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परीक्षण रिपोर्ट
TEST REPORT

क्र.सं. / Sl. No. 10301

ANALYSIS REPORT

Issued to :
M/s. SIDDHI FLEXIPACK
Survey No. 336/2 (5),
Behind Patel Cricket Ground,
Village – Kachigam, Daman.

Test Report No : 23298
Date: 13.07.2023

Customer Ref. No. & date : Letter dt 05.12.2022
Work order Ref.No. : 502/22-23
As per Standard: : As per part C

PART A : PARTICULARS OF SAMPLE SUBMITTED

a)Name of the sample	:	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 cartoon/polypouch/container or not)	:	Sealed carton
f)Date of receipt of sample	:	05.12.2022
g)Date of Performance of test	:	12.12.2022 -10.07.2023
h)Any other information	:	Interim Report No. 23066 dt. 02.05.2023

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	:	---

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परीक्षण रिपोर्ट
TEST REPORT

ANALYSIS REPORT

क्र.सं. / Sl. No. 10301

PART C: TEST RESULTS

Report No.: 23298
Date: 13.07.2023

Sl. No	Name of the test	Test Method/ Standard	Unit	Results Obtained	Specified Requirement
Sample details: Compostable Film as stated by the party					
1.	Material Identification	FTIR/DSC	--	Poly (lactic Acid) (PLA) & Poly (butylene Adipate-Co-Terephthalate (PBAT)	--
2.	Disintegration (Dry mass remains in 2mm sieve after 84 days)	Cl. 6.2 of ISO 17088-2021	%	8.59	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	%	90.63 (at the end of 136 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)	% %	93 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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Continuation Sheet

ANALYSIS REPORT

PART C: TEST RESULTS

Report No.: 23298
Date: 13.07.2023

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		%	93.15	
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		%	93	
d.	Biomass at the end of 56 days		%	93.44	

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ANALYSIS REPORT

PART C: TEST RESULTS

Report No.: 23298
Date: 13.07.2023

Sl. No.	Property	Test method / Standard	Unit	Results obtained	Specified Requirements (Max.)
7.	Heavy Metal Analysis (on dry mass basis) 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 / kg	 0.0093 0.6411 1.8623 0.7441 0.3749 0.0214 0.4391 2.2041	 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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Continuation Sheet

TR. NO.: 23298 | ANALYSIS RESULT | Date: 13.07.2023

OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2021

Name of the Customer:

M/s. SIDDHI FLEXIPACK
Survey No. 336/2 (5),
Behind Patel Cricket Ground,
Village – Kachigam, Daman.

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

   The average thickness of film sample was observed as 13 microns.

2. **Material Identification by FTIR & DSC:** Poly (lactic Acid) (PLA) &
   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 (%)	: 53.30 %
Volatile content (%)	: 33.44%
CO_2 evolved during 1st 10 days in blank vessels	: 54.01 mg/g of volatile solids of compost
Test Duration (Days)	:136 Days
Reference material	: Cellulose
Volume of reaction Vessel	: 3000ml

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Continuation Sheet

TR. NO.: 23298 **ANALYSIS RESULT** **Date: 13.07.2023**

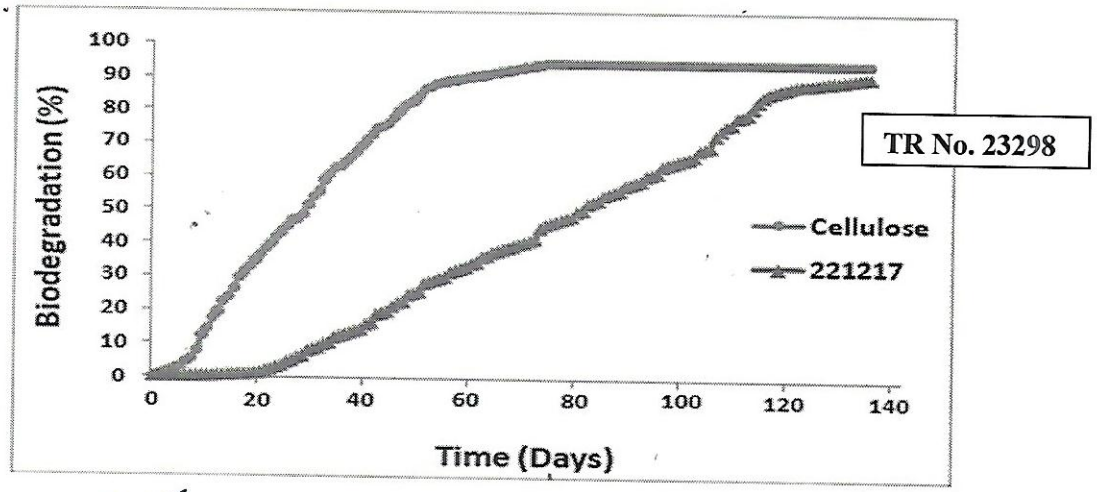
b. pH of test medium

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

4. Result: Percentage biodegradation relative to positive reference

Mean(%) : 90.63%

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



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Continuation Sheet

TR. NO.: 23298 **ANALYSIS RESULT** **Date: 13.07.2023**

5. Visual observation of Sample

Description	Week 1	Week 5	Week 10	Week 15	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 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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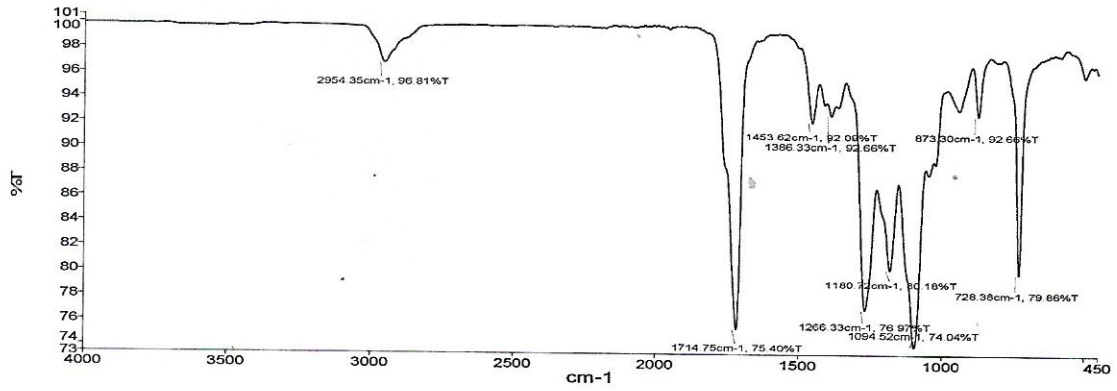
TR. NO.: 23298 **ANALYSIS RESULT** **Date: 13.07.2023**

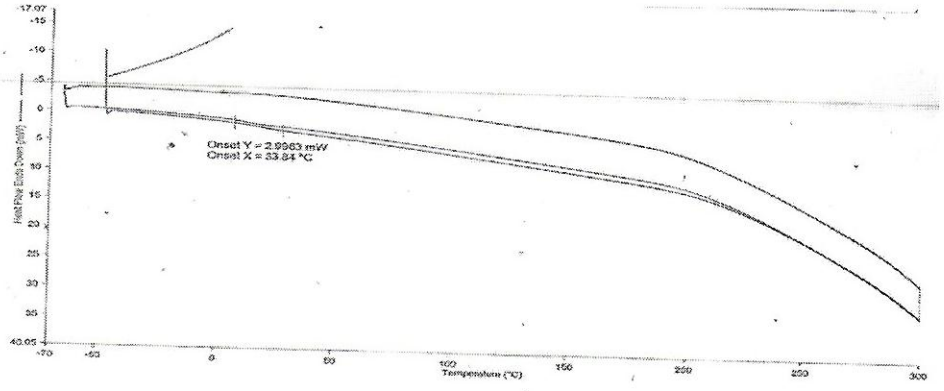
Sample Details: Compostable Film as stated by the party

7. FTIR Analysis



Wave number(cm^{-1})	Nature of Bond
2954.35	C-H stretching vibration
1714.75	C=O stretching vibration
1453.62	C-H bending vibration
1180.72	C-O stretching vibration
1094.52	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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Continuation Sheet

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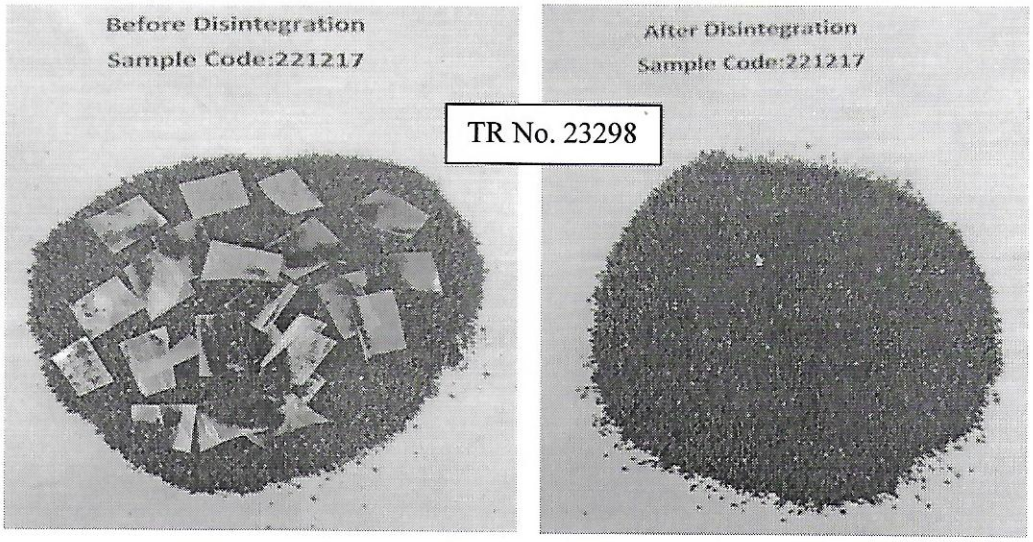
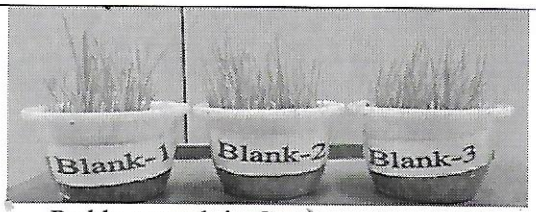
9. DISINTEGRATION- AFTER 12 WEEKS

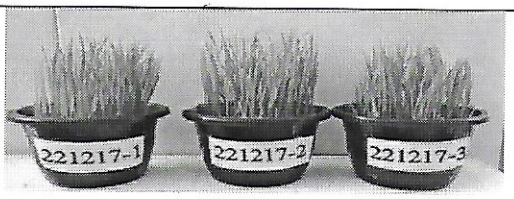


The disintegration of the supplied sample by passing through 2 mm sieve after 12 week in composting condition as per ISO 17088-2021 was found not more than 10% of original dry mass remain.

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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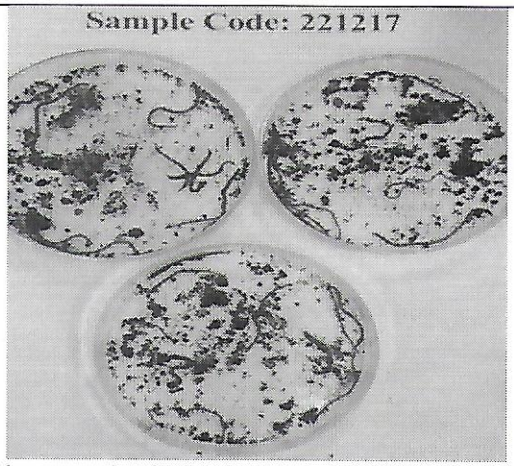
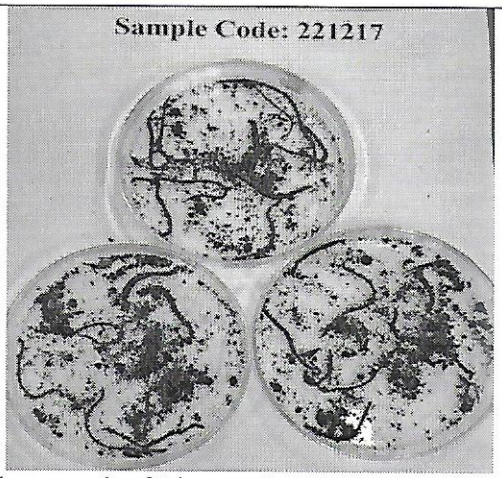
11. Acute & Chronic Ecotoxicity effects to Earthworm

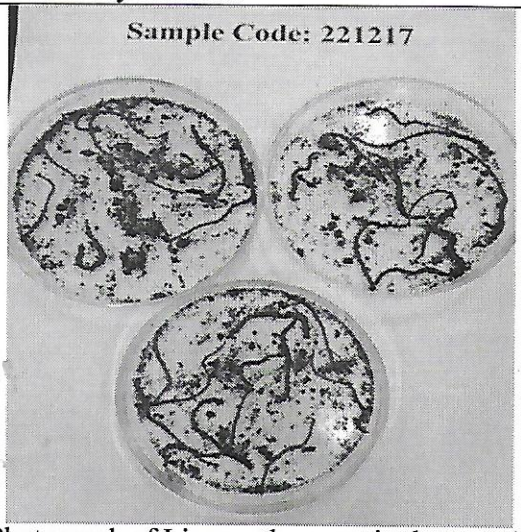


Photograph of Live earthworm in the sample compost at the end of 7 days

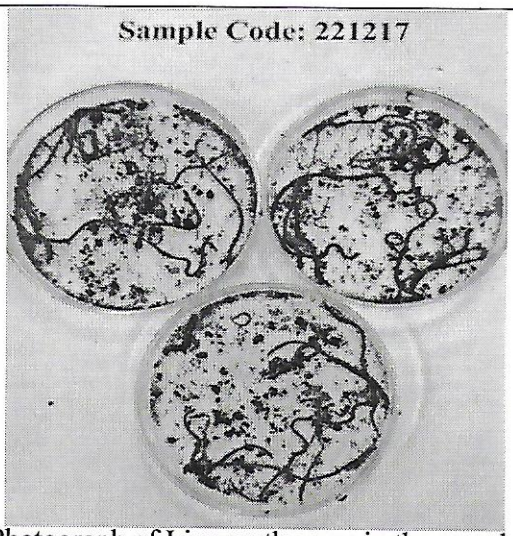


Photograph of Live earthworm in the sample compost at the end of 14 days

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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