

सिपेट : इंस्टिट्यूट ऑफ प्लास्टिक्स टेक्नोलॉजी
(रसायन एवं उर्वरक मंत्रालय, भारत सरकार)
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को जारी /
Issued to :

MAHAVEER GREEN WORLD
G-125, RIICO Industrial Area, Kekri, Ajmer,
Rajasthan 305404.

परीक्षण रिपोर्ट / TEST REPORT

क्र.सं / SI. No. **26712**

रिपोर्ट सं / REPORT NO. : **62346**

दिनांक / Date : **30-03-2021**

02-01-2020 Pages.....Nos. Part A,B,C & D

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 : Compostable carry bags - as stated by the party
- आ) सैपिल प्राप्त होने की तारीख / b) Date of Receipt of sample : 02-01-2020
- 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 : 1.5 kg
- ए) पैकिंग की रीति / h) Mode of Packing : Packed in Aluminium cover
- ऐ) मोहर बंद या नहीं / i) Sealed or not : Not Sealed
- ओ) कोई अन्य सूचना / j) Any other information : --

भाग - ख / PART - B

192142

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
ब) 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

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भाग - ग / PART - C

परीक्षण परिणाम / TEST RESULTS



Test Duration: 02.01.2020 to 30.03.2021

Sl.No	Name of the Test	Test Method/ Standard	Unit	Results Obtained	Specified Requirements
1	Material Identification	FTIR & DSC	-	Blend of Poly Lactic Acid (PLA) and Poly Butylene Adipate Co-Terephthalate (PBAT)	-
2	Disintegration (Dry mass remains in 2 mm sieve after 84 days)	ISO 17088:2012 / IS 17088:2008	%	7.6	No more than 10%
3	Ultimate aerobic Biodegradation (with reference to 100% degradation of positive reference)	ISO 17088:2012 / IS 17088:2008	%	90.11% (at the end of 117 days)	> 90 (at the end of the test period not more than 180 days.)
4	Plant Growth study				
	Monocotyledon (Rice) % Seed emergence	ISO 17088:2012 / IS 17088:2008	%	92	> 90
	Dicotyledon (Radish) % Seed Emergence		%	91	> 90

The detailed observation on biodegradability test is enclosed as Annexure

Contd.

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परीक्षण परिणाम / TEST RESULTS

दिनांक / Date : 30-03-2021

PART C - TEST RESULTS

Sl.No	Name of the Test	Test Method/ Standard	Unit	Results Obtained	Specified Requirements*
5	Heavy metals concentration				
a.	Arsenic (As)			0.001	20
b.	Copper (Cu)			0.036	500
c.	Nickel (Ni)			0.314	100
d.	Zinc (Zn)	ISO 17088:2012 /		0.392	2500
e.	Cobalt (Co)	IS 17088:2008	mg/L	0.051	-
f.	Chromium (Cr)			0.097	300
g.	Molybdenum (Mo)			0.18	-
h.	Mercury (Hg)			0.0004	10
i.	Cadmium (Cd)			BDL(DL-0.0008)	20
j.	Lead (Pb)			0.173	500
k.	Selenium (Se)			0.001	-

* 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.

Note: BDL - Below Detection Limit; DL - Detection Limit

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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परीक्षण परिणाम / TEST RESULTS

दिनांक / Date : 30-03-2021

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

Name of the Party : M/s.MAHAVEER GREEN WORLD,
G-125,RIICCO Industrial Area,Kekri,
Ajmer,Rajasthan 305 404

- 1 Sample Details (As stated by Party): Compostable Carry Bags
2 Material Identification by FTIR : Blend of Poly Lactic Acid (PLA) and Poly Butylene 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 (%) : 54.1

Volatile content (%) : 13.2

CO₂ evolved during first 10days in blank vessels (mg/g of volatile content of compost) : 75.3mg/g

Test duration (days) : 117 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	7.3	7.2
2	Blank 2	7.3	7.2
3	Blank 3	7.2	7.2
4	Cellulose 1	7.6	7.3
5	Cellulose 2	7.6	7.3
6	Cellulose 3	7.5	7.2
7	Negative 1	7.4	7.3
8	Negative 2	7.4	7.3
9	Negative 3	7.4	7.2
10	Sample 1	7.6	7.3
11	Sample 2	7.5	7.3
12	Sample 3	7.6	7.2

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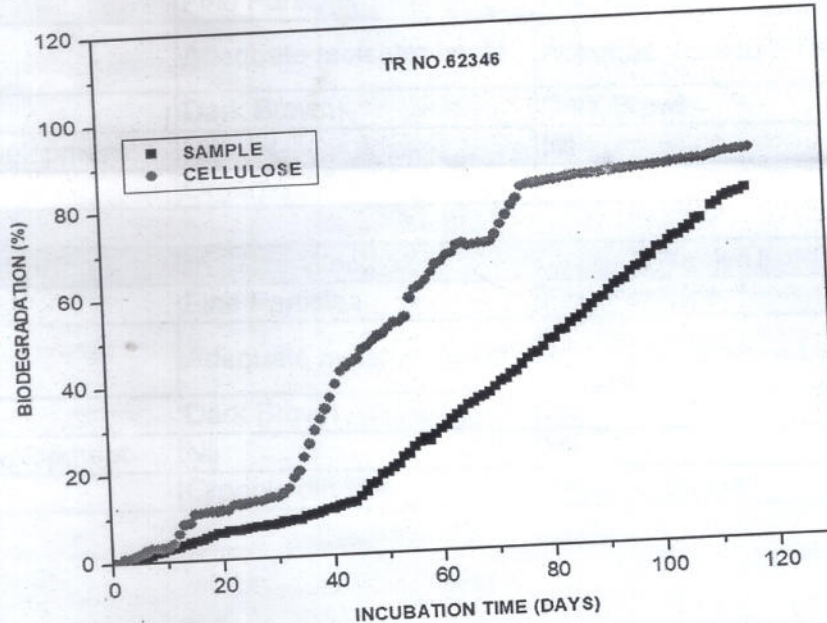
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- 4 **Result:** Percentage biodegradation relative to positive reference
 Sample (Mean) : 90.11% at the end of 117 days
 The reference Material - cellulose : ~ 100%



5 **Visual Observation of Sample**

Description	Week 3		Week 6		Week 9	
	Structure	Cut pieces	Cut pieces	Cut pieces	Fragmented pieces	Fragmented pieces
Moisture	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level
Colour	Pale white	Pale white	Dirty	Dirty	Dirty	Dirty
Fungal Development	None	None	None	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like

Description	Week 12		Week 15		Week 17	
	Structure	Fragmented pieces	Fragmented pieces	Fragmented pieces	Fragmented pieces	Fragmented pieces
Moisture	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level	Adequate moisture Level
Colour	Dirty	Dirty	Dirty	Dirty	Dirty	Dirty
Fungal Development	None	None	None	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like

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परीक्षण परिणाम / **TEST RESULTS**

दिनांक / **Date : 30-03-2021**

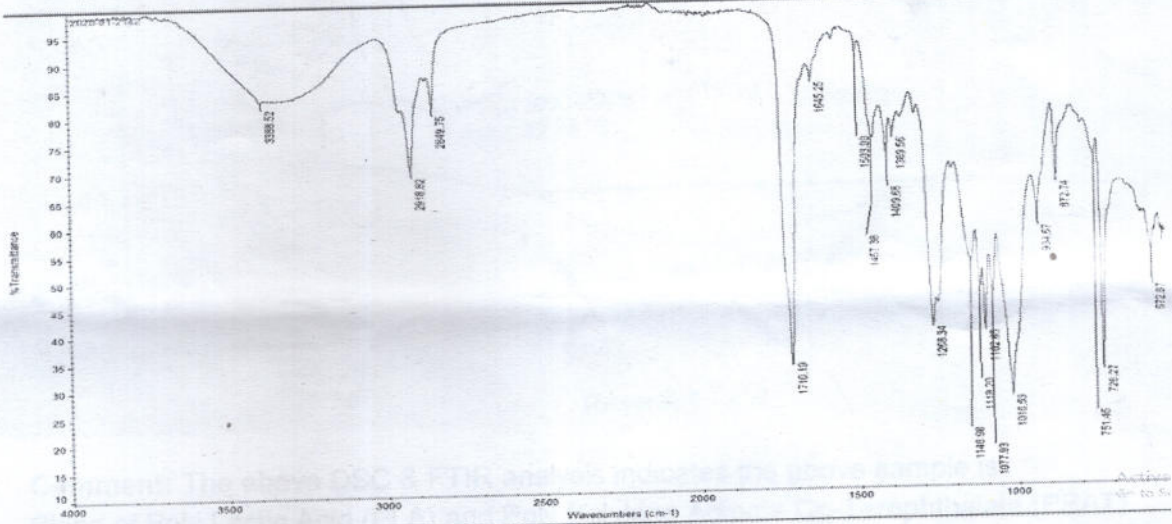
6 Visual Observation of Compost

Description	Week 3	Week 6	Week 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 12	Week 15	Week 17
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): Compostable Carry Bags



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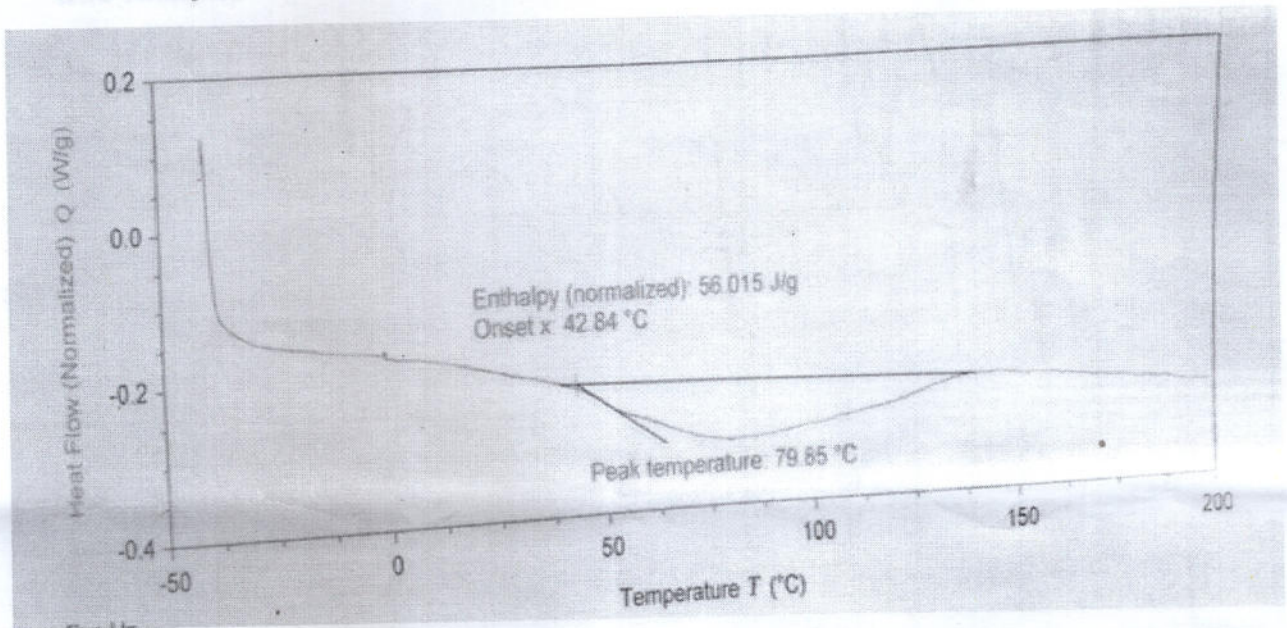
परीक्षण परिणाम / TEST RESULTS

दिनांक / Date : **30-03-2021**

FTIR Interpretation

Wave number (cm ⁻¹)	Nature of Bond
2918	CH ₂ asymmetric stretching
1710	C=O in PLA and PBAT
1457	-CH ₂ Plane Bending
1268	C-O bonds of PBAT
1118	C-O bonds of PBAT
1016	C-O bonds of PBAT
872	O-CH-CH ₃ of ester
726	CH plane of benzene ring

8 DSC Analysis



Comment: The above DSC & FTIR analysis indicates the above sample is Blend of Poly Lactic Acid (PLA) and Poly Butylene Adipate Co-Terephthalate (PBAT)

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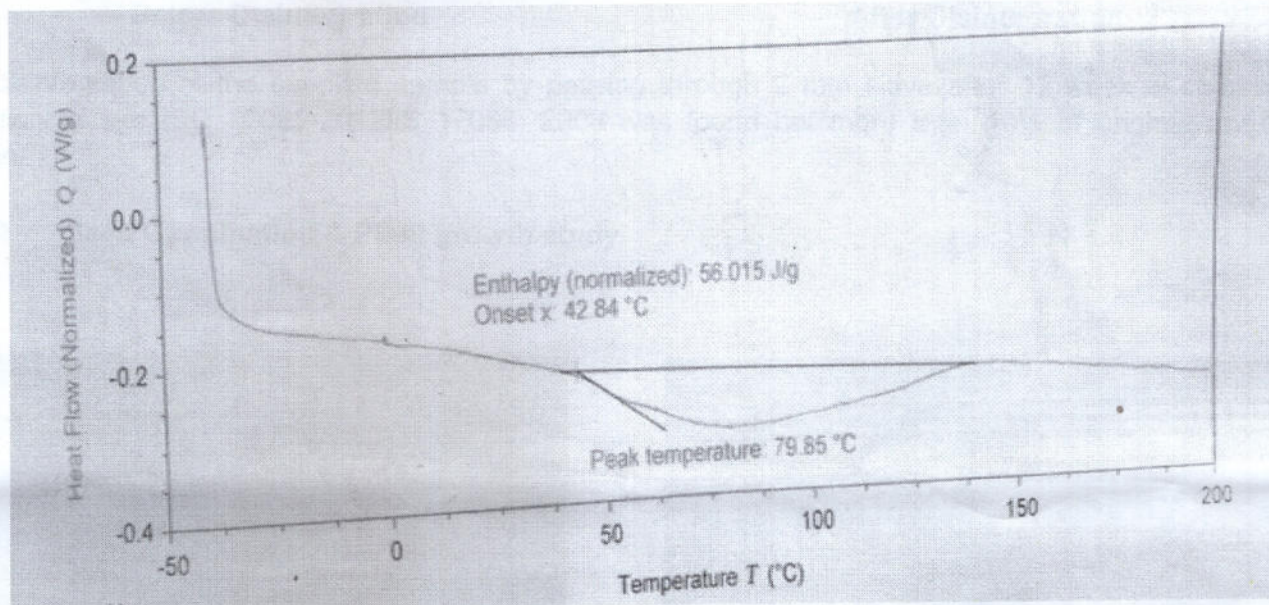
परीक्षण परिणाम / TEST RESULTS

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1016	C-O bonds of PBAT
872	O-CH-CH ₃ of ester
726	CH plane of benzene ring

8 DSC Analysis




Comment: The above DSC & FTIR analysis indicates the above sample is Blend of Poly Lactic Acid (PLA) and Poly Butylene Adipate Co-Terephthalate (PBAT)

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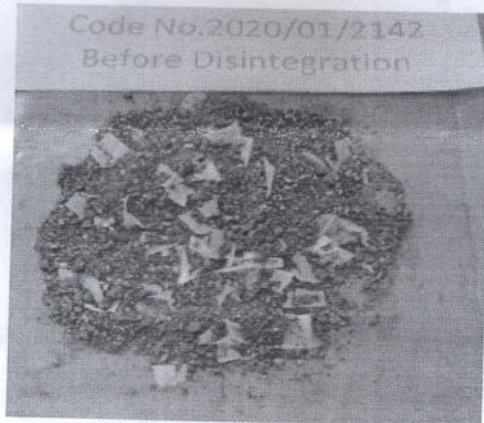
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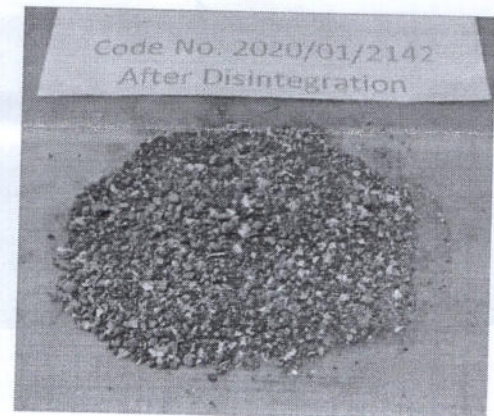
परीक्षण परिणाम / TEST RESULTS

दिनांक / Date :
30-03-2021

9 Disintegration After 12 Weeks



Before Disintegration



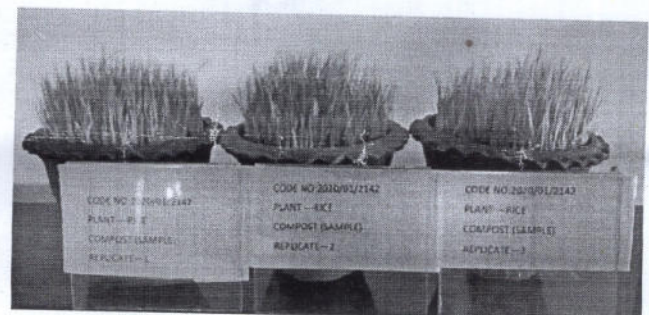
After Disintegration

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

10 Seed Germination & Plant growth study



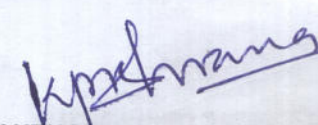
Rice Compost (Control)



Rice Compost (Sample)

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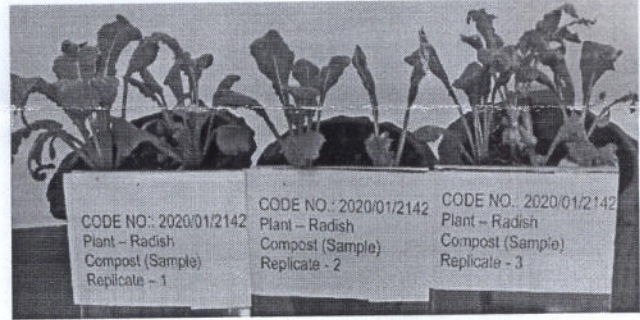
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Radish Compost (Control)



Radish Compost (Sample)

The percentage of seed germination rate is found to be greater than 90% for both Rice and Radish


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