

केंद्रीय पेट्रोसायन अभियांत्रिकी एवं
प्रौद्योगिकी संस्थान (सिपेट)

(पूर्व में सेंट्रल इंस्टिट्यूट ऑफ प्लास्टिक्स इंजीनियरिंग एण्ड टेक्नोलॉजी)
इंस्टिट्यूट ऑफ पेट्रोकेमिकल्स टेक्नोलॉजी (आई.पी.टी.)

रसायन एवं पेट्रोसायन विभाग

रसायन एवं उर्वरक मंत्रालय, भारत सरकार
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सिपेट CIPET

परीक्षण रिपोर्ट

TEST REPORT

CENTRAL INSTITUTE OF PETROCHEMICALS
ENGINEERING & TECHNOLOGY (CIPET)

(Formerly Central Institute of Plastics Engineering & Technology)

INSTITUTE OF PETROCHEMICALS TECHNOLOGY (IPT)

Department of Chemicals & Petrochemicals

Ministry of Chemicals & Fertilizers, Govt. of India

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क्र.सं. / SI.No. 11039

ANALYSIS REPORT

Issued to :

M/s.SMART GREEN PRODUCTS

97/13-3, 97/12, Ithipuzha, Ithipuzha – Kottaram Road

Near Kottaram Temple, Udayanapuram S. O

Kottayam – 686143.

Page 1 of 4

Customer Ref. No. & date : Letter dt 07.06.2023

Work order Ref.No. : 162/23-24

As per Standard: : As per part C

Test Report No :23954

Date: 12.01.2024

PART A : PARTICULARS OF SAMPLE SUBMITTED

a)Name of the sample	: Biodegradable and Compostable Film as stated by the party
b)Grade / Variety / type / Size / Class etc.	: Nil
c)Code No.	: Nil
d)Quantity (pcs/mtr/gm/nos)	: 2 Kg
e)Mode of Packing	: Sealed carton
(Sealed cartoon/polypouch/container or not)	
f)Date of receipt of sample	: 08.06.2023
g)Date of Performance of test	: 15.06.2023 -08.01.2024
h)Any other information	: Interim Report No. 23607 dt. 26.10.2023

PART B: SUPPLEMENTARY INFORMATION

a) Reference to sampling procedure	: Drawn & Supplied by the party
b) Supporting documents for measurements taken and results derived like graphs, tables, sketches and / or Photographs as appropriate to test report, if any (to be attached)	: As per part -C
c) Deviation from the test methods as prescribed in relevant ASTM/ISO/BIS / Work instructions, if any	: ---

Dr. K. P. Bhuvana

Manager (Technical)

Authorized Signatory

Dr. S. Anbudayanidhi

Manager (Technical)

Authorized Signatory

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PART C: TEST RESULTS

Report No.:23954

Date: 12.01.2024

Sl. No	Name of the test	Test Method/ Standard	Unit	Results Obtained	Specified Requirement as per ISO : 17088-2021
Sample details: Biodegradable and Compostable Film as stated by the party					
1.	Material Identification	FTIR/DSC	--	Poly (lactic Acid) (PLA) and Poly (Butylene Adipate - co-Terephthalate) (PBAT)	--
2.	Disintegration (Dry mass remains in 2mm sieve after 84 days)	ISO 20200:2015	%	8.24	Not more than 10% of its original dry mass
3.	Ultimate aerobic biodegradation (with reference to 100% degradation of positive reference)	ISO 14855-1:2012	%	91.75 (at the end of 133 days)	> 90% (At the end of the test period not more than 180 days)
4.	Plant Growth study Monocotyledon(Paddy) % Seed emergence Dicotyledon(Tomato) % Seed emergence	OECD : 208 Guidelines	% %	91 92	> 90% of those from the corresponding blank compost

Note: The detailed observation on biodegradability test is enclosed as Annexure. I

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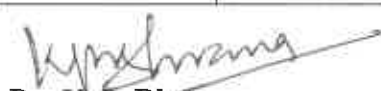
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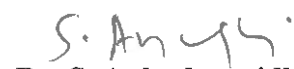
PART C: TEST RESULTS

Report No.:23954

Date: 12.01.2024

Sl. No	Name of the test	Test Method/ Standard	Unit	Results Obtained	Specified Requirement as per ISO : 17088-2021
5.	Acute Ecotoxic Effects to earthworm				
a.	Survival of adult earthworm at the end of 7 days	ISO 11268-1:2012	%	96	> 90% of those from the corresponding blank compost
b.	Survival of adult earthworm at the end of 14 days		%	93.75	
c.	Biomass at the end of 14 days		%	93.44	
6	Chronic Ecotoxic Effects to earthworm				
a.	Survival of adults earthworm at the end of 28 days	ISO 11268-2:2023	%	96.77	> 90% of those from the corresponding blank compost
b.	Offspring at the end of 56 days		%	94.24	
c.	Biomass at the end of 56 days		%	93.89	


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PART C: TEST RESULTS

Report No.: 23954

Date: 12.01.2024

Sl. No.	Property	Test method / Standard	Unit	Results obtained	Specified Requirements as per IS 17899 T:2022 (Max)
7.	<u>Heavy Metal Analysis</u> (on dry mass basis)				
	Arsenic (As)	IS 3025 (Part 37):2022	mg / kg	0.0204	10
	Copper (Cu)	IS 3025 (Part 42):1992		0.9581	300
	Nickel (Ni)	IS 3025 (Part 54):2003		0.7220	50
	Zinc (Zn)	IS 3025 (Part 49):1994		1.3051	1000
	Chromium (Cr)	IS 3025 (Part 52):2003		0.6311	50
	Mercury (Hg)	IS 3025 (Part 48):1994		0.0115	0.15
	Cadmium(Cd)	IS 3025 (Part 41):2023		1.0058	5
	Lead (Pb)	IS 3025 (Part 47):1994		1.5987	100

PART D: REMARKS: NIL

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): S.No.1


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ANNEXURE-I

Page 1 of 6

TR. NO.:23954

ANALYSIS RESULT

Date: 12.01.2024

OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2021

Name of the Customer :

M/s.SMART GREEN PRODUCTS

97/13-3, 97/12, Ithipuzha, Ithipuzha – Kottaram Road

Near Kottaram Temple, Udayanapuram S. O

Kottayam – 686143.

1.Sample Details: Biodegradable and Compostable Film as stated by the party.

The average thickness of film sample was observed as 36 microns.

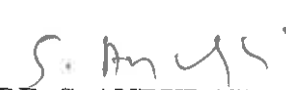
2. Material Identification by FTIR & DSC: Poly (lactic Acid) (PLA) and
Poly (Butylene Adipate - co- Terephthalate) (PBAT)

3. Observations:

a. Conditions of reaction Mixture

Origin of Compost	: Livestock excrement, municipal and vegetable waste
Reaction Temperature	: 58°C (±2°C)
Dry Solid (%)	: 54.87 %
Volatile content (%)	: 35.21%
CO ₂ evolved during 1 st 10 days in blank vessels	: 56.33 mg/g of volatile solids of compost
Test Duration (Days)	: 133 Days
Reference material	: Cellulose
Volume of reaction Vessel	: 3000ml


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MANAGER (TECHNICAL)
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ANALYSIS RESULT

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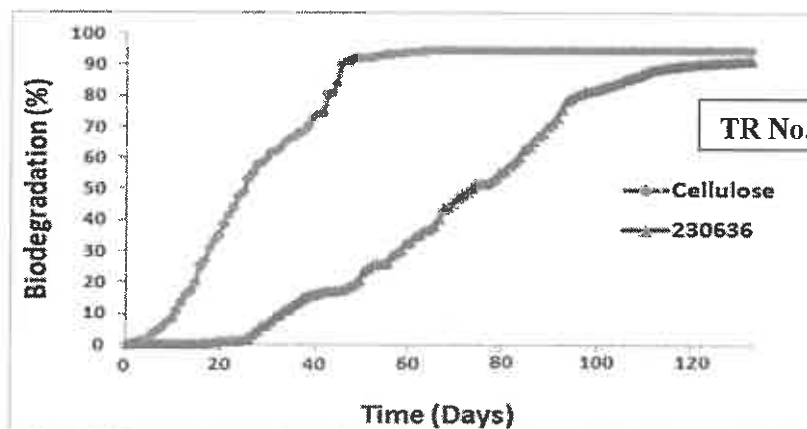
b. pH of test medium

Sl. No	Composting Vessel (Material with test medium)	pH (Before)	pH (After)
1	Sample 1	7.3	7.6
2	Sample 2	7.5	7.7
3	Sample 3	7.3	7.5
4	Blank	7.2	7.3
5	Blank	7.1	7.3
6	Blank	7.3	7.5
7	Positive 1	7.7	7.8
8	Positive 2	7.6	7.8
9	Positive 3	7.7	7.8
10	Negative	7.5	7.6
11	Negative	7.5	7.7
12	Negative	7.5	7.6

4. Result: Percentage biodegradation relative to positive reference

Mean(%) : 91.75%

The reference material- cellulose (%) : ~100%



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TR. NO.:23954

ANALYSIS RESULT

Date: 12.01.2024

5. Visual observation of Sample

Description	Week 1	Week 7	Week 11	Week 15	Week 19
Structure	Film Sample	Film Sample	Disintegrated Film Sample	--	--
Moisture	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level
Colour	Milky White	Milky White	--	--	--
Fungal Development	Nil	Nil	Nil	Nil	Nil
Smell	Organic/ Dirt Like	Organic/ Dirt Like	Organic/ Dirt Like	Organic/ Dirt Like	Organic/ Dirt Like

6. Visual observation of compost

Description	Week 1	Week 7	Week 11	Week 15	Week 19
Structure	Fine Particles	Fine Particles	Fine Particles	Fine Particles	Fine Particles
Moisture	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level
Colour	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown
Fungal Development	Nil	Nil	Nil	Nil	Nil
Smell	Organic/ Dirt Like	Organic/ Dirt Like	Organic/ Dirt Like	Organic/ Dirt Like	Organic/ Dirt Like


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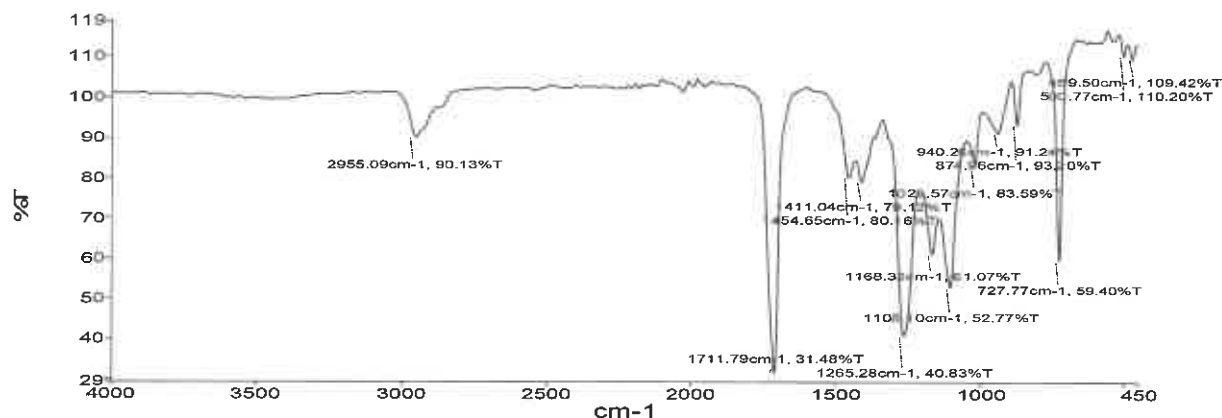
TR. NO.: 23954

ANALYSIS RESULT

Date: 12.01.2024

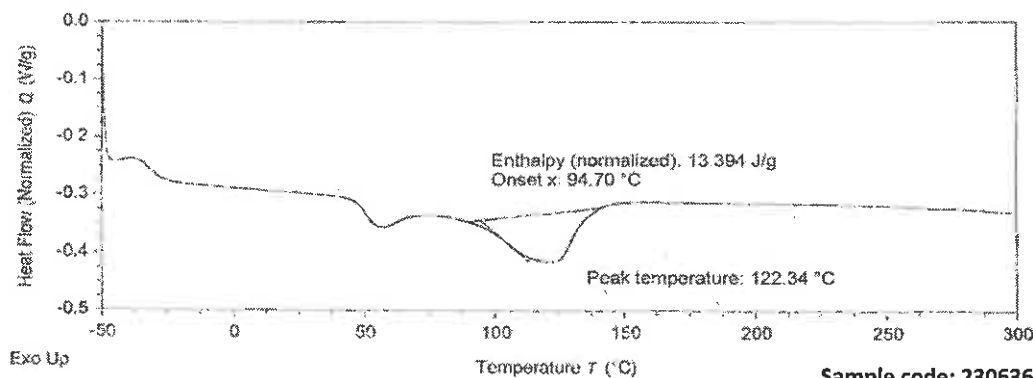
Sample Details: Biodegradable and Compostable Film as stated by the party.

7. FTIR Analysis



Wave number(cm ⁻¹)	Nature of Bond
2955.09	C-H stretching vibration
1711.79	C=O stretching vibration
1454.65	C-H bending vibration
1411.04	C=C stretching vibration
1168.32	C-O stretching vibration

8. DSC Analysis



Comment: The above DSC & FTIR analysis indicates the above sample is Poly (lactic Acid) (PLA) and Poly (Butylene Adipate - co- Terephthalate) (PBAT).

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(पूर्व में सेंट्रल इंस्टिट्यूट ऑफ प्लास्टिक्स इंजीनियरिंग एण्ड टेक्नोलॉजी)

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पप

सिपेट CIPET

Continuation Sheet

CENTRAL INSTITUTE OF PETROCHEMICALS
ENGINEERING & TECHNOLOGY (CIPET)

(Formerly Central Institute of Plastics Engineering & Technology)

INSTITUTE OF PETROCHEMICALS TECHNOLOGY (IPT)

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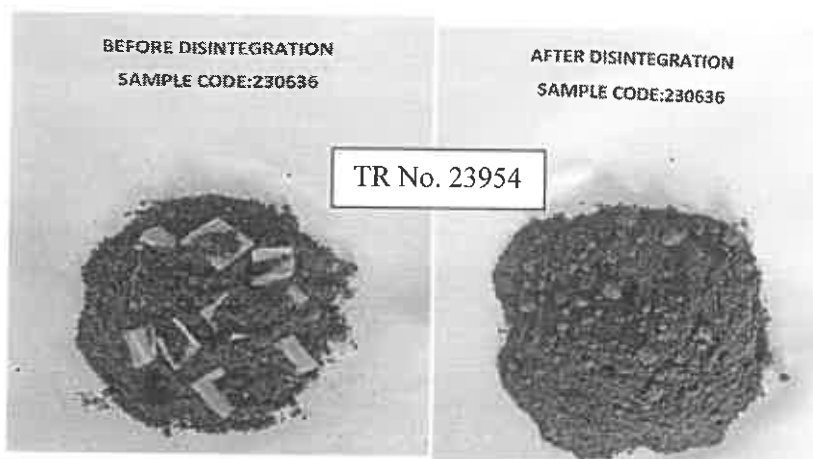
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TR. NO.: 23954

ANALYSIS RESULT

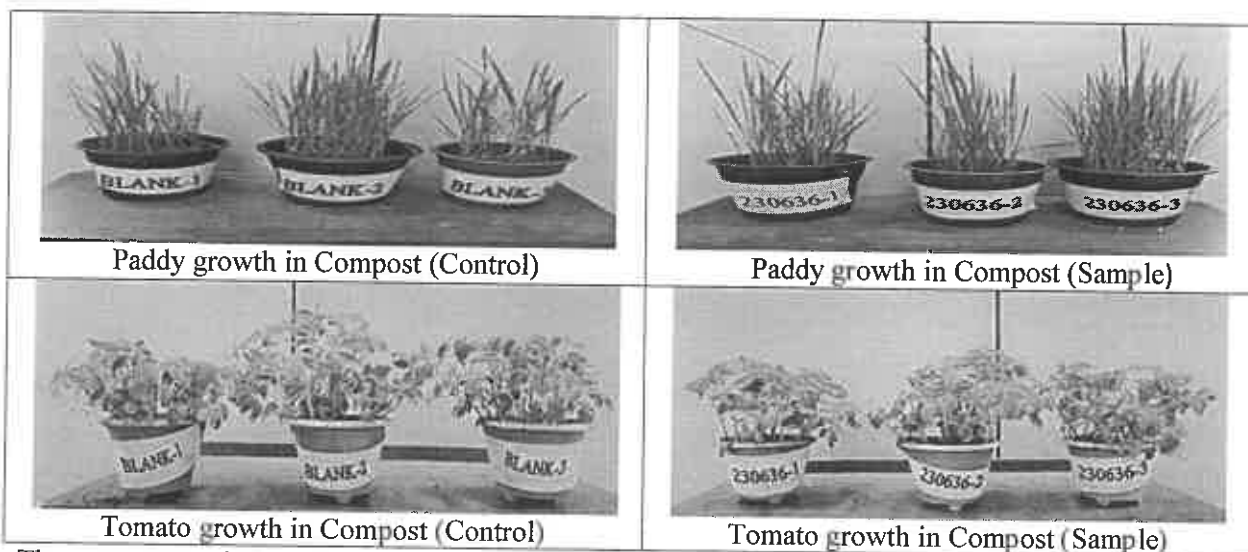
Date: 12.01.2024

9. DISINTEGRATION- AFTER 12 WEEKS



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. SEED GERMINATION AND PLANT GROWTH STUDY



The percentage of seed germination was found to be greater than 90% for both control and sample.

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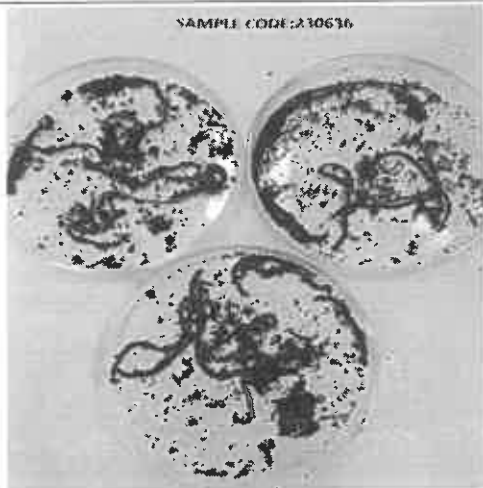
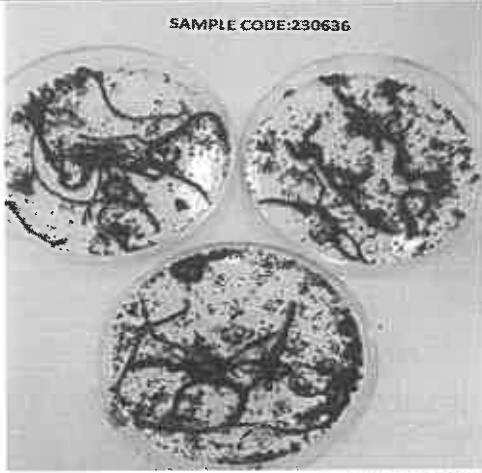
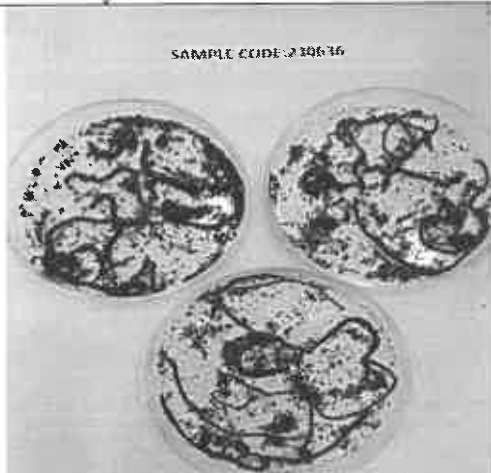
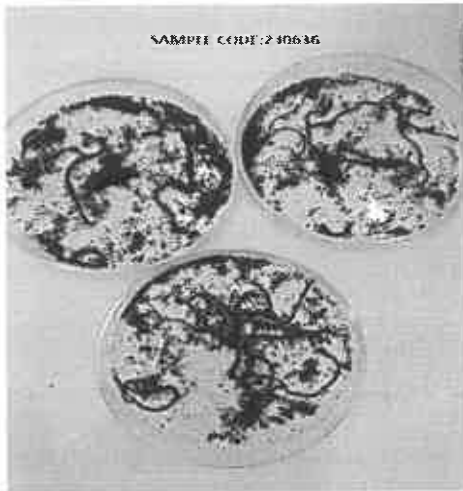
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ANALYSIS RESULT

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11. Acute & Chronic Ecotoxicity effects to Earthworm

 Photograph of Live earthworm in the sample compost at the end of 7 days.	 Photograph of Live earthworm in the sample compost at the end of 14 days.
The surviving adult earthworms grown in the sample compost exposed to the test material after an incubation period of 14 days is more than 90 % of those from the corresponding blank compost not exposed to any material.	
 Photograph of Live earthworms in the sample compost at the end of 28 days.	 Photograph of Live earthworm in the sample compost at the end of 56 days.
The surviving adult earthworms grown in the sample compost exposed to the test material after an incubation period of 28 days and the counted number of offspring after an incubation period of 56 days is more than 90 % of those from the corresponding blank compost.	

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