केंद्रीय पेट्रोरसायन अभियांत्रिकी एवं
प्रौद्योगिकी संस्थान (सिपेट)
(पूर्व में सेन्ट्रल इंस्टिट्यूट ऑफ प्लास्टिक्स इंजीनियरिंग एण्ड टेक्नोलॉजी)
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स्वच्छ भारत
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आजादी का अमृत महोत्सव

CENTRAL INSTITUTE OF PETROCHEMICALS ENGINEERING & TECHNOLOGY (CIPET)
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सिपेट:आई पी टी-कोच्ची /परीक्षण/२०२२-२३
CIPET: IPT-Kochi /Testing/2022-23/

दिनांक :२७.०६.२०२२
Date: 27.06.2022

सेवा में / To

M/s SS Polymers
Shed No: B-41, 4th Cross,
Devasandra ITI Industrial Estate,
Mahadevapura Post, Bangalore Urban
Karnataka- 560048

प्रिय महोदय / Dear Sir,

विषय : नमूनों की परीक्षण - संदर्भ में।
Sub.: Final Analysis Report – Reg
Ref.: Letter dt 15.12.2021
Interim Test Report No. 22093 dt 05.05.2022

हम इसके साथ परीक्षण के लिए प्रस्तुत नमूने से संबंधित टेस्ट रिपोर्ट क्रमांक **22259** दिनांकित **27.06.2022** संलग्न कर रहे हैं।

We are enclosing herewith Analysis Report No. **22259** dt. **27.06.2022** pertaining to the samples submitted for testing.

कृपया संलग्न कस्टमर फीडबैक फॉर्म भरकर वापस भेजने का कष्ट करें।

Please find enclosed herewith the feedback form. Kindly fill and send it back to us.

धन्यवाद तथा सबसे अच्छी सेवा देने का आश्वासन के साथ,

Thanking you and assuring you our best services,

सादर, / Yours sincerely,

संयुक्त निदेशक और प्रमुख
Joint Director & Head

संलग्न यथोक्त / Encl. as above.

केंद्रीय पेट्रोकेमिकल्स इंजीनियरिंग
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परीक्षण रिपोर्ट
TEST REPORT

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क्र.सं. / Sl.No. 9216

ANALYSIS REPORT

Issued to :
M/s SS Polymers
Shed No: B-41, 4th Cross,
Devasandra ITI Industrial Estate,
Mahadevapura Post, Bangalore Urban
Karnataka- 560048

Test Report No : 22259
Date: 27.06.2022

Customer Ref. No. & date : Letter dt 15.12.2021
Work order Ref.No. :509/21-22
As per Standard: : As per part C

PART A : PARTICULARS OF SAMPLE SUBMITTED

a)Name of the sample	:	Biodegradable & Compostable film as stated by 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 cartoon/polypouch/container or not)	:	Sealed carton
f)Date of receipt of sample	:	28.12.2021
g)Date of Performance of test	:	28.12.2021 - 25.06.2022
h)Any other information	:	Interim Report No. 22093 dt. 05.05.2022

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	:	---

Manjula K S

Dr.Manjula K S
Technical Officer
Authorized Signatory

S. Anbu

Dr.S.Anbudayanidhi
Sr.Technical Officer
Authorized Signatory

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ANALYSIS REPORT

PART C: TEST RESULTS

Report No.:22259
Date: 27.06.2022

Sl. No	Name of the test	Test Method/ Standard	Unit	Results Obtained	Specified Requirement
Sample details: Biodegradable & Compostable film as stated by the party					
1.	Material Identification	FTIR/DSC	--	Polylactic Acid(PLA) and Polybutylene Adipate-Co-Terephthalate (PBAT)	--
2.	Disintegration (Dry mass remains in 2mm sieve after 84 days)	ISO 17088:2012 / IS 17088:2008	%	7.06	Not more than 10%
3.	Ultimate aerobic biodegradation (with reference to 100% degradation of positive reference)	ISO 17088:2012 / IS 17088:2008	%	90.29 (at the end of 128 days)	>90(at the end of the test period not more than 180 days)
4.	Plant Growth study **Monocotyledon(Paddy)** % Seed emergence	ISO 17088:2012 / IS 17088:2008	%	91	>90
	Dicotyledon(Tomato) % Seed emergence		%	91	>90

Note: The detailed observation on biodegdability test is enclosed as Annexure-I

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Dr.S.Anbudayanidhi
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केंद्रीय पेट्रोकेमिकल्स इंजीनियरिंग
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ANALYSIS REPORT

PART C: TEST RESULTS

Report No.: 22259
Date: 27.06.2022

Sl. No	Name of the test	Test Method/ Standard	Unit	Results Obtained	Specified Requirement
5.	**Heavy Metals concentration #**	ISO 17088:2012 / IS 17088:2008	mg/l		(Max)
	Arsenic (As)			0.8144	20
	Copper (Cu)			0.9547	500
	Nickel (Ni)			0.0856	100
	Zinc (Zn)			1.1473	2500
	Cobalt (Co)			0.4357	-
	Chromium (Cr)			0.1393	300
	Molybdenum (Mo)			1.0544	-
	Mercury (Hg)			0.2259	10
	Cadmium(Cd)			0.0248	20
	Lead (Pb)			0.0472	500
	Selenium (Se)			0.6314	-

#Note: Based on Municipal Waste (Management and Handling) Rules, 1999 notified on 27th September 1999 by Ministry of Environment and Forests, Government of India. Note that concentration of metals like Cobalt, Molybdenum and Selenium is not mentioned in the notification.

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): Nil

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Authorized Signatory

Dr.S.Anbudayanidhi
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*** End of the Report***

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ANNEXURE-I

TR. NO.: 22259 **ANALYSIS RESULT** **Date: 27.06.2022**

OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2012/ IS 17088:2008

Name of the Customer :
M/s SS Polymers
Shed No: B-41, 4th Cross,
Devasandra ITI Industrial Estate,
Mahadevapura Post, Bangalore Urban
Karnataka- 560048

1. Sample Detail: Biodegradable & Compostable film (as declared by the party)

The average thickness of film sample was observed 38 microns.

2. Material Identification by FTIR & DSC: Polylactic acid (PLA) and Polybutylene 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 (%)	: 52.202 %
Volatile content (%)	:36.21%
CO_2 evolved during 1st 10 days in blank vessels	:69.12 mg/g of volatile solids of compost
Test Duration (Days)	:128 Days
Reference material	: Cellulose
Volume of reaction Vessel	: 3000ml

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TR. NO.:22259 **ANALYSIS RESULT** **Date: 27.06.2022**

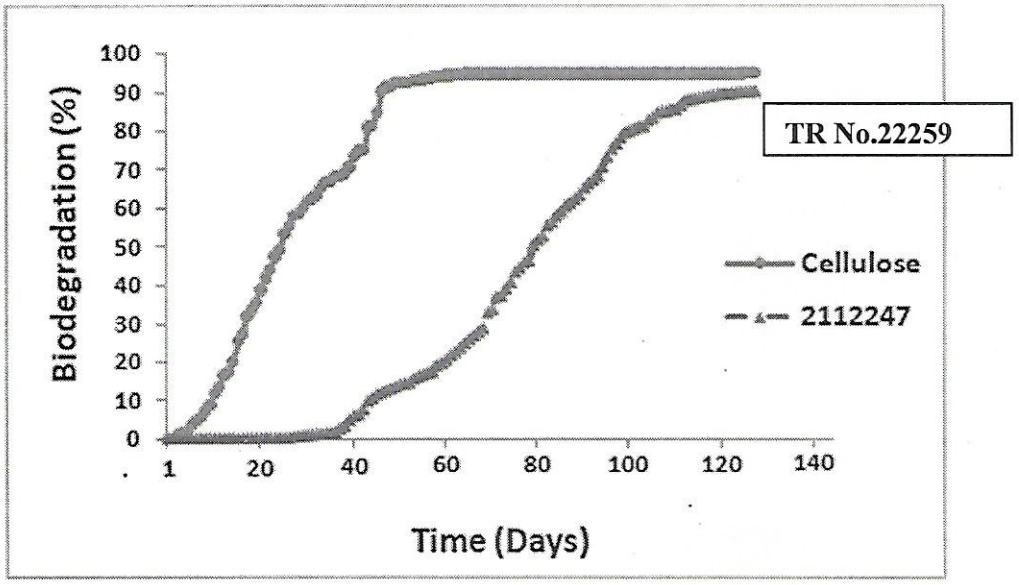
b. pH of test medium

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

4. Result: Percentage biodegradation relative to positive reference

Mean(%) : 90.29%

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



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S. An

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Sr.Technical Officer
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TR. NO.:22259 **ANALYSIS RESULT** **Date: 27.06.2022**

5. Visual observation of Sample

Description	Week 1	Week 5	Week 10	Week 14	Week 19
Structure	Film Sample	Disintegrated film	Disintegrated film	--	--
Moisture	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level
Colour	Milky White	Faded White	Faded 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 5	Week 10	Week 14	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

Dr.Manjula K S
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CENTRAL INSTITUTE OF PETROCHEMICALS ENGINEERING & TECHNOLOGY (CIPET)
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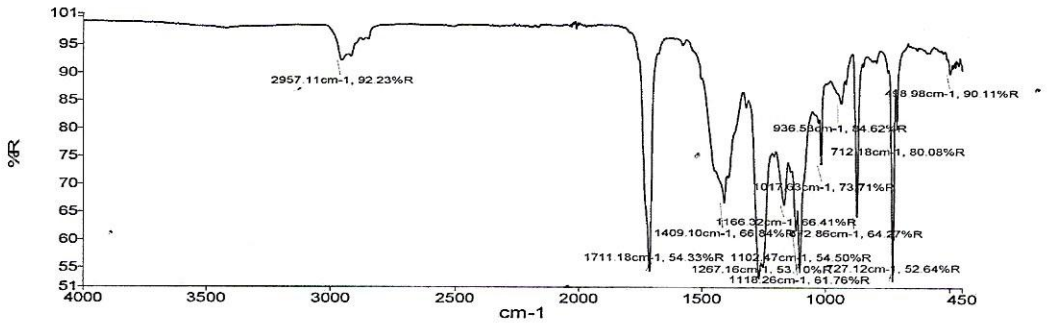
Continuation Sheet

TR. NO.: 22259 **ANALYSIS RESULT** **Date: 27.06.2022**

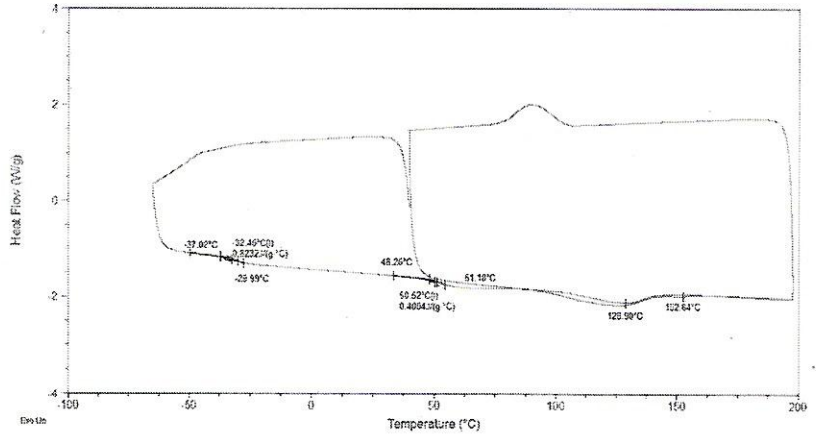
Sample Details: Biodegradable & Compostable film sample (as declared by the party)

7. FTIR Analysis



Wavenumber(cm^{-1})	Nature of Bond
2957.11	C-H stretching vibration
1711.18	C=O stretching vibration
1267.16	C-O stretching vibration
1102.47	C-O stretching vibration
727.12	C=C bending vibration

8. DSC Analysis



Comment: The above DSC & FTIR analysis indicates the above sample isPolylactic acid (PLA) and Polybutylene Adipate-Co-Terephthalate (PBAT)

Dr.Manjula K S
Technical Officer
Authorized Signatory

Dr.S.Anbudayanidhi
Sr.Technical Officer
Authorized Signatory

केंद्रीय पेट्रोकेमिकल्स इंजीनियरिंग
एवं तकनीकी संस्थान (सिपेट)
(पूर्व में सेन्ट्रल इंस्टिट्यूट ऑफ प्लास्टिक्स इंजीनियरिंग एण्ड टेक्नोलॉजी)
इंस्टिट्यूट ऑफ पेट्रोकेमिकल्स टेक्नोलॉजी (आई.पी.टी.)
रसायन एवं पेट्रोरसायन विभाग
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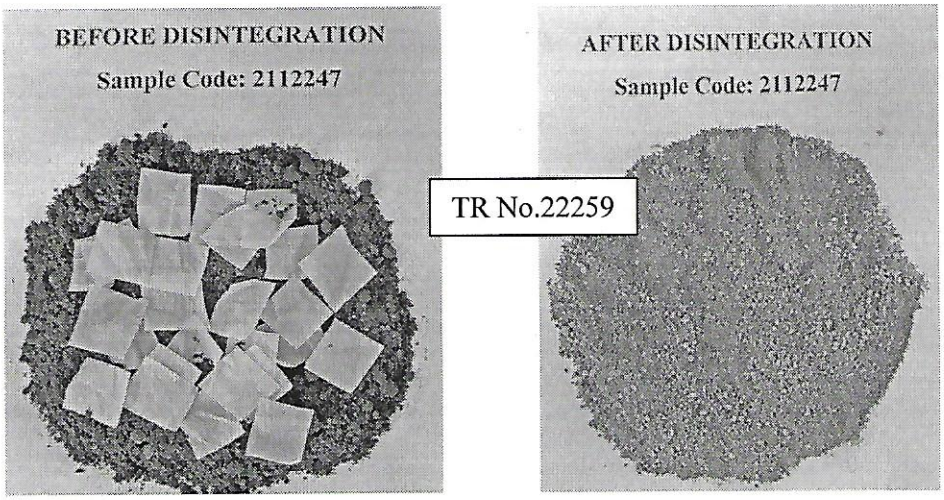
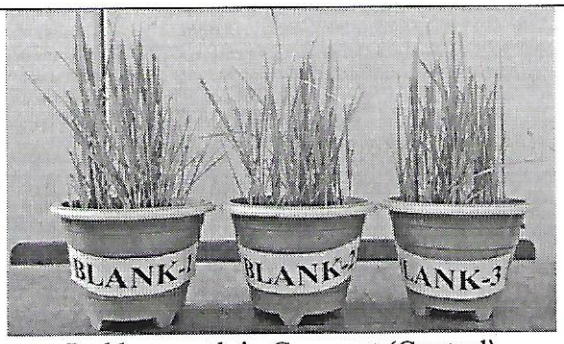
9. DISINTEGRATION- AFTER 12 WEEKS

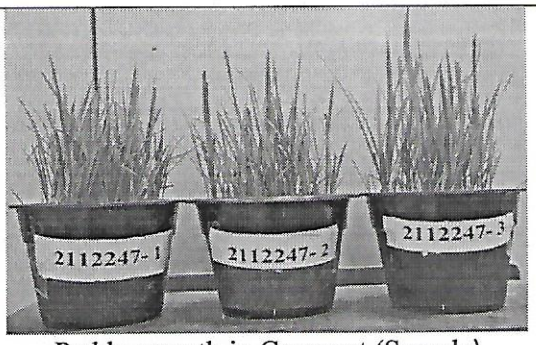


The disintegration of the supplied sample by passing through 2 mm sieve after 12 week in composting condition as per ISO 17088-2012/IS 17088: 2008 was found not more than 10% of original dry mass remain.

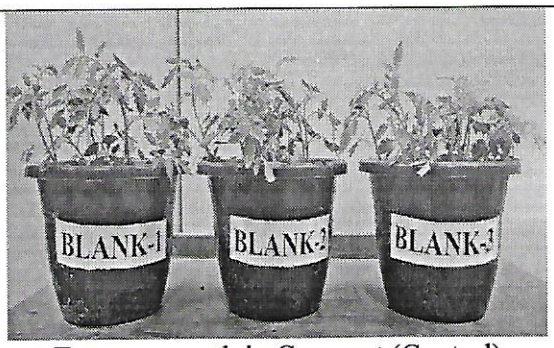
10.SEED GERMINATION AND PLANT GROWTH STUDY



Paddy growth in Compost (Control)



Paddy growth in Compost (Sample)



Tomato growth in Compost (Control)

Tomato growth in Compost (Sample)

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

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***** End of the Report*****