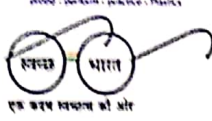


सिपेट : स्कूल फोर एडवांस्ड रिसर्च इन पोलिमेरस
(एस.ए.आर.पि) - एल.ए.आर.पि.एम

रसायन एवं पेट्रोसायन विभाग
रसायन एवं उर्वरक मंत्रालय, भारत सरकार
बी-२५, सी.एन.आई.कॉम्प्लेक्स, पटिया, भुवनेश्वर - 751024
दूरभाष : 0674-2742852 / 2740173 फैक्स - 0674-2740463
ई-मेल : larpmcipet@larpm.in, वेबसाइट : www.larpm.gov.in
मुख्यालय : सिपेट, गुण्डी, चेन्नई - 600 032



CIPET सि पेट



CIPET : SCHOOL FOR ADVANCED RESEARCH
IN POLYMERS (SARP) -LARPM

Department of Chemicals & Petrochemicals
Ministry of Chemicals & Fertilizers, Govt. of India
B-25, C.N.I. Complex, Patia, Bhubaneswar-751024
Phone : 0674-2742852 / 2740173, Fax : 0674-2740463
Email : larpmcipet@larpm.in, Web : www.larpm.gov.in
Head Office : CIPET, Guindy, Chennai - 600 032

LARPM/CIPET/Testing/2020-21/

Date- 17.12.2020

To

Dr. Sambeet Kumar Mallik
M/s. Eshan Ecodrive Private Limited
Plot No -212/10 ,Aerodrome Area Lane -3
Bhubaneswar-751020
Mob-9668800108

Sub -Test Report -Reg.

Dear Sir,

Ref No: 1) Your letter dated 21.04.2020
2) Our Work Order No.: LARPM/BBS./2020-21/004 dated 27.04.2020
3) Interim Test Report No 00121 dated 23.11.2020.

With reference to the above cited subject, please find enclosed herewith Test Report No.00139 dated 17.12.2020.

Kindly acknowledge the receipt of the same.

Thanks & Regards,

Director & Head
(Principal Scientist)

Encl: As above

सिपेट : स्कूल फोर एडवांस्ड रिसर्च इन पोलिमरस
(एस.ए.आर.पि) - एल.ए.आर.पि.एम्

रसायन एवं पेट्रोसायन विभाग
रसायन एवं उर्वरक मंत्रालय, भारत सरकार
बी-२५, सी.एन.आई.कॉम्प्लेक्स, पटिया, भुवनेश्वर - 751024
दूरभाष : 0674-2742852 / 2740173 फैक्स - 0674-2740463
ई-मेल : larpmcipet@larpm.in, वेबसाइट : www.larpm.gov.in
मुख्यालय : सिपेट, गिण्डी, चेन्नई - 600 032



CIPET : SCHOOL FOR ADVANCED RESEARCH
IN POLYMERS (SARP) -LARPM

Department of Chemicals & Petrochemicals
Ministry of Chemicals & Fertilizers, Govt. of India
B-25, C.N.I. Complex, Patia, Bhubaneswar-751024
Phone : 0674-2742852 / 2740173, Fax : 0674-2740463
Email : larpmcipet@larpm.in, Web : www.larpm.gov.in

Head Office : CIPET, Guindy, Chennai - 600 032

CERTIFICATE OF ANALYSIS AS PER IS 17088:2008/ISO 17088:2012

LARPM/CIPET/Testing/2020-21/

Date-17.12.2020

To
M/s. Eshan Ecodrive Private Limited
Plot No -212/10 ,Aerodrome Area Lane -3
Bhubaneswar-751020

Sub -Test Report-Reg.

Dear Sir,

Ref No : 1) Your letter dated 21.04.2020
2) Our Work Order No.: LARPM/BBS./2020-21/004 dated 27.04.2020
3) Interim Test Report No 00121 dated 23.11.2020.

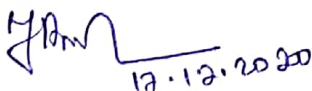
With reference to the above, the submitted sample was analyzed as per IS 17088:2008/ISO 17088:2012.
The summary detail of testing & analysis is given below:

Company Name & Address	: M/s. Eshan Ecodrive Private Limited Plot No -212/10 ,Aerodrome Area Lane -3 Bhubaneswar-751020
Test Standard	: IS 17088:2008/ISO 17088:2012
Sample Details	: "Compostable Carry Bags" -As stated by the party.
Test Report No	: 00139 & dated 17.12.2020
Date of Receipt of sample	: 21.04.2020
Date of Initiation	: 09.06.2020
Date of Completion	: 16.12.2020
Percentage of Compostability	: 91.37
In 161 days	
Requirement of Compostability in	: 90 %
180 days as per IS 17088:2008/ ISO 17088:2012	

The sample submitted by. M/s. Eshan Ecodrive Private Limited, is compostable and the percentage of Compostability in 161 days reported vide test report No. 00139 is 91.37%.

The submitted sample also complies with the terms of Compostability, seed germination and disintegration as per ISO: 17088:2012/IS 17088: 2008.

Thanks & Regards,


17.12.2020
Quality Manager

Encl : Analysis Report

**सिपेट : स्कूल फोर एडवांस्ड रिसर्च इन पोलिमेरस
(एस.ए.आर.पि) - एल.ए.आर.पि.एम्**

रसायन एवं पेट्रोसायन विभाग
रसायन एवं उर्वरक मंत्रालय, भारत सरकार
बी-२५, सी.एन.आई.कॉम्प्लेक्स, पटिया, भुवनेश्वर - 751024
दूरभाष : 0674-2742852 / 2740173 फेक्स - 0674-2740463
ई-मेल : larpmcipet@larpm.in, वेबसाइट : www.larpm.gov.in
मुख्यालय : सिपेट, गिण्डी, चेन्नई - 600 032



**CIPET : SCHOOL FOR ADVANCED RESEARCH
IN POLYMERS (SARP) -LARPM**

Department of Chemicals & Petrochemicals
Ministry of Chemicals & Fertilizers, Govt. of India
B-25, C.N.I. Complex, Patia, Bhubaneswar-751024
Phone : 0674-2742852 / 2740173, Fax : 0674-2740463
Email : larpmcipet@larpm.in, Web : www.larpm.gov.in
Head Office : CIPET, Guindy, Chennai - 600 032

ANALYSIS REPORT

Page : 01 of 03

Report No. : 00139

Date : 17.12.2020

Issued to

M/s. Eshan Ecodrive Private Limited
Plot No -212/10 ,Aerodrome Area Lane -3
Bhubaneswar-751020

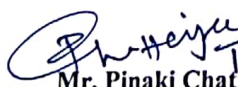
Customer Ref. No. & Date : Your letter dated 21.04.2020
Work order Ref. No. & Date : LARPM/BBS./2020-21/004 dated 27.04.2020
As per Standard : As per part C

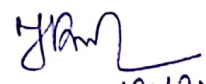
PART A: PARTICULARS OF SAMPLE SUBMITTED

- | | |
|--|--|
| a) Name of the Sample | : "Compostable Carry Bags" -As stated by the party |
| b) Grade/verity/Type/Size/Class etc. | : Film Sample - as supplied by the party. |
| c) Code No. | : Nil. |
| d) Quantity (pcs./mtr/gm/nos) | : 1.5 Kg. |
| e) Mode of packing
(Sealed carton/polypouch/container or not) | : Packed in Envelope. |
| f) Date of receipt of sample | : 21.04.2020 |
| g) Date of Performance of test | : 09.06.2020 – 16.12.2020 |
| h) Any other information | : NIL. |

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- | : Nil |


Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY


17.12.2020
Dr. Manoranjan Biswal
AUTHORISED SIGNATORY

**सिपेट : स्कूल फोर एडवांस्ड रिसर्च इन पोलिमरस
(एस.ए.आर.पि) - एल.ए.आर.पि.एम्**

रसायन एवं पेट्रोरसायन विभाग
रसायन एवं उर्वरक मंत्रालय, भारत सरकार
बी-२५, सी.एन.आई कॉम्प्लेक्स, पटिया, भुवनेश्वर - 751024
दूरभाष : 0674-2742852 / 2740173 फैक्स - 0674-2740463
ई-मेल : larpmpipet@larpmp.in, वेबसाइट : www.larpmp.gov.in
मुख्यालय : सिपेट, गिण्डी, चेन्नई - 600 032



CIPET सि पेट
probe · perform · practice · Plastics



**CIPET : SCHOOL FOR ADVANCED RESEARCH
IN POLYMERS (SARP) -LARPM**

Department of Chemicals & Petrochemicals
Ministry of Chemicals & Fertilizers, Govt. of India
B-25, C.N.I. Complex, Patia, Bhubaneswar-751024
Phone : 0674-2742852 / 2740173, Fax : 0674-2740463
Email : larpmpipet@larpmp.in, Web : www.larpmp.gov.in

Head Office : CIPET, Guindy, Chennai - 600 032

Page : 02 of 03

PART C: TEST RESULTS

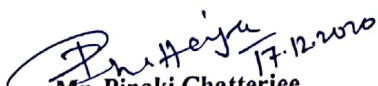
ANALYSIS REPORT

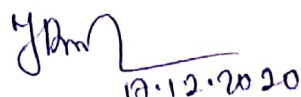
Report no : 00139

Date : 17.12.2020

Sl. No	Name of the Test	Test Method/Standard	Unit	Results Obtained	Specified Requirements
Sample Details: "Compostable Carry Bags"-As stated by the party.					
1.	Material Identification	FTIR/DSC	--	Starch based Polybutylene adipate terephthalate (PBAT) Material.	---
2.	Disintegration (Dry mass remains in 2 mm sieve after 84 days)	ISO 17088:2012 / IS 17088:2008	%	7.12	No more than 10% of original dry mass remain
3.	Ultimate aerobic Biodegradation (with reference to 100% degradation of positive reference)	ISO 17088:2012 / IS 17088:2008	%	91.37 (at the end of 161 days)	> 90 (at the end of the test period not more than 180 days.)
4.	Plant Growth study a) Monocotyledon (Rice) % Seed Emergence b) Dicotyledon (Mungo) % Seed Emergence	ISO 17088:2012 / IS 17088:2008	% %	94.16 94.30	> 90 > 90

Note: The detailed observation on biodegradability test is enclosed as **Annexure-I**.


Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY


17.12.2020
Dr. Manoranjan Biswal
AUTHORISED SIGNATORY

**सिपेट : स्कूल फोर एडवांस्ड रिसर्च इन पोलिमेरस
(एस.ए.आर.पि) - एल.ए.आर.पि.एम्**

रसायन एवं पेट्रोसायन विभाग
रसायन एवं उर्वरक मंत्रालय, भारत सरकार
बी-२५, सी.एन.आई.कॉम्प्लेक्स, पटिआ, भुवनेश्वर - 751024
दूरभाष : 0674-2742852 / 2740173 फैक्स - 0674-2740463
ई-मेल : larpmcipet@larpm.in, वेबसाइट : www.larpm.gov.in
मुख्यालय : सिपेट, गिन्डी, चेन्नई - 600 032



**CIPET : SCHOOL FOR ADVANCED RESEARCH
IN POLYMERS (SARP) -LARPM**

Department of Chemicals & Petrochemicals
Ministry of Chemicals & Fertilizers, Govt. of India
B-25, C.N.I. Complex, Patia, Bhubaneswar-751024
Phone : 0674-2742852 / 2740173, Fax : 0674-2740463
Email : larpmcipet@larpm.in, Web : www.larpm.gov.in
Head Office : CIPET, Guindy, Chennai - 600 032

Page : 03 of 03

ANALYSIS REPORT

Report No.: 00139

Date : 17.12.2020

Sl. No	Name of the Test	Test Method/Standard	Unit	Results obtained	Specified Requirements
5.	Heavy metals concentration(#)	ISO 17088:2012 / IS 17088:2008	ppm		
	Arsenic (As)			0.006	20
	Copper (Cu)			0.179	500
	Nickel (Ni)			BDL (DL: 0.005)	100
	Zinc (Zn)			BDL (DL: 0.003)	2500
	Cobalt (Co)			0.270	--
	Chromium (Cr)			0.022	300
	Molybdenum (Mo)			BDL (DL: 0.006)	--
	Mercury (Hg)			0.005	10
	Cadmium (Cd)			BDL (DL: 0.0008)	20
	Lead (Pb)			0.666	500
	Selenium (Se)			0.002	--

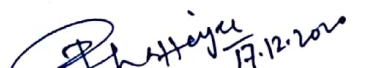
• BDL-Below Detection Limit, DL-Detection Limit

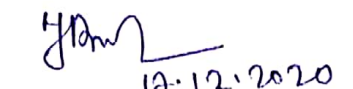
* Based on Municipal waste (Management and Handling) Rules, 1999 notified on 27th September, 1999 by Ministry of Environment and Forests, Government of India. Note that concentration of metals like cobalt, molybdenum, fluorine and selenium is not mentioned in the notification.

PART D: REMARKS: NIL

- Note:**
1. This Test Report / Certificate is issued only for the samples submitted to CIPET:SARP-LARPM.
 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 CIPET:SARP-LARPM within 30 days from the date of issue.
 6. Subcontracted Tests (if any): Test marked as (#) Sub-contracted to the third party laboratory (CIPET, Chennai).

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


Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY


Dr. Manoranjan Biswal
AUTHORISED SIGNATORY

OBSERVATION FOR BIODEGRADABILITY TEST AS PER ISO 17088:2012/IS17088:2008

To

M/S Eshan Ecodrive Private Limited
Plot No -212/10 ,Lane -3,Aerodrome Area
Bhubaneswar-751020

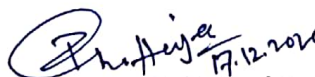
Date of Initiation : 09.06.2020

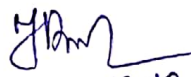
Date of Completion : 16.12.2020

1. Sample detail: "Compostable Carry Bags" - As Stated by the party.
2. Material Identification by DSC & FTIR: DSC & FTIR graph indicates the base material of the supplied sample is Starch based Polybutylene adipate terephthalate (PBAT) Material.
3. Observation:-
 - a. Conditions of reaction mixtures

Origin of compost: Livestock excreta, municipal and vegetable waste
Reaction Temperature : 58°C (±2°C)
Dry Solid : 53.92(%)
Volatile Solid : 22.51(%)
CO₂ evolved during 1st 10days in blank vessels : 56.57 mg/g of volatile solids of compost
Test duration : 161 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	7.4	7.3
2	Blank 2	7.3	7.3
3	Blank 3	7.4	7.4
4	Cellulose1	7.5	7.3
5	Cellulose2	7.7	7.5
6	Cellulose3	7.8	7.7
7	Negative 1	7.8	7.6
8	Negative 2	7.6	7.4
9	Negative3	7.7	7.5
10	Sample 1	7.8	7.6
11	Sample 2	7.5	7.4
12	Sample 3	7.7	7.5

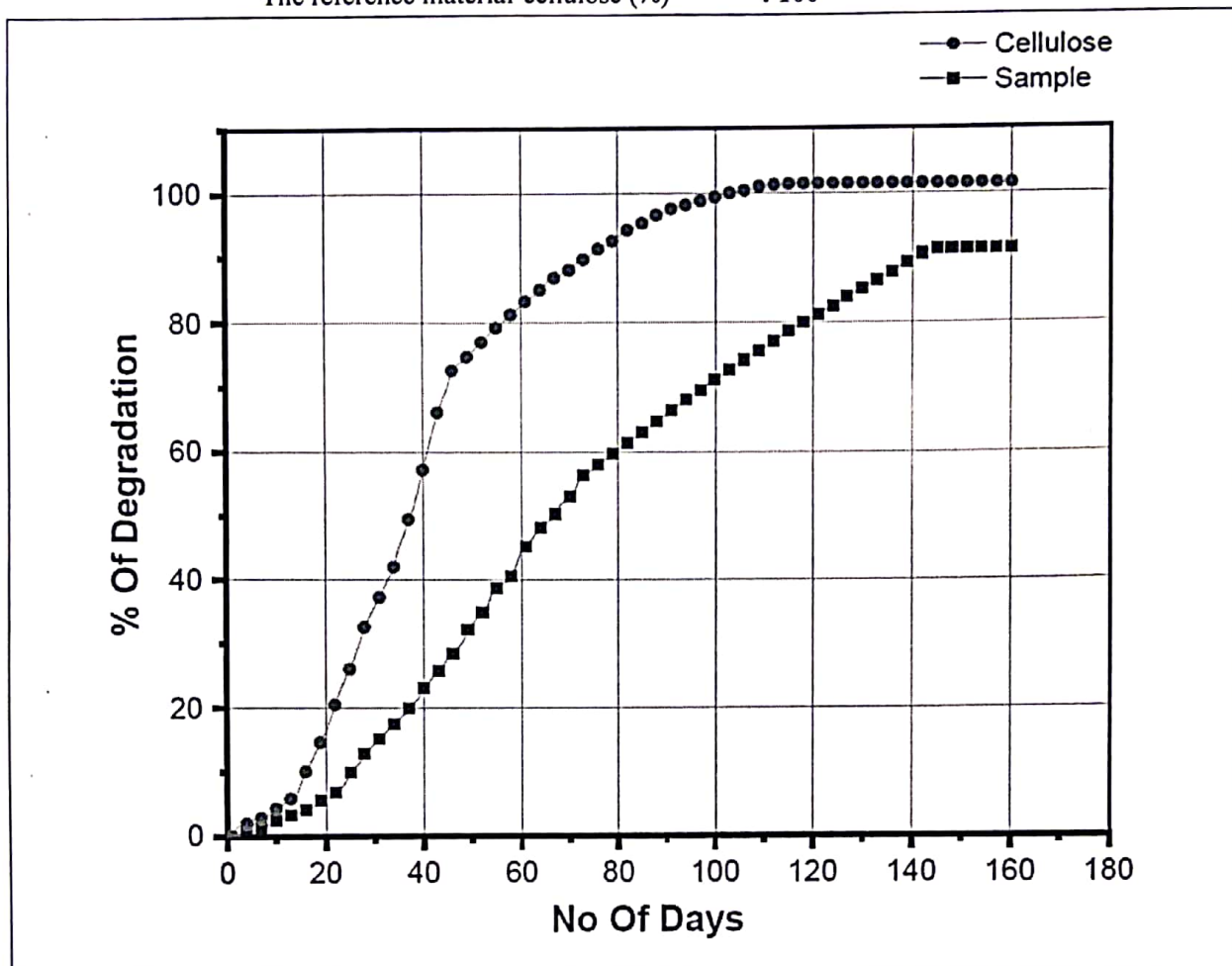

Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY


17.12.2020
Dr. Manoranjan Biswal
AUTHORISED SIGNATORY

4. Result: Percentage biodegradation relative to positive reference

MEAN(%) : 91.37

The reference material-cellulose (%) : 100



5. Visual Observation:-

	Week 1	Week 2	Week 3	Week 4	Week 5
Film sample	Film sample	Film sample	Film sample	Film sample	Film sample
Structure					
Moisture	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level
Color	White	White	White	White	White
Fungal Development	None	None	None	None	None
Smell	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like	Organic/dirt like

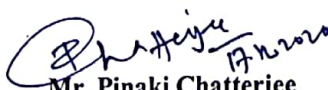
Pinaki Chatterjee
17.12.2020
Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY

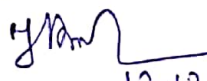
Dr. Manoranjan Biswal
17.12.2020
Dr. Manoranjan Biswal
AUTHORISED SIGNATORY

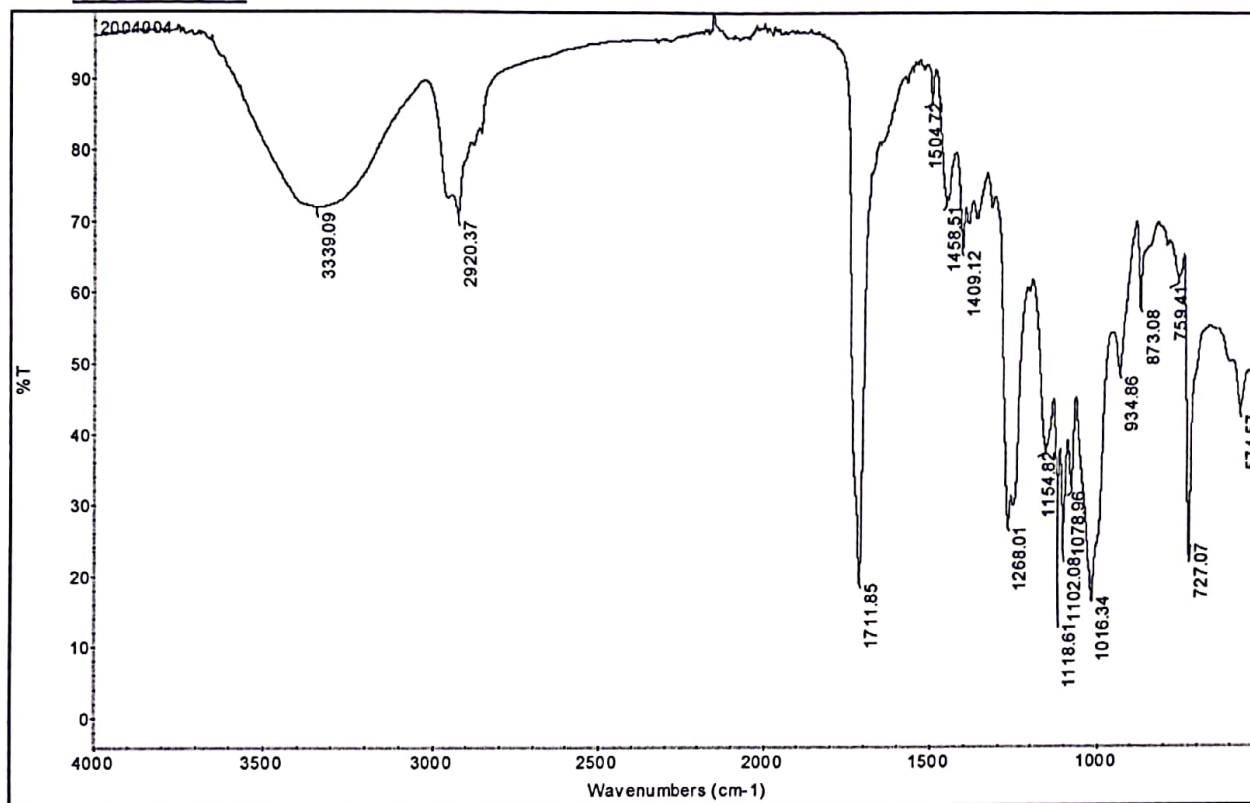
	Week 6	Week 7	Week 8	Week 9	Week 10
Structure	Film sample	Film sample	Film sample	Film sample	Disintegration Initiated
Moisture	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level
Color	White	White	White	White	-----
Fungal 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 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

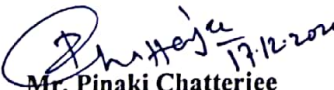
	Week 16	Week 17	Week 18/19	Week 20/21	Week 22/23
Structure	Disintegration observed	Disintegration observed	Disintegration observed	Disintegration observed	Disintegration observed
Moisture	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate moisture Level	Appropriate 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

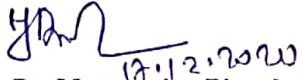

 Mr. Pinaki Chatterjee
 AUTHORISED SIGNATORY

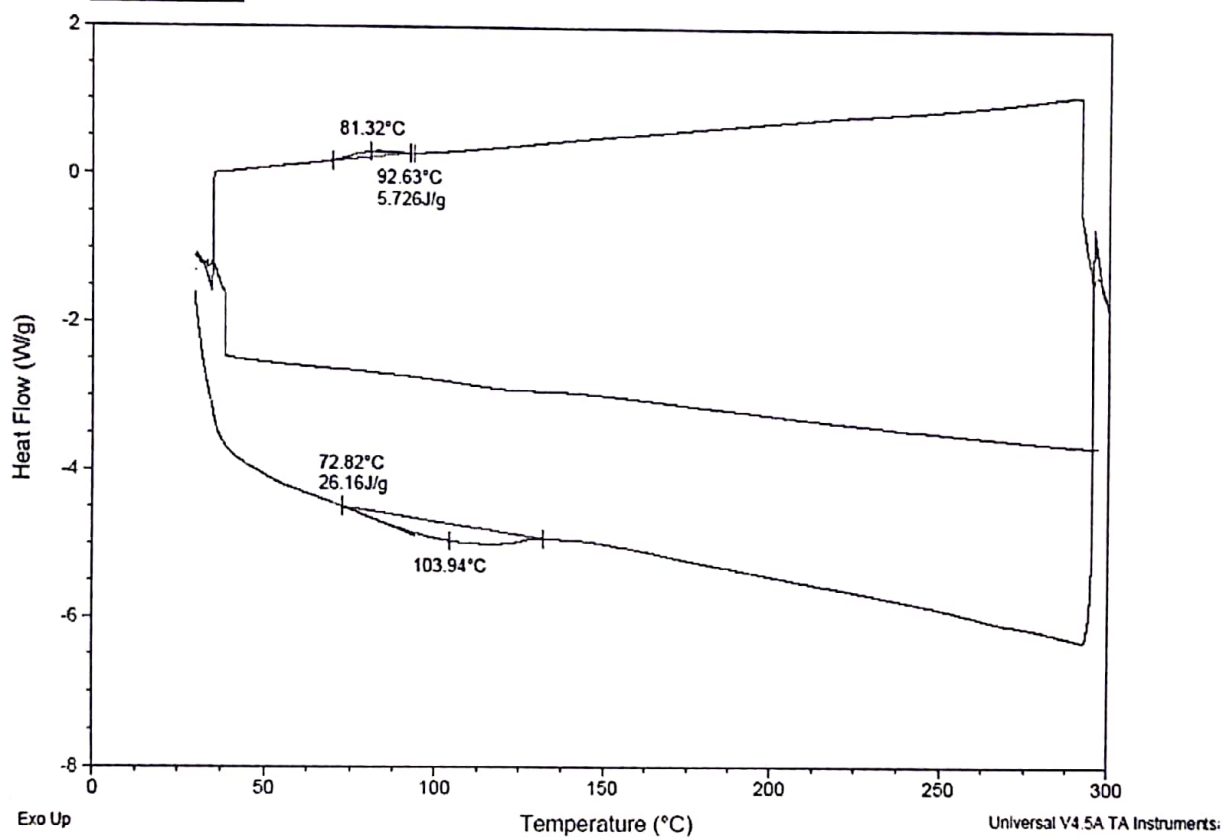

 17.12.2020
 Dr. Manoranjan Biswal
 AUTHORISED SIGNATORY

6. FTIR Analysis:

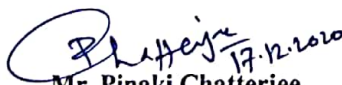
Wave number (cm ⁻¹)	Possible Nature of Bond
3339.09	CH Stretch
2920.37	CH Stretch
1711.85	C=O Stretch
1458.51	CH ₂ Bend
1268.01	C-O Stretch
1102.08	C-O Stretch
727.07	Bending Vibration of CH plane of benzene ring

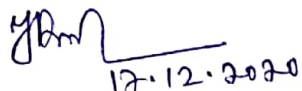

 Mr. Pinaki Chatterjee
 AUTHORISED SIGNATORY


 Dr. Manoranjan Biswal
 AUTHORISED SIGNATORY

7. DSC Analysis:-

Comment: DSC & FTIR graph indicates the base material of the supplied sample is Starch based Polybutylene adipate terephthalate (PBAT) Material.


Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY


Dr. Manoranjan Biswal
AUTHORISED SIGNATORY

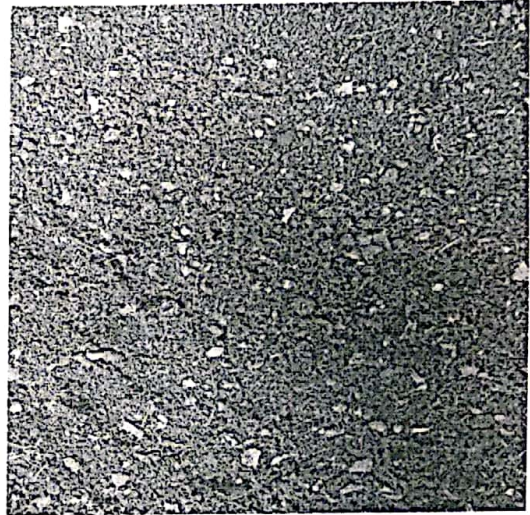
8.DISINTEGRATION- AFTER 12 WEEKS

BEFORE DISINTEGRATION
2004004



BEFORE DISINTEGRATION

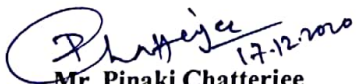
AFTER DISINTEGRATION
2004004

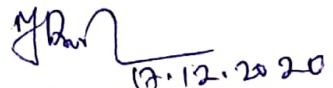


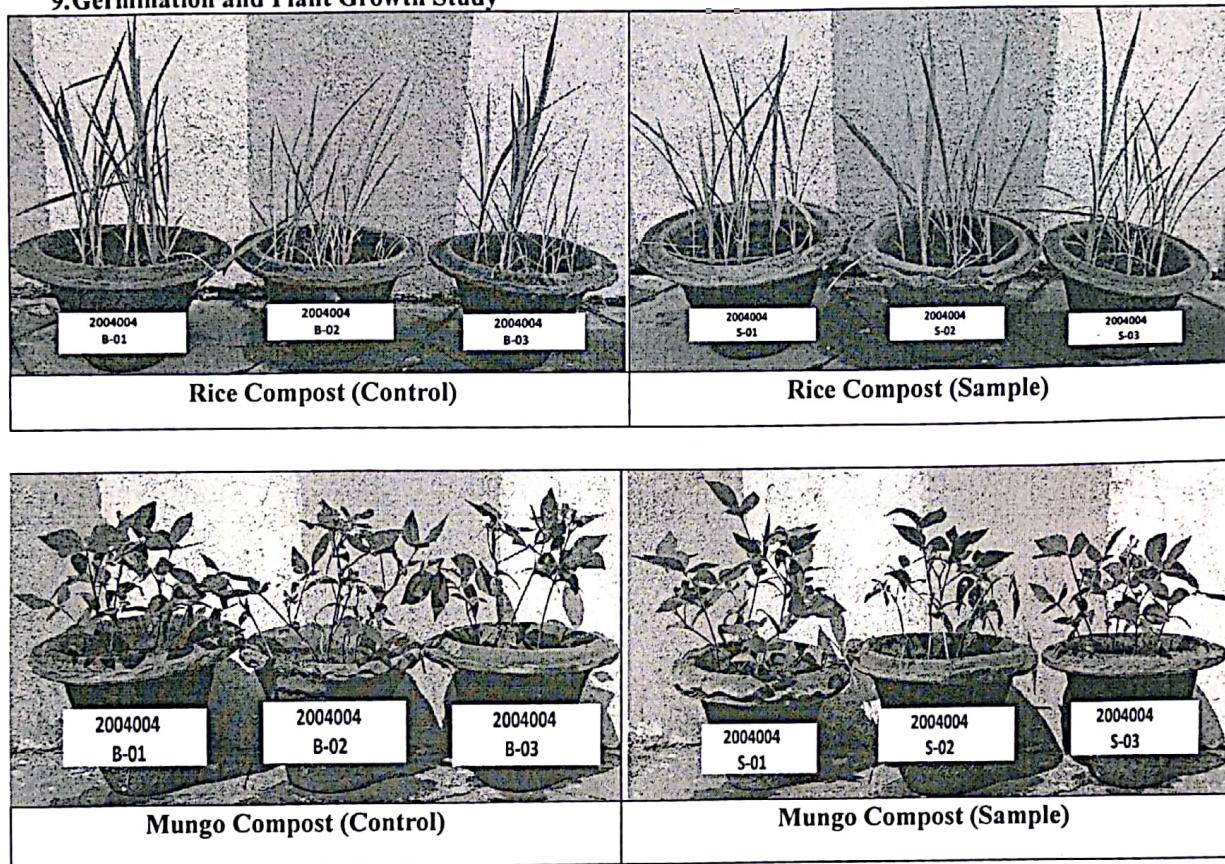
AFTER DISINTEGRATION

Comment:-

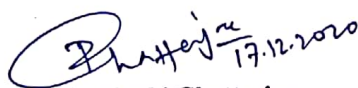
The disintegration of the supplied sample by passing through 2 mm sieve after 12 week in composting condition as per ISO 17088-2012/IS 17088: 2008 was found not more than 10% of original dry mass remain.

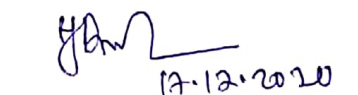

17.12.2020
Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY


17.12.2020
Dr. Manoranjan Biswal
AUTHORISED SIGNATORY

9. Germination and Plant Growth Study

The percentage of seedling germination rate was found greater than 90% for both Rice and Mungo Bean.


Mr. Pinaki Chatterjee
AUTHORISED SIGNATORY


Dr. Manoranjan Biswal
AUTHORISED SIGNATORY