

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 पेट्रोसायन विभाग

रसायन एवं उर्वरक मंत्रालय, भारत सरकार
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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. 9938

ANALYSIS REPORT

Issued to :

M/s. Hi- Tech International

Plot No.18 , Sector -6

IMT Manesar, Gurugram.

Page 1 of 4

Test Report No : 22938

Date: 16.03.2023

Customer Ref. No. & date : Letter dated 29.07.2022

Work order Ref.No. : 293/22-23

As per Standard: : As per part C

PART A : PARTICULARS OF SAMPLE SUBMITTED

- a)Name of the sample : Compostable Cutlery made out of 'Dr. Bio' polymer material as stated by the party
- b)Grade / Variety / type / Size / Class etc. : Nil
- c)Code No. : Nil
- d)Quantity (pcs/mtr/gm/nos) : 20 pcs
- e)Mode of Packing : Sealed carton
(Sealed cartoon/polypouch/container or not)
- f)Date of receipt of sample : 11.08.2022
- g)Date of Performance of test : 05.09.2022 - 08.03.2023
- h)Any other information : Interim Report No. 22757 dt. 10.01.2023

PART B: SUPPLEMENTARY INFORMATION

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

Dr. Manjula K.S.

Sr. Technical Officer

Authorized Signatory

Dr. S. Anbudayanidhi
Manager (Technical)
Authorized Signatory

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PART C: TEST RESULTS

Report No.: 22938

Date: 16.03.2023

Sl. No	Name of the test	Test Method/ Standard	Unit	Results Obtained	Specified Requirement
Sample details: Compostable Cutlery made out of 'Dr. Bio' polymer material 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)	Cl. 6.2 of ISO 17088-2021	%	8.98	Not more than 10% of its original dry mass
3.	Ultimate aerobic biodegradation (with reference to 100% degradation of positive reference)	Cl. 6.3.1 of ISO 17088-2021 ISO:14855-1	%	90.23 (at the end of 124 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	Cl. 6.4.3 of ISO 17088:2021 (Annex C)	% %	92 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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PART C: TEST RESULTS

Report No.: 22938

Date: 16.03.2023

Sl. No	Name of the test	Test Method/ Standard	Unit	Results Obtained	Specified Requirement
5.	Acute Ecotoxic Effects to earthworm				
a.	Survival of adult earthworm at the end of 7 days	Cl. 6.4.4 of ISO 17088:2021 (Annex D)	%	100	> 90% of those from the corresponding blank compost
b.	Survival of adult earthworm at the end of 14 days		%	100	
c.	Biomass at the end of 14 days		%	92.14	
6.	Chronic Ecotoxic Effects to earthworm				
a.	Survival of adults earthworm at the end of 28 days	Cl. 6.4.5 of ISO 17088:2021 (Annex E)	%	100	> 90% of those from the corresponding blank compost
b.	Survival of adults earthworm at the end of 56 days		%	100	
c.	Offspring at the end of 56 days		%	92	
d.	Biomass at the end of 56 days		%	93.89	

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ANALYSIS REPORT

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PART C: TEST RESULTS

Report No.: 22938

Date: 16.03.2023

Sl. No.	Property	Test method / Standard	Unit	Results obtained	Specified Requirements (Max.)
7.	<u>Heavy Metal Analysis</u> Arsenic (As) Copper (Cu) Nickel (Ni) Zinc (Zn) Chromium (Cr) Mercury (Hg) Cadmium(Cd) Lead (Pb)	Cl. 6.5.2 of ISO 17088:2021/Cl.4.3 of IS 17899 T:2022	mg / l	0.2032 0.1266 0.0964 0.0653 0.0127 0.0031 0.0022 1.0620	10 300 50 1000 50 0.15 5 100

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.: 22938

ANALYSIS RESULT

Date: 16.03.2023

OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2021

Name of the Customer :

M/s. Hi- Tech International

Plot No.18 , Sector -6,

IMT Manesar, Gurugram.

1. Sample Detail: Compostable Cutlery made out of 'Dr. Bio' polymer material as stated by the party

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 (%)	: 55.18 %
Volatile content (%)	: 35.36%
CO ₂ evolved during 1 st 10 days in blank vessels	: 66.64 mg/g of volatile solids of compost
Test Duration (Days)	: 124 Days
Reference material	: Cellulose
Volume of reaction Vessel	: 3000ml

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TR. NO.: 22938

ANALYSIS RESULT

Date: 16.03.2023

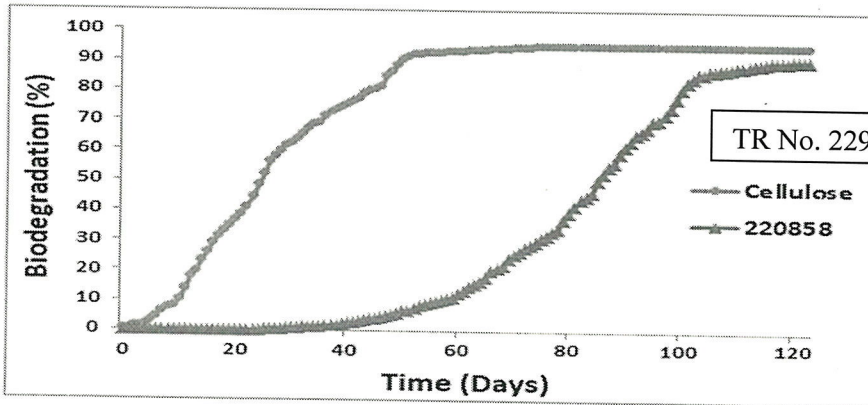
b. pH of test medium

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

4. Result: Percentage biodegradation relative to positive reference

Mean (%) : 90.23%

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



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TR. NO.: 22938

ANALYSIS RESULT

Date: 16.03.2023

5. Visual observation of Sample

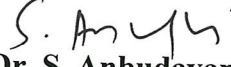
Description	Week 1	Week 5	Week 10	Week 14	Week 17
Structure	Grinded pieces of cutlery	Disintegrated pieces of cutlery	Disintegrated pieces of cutlery	--	--
Moisture	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level	Adequate moisture level
Colour	Milky White	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

Note: Grinded pieces of cutlery have taken for testing.

6. Visual observation of compost

Description	Week 1	Week 5	Week 10	Week 14	Week 17
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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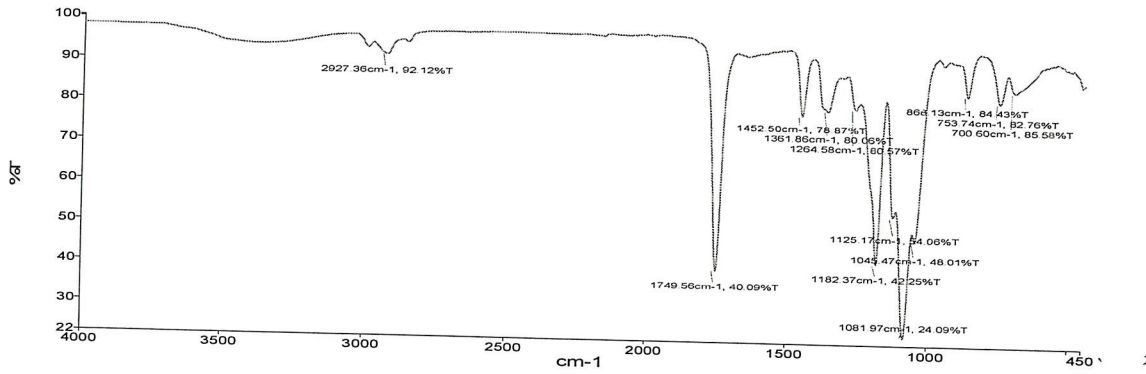
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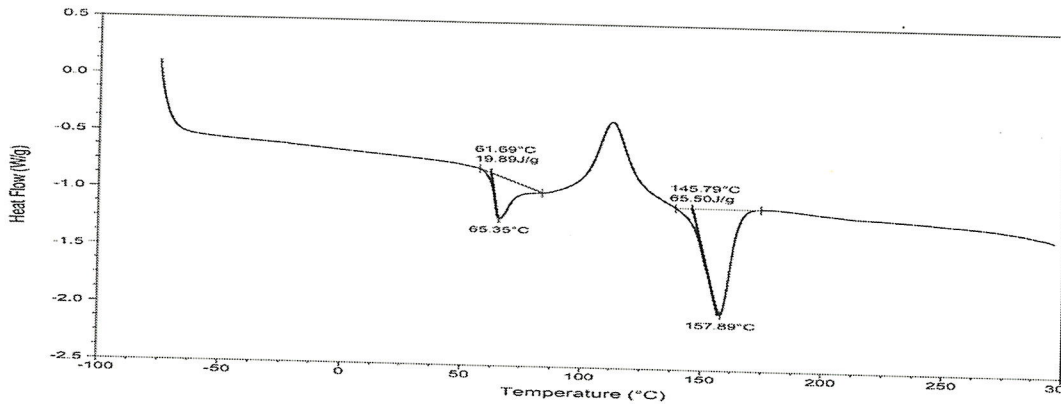
Sample Details: Compostable Cutlery made out of 'Dr. Bio' polymer material as stated by the party

7. FTIR Analysis



Wave number(cm ⁻¹)	Nature of Bond
2927.36	C-H stretching vibration
1749.56	C=O stretching vibration
1452.50	C-H bending vibration
1182.37	C-O stretching vibration
1081.97	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 सेन्ट्रल इंस्टिट्यूट ऑफ प्लास्टिक्स इंजीनियरिंग एण्ड टेक्नोलॉजी)
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रसायन एवं पेट्रोरसायन विभाग

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Continuation Sheet

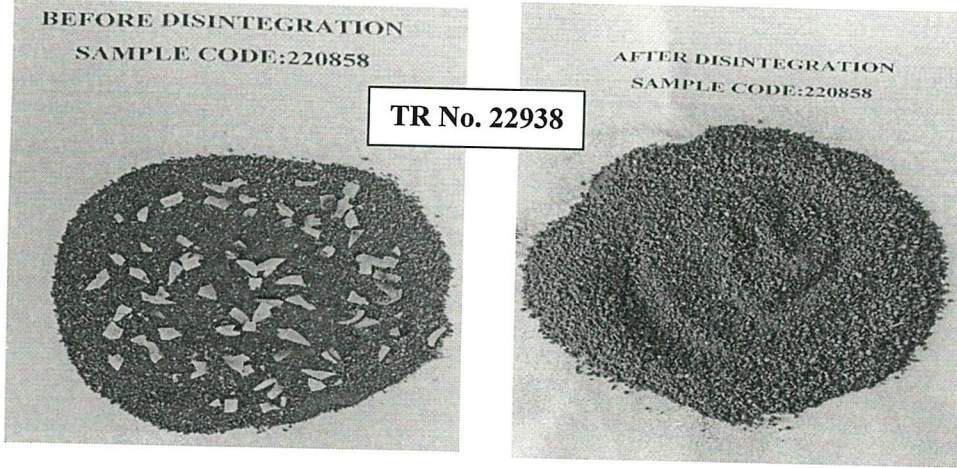
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ANALYSIS RESULT

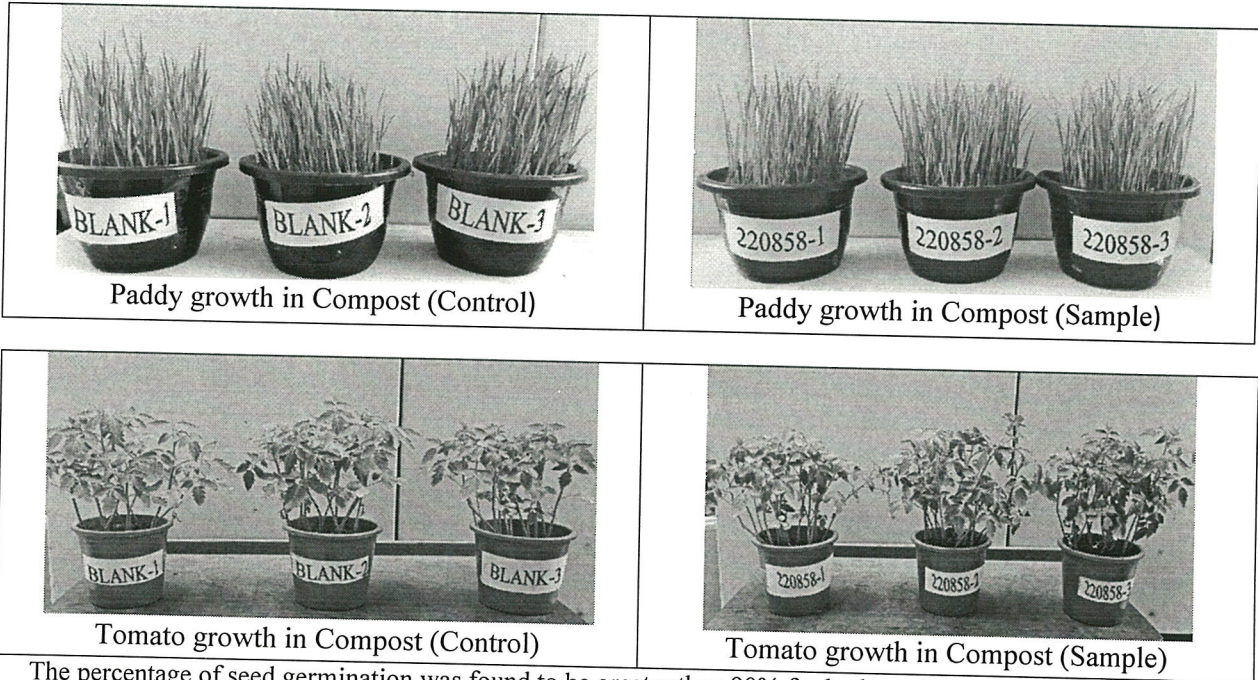
Date: 16.03.2023

9. DISINTEGRATION- AFTER 12 WEEK



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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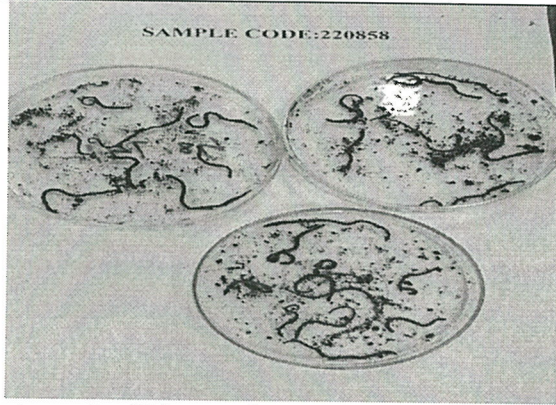
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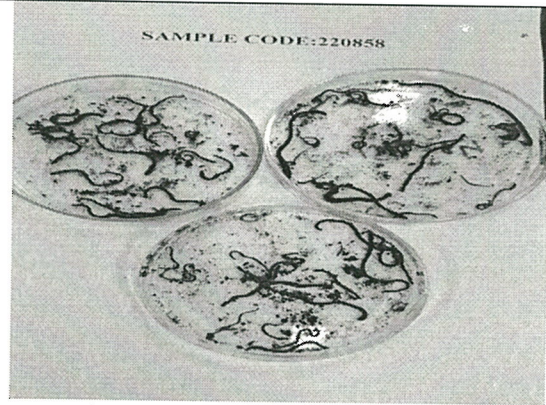
ANALYSIS RESULT

Date: 16.03.2023

11. Acute & Chronic Ecotoxicity effects to Earthworm



Photograph of Live earthworm in the sample compost at the end of 7 days

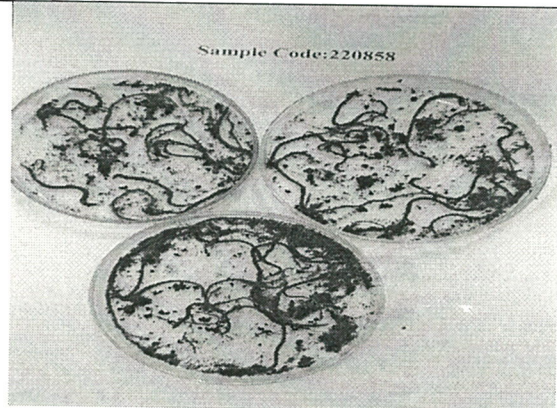


Photograph of Live earthworm in the sample compost at the end of 14 days

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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