

# Biodegradable and compostable co-polyesters

## Sipol achieves “OK compost INDUSTRIAL” certification for Technipol Bio 1160

*Sipol, the Italian producer of high-performance co-polyesters and co-polyamides, is widening its product portfolio for a sustainable growth from both financial and environmental point of view. The company is successfully acting on several major markets such as automotive, footwear, packaging, E & E, cosmetics and other industrial sectors, thanks to its range of copolymers which covers the most diverse and demanding requirements. The growing needs to combine environmental and economic sustainability has prompted Sipol to implement a strong evolution of its products towards sustainability developing bio-based materials, materials from post-consumer recycling as well as a combination of the two. The first result of this strategy was the launch of a new range of bio-degradable and compostable grades named Technipol Bio.*

### 1 Introduction

According to the current legislation EN 13432, a specific test process for the evaluation of biodegradability and compostability has initiated through the partnership together with the accredited laboratories Laboratori Archa S.r.l. in Pisa and with TÜV Austria Certifying Body to obtain the “OK compost INDUSTRIAL” (OKI), “OK compost HOME” (OKH) and Seedling certifications. Technipol Bio 1160, an aliphatic-aromatic co-polyester, is the first of the new range to have obtained the OKI certification (**fig. 1**), a further tangible step towards sustainability with the circular co-polyesters developed by Sipol.

**Fig. 1:** Technipol Bio 1160 has obtained the “OK compost INDUSTRIAL certification”. Packaging or products bearing this mark are guaranteed as biodegradable in an industrial composting plant (harmonized standard EN 13432:2000).

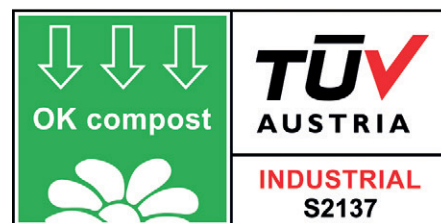


### 2 Biodegradable co-polyesters

Sipol expands its range of circular co-polyesters with the new Technipol Bio, biodegradable and compostable that also have an increased content of bio-based raw

materials to meet with greater flexibility of both market and environmental sustainability demands. An extensive research activity and innovative approach brought the development of high-performance circular polymers mainly used in the fields of adhesives for footwear and automotive applications as well as specialty products for cosmetic, medical and agricultural applications.

Sipol has always had a strong propensity for sustainability in its imprinting. The biodegradable co-polyesters developed and currently industrially produced are Technipol Bio 707, Technipol Bio 1120, and Technipol Bio 1160.



For any of the above-mentioned grades, there are also grades available where the bio-based content has been increased using monomers from renewable source.

- Technipol Bio 707 is a bio-based co-polyester fully linear and biodegradable. Its content of raw materials coming from renewable sources (castor oil derivatives)

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is over 60 % in its standard formulation. The product is characterized by a low melting point which makes it suitable as adhesive in the footwear and textile industries. In addition, it finds application in the compounding industry as polymer feedstock for biodegradable compounds. The same polymer is also available in the Technipol Bio 709 version that, thanks to the replacement of synthetic 1,4-butanediol with 1,4-bio-BDO, it reaches over 90 % of renewable sources content.

- Technipol Bio 1120 is a biodegradable PBS-based polyester. In comparison to the other biodegradable polyesters available on the market, Technipol Bio 1120 shows a relatively high hardness and high melting temperature with performances close to PP. Sipol also developed versions with increased bio-based content such as the grades Technipol Bio 1124, 1125 and 1129, the latter containing over 90 % of raw materials from renewable sources.
- Technipol Bio 1160 is an aliphatic-aromatic biodegradable co-polyester, characterized by medium crystallinity and low melting temperature, chemically similar to the PBAT series. It is used in biodegradable and compostable compounds as well as carrier for biodegradable masterbatches. In addition, Technipol Bio 1160 shows good compatibility with other biodegradable polymers such as polylactic acid and starch. This polymer is also available in the Technipol Bio 1164 version which has over 40 % of bio-based content. Technipol Bio 1160 is the first in the new range which has already obtained the "OK compost INDUSTRIAL" certification.

### 3 Technipol Bio 1160 properties and applications

Purely aliphatic polyesters represent the family of polymers with the best biodegradability properties thanks to the ester bonds particularly susceptible to hydrolytic action, both chemically and enzymatically. However, purely aliphatic polyesters are characterized by poor thermal and mechanical properties

Tab. 1: Properties of Technipol Bio

Properties	Unit	Technipol Bio 707	Technipol Bio 1120	Technipol Bio 1160
DSC melting temperature	°C	64	114	115
Hardness (instantaneous)	Shore D	54	61	34
Strength at break	MPa	16	50	17
Elongation at break	%	370	450	365

which strongly limit their application fields. On the other hand, classic aliphatic-aromatic polyesters such as PET and PBT are characterized by excellent chemical-physical properties including, of course, also a high resistance to any hydrolytic attack of microorganisms that make them not-biodegradable. By applying an appropriate balance between the aliphatic and aromatic portion of the polymer it has been proved that a good compromise between biodegradability and material properties can be achieved. Technipol Bio 1160 is therefore an aromatic-aliphatic co-polyester developed to combine and satisfy both the eco-sustainable properties and market requirements that make it suitable for several application fields. Chemically speaking, it belongs to the family of PBAT (polybutylene adipate co-terephthalate) of medium crystallinity and a melting point of 115 °C (tab. 1). Technipol Bio 1160 has passed all EN 13432 standard compliance tests for disintegration, biodegradability and compostability with >90 % biodegradation in less than three months (fig. 2).

Tab. 2: Renewable resources content of Technipol Bio grades

Technipol Bio grade	Renewable resources content %
707	65 %
709	100 %
1120	0 %
1124	48 %
1125	52 %
1129	100 %
1160	0 %
1164	42 %

Thanks to their intrinsic properties and their compatibility with other biodegradable polymers such as PLA and starch, Technipol Bio 1160 and 1164 are suitable for different specific uses including the food contact materials sector and are also compliant with the requirements of the main industry regulations such as EU10/2011 and FDA as well as agricultural, cosmetic and footwear sectors.

Fig. 2: Technipol Bio 1160 biodegradability vs. standard reference (cellulose). After 45 days of incubation the biodegradation of the cellulose reference >70 %.

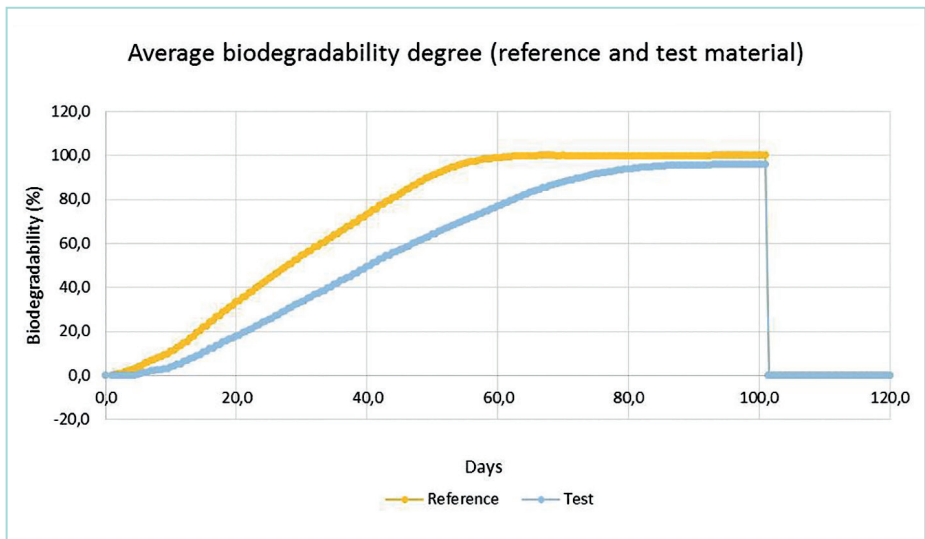
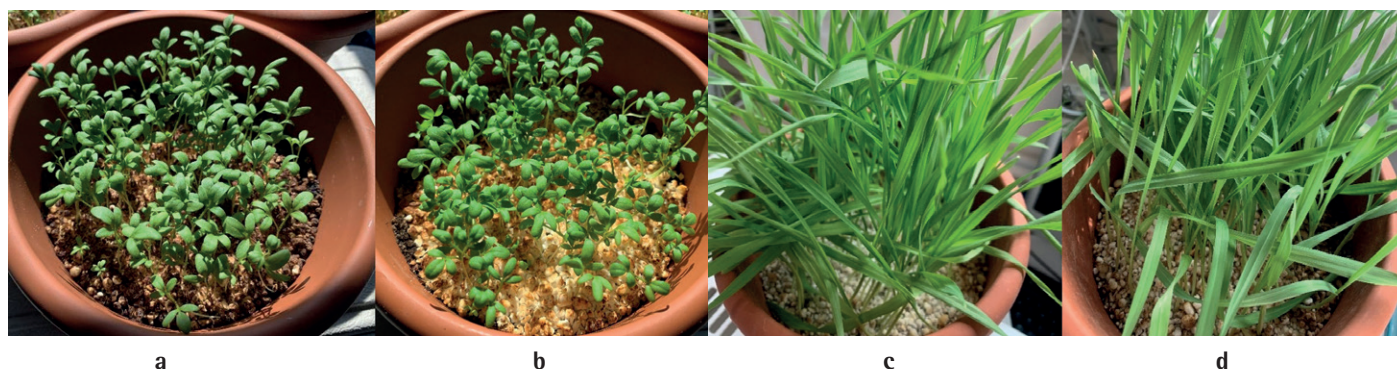


Fig. 3: Phytotoxicity tests on barley plants (a) control (b) 50 % sample and watercress (Brassicaceae) (c) control (d) 50 % sample



## 4 The certification process

The "OK compost INDUSTRIAL" (OKI) and "OK compost HOME" (OKH) certification process of the Technipol Bio series has started with TÜV Austria Certifying Body (which is authorized by the European Association of Bioplastics), following a precise sequence of activities, starting from preliminary evaluations on material characteristics and composition to the definition of experimental tests necessary for the certification path.

First, it is necessary to get through the document analysis and collection of the essential information on the material; then we proceed with the determination of the chemical-physical characteristics, the technical specifications, the thickness to be certified and the FT-IR spectrophotometric recording. For subsequent tests, the Certifying

Body shall make a list of accredited laboratories available; among these, Sipol started the procedure with Archa Laboratories, located in Pisa and already well known by Sipol thanks to a previous collaboration in an European project aimed at creating sustainable value chains.

After a preliminary analysis of the material, including the evaluation of the content of heavy metals and volatile organic compounds, it contemporaneously followed the biodegradability tests for composting in accordance with UNI EN ISO 14855-1:2013 with a maximum duration of six months and disintegration at high and low temperature, respectively for the OKI and OKH certification with a maximum duration of twelve weeks. After the disintegration and biodegradation tests, the certification path proceeds with the evaluation of the quality

of the final compost according to UNI EN 13432:2002 which consists in the evaluation of the general appearance of the compost and its characterization with respect to the initial composition in terms of the heavy metal content, salinity, pH, dry residue, total organic carbon, ammonia, nitrogen, phosphorus, magnesium and potassium. Then the ecotoxicity of the material is evaluated, as defined by EN 13432:2002 with a maximum duration of 1 month. For this purpose, the growth of plant species in the presence of known quantities of the material under test in the soil is evaluated (fig. 3).

A detailed reporting of the tests is then presented to the Certifying Body which ascertains the compliance of the material and issues the certification, after a careful evaluation.

## Hexpol TPE: Publication of inaugural Impact Report

**Hexpol TPE** released their **2020 Impact Report**. It is the first report of its kind from the company. Energy usage is one of the areas the company is tackling. Work involving surveys and measures to increase efficiency continued in 2020 as well as investment in energy efficient equipment and infrastructure. The report includes performance over a three-year period. There was a reduction in energy consumption of 4,345 MWh from 2019 to 2020, despite an increase in total volume produced. The Hexpol TPE companies work within the ISO 14001

and/or ISO 50001 frameworks and from 2021 all European sites are using 100 % renewable

Hexpol TPE has published their first Impact Report.



electricity. Water consumption and waste generation also showed a downward trend for 2020. Recycling rates have increased by more than 70 % from 2018 to 2020.

Material and technology developments are also covered in the report. Applications using biobased, bio-composites and TPEs with recycled content are included, highlighting possibilities with renewable and non-virgin polymer materials.

[www.hexpoltppe.com](http://www.hexpoltppe.com)