

केंद्रीय पेट्रोसायन अभियांत्रिकी एवं
प्रौद्योगिकी संस्थान

पेट्रोकेमिकल्स तकनीकी संस्थान

रसायन एवं पेट्रोसायन विभाग
रसायन एवं उर्वरक मंत्रालय, भारत सरकार
मिण्डो, चेन्नै - 600 032.

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CENTRAL INSTITUTE OF PETROCHEMICALS
ENGINEERING & TECHNOLOGY
INSTITUTE OF PETROCHEMICALS TECHNOLOGY
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परीक्षण रिपोर्ट / TEST REPORT

को जारी /
Issued to :

क्र.सं / Sl. No. 35470

रिपोर्ट सं / REPORT NO. : 77799

दिनांक / Date : 16-07-2024

Pages.....9.....Nos. Part A,B,C & D

संदर्भ / Customer Let. Ref : --

03-11-2023

परीक्षण मानक स्तर के अनुसार परीक्षण रिपोर्ट / TEST REPORT AS PER TEST STANDARD : Refer Part C

भाग - क / PART - A

प्रस्तुत सैपल का विवरण / PARTICULARS OF SAMPLE SUBMITTED

- अ) सैपल का नाम / a) Name of the Sample : Plastic Free & Food Grade Paper - as stated by the party.
- आ) सैपल प्राप्त होने की तारीख / b) Date of Receipt of sample : 18-11-2023
- इ) ग्रेड/प्रकार/आकार/वर्ग / c) Grade / variety / type / size / class : Nil
- ई) घोषित मूल्य / d) Declared value, If any : Nil
- उ) कोड सं. / e) Code No. : Nil
- ऊ) बैच सं. एवं निर्माण तारीख / f) Batch No. and Date of Manufacture : Nil
- ऋ) मात्रा / g) Quantity : 1.5 kg
- ए) पैकिंग की रीति / h) Mode of Packing : Packed in envelope
- ऐ) मोहर बंद या नहीं / i) Sealed or not : Sealed
- ओ) कोई अन्य सूचना / j) Any other information :

23112726

भाग - ख / PART - B

अनुपूरक सूचनाएँ / SUPPLEMENTARY INFORMATIONS

- अ) सैपिलिंग कार्यवाहियों हेतु संदर्भ / a) Reference to sampling procedure : Sampling not done by this lab
- आ) माप करने हेतु लिए गए सहायक दस्तावेज एवं प्राप्त परिणाम
- ब) Supporting documents for the measurement taken and result derived : As given in Part C
- इ) संबंधित कार्य अनुदेशों में निर्धारित के अनुसार परीक्षण रीति से कोई परिवर्तन
- c) Deviation from the test method as prescribed in relevant work instructions, if any : No deviation from the standard

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भाग - ग / PART - C

परीक्षण परिणाम / TEST RESULTS

Test Duration: 11.12.2023 to 16.07.2024

Sl.No	Name of the Test	Test Method/ Standard	Unit	Results Obtained	Specified Requirements
1	Material Identification	FTIR & DSC	-	Paper Sheet (Cellulose)	-
2	Disintegration (Dry mass remains in 2 mm sieve after 84 days)	ISO 17088:2021	%	8.7	No more than 10%
3	Ultimate aerobic Biodegradation (with reference to 100% degradation of positive reference)	ISO 17088:2021	%	91.4 (at the end of 135 days)	> 90 (at the end of the test period not more than 180 days.)
4	Plant Growth study				
	Monocotyledon (Onion) % Seed emergence	ISO 17088:2021	%	91	> 90
	Dicotyledon (Fenugreek) % Seed Emergence	Cl.6.4.3	%	96	> 90
5	Acute Ecotoxic effects to earthworm				
a	Survival of adult earthworm at the end of 7 days	ISO:17088:2021 Cl.6.4.4	%	100	> 90
b	Survival of adult earthworm at the end of 14 days			98	> 90
c	Biomass end of the 14 days			97	> 90
6	Chronic Ecotoxic effects to earthworm				
a	Survival of adult earthworm at the end of 28 days	ISO:17088:2021 Cl.6.4.5	%	93	> 90
b	Survival of adult earthworm at the end of 56 days			92	> 90
c	Offspring at the end of 56 days			92	> 90
d	Biomass end of the 56 days			97	> 90

The detailed observation on biodegradability test is enclosed as Annexure

Contd.

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Perumbavoor - 683 105, Kerala.

Ref. Letter Dated. 03-11-2023

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Technical Officer


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S. Udhayamalar,
Sr. Technical Officer



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परीक्षण परिणाम / TEST RESULTS

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PART C - TEST RESULTS

Sl.No	Name of the Test	Test Method/ Standard	Unit	Results Obtained	Specified Requirements*
7	Heavy metals concentration				
a.	Arsenic (As)			0.045	10
b.	Copper (Cu)			6.7403	300
c.	Nickel (Ni)			4.0973	50
d.	Zinc (Zn)			8.8373	1000
e.	Cobalt (Co)	ISO 17088:2021	mg/kg	8.0918	-
f.	Chromium (Cr)			8.4038	50
g.	Molybdenum (Mo)			0.045	-
h.	Mercury (Hg)			0.0053	0.15
i.	Cadmium (Cd)			0.0308	5
j.	Lead (Pb)			4.2158	100
k.	Selenium (Se)			0.0975	-

* Based on Municipal solid waste (Management and Handling) Rules, 2016 notified on 8th April, 2016 by Ministry of Environment , Forests and climate change, Government of India. Note that concentration of metals like cobalt, molybdenum, and selenium is not mentioned in the notification.

PART D - REMARKS

- Note
1. This Test Report / Certificate is issued only for the samples submitted to the laboratory.
 2. The results stated above related only to the items tested.
 3. The quality of the subsequent production lot has to be ensured by the purchaser.
 4. This Test Report shall not be reproduced except in full without the written approval of the laboratory.
 5. Any anomaly/discrepancy in this report should be brought to the notice of the laboratory within 30 days from the
 6. Subcontracted Tests (if any): Nil

Contd.



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OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2021

- 1 **Sample Details (As stated by Party):** Plastic free and food grade paper
2 **Material Identification by FTIR :** Paper Sheet (Cellulose)

BIODEGRADABILITY TEST AS PER ISO:14855-1

- 3 **Observation**
(i) **Conditions of reaction mixtures**
Origin of Compost: Livestock excrement, municipal and vegetable waste
Reaction Temperature (°C) : 58
Dry Solid (%) : 53.4
Volatile content (%) : 17.9
CO₂ evolved during first 10days in blank : 51.6 mg/g
Test duration (days) : 135 days
Reference material : Cellulose
Volume of reaction vessel (mL) : 3000 ml
(ii) **pH of test medium** :

S.No.	Compost Vessel	pH (Before)	pH (After)
1	Blank 1	7.4	7.2
2	Blank 2	7.2	7.1
	Blank 3	7.2	7.2
4	Cellulose 1	7.4	7.2
5	Cellulose 2	7.3	7.2
6	Cellulose 3	7.2	7.1
7	Negative 1	7.4	7.3
8	Negative 2	7.1	7
9	Negative 3	7.3	7.2
10	Sample 1	7.4	7.2
11	Sample 2	7.3	7.2
12	Sample 3	7.3	7.1

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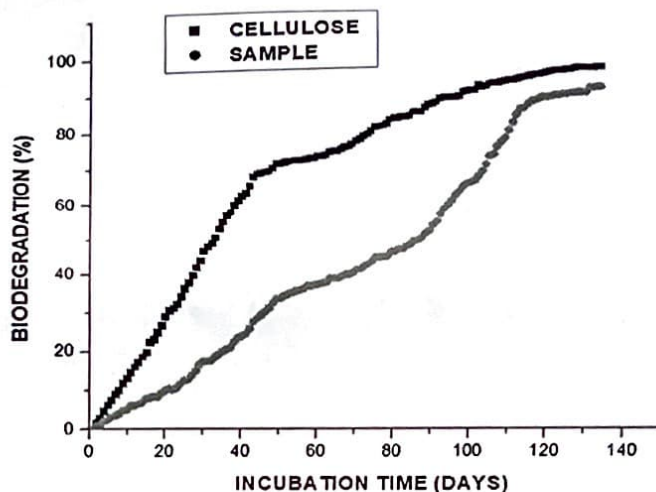
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- 4 Result: Percentage biodegradation relative to positive reference
Sample (Mean) : 91.4 % at the end of 135 days
The reference Material - cellulose : ~ 100%



5 Visual Observation of Sample

Description	Week 1-4	Week 5-8	Week 9-12
Structure	Cut pieces	Cut pieces	Fragmented pieces
Moisture	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level
Colour	White	Dirty	Dirty
Fungal Development	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like

Description	Week 13-16	Week 17-18	week 19-20
Structure	Fragmented pieces	Fragmented pieces	Fragmented pieces
Moisture	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level
Colour	Dirty	Dirty	Dirty
Fungal Development	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like

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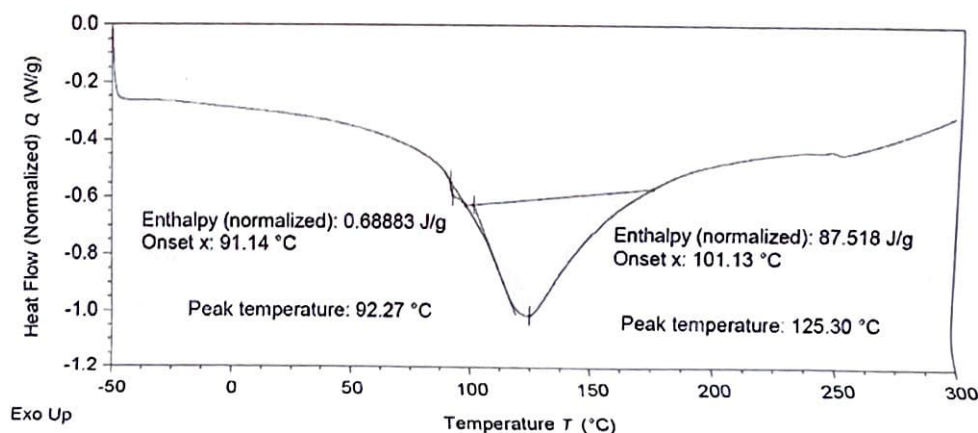
Customer Letter Ref. Letter Dated. 03-11-2023

6 Visual Observation of Compost

Description	Week 1-4	Week 5-8	Week 9-12
Structure	Fine Particles	Fine Particles	Fine Particles
Moisture	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level
Colour	Dark Brown	Dark Brown	Dark Brown
Fungal Development	Nil	Nil	Nil
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like

Description	Week 13-16	Week 17-18	week 19-20
Structure	Fine Particles	Fine Particles	Fine Particles
Moisture	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level
Colour	Dark Brown	Dark Brown	Dark Brown
Fungal Development	Nil	Nil	Nil
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like

7 DSC Analysis



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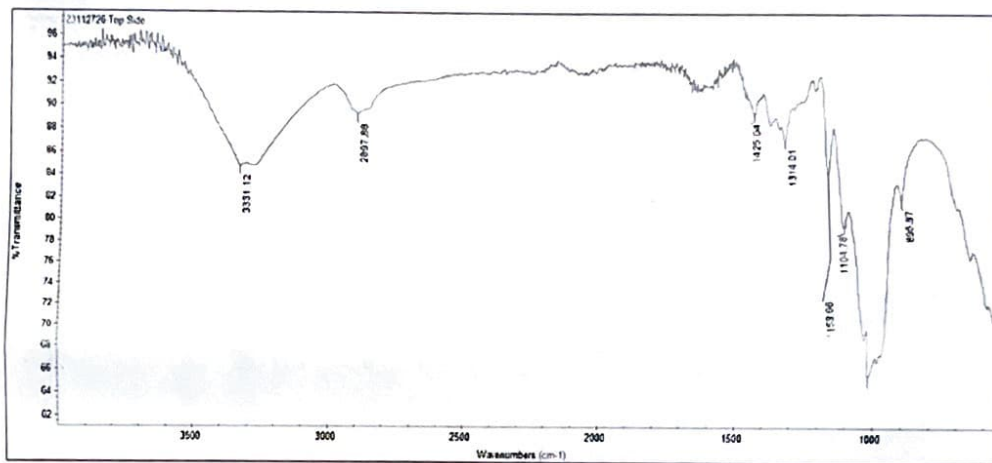
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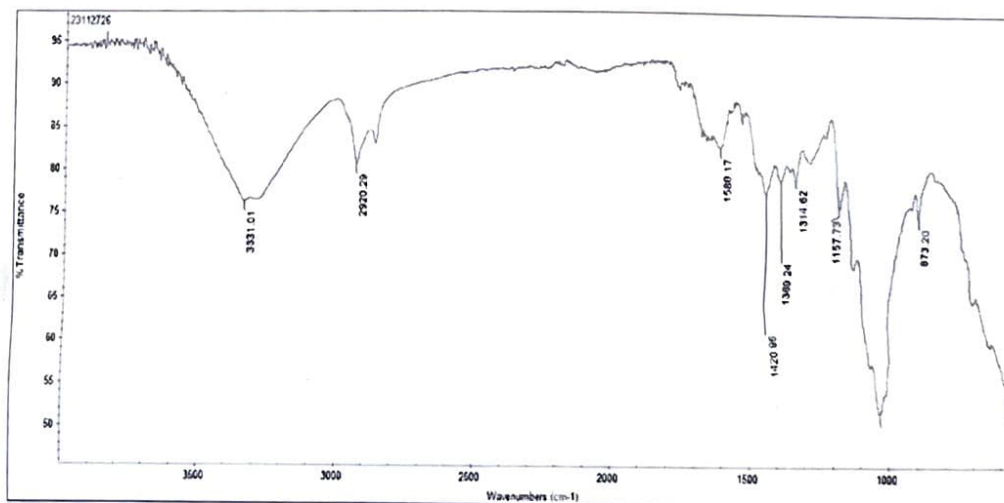
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8 FTIR Analysis

Top side



Bottom side



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Continuation Sheet

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FTIR Interpretation

Top side

Wave number (cm ⁻¹)	Nature of Bond
3331	O-H stretching in cellulose
2897	C-H stretch
1425	C=O stretch
1314	C=C stretch
1158	C-C stretch
1108	C-C stretch
895	C-H bend

Bottom Side

Wave number (cm ⁻¹)	Nature of Bond
3331	O-H stretching in cellulose
2920	C-H stretch
1420	C=C stretch
1314	C-H in Plane bend
1157	C-C stretch
873	C-H bend

Comment: The above DSC & FTIR analysis indicates the above sample is Paper Sheet (Cellulose)

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Disintegration After 12 Weeks

9



Before Disintegration



After Disintegration

The disintegration of the supplied sample by passing through 2 mm sieve after 12 week in composting condition as per ISO 17088-2021 was found not more than 10% of original dry mass remain.

10 Plant growth study



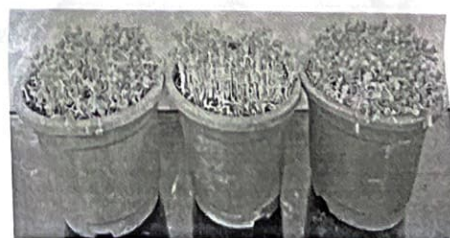
REP-1 REP-2 REP-3
Fresh compost with Onion seeds



REP-1 REP-2 REP-3
Bio-degradation tested compost with Onion seeds



REP-1 REP-2 REP-3
Fresh compost with fenugreek seeds



REP-1 REP-2 REP-3
Bio-degradation tested compost with fenugreek seeds

The percentage of seed germination rate is found to be greater than 90% for both Onion and Fenugreek

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