TEST REPORT

Intertek India Private Limited
"F" wing Tex Centre,
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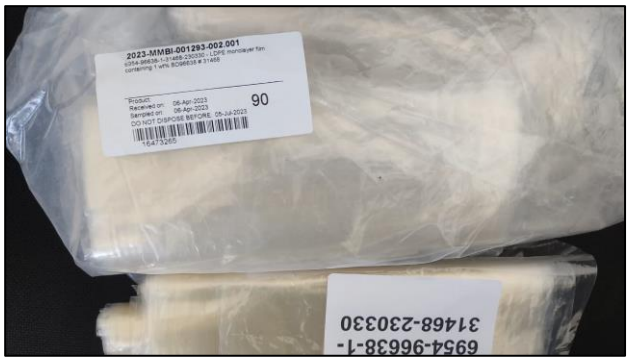
Off. Saki Vihar Road, Andheri (East)
Mumbai – 400 072, India.
Tel : +91 22 42450100
www.intertek.com

Report No.: MUM/001293BR/2023	**Sample No:** 16473265	**Report Date:** 26/02/2025

Sample Registration Date	06/04/2023
Analysis Starting Date	06/04/2023
Analysis Completed on	25/01/2025
Sampling Done by	Sample drawn and supplied by customer
Deviation from the test methods:	None
Packaging Condition/sealed/unsealed	Sealed with box
Sample Image	 **Figure 1: Test sample**

DETAILS PROVIDED BY THE CUSTOMER

Customer Name:	WELLS PERFORMANCE MATERIALS LIMITED
Contact Person:	Dr. Gary Ogden
Address:	Emerald Way, Stone Business Park, Stone, Staffordshire. ST15 0 SR UK
Sample submitted as	Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch
Description on label/Sample Bottle	Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch
Sample type	Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch
Quantity	1 box
Mode of Packaging	Courier Box
Sample condition	Sample was at ambient temperature in good condition
Test Method	ASTM D6954 - Exposing and Testing Plastics that Degrade in the Environment by a Combination of Oxidation and Biodegradation

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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 06/04/2023 at the Intertek testing facility. The sample was sent through courier. The sample was at ambient temperature in good condition with no evidence of damage or contamination. No temperature preservation was required.

PROJECT DESCRIPTION

The sample Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch – Laboratory reference No.16473265 were submitted by WELLS PERFORMANCE MATERIALS LIMITED for testing under standard ASTM D6954.

TEST METHOD

ASTM D6954 standards are used in three tiers for accelerating and measuring the loss in properties and molecular weight by thermal and photo oxidation processes and other abiotic processes (Tier 1), measuring biodegradation (Tier 2), and assessing ecological impact of the products from these processes (Tier 3).

Description of three Tiers:

1) **Abiotic Degradation (Tier 1):** Using either accelerated or real time conditions, samples are subjected to a combination of oxygen, heat and/or light to reduce the molecular weight and/ or mechanical properties. Tier 1 measures the rate and extent of molecular weight loss resulting from oxidation that is indicative of losses in physical properties from oxidation. ASTM D 5208 covers the specific procedures applicable for fluorescent Ultraviolet (UV) exposure of photodegradable plastics

2) **Biotic Degradation (Tier 2):** The residues from Tier 1 are retrieved from biodegradation testing using the environment in which the material is intended to end up after disposal (compost, soil, water, and landfill). In Tier 2, after the test samples are exposed to the abiotic degradation process described in Tier 1, the entire test material is subjected to biodegradation tests as per ASTM D5338. The time profile of carbon dioxide evolution is recorded and the time to reach the appropriate thresholds are noted.

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3) **Eco- toxicity (Tier 3):** By using of different species of plant, the effect of the residues from Tier 2 on the growth and survival can be determined. Tier 3 involves considerations of the ecological impacts in the final disposal medium such as soil, as in all biodegradation testing methods, which is basically a comparison of the test medium before and following oxidation and biodegradation.

ABIOTIC DEGRADATION (TIER 1)

As mentioned in ASTM D5208, Cycle C - continuous UV with uninsulated black panel temperature controlled at 50°C is used for the study. Use Cycle C for materials that will be used for toxicity testing after exposure. This is essential because cycles that use condensation can wash away by-products of photochemical degradation. For thin films, the exposure period would be the time required for the film to reach 5 % or less elongation to break (Practice D3826) and the fragmented film to reach a recorded average weight-average molecular weight (MW) of 5000 or less.

A sample from Tier 1 residue is dissolved in an appropriate nonreactive solvent and the gel phase, if any, separated by filtration, the gel dried, and the amount of gel reported as weight fraction of total sample. This is regarded as non-degradable fraction of polymer. For measuring the extent of disintegration/fragmentation, a sieve test is performed. For products consisting of a single polymer (homopolymers or random copolymers), 60 % of the organic carbon must be converted to carbon dioxide before ending the test, and the gel content generated in Tier 1 must be no higher than 10 %. For products consisting of more than one polymer (block copolymers, segmented copolymers, blends, or addition of low molecular weight additives), 90 % of the organic carbon must be converted to carbon dioxide, before ending the test.

In Tier 1, the loss in weight of the sample is measured. The molecular weight and/or tensile elongation of the samples before and after the exposure are determined and recorded, along with % gel. This practice is intended to induce property changes associated with conditions that might be experienced when the material is discarded as litter, including the effects of sunlight, moisture, and heat.

For thin films, the pass Tier 1 requires reaching 5 % or less elongation to break and the fragmented film to reach a recorded average weight-average molecular weight (MW) of 5000 or less.

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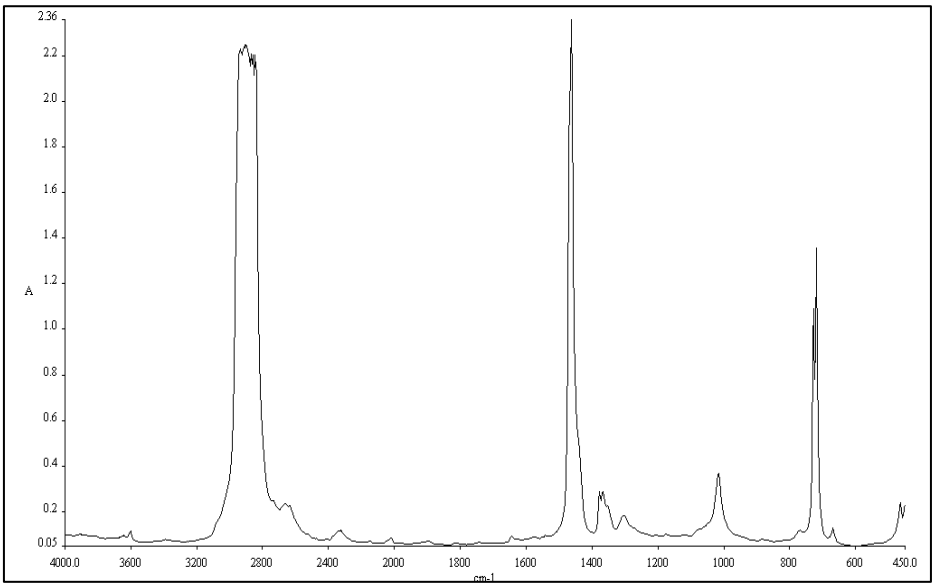
FTIR SPECTRA

FTIR spectra of Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch shown in Graph 1 to Graph 5 shows the IR bands characteristics. Degradation of polymers is mainly due to photooxidation and thermo oxidation causing the chain scission and cross-linking of polymer backbone, the formation of carbonyls (C=O) and vinyl (CH2=CH) groups, and, finally, changes in the conformation and crystallinity of the polymer.

Different peak in the spectra indicates the presence of different chromophoric groups such as carbon-carbon double bonds (C=C) and carbonyl groups (C=O), which are capable of absorbing UV energy. Graph 2 and Graph 5 show the Infrared spectra of Irradiated film and Graph 6 show the overlay spectra from the initial measurement through exposure up to 2000 hours. Notable visual differences are observed at various intervals, including the initial spectrum and those corresponding to 500, 1000, 1500, and 2000 hours of exposure. These changes indicate the progression of spectral characteristics over time.



Graph 1: FTIR Spectra of initial unexposed Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch (16473265)

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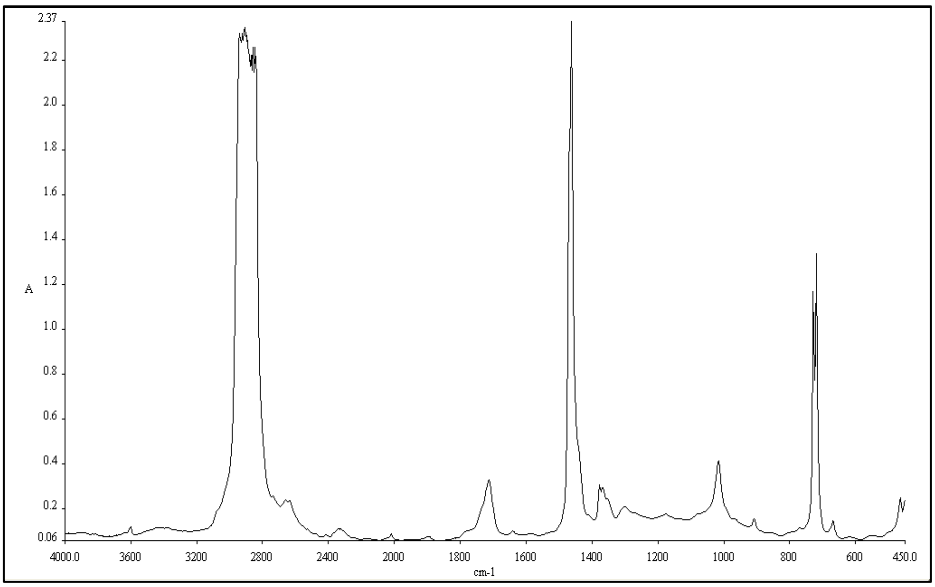
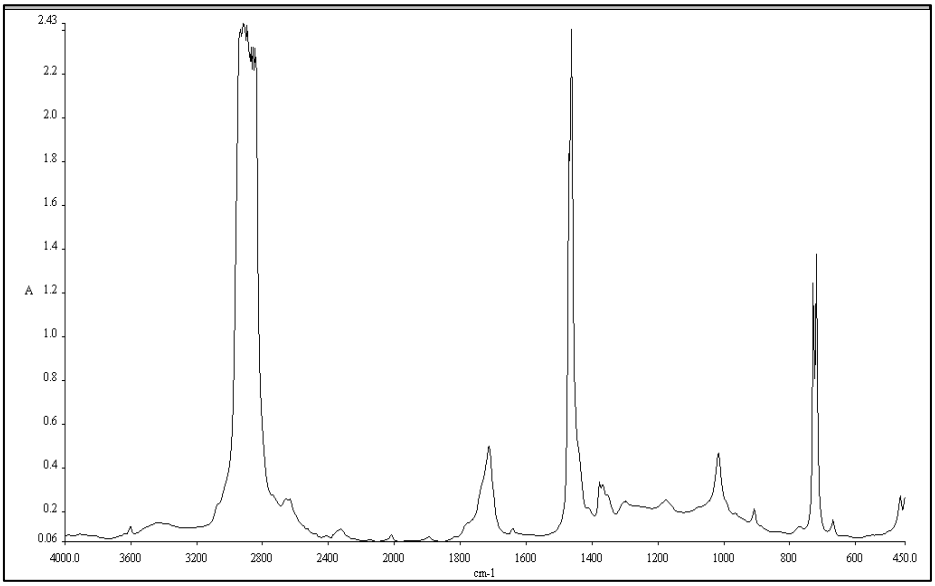


Graph 2: FTIR Spectra of irradiated Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) for 500 hrs



Graph 3: FTIR Spectra of irradiated Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) for 1000 hrs

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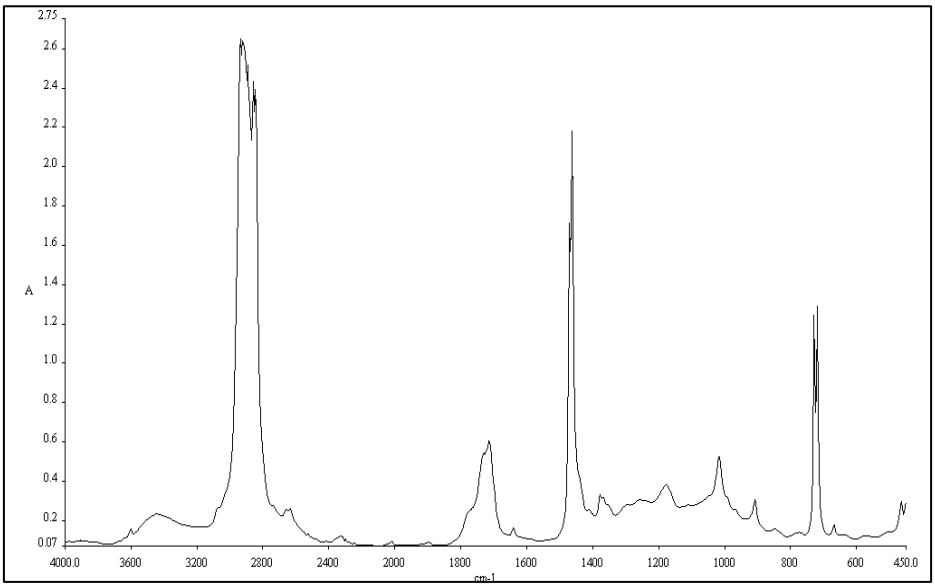
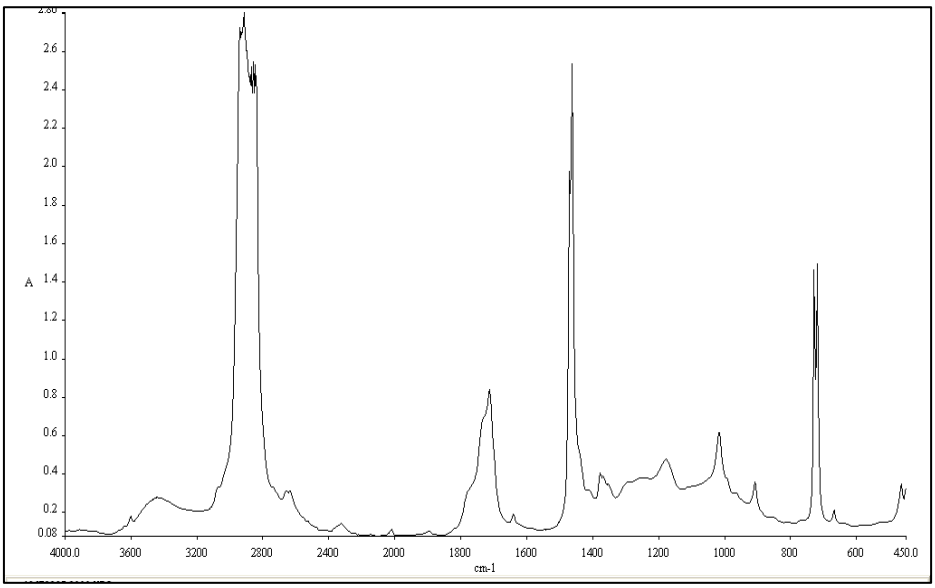


Graph 4: FTIR Spectra of irradiated Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) for 1500 hrs



Graph 5: FTIR Spectra of irradiated Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) for 2000 hrs

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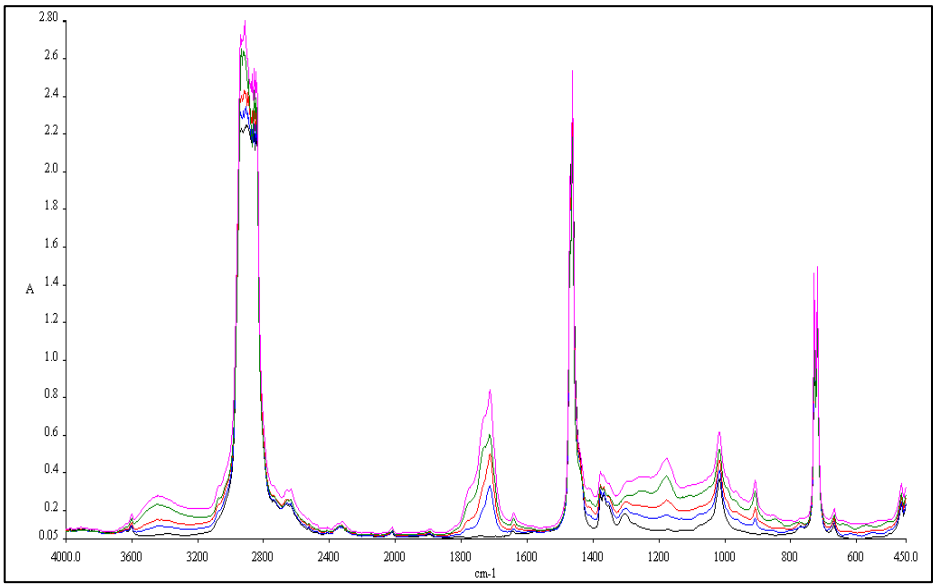

Graph 6: FTIR Spectra overlay irradiated Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) initial to 2000 hrs

Figure 2: Sample image after exposure for 3000 hrs

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MEASURING THE GEL CONTENT

Gel content of Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) sample from Tier 1 were used to study the percentage of gel formation due to oxidative degradation of polymers. After 3500 hrs, the sample showed 3.9 % gel formation.

MEASURING THE EXTENT OF DISINTEGRATION/FRAGMENTATION BY CONDUCTING SIEVE TEST

Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) sample after 3500 hrs exposure was used to perform Sieve test. 50 gms sample was passed through 2 mm sieve. The retained was used to calculate the degree of disintegration.

$$\% \text{ retained} = \frac{\text{Weight of sample in the sieve}}{\text{Total weight of sample}} \times 100$$

The degree of disintegration is equal to the % of sample passed through the sieve. The degree of disintegration of Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) sample using 2mm sieve was found to be 4.8 %.

Table 1: Carbonyl index determination

Duration	**Carbonyl index**
0 hours	0.0
500 hours	1.18
1000 hours	1.75
1500 hours	2.14
2000 hours	2.96

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MEASURING THE EXTENT OF DISINTEGRATION/FRAGMENTATION BY STUDYING THE PHYSICAL PROPERTIES

Table 2: Different physical properties of Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample (16473265) at different durations of UV exposure

Duration / Sample	'0' Hrs	'500' Hrs	'1000' Hrs	'1500' Hrs	'2000' Hrs	'2500' Hrs	'3000' Hrs	'3500' Hrs	'4300' Hrs
Percent elongation (%)	628.8	5.50	3.40	2.20	Brittle	Brittle	Brittle	Brittle	Brittle
Tensile strength (N)	50.99	29.42	24.52	15.60	Brittle	Brittle	Brittle	Brittle	Brittle

Table 3: Molecular weight analysis

Duration	Molecular weight (Dalton)
0 hours	94000
2000 hours	7150
3500 hours	4400

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BIOTIC DEGRADATION (TIER 2) (COMPOSTING CONDITIONS)

It has three basic provisions that govern how a product must perform in a simulated compost environment:

Disintegration during composting: The product must physically disintegrate to the extent that it cannot be "readily distinguishable" from the finished compost product.

Biodegradation: The product must actually biodegrade (be consumed by microorganisms) at a rate comparable to known compostable materials.

No impact on plant growth: Finally, the product cannot have adverse impacts on the ability of the compost to support plant growth.

Additionally, the material should not introduce unacceptable levels of regulated metals or hazardous substances into the environment, upon sample decomposition.

Principle of Biodegradation

The biodegradability of the entire fragmented product from Tier 1 is done using Test methods ASTM D5338. This method determines the degree and rate of aerobic biodegradation of plastic materials on exposure to a controlled composting environment under laboratory conditions, at thermophilic temperatures. The samples were exposed to an inoculum that is derived from compost from municipal solid waste. Aerobic composting takes place in an environment where temperature, aeration and humidity are closely monitored and controlled. The percentage of biodegradability is obtained by determining the percentage of carbon in the test sample that is converted into CO_2 during the duration of the test.

This method determines the degree and rate of aerobic biodegradation of plastic materials on exposure to a controlled composting environment under laboratory conditions, at thermophilic temperatures. The samples were exposed to an inoculum that is derived from compost from municipal solid waste. Aerobic composting takes place in an environment where temperature, aeration and humidity are closely monitored and controlled. The percentage of biodegradability is obtained by determining the percentage of carbon in the test sample that is converted into CO_2 during the duration of the test.

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Apparatus Setup

A series of 09 composting vessels of 2 - liter volume (1 blank i.e. compost, 1 positive i.e. cellulose mixed with compost, and 1 test plastic sample mixed with compost, all in 3 replicates). The entire composting vessel were kept in Incubator capable of maintaining the temperature of composting vessels at 58 ± 2°C (Figure 3). Pressurized air system that provides CO_2 free, H_2O saturated air to each of the composting vessels at accurate aeration rate. CO_2 evolved will be absorbed by 0.024 N Ba $(OH)_2$ and the amount of CO_2 will be determined by titrating with 0.05 N HCl.

Compost Inoculum

The compost inoculum should be 2 to 4 months old, well aerated compost from organic fraction of municipal solid waste, sieved on a screen of less than 10 mm, compost from plants, treating green or yard waste or mixtures of municipal solid waste and green waste should be used. The compost inoculum should produce 50-150 mg of CO_2 per gram of volatile solids over the first 10 days of the test and an ash content of less than 70% and a pH between 7 and 8.2, is desired. The amount of total dry solids may range from 50 to 55%. Compost should have sufficient porosity to enable aerobic conditions. The compost inoculum should be as free from larger inert materials (glass, stones, metals, etc.) as possible.

Figure 3: compost inoculum

Procedure

The composting vessels will be incubated in diffuse light minimum for a period of 45 days, or more & the temperature of the system will be maintained at 58 ± 2°C. The CO_2 & O_2 concentrations will be checked in the outgoing air. The air flow will be adjusted to maintain a CO_2 concentration of at least 2% vol /vol to allow accurate determination of CO_2 level in the exhaust air. Composting vessels will be shaken weekly to prevent extensive channeling, provide uniform attack on test specimen and provide an even distribution of moisture.

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OBSERVATIONS

The Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch were subjected to biodegradation as per ASTM D5338 biodegradability under controlled composting conditions at 58°C ± 2°C and biodegradability was determined by measuring the actual metabolic conversion of the compostable material into carbon dioxide using the standard test method.

After 180 days of incubation under dry (58 °C ± 2 °C), aerobic controlled compositing conditions using test method ASTM D5338, the reference material (Cellulose), Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch sample were gradually biodegraded. The reference material (Cellulose) was degraded 100.00 % after 97 days while Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch Laboratory reference No. 16473265 sample showed 91.41 % after 180 days.

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Table 4: Average Percentage Biodegradation of Reference material (Cellulose) and Test samples

Day	Percent Biodegradation	
	Reference material (Cellulose)	Test sample
0	0.00	0.00
3	3.75	1.88
6	8.74	3.76
10	15.61	7.84
14	21.86	10.04
18	29.04	12.07
21	34.04	13.17
24	40.59	15.37
27	48.09	16.93
30	53.40	17.88
35	60.27	19.44
40	66.82	20.70
45	73.69	22.42
52	79.31	26.50
60	84.62	28.54
67	86.50	31.05
72	90.87	34.81
80	94.93	38.42
90	97.42	42.49
97	100.00	48.92
105	-	55.51
112	-	58.33
120	-	62.25
127	-	65.23
135	-	68.52
142	-	75.26
150	-	77.15
157	-	79.03
162	-	82.95
170	-	87.18
180	-	91.41

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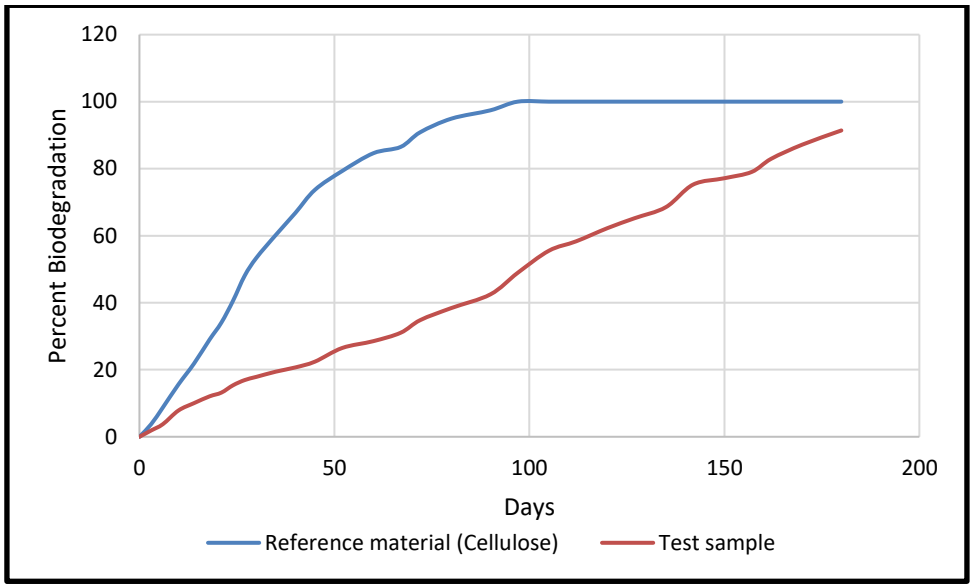

Graph 1: Percentage biodegradation of Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch under aerobic composting conditions

Table 5: Validity of the test:

Test parameter	**Acceptance criteria**	**Results**
Degree of biodegradation of the reference material (Cellulose)	> 70% after 45 days	73.69
Difference in the percentage of biodegradation across three replicates of the reference material (Cellulose)	< 20 %	< 20 %
Carbon Dioxide produced by Inoculum in the blank over the first 10 days of the test (mg CO_2 produced per g of volatile solids)	50 – 150 mg CO_2 / g	81

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ECO- TOXICITY (TIER 3)

PLANT GROWTH TEST ACCORDING TO OECD 208

In order to ensure that the composting of plastic products or materials does not have any harmful effects on the finished compost or on the environment, all requirements specified shall be met.

Ecotoxicity test scheme: Ecotoxicity tests are performed with compost samples produced with and without the addition of a plastics product or a material to determine and assess possible harmful effects on terrestrial organisms. The test scheme considers:

All relevant terrestrial organism groups such as plants, earthworms (invertebrates) and microorganisms.

Organism group	**Test methods**
Plants: - higher plants	Plant growth test according to OECD 208
Invertebrates: - earthworms	Acute earthworm test according to OECD 207

The sample shall have no adverse effect on the environment, which includes terrestrial organisms. After biodegradation, the **Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch** was subjected to eco-toxicity testing to check its effect on the environment. The results of Ecotoxicity are mentioned in Table 6 to 11.

Principle Of OECD 208

Seeds are placed in contact with soil treated with the test substance and evaluated for effects following 14 to 21 days after 50% emergence of the seedlings in the control group. Endpoints measured are visual assessment of seedling emergence, biomass (fresh or dry shoot weight, or shoot height) and visual detrimental effects (chlorosis, mortality, plant development abnormalities, etc.). Measurements are made at least weekly or more often when recording the emergence of the seeds and compared to those of untreated control plants.

Validity of the test

For the test to be considered **Valid,** the following performance criteria must be met in the controls:

- the seedling emergence is at least 70%.
- the seedlings do not exhibit visible phytotoxic effects (e.g. chlorosis, necrosis, wilting, leaf and stem deformations) and the plants exhibit only normal variation in growth and morphology for that particular species.
- the mean control survival is at least 90% for the duration of the study.
- environmental conditions for a particular species are identical and growing media contain the same amount of soil matrix, support media, or substrate from the same source.

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Description of the method

Production of compost

After 180 days of biodegradation, Test sample compost and blank compost are sieved through a standard 10 mm sieve individually. Separate the sieved material further by sieving it through a standard 2 mm sieve. Compost obtained is used for the toxicity test as per the ratio mentioned in preparation of sample and blank mixtures.

Preparation of mixtures of sample and blank compost

For preparing the mixture use reference soil with 25% and 50% (m/m or v/v) of the compost. Compost obtained after biodegradation of the test material (sample compost) and the blank compost obtained from the parallel process after addition of test material. Prepare the concentration as mentioned below.

1) Test Sample

Mixture 1 - 25 % (25 % of Sample compost + 75 % reference soil)

Mixture 2 - 50 % (50% of Sample compost + 50 % reference soil)

2) Blank

Mixture 1 - 25 % (25% of Blank compost + 75 % reference soil)

Mixture 2 - 50 % (50% of Blank compost + 50 % reference soil)

Selection Of Plant Species

Plant Species Used

1. Monocot

Family: *Brassicaceae*

Species: *Brassica sinapis alba*

Common name: Mustard

2. Dicot

Family: *Poaceae*

Species: *Triticum aestivum*

Common name: Wheat

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Procedure

Fill each tray with a minimum of 200 g of the sample and add as a minimum 100 seeds on the top. Cover the seeds with a thin layer of inert material such as siliceous sand or perlite. Perform the test in triplicate for each mixture. Add water until 70% to 100 % of the water holding capacity is reached. Supply evaporated water periodically during the whole test duration as needed.

Test Conditions

The test conditions should approximate those conditions necessary for normal growth for the species and varieties tested.

The following conditions are generally recommended for greenhouse testing:

• temperature: 22°C ± 10°C

• humidity: 70 % ± 25%

• photoperiod: minimum 16-hour light

• light intensity: 350 ± 50 µE/m2 /s

The Test Sample and Blank must be kept under the same environmental conditions; however, adequate measures should be taken to prevent cross exposure.

The texture of the compost used is sandy with organic carbon 3.06 % and pH 7.52 and salt content as electrical conductivity is 3.29 (mS/cm).

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Table 6: Germination Rate and Biomass of *Brassica sinapis alba* and *Triticum aestivum* seeds after 21days.

	Plant species	Dose	Germination Rate (%)	Biomass (g)	Shoot Length (cm)	Root Length (cm)
Blank	*Brassica sinapis alba*	25%	98	0.0709	10.3	5.6
		25%	99	0.0695	9.8	4.2
		25%	99	0.0745	11.1	3.2
		50%	100	0.0711	10.6	3.7
		50%	98	0.0736	11.4	4.2
		50%	97	0.0723	10.7	5.1
	Triticum aestivum	25%	97	0.1443	14.5	7.8
		25%	98	0.1521	13.7	5.6
		25%	99	0.1466	12.8	5.8
		50%	100	0.1578	13.6	5.7
		50%	98	0.1436	15.8	7.8
		50%	99	0.1407	14.8	4.9

	Plant species	Dose	Germination Rate (%)	Biomass (g)	Shoot Length (cm)	Root Length (cm)
Test Sample	*Brassica sinapis alba*	25%	94	0.0701	9.9	5.3
		25%	94	0.0677	9.5	3.9
		25%	94	0.0632	10.5	3.1
		50%	95	0.0721	9.3	3.4
		50%	96	0.0671	10.2	3.9
		50%	94	0.0647	9.8	4.8
	Triticum aestivum	25%	94	0.1401	12.5	6.8
		25%	96	0.1412	10.1	5.2
		25%	94	0.1399	10.8	5.4
		50%	95	0.1454	13.2	5.2
		50%	95	0.1324	13.2	7.1
		50%	96	0.1364	14.2	4.2

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Table 7: Average germination Rate and Biomass of *Brassica sinapis alba* and *Triticum aestivum* seeds after 21 days.

	Plant species	Dose	Germination Rate (%)	Dry biomass(g)	Shoot Length (cm)	Root Length (cm)
Blank	*Brassica sinapis alba*	25%	99	0.0716	10.4	99
		50%	98	0.0723	10.9	98
	Triticum aestivum	25%	98	0.1477	13.7	98
		50%	99	0.1474	14.7	99

	Plant species	Dose	Germination Rate (%)	Dry Biomass(g)	Shoot Length (cm)	Root Length (cm)
Test sample	*Brassica sinapis alba*	25%	94	0.0670	10.0	94
		50%	95	0.0680	9.8	95
	Triticum aestivum	25%	95	0.1404	11.1	95
		50%	95	0.1381	13.5	95

	Plant species	Dose	Germination Rate (%) as compared with Blank	Dry biomass (%) as compared with Blank
Test sample	*Brassica sinapis alba*	25%	95	94
		50%	97	94
	Triticum aestivum	25%	97	95
		50%	96	94

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Blank 25%	**Blank 50%**
	
Test Sample 25%	**Test Sample 50%**

Figure 4: Effect of compost Polyethylene Films Containing 1wt% Reverte Bt 96638 Additive Masterbatch – Laboratory Reference No. 16473265 sample on *Triticum aestivum* growth

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Blank 25%	**Blank 50%**
	
Test Sample 25%	**Test Sample 50%**

Figure 5: Effect of compost Polyethylene Films Containing 1wt% Reverte Bt 96638 Additive Masterbatch – Laboratory Reference No. 16473265 sample on *Brassica sinapis alba* growth

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ACUTE EARTHWORM TEST ACCORDING TO OECD 207

Principle

Eisenia fetida species of earthworm are used for earthworm toxicity testing. The artificial test involves keeping earthworms in samples of a precisely defined artificial soil to which a range of concentrations of the test substance has been applied. Mortality is assessed 14 days after application. Control is used to assure that effects observed are associated with or attributed only to the test substance exposure. The earthworm is brought from Vermicomposting beds. The mean survival of all controls should be more than 90 percent at the end of the test. The toxicity of test soils or the bioavailability of contaminants are assessed during the continuous exposure of terrestrial organisms.

Soils tested may be the following:

1. soils collected from potentially contaminated sites,
2. soils collected from reference sites,
3. artificial soil (see Annex A2) spiked with compounds,
4. site soil spiked with compounds,
5. reference soil spiked with compounds,
6. site soil diluted with artificial soil,
7. site soil diluted with reference soil, or
8. reference soil diluted with artificial soil.

A negative control of artificial or reference soil is used for the following:

1. to yield a measure of the acceptability of the test;
2. to provide evidence of the health and relative quality of the test organisms.
3. to determine the suitability of test conditions, food, and handling procedures; and
4. to provide a basis for interpreting data obtained from the test soils.

Specified data are obtained to determine the toxic effects on survival.

Validity:

The mortality in the controls should not exceed 10 percent at the end of either test.

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Earthworm Species used: *Eisenia fetida*

Preparation of compost:

After 180 days, test soil is sieved through a standard 10 mm sieve, Separate the sieved material further by again sieving it through a standard 2 mm sieve. Compost obtained is used for the test. The mixture prepared a concentration of 25% and 50% (m/m or v/v) of the sample compost.

For each test, 700 g of the test medium is placed into each glass container and ten earthworms are placed on the test medium surface.

The containers are covered with perforated plastic film to prevent the test medium from drying and kept under the test conditions for 14 days. The test duration is 14 days (assessment of mortality at 7 and 14 days), and the test temperature is 22° ± 3°C. Testing is done in continuous light (to ensure that worms remain in the test medium throughout duration of test). The mortality and biomass changes is assessed at 7 and 14 days. emptying test medium onto a glass tray or plate, sorting worms from the medium and testing their reaction to a mechanical stimulus at the front end. After the 7-day assessment worms and medium are replaced in the test container. The behavioral or pathological symptoms are studies and noted.

The earthworm acute results are as follows:

Table 8: pH, Temperature and Moisture content of Test soil before and after study.

Concentration	Test Initiation Moisture content (%)	Test Initiation pH	Test Initiation Temperature °C	Test Termination Moisture content (%)	Test Termination pH	Test Termination Temperature °C
Blank	39.12	7.05	22.0	37.53	7.09	22.1
Test Sample	41.73	7.13	22.0	39.74	7.17	22.0

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Table 9: Average weight of earthworms before and after study and difference in weight.

Particulars		**Average Initial weight (g)**	**Average Final weight (g)**	**Mean difference in weight (g)**	**Percentage weight**
Blank	**25 %**	0.4685	0.5004	0.0319	6.81
	50 %	0.4931	0.5228	0.0297	6.02
Test Sample compost	**25 %**	0.4982	0.5321	0.0339	6.80
	50 %	0.4851	0.5268	0.0417	8.60

The average weight of earthworms increased as compared to control, no weight loss was observed at the end of the test duration.

Table 10: Mortality rate of earthworms after study

Particulars		**Mortality (%)**
Blank	**25 %**	0
	50 %	0
Test Sample compost	**25 %**	0
	50 %	0

The mortality rate was found to be 0%.

Table 11: Percent Survival rate

Particulars		**7 days**	**14 days**
Blank	Average no. of earthworm survived	40	40
Test Sample compost	Average no. of earthworm survived	40	40
	Survival rate (%)	100	100

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Figure: 6 Earthworm before exposing it to the compost containing residue of Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch

Figure: 7 Earthworm after exposing it to the compost containing residue of Polyethylene films containing 1wt% Reverte BT 96638 additive masterbatch

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Table 12: Chemical characteristics and Heavy metal analysis of residue collected after biodegradation

Heavy Metals (Parameters)	**Unit**	**Test sample**	**Compost**
pH	-	7.10	7.09
Magnesium (Mg)	mg/kg	<1.0	899.82
Calcium (Ca)		40.6	646.10
Phosphorus (P)		<1.0	832.34
Manganese (Mn)		<1.0	708.46
Zinc		2.5	62.66
Copper		5.1	11.34
Nickel		<1.0	8.52
Lead		<1.0	<1.0
Mercury		<1.0	<1.0
Molybdenum		<1.0	<1.0
Arsenic		<1.0	<1.0
Selenium		<1.0	0.00
Cadmium		<1.0	<1.0
Cobalt		<1.0	4.00

As per the Environmental Protection Agency (EPA) the metal concentration in the sample are well within the prescribed limit.

TEST REPORT

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INTERPRETATION:

The Polyethylene Films Containing 1wt% Reverte Bt 96638 Additive Masterbatch – Laboratory Reference No. 16473265 sample submitted by Wells Performance Materials Limited passed the Tier 1, Tier 2 and Tier 3 in accordance with the conditions set forth in ASTM D6954: 2024 and did not show any adverse effect on the seedling emergence, seedling growth and passed the earthworm acute toxicity test.

Reviewed By

Alok Pandey
Assistant Manager – Biodegradability Services

Authorized Signatory

Ushadevi Yadav
Deputy Manager – Biodegradability Services

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