



## Product Data Sheet Biotransformation

# Cycle +<sup>®</sup> PLMv2.3

Advanced biodegradable additive masterbatch for plastic products.

### Product Description

*Cycle+<sup>®</sup> PLM v2.3* is a proprietary additive specifically designed to biodegrade plastic products on land. It develops its superior performance from the synergistic action of all the natural agents of decay i.e., air, moisture, heat and sunlight in addition to the effect of synthetic mimics or “pre-biotics” that draw in microorganisms at an early stage. Unlike Oxo-additives, *Cycle+<sup>®</sup> PLMv2.3* does not leave microplastic behind and enables a safe and full biodegradation into carbon dioxide, water and biomass over a relatively short time period. The additive complies with existing food safety standards<sup>1</sup>.

A product containing *Cycle+<sup>®</sup> PLMv2.3* is recyclable the same way as a non-biodegradable plastic within the product’s defined service life.

The biotransformation of a product formulated with *Cycle+<sup>®</sup> PLMv2.3* is assessed under an augmented version of the global standard ASTM D6954 which includes stringent pass/fail criteria on molecular weight, carbonyl index and eco-toxicity.

### Applications

*Cycle+<sup>®</sup> PLMv2.3* is for resin producer, plastic packaging manufacturer and brand owner who want to provide an environmentally safe end-of-life solution for their branded plastic product in the event that the item is disposed of into the open environment after its use life through irresponsible littering or by escaping the recycling stream.

It is particularly effective in polypropylene (homopolymers, random copolymers, impact copolymers) intended for injection moulded items (e.g., tubs, pots, cups, caps) and for thermoformed items (e.g., cups, trays, deli containers). Furthermore, it is effective in Linear low density (LLDPE) and Low density (LDPE) polyethylene intended for films (e.g. shrink films, primary films for food packaging) and for injection moulded items (e.g., lids, sealing). The masterbatch can be pre-mixed with the plastic pellets before processing or fed into the polymer stream at the melt processing stage at a dosage rate between of 2% w/w.

### Benefits and Features

- Non-Oxo degradable additive, no toxic microplastics post degradation.
- No compromise on processability during the conversion process and on final product properties.
- Complies with existing food safety standards<sup>1</sup>.
- Onset of degradation typically within 2 years from the point of production.
- Full biodegradation achieved in contrast to alternative materials.
- No negative environmental impact at any stage of the process.
- Compatible with recycling within product’s service life.

<sup>1</sup> US GRAS statement and EU Framework Regulation (EC) No. 935/2004 and GMP regulations No. 2003/2006 and Polymers and additives by Regulation (EU) No. 10/2011 as subsequently amended

## **Specifications**

### Masterbatch: Physical Properties

Carrier	PE
Relative density (g/cm <sup>3</sup> )	0.92 – 1.02
Colour	Beige/off-white light brown

### Biotransformation: Pass/Fail test criteria

To ensure no microplastic post-degradation and full biodegradation is achieved, products containing *Cycle+® PLMV2.3* should be tested against an augmented version of the de-facto global standard ASTM D6954. The augmented version includes stringent guidelines for pass/fail criteria on Molecular weight, carbonyl index and eco-toxicity.

- Phase 1: Abiotic degradation & post-degradation eco-toxicity test pass/fail criteria

Parameters	Unit	Target value	Test method
Elongation at break	%	< 5%	ASTM D3826
Reduction in weight average molecular weight (Mw)	%	≥ 90% of its initial value	ASTM D6467
Number average molecular weight (Mn)	Da	Mn < 5000	ASTM D6467
Carbonyl Index		≥ 1	Measured as A(1850-1650)/A(1510-1410) by FT-IR
<b>Post-degradation Eco-toxicity</b>			
Earthworm acute toxicity & reproduction		Pass	OECD 207 and 222
Aquatic Eco Toxicity		Pass	OECD 211 and OECD 202
Plant Toxicity		Pass	OECD 208

- Commercialisation point
- Phase 2 (post-commercialisation): Biodegradation in soil & eco-toxicity tests

Parameters	Unit	Target value	Test method
Organic carbon conversion to CO <sub>2</sub>	%	> 90% within less 3 years	ASTM D5988
<b>Post-biodegradation eco-toxicity</b>			
Plant Toxicity		Pass	OECD 208
Earthworm acute toxicity		Pass	OECD 207

## **Packaging and Handling**

**Delivery form:** Pellet form.

**Packaging:** Supplied in sealed Aluminium bags in various weights.

**Storage:** Sealed in a cool dry place and used within 24 hours of opening.

## **Contact us:**

### **Polymateria Limited**

Imperial Innovation I-Hub

White city Campus, 80 Wood Lane

London W12 0BZ

### **Information**

Tel: +44 (0) 203 7132944

info@polymateria.com

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