract processor, please refer to the respective data protection information. You can contact the Group Data Protection Officer of TÜV Rheinland by e-mail at dataprotection@tuv.com or by post at the following address: TÜV Rheinland AG, c/o Group Data Protection Officer, Am Grauen Stein, 51105 Cologne, Germany.

15. Retention of test material and documentation

15.1 The test samples submitted by the client to TÜV Rheinland for testing will be scrapped following testing or will be returned to the client at the client's expense. The only exceptions are test samples, which are placed in storage on the basis of statutory regulations or of another agreement with the client.

15.2 Charges apply if the test samples are stored at the premises of TÜV Rheinland. The cost of placing a test sample into storage will be disclosed to the client in the quotation.

15.3 If reference samples or documentations are given to the client to be placed in storage at their premises, the reference samples or documentations must be made available to TÜV Rheinland upon request promptly and free of charge. If the client, in response to such a request, is incapable of making available the reference samples and/or documentation, any liability claims for material and pecuniary damage resulting from the respective testing and certification that is brought forward by the client against TÜV Rheinland shall be voided.

15.4 The retention period for the documentation shall be 10 (ten) years after the expiry of the test mark certificates or shall meet the applicable legal requirements for EU/EC certificates of conformity and GS mark certificates.

15.5 The costs of the handover and dispatch of the test samples for storage on the client's premises are borne by the client. TÜV Rheinland will be liable for the loss of test samples or reference samples from the laboratories or warehouses of TÜV Rheinland only in case of gross negligence.

16. Termination of the contract

16.1 Notwithstanding clause 3.3 of the GTCB, TÜV Rheinland and the client are entitled to terminate the contract in its entirety or, in the case of services combined in one contract, each of the combined parts of the contract individually and independently of the continuation of the remaining services with six (6) months' notice to the end of the contractually agreed term. The notice period shall be shortened to six (6) weeks in case TÜV Rheinland is prevented from performing the services due to a loss or a suspension of its accreditation or notification.

16.2 For good causes, TÜV Rheinland may consider giving a written notice to the client to terminate the contract without bearing any liabilities and the client shall pay the relevant service fees for the services provided by TÜV Rheinland due to the termination date of the contract. The aforesaid good causes includes but not limited to the following:

a) the client does not immediately notify TÜV Rheinland of changes in the conditions within the company which are relevant for certification or signs of such changes;

b) the client misuses the certificate or certification mark or uses it in violation of the contract;

c) in the event of several consecutive delays in payment (at least three times);

d) a substantial deterioration of the financial circumstances of the client occurs and as a result the payment claims of TÜV Rheinland under the contract are considerably endangered and TÜV Rheinland cannot reasonably be expected to continue the contractual relationship.

e) in the event of any serious misrepresentation, be it by intentional fraud or grossly negligent behavior of the managers, employees or agents of the client;

f) if TÜV Rheinland, for reasons beyond its control, is temporarily or finally not able or entitled to continue or finalize the performance of the service, e.g. in case of force majeure, government interference, sanctions, loss of accreditation or notification, or other.

g) if the country/region involved in the whole contract or the specific service project in the contract does not belong to the insurance coverage applicable to TÜV Rheinland, and TÜV Rheinland believes that there is a risk or some risks beyond its control to continue to perform the contract.

16.3 In the event of termination with written notice by TÜV Rheinland for good cause, TÜV Rheinland shall be entitled to a lump-sum claim for damages against the client if the conditions of a claim for damages exist. In this case, the client shall owe 15% of the remuneration to be paid until the end of the fixed contract term as lump-sum compensation. The client reserves the right to prove that there is no damage or a considerably lower damage, TÜV Rheinland reserves the right to prove a considerably higher damage in individual cases.

16.4 TÜV Rheinland is also entitled to terminate the contract with written notice if the client has not been able to make use of the time windows for auditing /service provision provided by TÜV Rheinland within the scope of a certification procedure and the certificate therefore has to be withdrawn (for example during the performance of monitoring audits). Clause 16.3 applies accordingly.

17. Force Majeure

17.1 "Force Majeure" means the occurrence of an event or circumstance that prevents or impedes a Party from performing one or more of its contractual obligations under the contract, if and to the extent that that Party proves: (a) that such impediment is beyond its reasonable control; and (b) that it could not reasonably have been foreseen at the time of the conclusion of the contract; and (c) that the effects of the impediment could not reasonably have been avoided or overcome by the affected Party.

17.2. In the absence of proof to the contrary, the following events affecting a Party shall be presumed to fulfil conditions (a) and (b) under paragraph 1 of this Clause: (i) war (whether declared or not), hostilities, invasion, act of foreign enemies, extensive military mobilization; (ii) civil war, riot, rebellion and revolution, military or usurped power, insurrection, act of terrorism, sabotage or piracy; (iii) currency and trade restriction, embargo, sanction; (iv) act of authority whether lawful or unlawful, compliance with any law or governmental order, expropriation, seizure of works, requisition, nationalization; (v) plague, epidemic, natural disaster or extreme natural event; (vi) explosion, fire, destruction of equipment, prolonged break-down of transport, telecommunication, information system or energy; (vii) general labor disturbance such as boycott, strike and lock-out, go-slow, occupation of factories and premises.

17.3. The Party successfully invoking this Clause is relieved from its duty to perform its obligations under the contract and from any liability in damages or from any other contractual remedy for breach of contract, from the time at which the impediment causes inability to perform, provided that the notice thereof is given without delay. If notice thereof is not given without delay, the relief is effective from the time at which notice thereof reaches the other Party. Where the effect of the impediment or event invoked is temporary, the above consequences shall apply only as long as the impediment invoked impedes performance by the affected Party. Where the duration of the impediment invoked has the effect of substantially depriving the contracting Parties of what they were reasonably entitled to expect under the contract, either Party has the right to terminate the contract by notification within a reasonable period to the other Party. Unless otherwise agreed, the Parties expressly agree that the contract may be terminated by either Party if the duration of the impediment exceeds 120 days.

18. Hardship

18.1 The Parties are bound to perform their contractual duties even if events have rendered performance more onerous than could reasonably have been anticipated at the time of the conclusion of the contract.

18.2. Notwithstanding paragraph 1 of this Clause, where a Party proves that:

(a) the continued performance of its contractual duties has become excessively onerous due to an event beyond its reasonable control which it could not reasonably have been expected to have taken into account at the time of the conclusion of the contract; and that

(b) it could not reasonably have avoided or overcome the event or its consequences, the Parties are bound, within a reasonable time of the invocation of this Clause, to negotiate alternative contractual terms which reasonably allow to overcome the consequences of the event.

18.3. Where Clause 18.2 applies, but where the Parties have been unable to agree alternative contractual terms as provided in that paragraph, the Party invoking this Clause is entitled to terminate the contract, but cannot request adaptation by the judge or arbitrator without the agreement of the other Party.

19. Partial invalidity, written form, place of jurisdiction and dispute resolution

19.1 All amendments and supplements must be in writing in order to be effective. This also applies to amendments and supplements to this clause 17.1.

19.2 Should one or several of the provisions under the contract and/or these terms and conditions be or become ineffective, the contracting parties shall replace the invalid provision with a legally valid provision that comes closest to the content of the invalid provision in legal and commercial terms.

19.3 Unless otherwise stipulated in the contract, the governing law of the contract and these terms and conditions shall be chosen following the rules as below:

a) if TÜV Rheinland in question is legally registered and existing in the People's Republic of China, the contracting parties hereby agree that the contract and these terms and conditions shall be governed by the laws of the People's Republic of China.

b) if TÜV Rheinland in question is legally registered and existing in Taiwan, the contracting parties hereby agree that the contract and these terms and conditions shall be governed by the laws of Taiwan.

c) if TÜV Rheinland in question is legally registered and existing in Hong Kong, the contracting parties hereby agree that the contract and these terms and conditions shall be governed by the laws of Hong Kong.

19.4 Any dispute in connection with the contract and these terms and conditions or the execution thereof shall be settled friendly through negotiations.

Unless otherwise stipulated in the contract, if no settlement or no agreement in respect of the extension of the negotiation period can be reached within two months of the arising of the dispute, the dispute shall be submitted:

a) in the case of TÜV Rheinland in question being legally registered and existing in the People's Republic of China, to China International Economic and Trade Arbitration Commission (CIETAC) to be settled by arbitration under the Arbitration Rules of CIETAC in force when the arbitration is submitted. The arbitration shall take place in Beijing, Shanghai, Shenzhen or Chongqing as appropriately chosen by the claiming party.

b) in the case of TÜV Rheinland in question being legally registered and existing in Taiwan, to Chinese Arbitration Association, Taipei to be arbitrated in accordance with its then current Rules of Arbitration. The arbitration shall take place in Taipei.

c) in the case of TÜV Rheinland being legally registered and existing in Hong Kong, to Hong Kong International Arbitration Centre (HKIAC) to be settled by arbitration under the HKIAC Administered Arbitration Rules in force when the Notice of Arbitration is submitted in accordance with these rules. The arbitration shall take place in Hong Kong.

The decision of the relevant arbitration tribunal shall be final and binding on both parties. The arbitration fee shall be borne by the losing party.