



TEST REPORT / REPORT OF ANALYSIS

Record No

2022/CAA/7.8/01- 002409A6

Document No

QR/IPL/CAA/7.8/01-03

PROGRESS REPORT

IS 17899 T : 2022

ASSESSMENT OF BIODEGRADABILITY OF PLASTICS IN VARIED CONDITIONS (Anaerobic)

INTERTEK INDIA PRIVATE LIMITED


IPL/17025/ENV/QF/7.8/01-03

Issue No.: 02

Issue Date.: 22.12.2022

Amend No.: 01

Amend Date.: 29.05.2023

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Client: BAGLA POLIFILMS LIMITED

Sample Registration Date: 21/07/2022

Analysis starting date: 21/07/2022

Analysis completed on: in process

Name of product: BIODEGRADABLE POLYOLEFIN SHRINK FILM(POF)

Quantity received and packing: - 500gms packing

Sample details: BIODEGRADABLE POLYOLEFIN SHRINK FILM(POF)

Test Required: IS 17899 T: 2022 ASSESSMENT OF BIODEGRADABILITY OF PLASTICS IN VARIED CONDITIONS (Anaerobic)


Sampling done by: Sample not drawn by Intertek

Report No. MUM/002409A6/2022

Report Date: 11/07/2023

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LABORATORY

Testing as presented in this report was conducted by Environmental division of Intertek India Private Limited. The testing facility is located at F wing, 2nd Floor, Chandivali Saki vihar Road, Andheri (East), Mumbai – 400 072, India.

SAMPLE RECEIPT

The sample was received on 21/07/2022 at the Intertek testing facility. The sample was sent through courier. Sample was at ambient temperature in good condition with no evidence of damage or contamination. No temperature preservation was required.

SAMPLE DESCRIPTION:



Figure 1 BIODEGRADABLE POLYOLEFIN SHRINK FILM(POF)

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PROJECT DESCRIPTION:

BIODEGRADABLE POLYOLEFIN SHRINK FILM(POF) were submitted by BAGLA POLIFILMS LIMITED for testing under standard IS 17899T:2022. This Standard specifies the procedures and assessment of biodegradability of plastics under varied conditions. This provisional standard addresses the following aspects:

1. Biodegradation
2. Negative effects of resulting biomass on terrestrial plant growth/organism.
3. Negative effects of the quality of the resulting biomass including the presence of high levels of regulated heavy metals.

This provisional standard is applicable for assessing the biodegradability of plastics under anaerobic conditions.

Table 1 Assessment of Anaerobic Biodegradability (IS 17899 T) in Plastics.

Sr. No.	Characteristics	Requirement	Method of Test followed
1	Ultimate anaerobic biodegradation, Minimum	90 percent within 2 years	IS/ISO 15985
2	Regulated Heavy Metal Analysis (mg/kg on dry mass basis, Maximum)		
	Arsenic (as As)	10.00	IS 3025 (Part 65)
	Cadmium (as Cd)	5.00	
	Chromium (as Cr)	50.00	
	Copper (as Cu)	300.00	
	Lead (as Pb)	100.00	
	Mercury (as Hg)	0.15	
	Nickel (as Ni)	50.00	
Zinc (as Zn)	1000.00		
3	Eco-toxicity Test		
	Assessment of adverse impact on environment (Terrestrial plants growth test), Minimum	90 percent plant germination and plant biomass compared to control.	OECD 208/Annex-C of IS/ISO 17088

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Determination of acute/chronic ecotoxicity effects to earthworm, Minimum	90 percent of surviving earthworm grown in sample compost exposed to test material as well as reference compost exposed to reference material	ISO 11268-1 / Annex-D of IS/ISO 17088 and ISO 11268-2 / Annex-E of IS/ISO 17088
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ULTIMATE ANAEROBIC BIODEGRADATION AS PER IS/ISO 15985

Breakdown of an organic compound by microorganisms in the absence of oxygen to carbon dioxide, methane, water, and mineral salts of any other elements present (mineralization) plus new biomass.

PROJECT DESCRIPTION:


BIODEGRADABLE POLYOLEFIN SHRINK FILM(POF) were submitted by BAGLA POLIFILMS LIMITED for testing under standard ISO 15985:2014 This test method covers the determination of the degree and rate of anaerobic biodegradation of plastic materials in high-solids anaerobic conditions. The test materials are exposed to a methanogenic inoculum derived from anaerobic digesters operating only on pretreated household waste. The anaerobic decomposition takes place under high-solids (more than 30 % total solids) and static non-mixed conditions. This test method is designed to yield a percentage of conversion of carbon in the sample to carbon in the gaseous form under conditions found in high-solids anaerobic digesters, treating municipal solid waste.

INOCULUM COLLECTION AND CONDITIONING

The anaerobic digested sewage sludge (Figure 2) mixed with household waste was obtained from the Chembur (Mumbai). To make the sludge adapted and stabilized during a short post-fermentation at 53°C, the sludge was pre-incubated (one week) at 53°C. This means that the concentrated inoculum was not fed but allowed to post ferment the remains of previously added organics allowing large easily

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biodegradable particles were degraded during this period and reduce the background level of biogas from the inoculums itself.



Figure 2: Anaerobic microbial inoculum

INOCULUM PROPERTIES

A sample of the anaerobic digested sewage sludge was analyzed for pH, percent dry solids, Volatile Fatty Acids and NH₄⁺-N as well as, the amount of CO₂ and CH₄ evolution during the testing. Table 1 lists the results of this initial testing.

METHODOLOGY:

Inoculum Medium: Remove enough inoculum (approximately 15 kg) from the post-fermentation vessel and mix carefully and consistently by hand in order to obtain a homogeneous medium. Test three replicates each of a blank (inoculum only), Positive control (Reference material) (thin-layer chromatography cellulose), negative control (optional), and the test substance being evaluated.

Manually mix 1000 g wet weight (at least 20 % dry solids) of inoculum in a small container for a period of 2 to 3 min with 15 to 100 g of volatile solids of the test substance or the controls for each replicate. For the three blanks containing inoculum only, manually mix 1000 g of the same inoculum in a small container for a period of 2 to 3 min with the same intensity as was done for the other vessels containing test substance or controls. Determine the weight of the inoculum and test substance added to each

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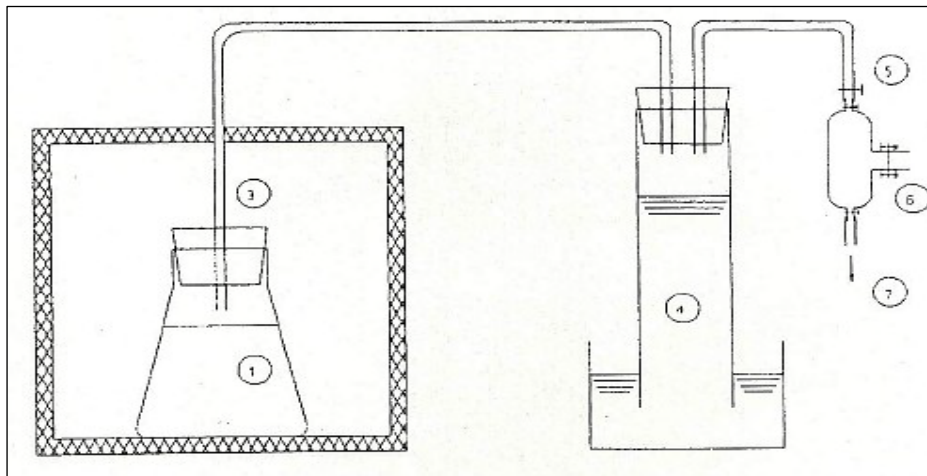
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individual Erlenmeyer flask accurately. Add the mixtures to a 2-L wide-mouth Erlenmeyer flask and gently spread and compact the material evenly in the flask to a uniform density.

After placing the Erlenmeyer flask in incubator, connect it with the gas collection device. Incubate the Erlenmeyer flasks in the dark or in diffused light at 52°C (±2°C) for thermophilic conditions, The incubation time shall be run until no net gas production is noted for at least five days from both the Positive control (Reference material) and test substance reactors. Control the pH of the water used to measure biogas production to less than two by adding HCl.

ANAEROBIC DIGESTER SETUP FOR THE PLASTIC BIODEGRADATION

The biodegradation testing of sample was performed in the digester as shown in the (Figure-3).




- 1. Digester
- 2. Incubator
- 3. Gas outlet
- 4. Gas collector
- 5. Valve
- 6. Gas Sampling
- 7. Gas Discharge

Figure-3: Digester setup

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RESULT:

The most important biochemical characteristics of the inoculum such as pH, Volatile Fatty Acids, NH₄⁺-N— and dry solids were studied.

Table 2: Results of Initial testing of the anaerobic digested sewage sludge

Parameters	Requirement	Actual results
pH	7.5 to 8.5	7.53
Kjeldahl nitrogen	0.5 to 2 g/kg wet weight	1.38
Dry Solids at 105 °C	>20%	43.00
Volatile fatty acid	Below 1 g/kg wet weight	0.71

The biogas volume in the gas sampling bag was measured (Table- 2). Presence of gas in the gas collector of Positive control (Reference material) indicated that the inoculum was viable and gas displacement was observed both in Positive control (Reference material) and Test Sample.

ISO 15985 states that for the test to be considered valid, the positive control (Reference Material) must achieve more than 70 % biodegradation after 15 days with deviation less than 20% of the mean between the replicates.

Positive control (Reference material) showed 73.24 % on 27th day with less than 20% of the mean difference between the replicates.

The gas displacement observed after 315 days is as shown in the table below.

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Table-3: Biogas volume of the evolved gas during the biodegradation process at 315 days

Biodegradation Test	Total Volume 315 days (mL)
Inoculum	4200
Positive control (Reference material)	9910
BIODEGRADABLE POLYOLEFIN SHRINK FILM (POF) sample	7600

The percent biodegradation of Positive control (Reference material) and Test sample was calculated by the measured cumulative carbon dioxide and methane production from each flask after subtracting carbon dioxide evolution and methane evolution from the blank samples at the end of 315 days of testing. Calculations were based on Total Organic Carbon obtained of both Positive control (Reference material) and Test sample.

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Table-4: Percentage biodegradability of Test sample with respect to Positive control (Reference material) Cellulose.

Group	Inoculum control	Positive control (Reference material)	BIODEGRADABLE POLYOLEFIN SHRINK FILM(POF) Sample
Weight	1000 ml	10.1785 g	10.4775 g
Total volume (ml)	4200.00	9910.00	7600.00
% CH ₄	15.40	39.20	36.20
Volume of CH ₄ (ml)	646.80	3884.72	2751.20
weight of CH ₄ (g)	0.4627	2.7791	1.9682
% CO ₂	18.50	41.20	39.50
Volume of CO ₂ (ml)	777.00	4082.92	3002.00
Weight of CO ₂ (g)	1.5385	8.0842	5.9440
Total weight of carbon in grams	0.7624	4.2671	3.0810
Theoretical weight of carbon in grams (Ci)	-	3.8078	8.2961
Biodegradation	-	0.9962	0.2795
% Biodegradation	-	99.62	27.95

----- End of Report -----

Authorized Signatory



Jayashree Acharya
Assistant Manager- Environment laboratory

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