

**सिपेट : पेट्रोकेमिकल्स तकनीकी
संस्थान (आईपीटी)**

(पूर्व में सेंट्रल इंस्टिट्यूट ऑफ प्लास्टिक्स इंजीनियरिंग एण्ड टेक्नोलॉजी)
रसायन एवं पेट्रोसायन विभाग
रसायन एवं उर्वरक मंत्रालय, भारत सरकार
गिण्डी, चेन्नै - 600 032.
फोन : 91-44-2225 4701 (6 लाइन)
फैक्स : 91-44-22254707
ई-मेल : chennai@cipet.gov.in
वेबसाइट : www.cipet.gov.in



CIPET सि पे ट
probe - perform - practice - Plastics



**CIPET : INSTITUTE OF PETROCHEMICALS
TECHNOLOGY (IPT)**

(Formerly Central Institute of Plastics Engineering & Technology)

Department of Chemicals & Petrochemicals

Ministry of Chemicals & Fertilizers, Govt. of India

Guindy, Chennai - 600 032.

Phone : 91-44-2225 4701 (6 Lines)

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Website : www.cipet.gov.in

संदर्भ/Ref: परीक्षण/TR/ 22071142

दिनांक/Date: 29-05-2023

प्रति /To,

Innoviron Industries Trading Private Limited

Plot No.255, Rampuram, Shyam Nagar, Kanpur, Uttar Pradesh -
208 013

विषय/Sub : Testing of samples-reg.

संदर्भ/Ref : Your letter no. --

Dated: 27-07-2022

महोदय,

कृपया हमारी परीक्षण रिपोर्ट क्रमांक प्राप्त करें। Please find enclosed herewith our Test Report no.	70301	दिनांक dated	29-05-2023
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धन्यवाद,

भवदीय


प्रबंधक (परीक्षण)

संलग्न : उपर्युक्तानुसार

Encl:1.a/a.

Remarks:

मुख्यालय : सिपेट, गिण्डी, चेन्नै - 600 032. Head Office : CIPET, Guindy, Chennai - 600 032.

केन्द्र : अहमदाबाद, अमृतसर, औरंगाबाद, अगरतला, बड़ी, बालासोर, बैंगलुरु, भोपाल, भुवनेश्वर, चन्द्रपुर, चेन्नई, देहरादून, गुरुग्राम, गुवाहाटी, ग्वालियर, हैदराबाद, हाजीपुर, हल्दिया, इम्फाल, जयपुर, कोच्चि, कोरबा, लखनऊ, मदुरै, मुरथल, मैसूरु, रायपुर, राँची, वलसाड, वाराणसी एवं विजयवाड़ा

Centres : Ahmedabad, Amritsar, Aurangabad, Agartala, Baddi, Balasore, Bengaluru, Bhopal, Bhubaneswar, Chandrapur, Chennai, Dehradun, Gurugram, Guwahati, Gwalior, Hyderabad, Hajipur, Haldia, Imphal, Jaipur, Kochi, Korba, Lucknow, Madurai, Murthal, Mysuru, Raipur, Ranchi, Valsad, Varanasi & Vijayawada

केंद्रीय पेट्रोसायन अभियांत्रिकी एवं
प्रौद्योगिकी संस्थान
पेट्रोकेमिकल्स तकनीकी संस्थान

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CENTRAL INSTITUTE OF PETROCHEMICALS
ENGINEERING & TECHNOLOGY
INSTITUTE OF PETROCHEMICALS TECHNOLOGY

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को जारी /
Issued to :

Invoviron Industries Trading Private Limited
Plot No.255, Rampuram, Shyam Nagar, Kanpur, Uttar
Pradesh - 208 013

परीक्षण रिपोर्ट / TEST REPORT

क्र.सं / SI. No. **32465**

रिपोर्ट सं / **REPORT NO. : 70301**

दिनांक / Date : **29-05-2023**

Pages... 08Nos. Part A,B,C & D
27-07-2022

संदर्भ / Customer Let. Ref : --

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

भाग - क / PART - A

प्रस्तुत सैपिल का विवरण / PARTICULARS OF SAMPLE SUBMITTED

- अ) सैपिल का नाम / a) Name of the Sample : Granules (Copolymer of PBAT, PLA and Keratin Protein) - as stated by the party
- आ) सैपिल प्राप्त होने की तारीख / b) Date of Receipt of sample : 18-07-2022
- 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 : 2 kg
- ए) पैकिंग की रीति / h) Mode of Packing : carton packing
- ऐ) मोहर बंद या नहीं / i) Sealed or not : Not Sealed
- ओ) कोई अन्य सूचना / j) Any other information : --

22071142

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
b) 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

केंद्रीय पेट्रोसायन अभियांत्रिकी एवं
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पेट्रोकेमिकल्स तकनीकी संस्थान

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परीक्षण रिपोर्ट / TEST REPORT

रिपोर्ट सं / REPORT NO. :

70301

29-05-2023

क्र.सं / Sl. No.

32465

दिनांक / Date :

भाग - ग / PART - C

परीक्षण परिणाम / TEST RESULTS

Test Duration: 14.11.2022 to 29.05.2023

Sl.No	Name of the Test	Test Method/ Standard	Unit	Results Obtained	Specified Requirements
1	Base Polymer Identification	FTIR & DSC	-	Polybutylene adipate co-terephthalate (PBAT)	-
2	Disintegration (Dry mass remains in 2 mm sieve after 84 days)	ISO 17088:2021	%	8.4	No more than 10%
3	Ultimate aerobic Biodegradation (with reference to 100% degradation of positive reference)	ISO 17088:2021	%	90.7 (at the end of 121 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 Cl.6.4.3	%	95	> 90
	Dicotyledon (Fenugreek) % Seed Emergence		%	93	> 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			99	> 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	%	95	> 90
b	Survival of adult earthworm at the end of 56 days			95	> 90
c	Offspring at the end of 56 days			96	> 90
d	Biomass end of the 56 days			96	> 90

The detailed observation on biodegradability test is enclosed as Annexure

Contd.

Issued to:
Invoviron Industries Trading Private Limited,
Plot No.255, Rampuram, Shyam Nagar, Kanpur, Uttar Pradesh - 208 013.

Ref. Letter dated 27-07-2022

2 of 2

AUTHORISED SIGNATORY
Dr. Rakesh
Technical Officer

AUTHORISED SIGNATORY
Vishal Verma
Manager (T)

सिपेट : आई पी टी -चेन्नै-32.

CIPET : IPT- Chennai-32.



Continuation Sheet

रिपोर्ट सं / REPORT NO. : 70301

परीक्षण परिणाम / TEST RESULTS

दिनांक / Date :

29-05-2023

Issued to: M/s. Invoviron Industries Trading Private Limited,
Plot No.255, Rampuram, Shyam Nagar, Kanpur, Uttar Pradesh - 208 013

Customer Letter Ref. No.: Dated 27-07-2022

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)			1.32	300
c.	Nickel (Ni)			1.425	50
d.	Zinc (Zn)			2.108	1000
e.	Cobalt (Co)	ISO 17088:2021	mg/kg	0.75	-
f.	Chromium (Cr)			1.702	50
g.	Molybdenum (Mo)			0.968	-
h.	Mercury (Hg)			0.005	0.15
i.	Cadmium (Cd)			0.038	5
j.	Lead (Pb)			0.563	100
k.	Selenium (Se)			0.098	-

* 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 date of issue.
6. Subcontracted Tests (if any): Nil

30/5


AUTHORISED SIGNATORY
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Technical Officer


Vishal Verma
Manager (T)
AUTHORISED SIGNATORY

रिपोर्ट सं / REPORT NO. : **70301**

परीक्षण परिणाम / TEST RESULTS

दिनांक / Date : **29-05-2023**

Issued to: M/s. Invoviron Industries Trading Private Limited,
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Customer Letter Ref. No.: Dated 27-07-2022

OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2021

- 1 **Sample Details (As stated by Party):** Granules (copolymer of PBAT, PLA and Keratin Protein)
- 2 **Base Polymer Identification by FTIR:** Polybutylene adipate co-terephthalate (PBAT)

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 (%)	: 53.8
Volatile content (%)	: 17.2
CO ₂ evolved during first 10days in blank	: 61.16 mg/g
Test duration (days)	: 121 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	7.2	7.1
2	Blank 2	7.1	7
3	Blank 3	7.2	7.1
4	Cellulose 1	7.3	7.2
5	Cellulose 2	7.4	7.3
6	Cellulose 3	7.4	7.3
7	Negative 1	7.3	7.2
8	Negative 2	7.2	7.2
9	Negative 3	7.4	7.3
10	Sample 1	7.3	7.2
11	Sample 2	7.3	7.1
12	Sample 3	7.4	7.2

Contd.,

4 of 8


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रिपोर्ट सं / REPORT NO. : **70301**

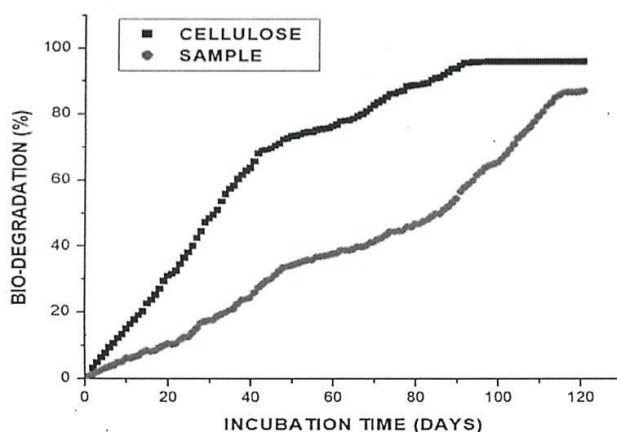
परीक्षण परिणाम / TEST RESULTS

दिनांक / Date : **29-05-2023**

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Plot No.255, Rampuram, Shyam Nagar, Kanpur, Uttar Pradesh - 208 013

Customer Letter Ref. No.: Dated 27-07-2022

- 4 **Result:** Percentage biodegradation relative to positive reference
Sample (Mean) : 90.7 (at the end of 121 days)
The reference Material - cellulose : ~ 100%



5 **Visual Observation of Sample**

Description	Week 1-3	Week 4-6	Week 7-9
Structure	Pieces	Pieces	Fragmented pieces
Moisture	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level
Colour	Buttermilk Yellow	Dirty	Dirty
Fungal Development	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like

Description	Week 10-12	Week 13-15	week 16-18
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

Contd., 598


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Continuation Sheet

रिपोर्ट सं / REPORT NO. : 70301

परीक्षण परिणाम / TEST RESULTS

दिनांक / Date :

29-05-2023

Issued to: M/s. Invoviron Industries Trading Private Limited,
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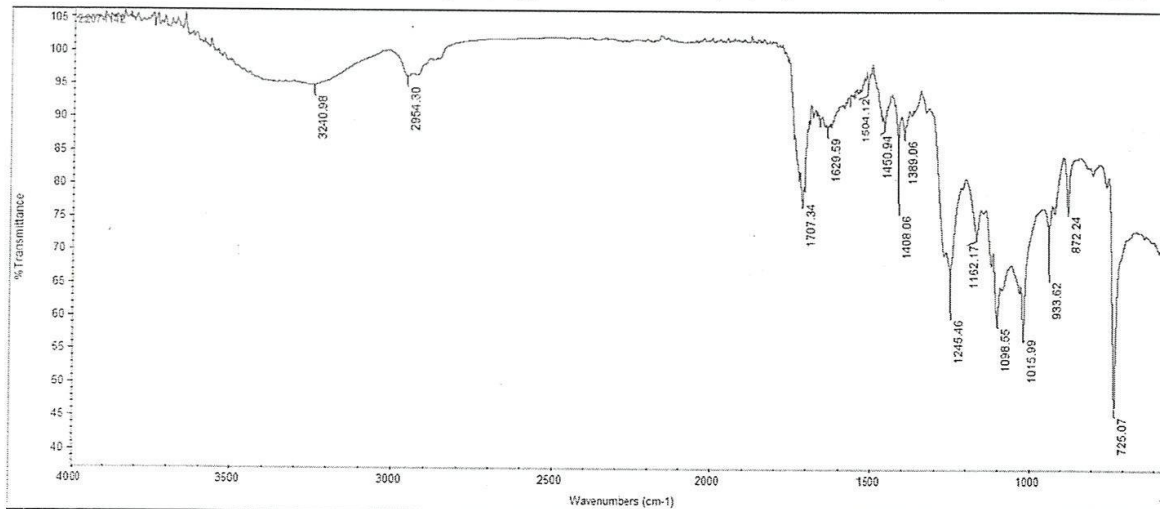
6 Visual Observation of Compost

Description	Week 1-3	Week 4-6	Week 7-9
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 10-12	Week 13-15	week 16-18
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 FTIR Analysis

Sample Details (As stated by Party): Granules (copolymer of PBAT, PLA and Keratin Protein)



Contd.,

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Continuation Sheet

रिपोर्ट सं / REPORT NO. : 70301

परीक्षण परिणाम / TEST RESULTS

दिनांक / Date :

29-05-2023

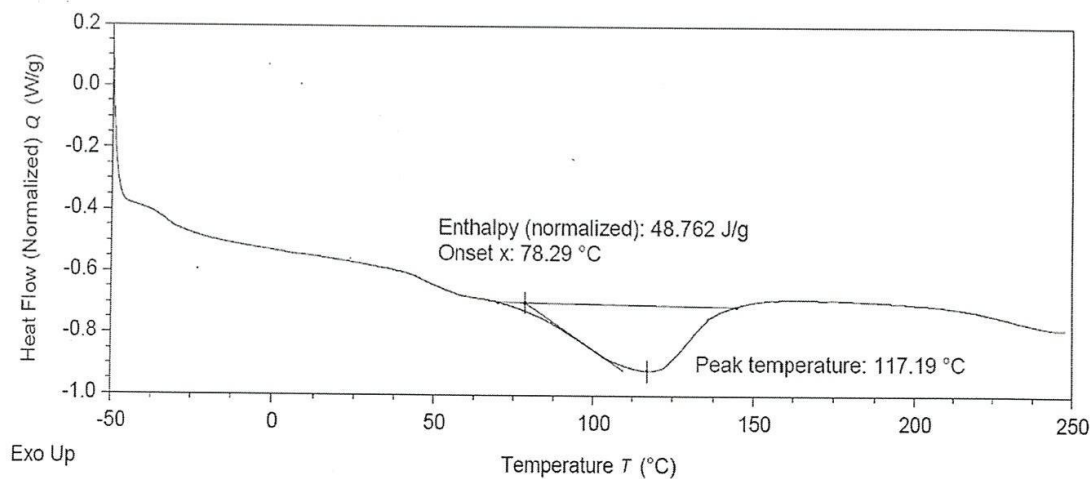
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FTIR Interpretation

Wave number (cm ⁻¹)	Nature of Bond
3240	C-H stretching
2954	CH ₂ asymmetric stretching
1450	CH ₂ Plane Bending
1389	C-O bonds of PBAT
1245	C-O bonds of PBAT
1162	C-O bonds of PBAT
872	O-CH-CH ₂ -H of ester
725	CH ₂ Plane of benzene ring

8 DSC Analysis



Comment: The above DSC & FTIR analysis indicates the above sample is Polybutylene adipate co-terephthalate (PBAT)

Contd.,

7/5


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Continuation Sheet

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परीक्षण परिणाम / TEST RESULTS

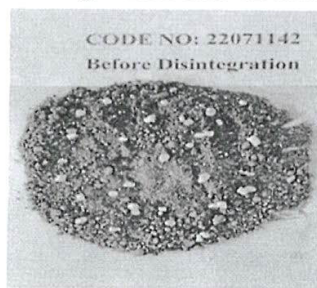
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29-05-2023

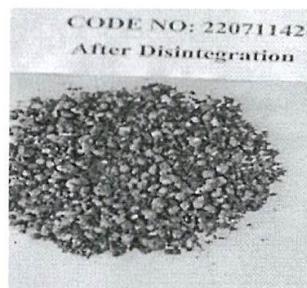
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9 Disintegration After 12 Weeks



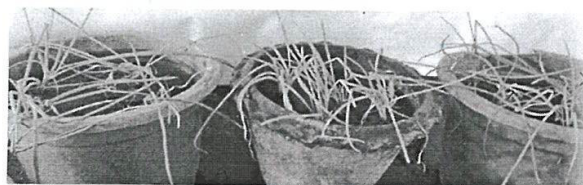
Before Disintegration



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

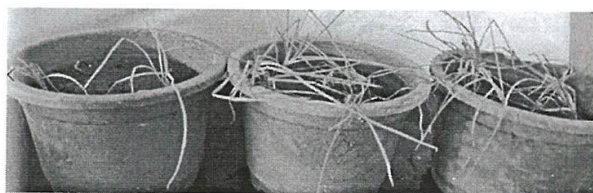


REP-1

REP-2

REP-3

Fresh compost with Onion seeds

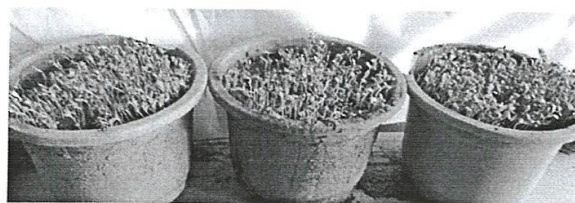


REP-1

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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