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REVOLUTION
Ecofriendly biodegradable Products & Machinery

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Annexure-I

TR.NO. -01146 ANALYSIS RESULT Date : 02.04.2024

OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2021

To

M/s. Greenware Revolution
42E, Choulpatty Road (Ardhendu Sekhar Naskar Sarani)
Kolkata, West Bengal - 700010

Date of Initiation : **09.08.2023**
Date of Completion : **25.03.2024**

1. **Sample detail: Biodegradable carry bags in different size"** - as stated by the party.
2. **Material Identification by DSC & FTIR:** DSC & FTIR graph indicates the base material of the supplied sample is Polylactic Acid (PLA) & Polybutylene adipate terephthalate (PBAT) based material.
3. **Observation: -**

a.Conditions of reaction mixtures

Origin of compost: Vermicompost, Garden Waste, Municipality Waste.
Reaction Temperature : 58°C (±2°C)
Dry Solid : 52.99(%)
Volatile Solid : 30.30(%)
Test duration : 153 days
Reference material : Cellulose
Volume of reaction vessel : 3000 ml

b. pH of test medium:-

Sl. No.	Composting Vessel	pH(before)	pH(After)
1	Blank 1	7.6	7.4
2	Blank 2	7.8	7.7
3	Blank 3	7.7	7.5
4	Cellulose1	7.4	7.2
5	Cellulose2	7.3	7.1
6	Cellulose3	7.6	7.5
7	Negative 1	7.5	7.4
8	Negative 2	7.7	7.5
9	Negative3	7.5	7.3
10	Sample 1	7.3	7.2
11	Sample 2	7.4	7.2
12	Sample 3	7.1	7.1

02/04/2024

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(Technical Manager)
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02/04/2024

Dr. Akshaya Kumar Palai
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TR.NO. -01146 **ANALYSIS RESULT** Date : 02.04.2024

	Week 6	Week 7	Week 8	Week 9	Week 10
Structure	Film Sample	Film Sample	Film Sample	Film Sample	Film Sample
Moisture	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level
Color	Transparent	Transparent	Transparent	Transparent	Transparent
Fungal Development	None	None	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like

	Week 11	Week 12	Week 13	Week 14	Week 15
Structure	Disintegration initiated	Disintegration observed	Disintegration observed	Disintegration observed	Disintegration observed
Moisture	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level
Color	Transparent	—	—	—	—
Fungal Development	None	None	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like

	Week 16	Week 17	Week 18	Week 19/20	Week 21/22
Structure	Disintegration observed	Disintegration observed	Disintegration observed	Disintegration observed	Disintegration observed
Moisture	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level
Color	—	—	—	—	—
Fungal Development	None	None	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like

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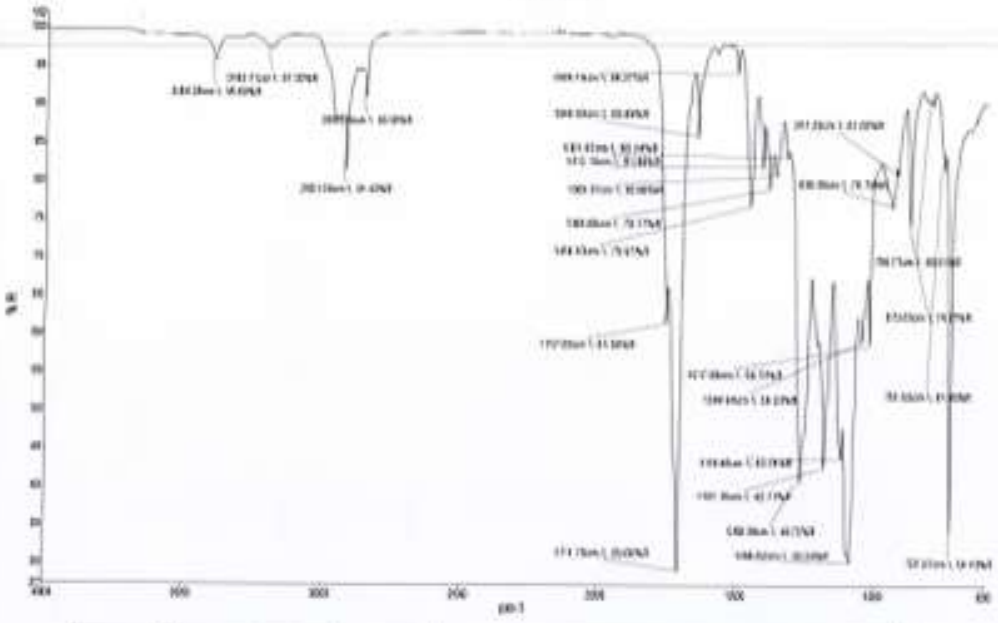
6. **FTIR Analysis:-**

One Side



Wave number (cm^{-1})	Possible Nature of Bond
2850.06, 2921.04	CH Stretch
1711.76, 1757.60	C=O Stretch
1410.18	CH_2 Bend
1268.39, 1086.62	C-O Stretch
727.07	Bending Vibration of CH plane of benzene ring

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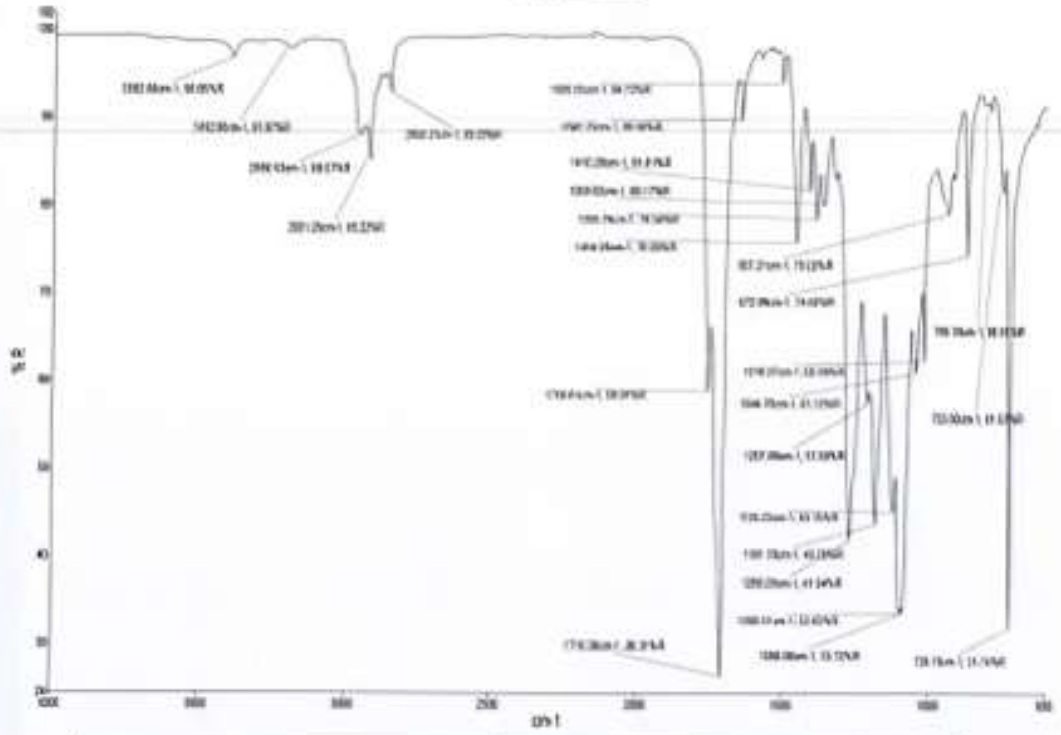
TR.NO. -01146 **ANALYSIS RESULT** Date : 02.04.2024

6.1 FTIR Analysis:-

Opposite Side



Wave number (cm^{-1})	Possible Nature of Bond
2956.53, 2921.20	CH Stretch
1710.38, 1758.61	C=O Stretch
1410.29	CH_2 Bend
1269.20, 1088.06	C-O Stretch
726.78	Bending Vibration of CH plane of benzene ring

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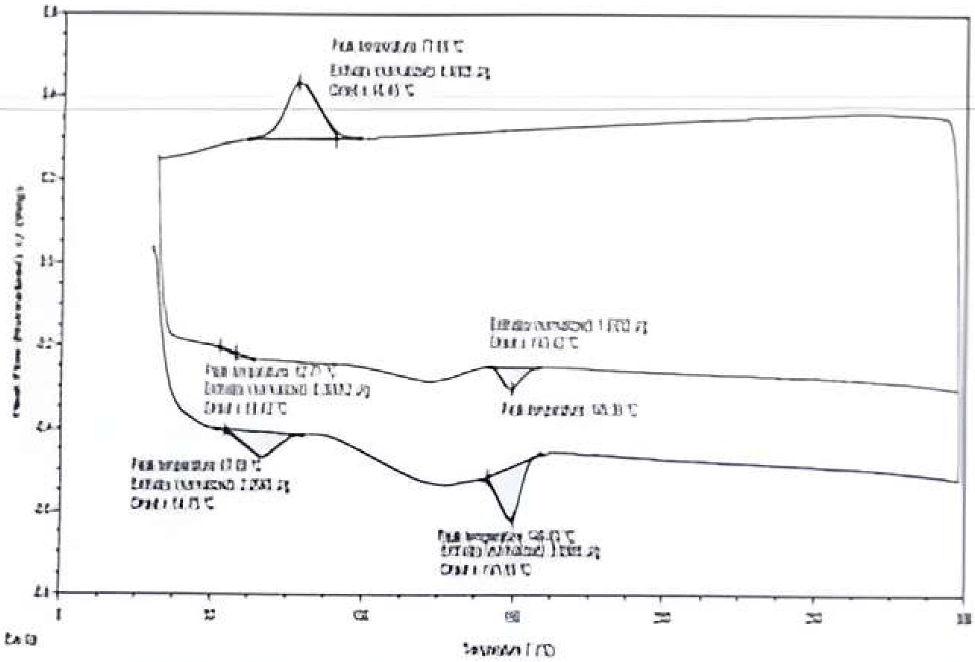
7. **DSC Analysis:-**



Comment: DSC & FTIR graph indicates the above sample is Poly lactic Acid (PLA) & Polybutylene adipate terephthalate (PBAT) based material.

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(Technical Manager)	(Quality Manager)
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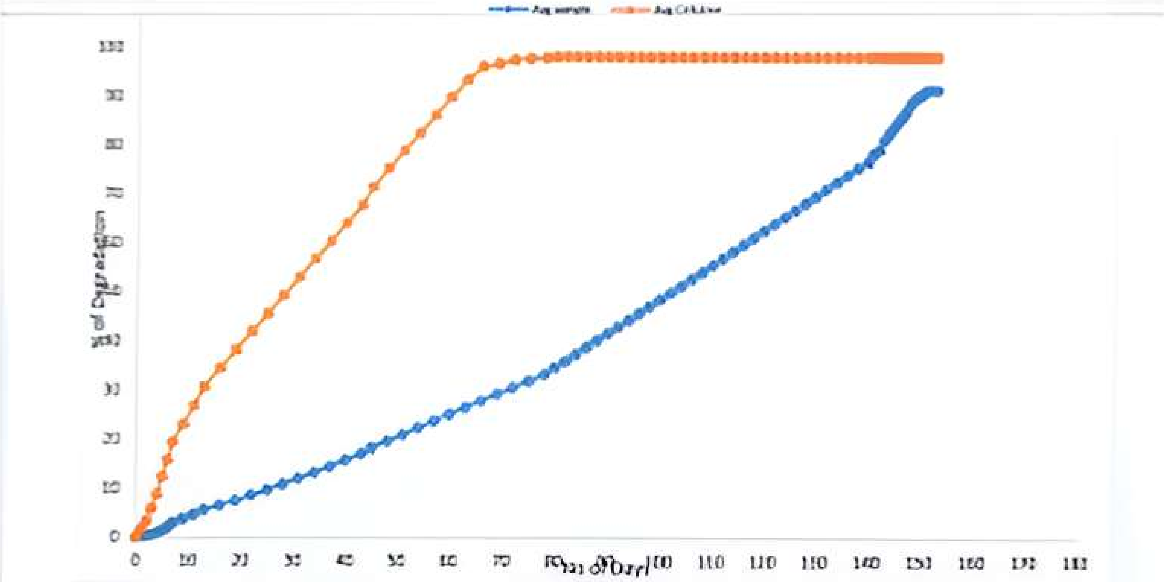
4. **Result:** Percentage biodegradation relative to positive reference

MEAN(%) : 91.44 %
The reference material-cellulose (%) : 100

Degradation Graph of Sample & Cellulose
Sample Code-2306064



5. **Visual Observation:**

	Week 1	Week 2	Week 3	Week 4	Week 5
Structure	Film Sample	Film Sample	Film Sample	Film Sample	Film Sample
Moisture	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level
Color	Transparent	Transparent	Transparent	Transparent	Transparent
Fungal Development	None	None	None	None	None
Smell	Organic/Dirt like	Organic/Dirt like	Organic/Dirt like	Organic/Dirt like	Organic/Dirt like

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8. DISINTEGRATION- AFTER 12 WEEKS

BEFORE DISINTEGRATION

AFTER DISINTIGRATION

Comment:-
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.

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