



Bluepha  
蓝晶微生物

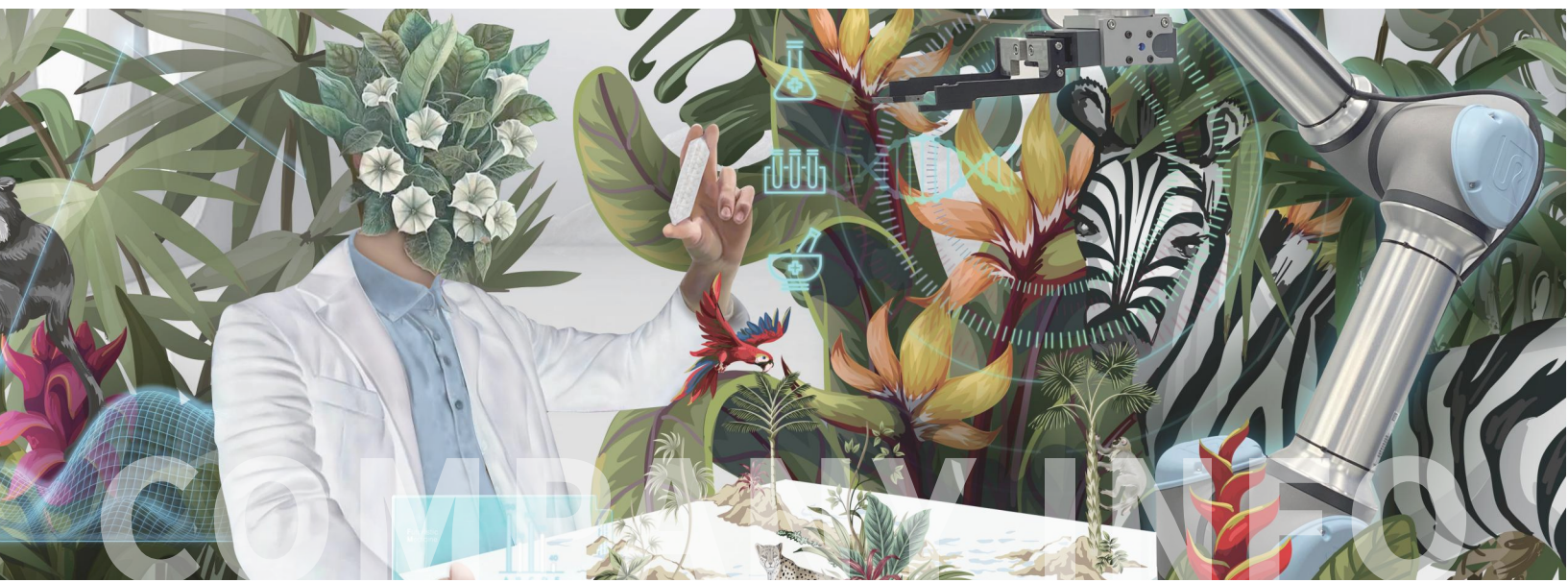
# 蓝晶™ PHA Bluepha® PHA

A Phabulous Blend  
with Nature



蓝晶™ PHA  
生物基 & 生物降解材料

Bluepha® PHA  
biobased & biodegradable material



# 公司简介

蓝晶微生物成立于 2016 年，是一家基于合成生物技术进行分子和材料创新的国家级高新技术企业。依靠专业自主的研发平台和全链条创新能力，我们致力于提供创新型生物基解决方案，帮助行业客户打造差异化竞争力，更好地推动可持续发展和双碳目标达成。

2022 年底，蓝晶微生物首个重大工程——用于生产天然材料 PHA 的超级工厂于江苏盐城建成投产，一期产线年产量 5,000 吨，蓝晶™ PHA 系列产品正式上市。二期（20,000 吨 / 年）及三期（50,000 吨 / 年）产线工程正在规划建设中。与许多传统塑料材料相比，蓝晶™ PHA 具有出色的可降解性和更低的碳足迹，同时可广泛应用于包装、消费品、纤维和农业等领域。我们期待与全球拥有共同愿景的合作伙伴携手向前，解决人类的塑料污染问题，创造可持续价值，共同构建一个与自然和谐共处的未来。

**We create life  
for the future.**







# About us

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Established in 2016, Bluepha Co., Ltd. (Bluepha) is a nationally recognized high-tech enterprise dedicated to molecular and material innovation through synthetic biotechnology. Our unique biology automation platforms enable us to engineer microorganisms, offering a novel approach to designing and manufacturing molecules and materials that contribute to global sustainability and carbon neutrality.

By the end of 2022, Bluepha's PHA production super factory, located in Yancheng, Jiangsu Province, has been fully constructed and operational. The initial phase of production, with an annual capacity of 5,000 tons, has successfully launched the Bluepha® PHA series of products. The second (20,000 tons per year) and third (50,000 tons per year) phase production lines are in the planning stages for construction.

Bluepha® PHA outperforms many conventional plastic materials in terms of biodegradability and carbon footprint reduction. It has diverse applications across packaging, consumer goods, fibers, and agriculture.

We eagerly seek collaboration with like-minded global partners to tackle the issue of plastic pollution, create sustainable value, and foster a future of harmonious coexistence with nature.

## We create life for the future.





# 合成生物学研发基础设施 Synbio OS™

## 迭代升级核心技术，构筑全流程研发壁垒

蓝晶微生物将合成生物学与自动化、云计算等「工业 4.0」技术相结合，搭建了合成生物学研发基础设施 Synbio OS™ (Synthetic Biology Operating System)，将合成生物学的 DBTL 闭环从实验室拓展到工业场景，为实现多管线并行提供了核心保障。

Synbio OS™ 包含菌株研发和工艺研发两大模块，将「飞轮效应」覆盖产品开发的全流程，大幅提升研发成功率及放大生产精准度，数量级地缩短研发周期及工艺开发周期。

- 菌株构建和测试通量提升了 30 倍
- 建成覆盖工艺开发全尺度的生物反应器阵列，监测数据维度提升一个数量级
- 菌株研发和工艺研发全过程数据可被完整追溯



# BIOREFINERY

## 蓝晶™ PHA 「超级工厂」

年产 5,000 吨蓝晶™ PHA 的「超级工厂——BioFAB1」位于江苏省盐城市滨海县，现已建成投产。BioFAB1 在产线全局的每个生产环节均采用了前沿设备和技术，提升工厂整体的运营效率。同时，工厂运营符合现代化运营管理体系，对人员、设备、原料管理、操作规程、环保安全、检验检测等多个环节予以精细控制，以确保向客户提供稳定可靠的产品。

滨海独特的地理区位、绿色能源与生物质原料的资源优势，有助于蓝晶微生物实现「生物合成 + 清洁能源」战略，打造示范性的合成生物学「零碳产业链」。我们将通过蓝晶™ PHA 的量产实现自身商业价值，并为人类社会提供更重要的环保价值。

目前，蓝晶微生物正全力推进二期工程的规划，工厂将形成总计每年 25,000 吨的蓝晶™ PHA 供应。





# Synthetic Biology Operating System (Synbio OS™)

Iteratively upgrade core technologies, and build a full-process research and development barrier

Bluepha established the synthetic biology infrastructure known as Synbio OS™ (Synthetic Biology Operating System) by combining synthetic biology with automation, cloud computing, and other 'Industry 4.0' technologies. This extends the DBTL (Design-Build-Test-Learn) cycle of synthetic biology from the laboratory to industrial scenarios, providing a core guarantee for the implementation of parallel product pipelines. Synbio OS™ includes two main modules: a strain development platform and a process development platform. Through Synbio OS™, the 'flywheel effect' covers the entire product development process, significantly improving the success rate and precision of scale-up production. The research and development cycle, as well as the process development cycle, can finally achieve an order of magnitude reduction.

- The throughput of strain construction and testing has increased by 30 times.
- An array of bioreactors covering the full scale of process development has been established, and the dimension of monitoring data was increased by an order of magnitude.
- The process data covering all stages of strain development and process development can be fully traced.



## Bluepha® Biorefinery

Our Bluepha® Biorefinery "BioFAB1", with an annual production capacity of 5,000 tonnes, is located in Yancheng, Jiangsu Province. BioFAB1 adopted advanced equipment and technologies at every step of the production line to improve overall operational efficiency. At the same time, the factory's operation conforms to a modern operation management system, which provides precise control over personnel, equipment, raw materials, operating procedures, environmental protection and safety, inspection and testing, and other aspects to ensure stable and reliable products delivery to our customers.

The unique geographical location of Yancheng and the resource advantages of green energy and biomass raw materials will help Bluepha achieve the strategy of "biosynthesis + clean energy", with the aim to demonstrate a "Zero Carbon Industrial Chain" of synthetic biology. Through mass production of Bluepha® PHA, we aim to valorize its commercial value and provide more significant environmental value to society.

Currently, Bluepha is fully invested in promoting Phase II of the project, which will result in an annual supply of 25,000 tonnes of Bluepha PHA.





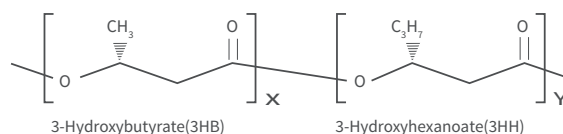
# 蓝晶™ PHA 与自然“晶”彩相融

蓝晶™ PHA (聚羟基脂肪酸酯) 是一种天然存在的生物基材料, 由微生物利用油脂或者淀粉生成。该材料不仅具有优异的气体阻隔性、耐热性等材料物理性能, 还能够所有自然与人工条件下生物降解, 包括在海洋环境中。蓝晶™ PHA同时具备天然存在、全生物基、应用广泛、全域降解等多重属性, 为实现「碳中和」并减少塑料污染提供独特的解决方案。

## ◎ 天然存在的有机物

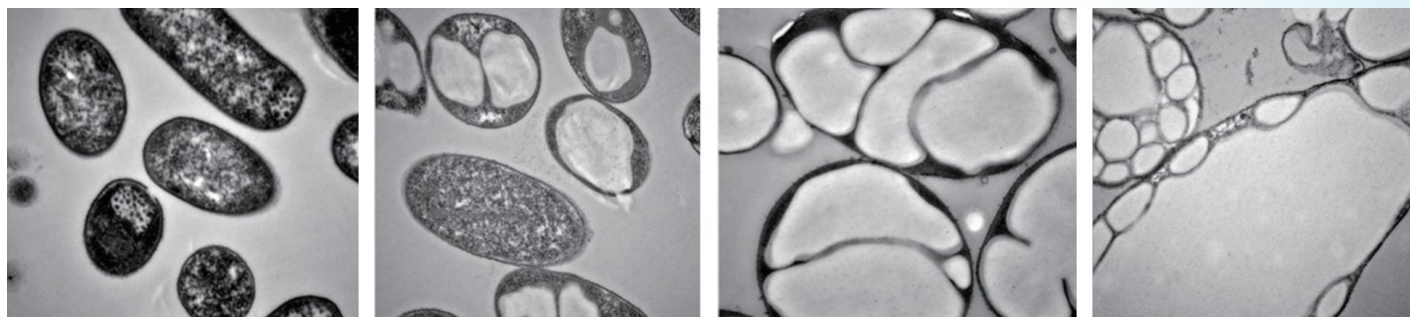
PHA 是一类常见的微生物能量存储载体,

在水体、土壤和人体中都有大量微生物能够合成 PHA, 而自然界也在不断进行 PHA 的合成和降解。



## ◎ 全生物基制造

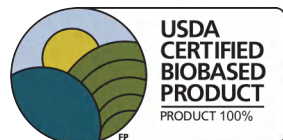
利用自研专有研发平台 synbio os™, 通过高通量筛选和全数字化技术得到的蓝晶微生物专有微生物细胞, 实现特定 PHA 的定向快速生产。



▲ 图为蓝晶微生物专有细胞微生物在发酵过程的电镜图

## 已获得相关认证

100% 生物基



# BLUEPHA PHA



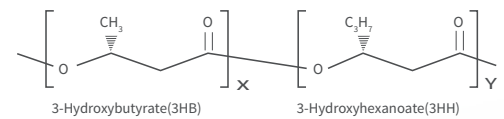
# Bluepha<sup>®</sup> PHA

## a phabulous blend with nature

Bluepha<sup>®</sup> PHA is a type of natural biobased material, produced by microorganisms using plant oil or starch. It has outstanding barrier properties, heat resistance and biodegradability under all conditions, including marine environments.

Naturally-occurring, fully bio-based, wide application, and all environment degradation, Bluepha<sup>®</sup> PHA provides a unique solution for achieving "carbon neutrality" and reducing plastic pollution.

### ☉ Naturally-occurring Biobased Material

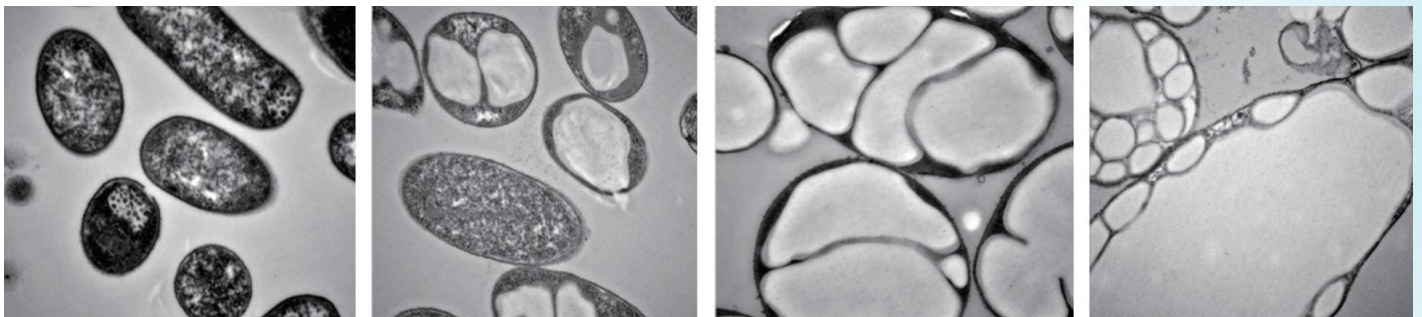


PHA compounds are prevalent form of energy storage for microorganisms.

These microbes, found in diverse environments such as water, soil, and even the human body, are capable of synthesizing and degrading PHA continuously.

### ☉ Bio-manufacturing Technology

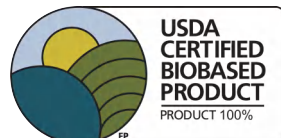
Utilizing our proprietary research and development platform, Synbio OS<sup>™</sup>, we have achieved high-speed production of specific PHAs by using high-throughput screening and fully digitalized technology to obtain proprietary microbial cells.



▲ SEM images of Bluepha<sup>®</sup> proprietary microorganisms during the fermentation process.

### Certifications

#### 100% Biobased



# BLUEPHA PHA



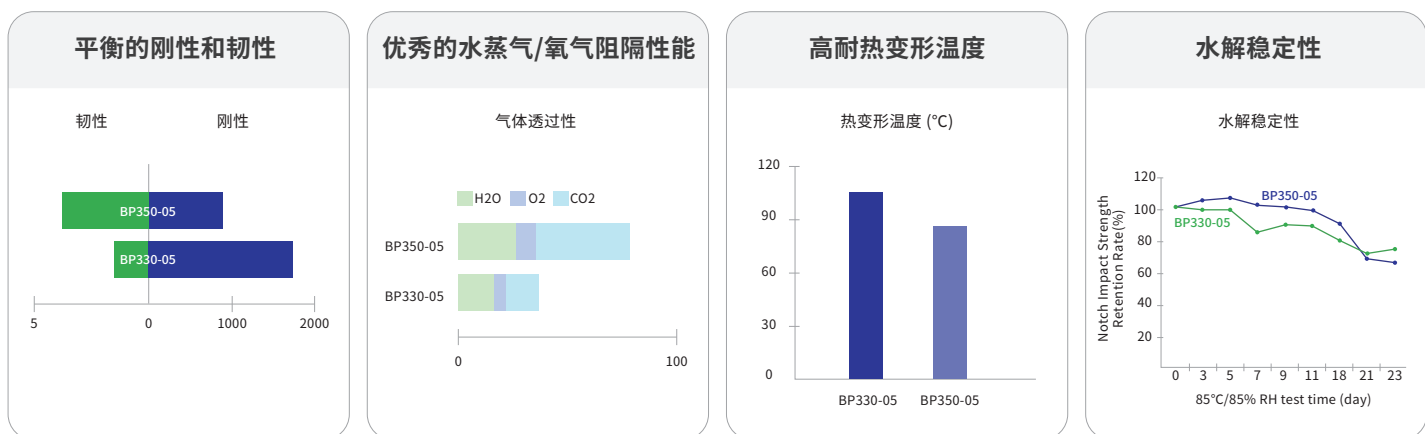
# ◎ 蓝晶™ PHA 系列产品

Bluepha® PHA 根据产品性能特点分为标准系列和增韧系列



## ◎ 应用广泛

蓝晶™ PHA 凭借其优异的材料性能，可以满足广泛的下游应用需求。

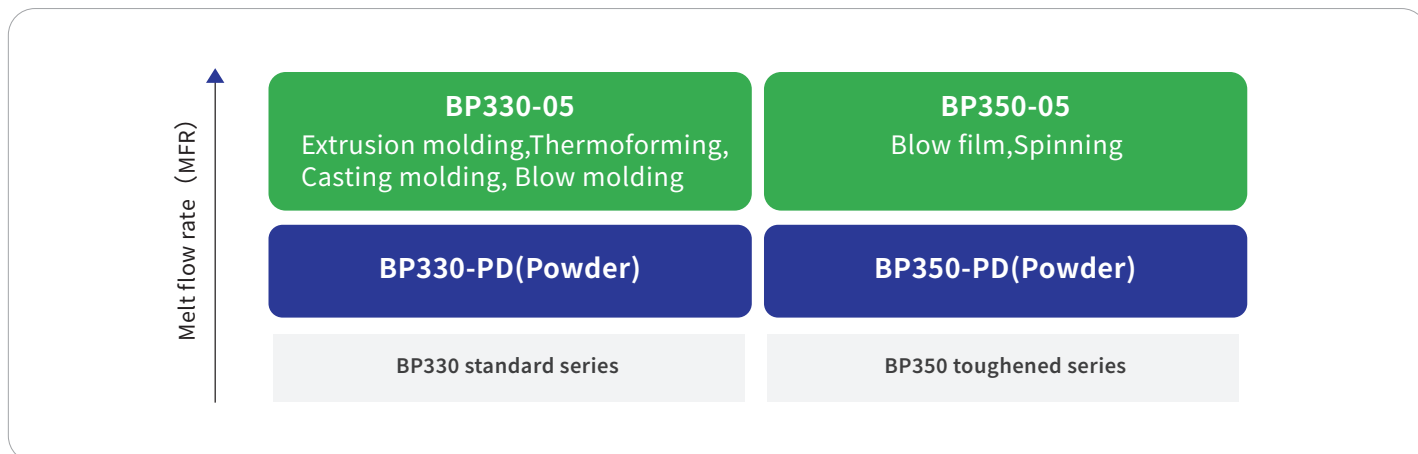


物性表

物理特性	检测标准/方法	单位	BP350-05	BP330-05
熔体流动指数 (165 °C/2.16 kg)	ISO 1133	g/10 min	2	3
熔融温度 (Tm)	ISO 11357	°C	132	148
玻璃化转变温度(Tg)	ISO 11357	°C	-1	1
热变形温度 (0.45 MPa)	ISO 75	°C	85	105
抗拉强度	ISO 527	MPa	27	36
断裂伸长率	ISO 527	%	≥ 10	≤ 5
拉伸模量	ISO 527	MPa	1080	1940
弯曲强度	ISO 178	MPa	28	42
弯曲模量	ISO 178	MPa	910	1760
简支梁无缺口冲击强度	ISO 179	kJ/m <sup>2</sup>	≥ 130	≤ 30

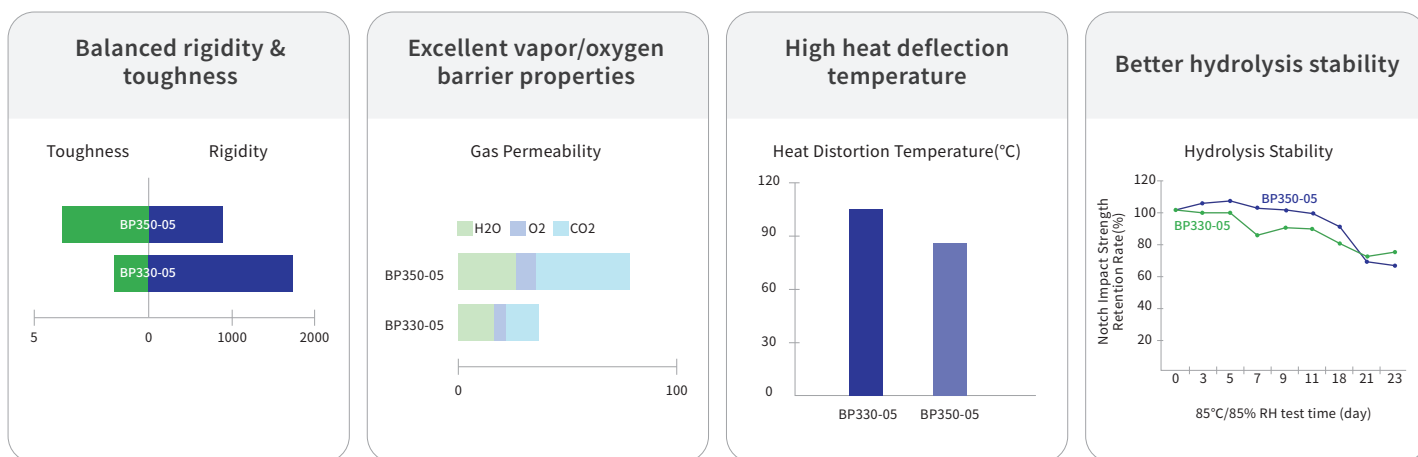
# Bluepha<sup>®</sup> PHA Products

Bluepha<sup>®</sup> PHA has two series of PHBH products: the standard series and the toughened series



## Versatility

The excellent performance of Bluepha<sup>®</sup> PHA ensures a wide range of downstream applications



### Typical physical properties

Property	Method	Unit	BP350-05	BP330-05
Melt Flow Index (165 °C/2.16 kg)	ISO 1133	g/10 min	2	3
Melting Temperature (T <sub>m</sub> )	ISO 11357	°C	132	148
Glass Transition Temperature (T <sub>g</sub> )	ISO 11357	°C	-1	1
Heat Deflection Temperature (0.45 MPa)	ISO 75	°C	85	105
Tensile Strength	ISO 527	MPa	27	36
Elongation At Break	ISO 527	%	≥ 10	≤ 5
Tensile Modulus	ISO 527	MPa	1080	1940
Flexural Strength	ISO 178	MPa	28	42
Flexural Modulus	ISO 178	MPa	910	1760
Charpy Unnotched Impact Strength	ISO 179	kJ/m <sup>2</sup>	≥ 130	≤ 30



## ◎ 全域降解

蓝晶™ PHA 是唯一能在所有自然和人工环境下降解的材料，能够被广泛存在于自然环境中的细菌和真菌降解，最终完全转化成二氧化碳和水。

### 已获得相关认证

#### 降解性认证

OK 海洋降解



OK 淡水降解



OK 土壤降解



OK 家庭堆肥



OK 工业堆肥



BPI 工业堆肥



JBPA 生物基生物降解



JBPA 海洋降解

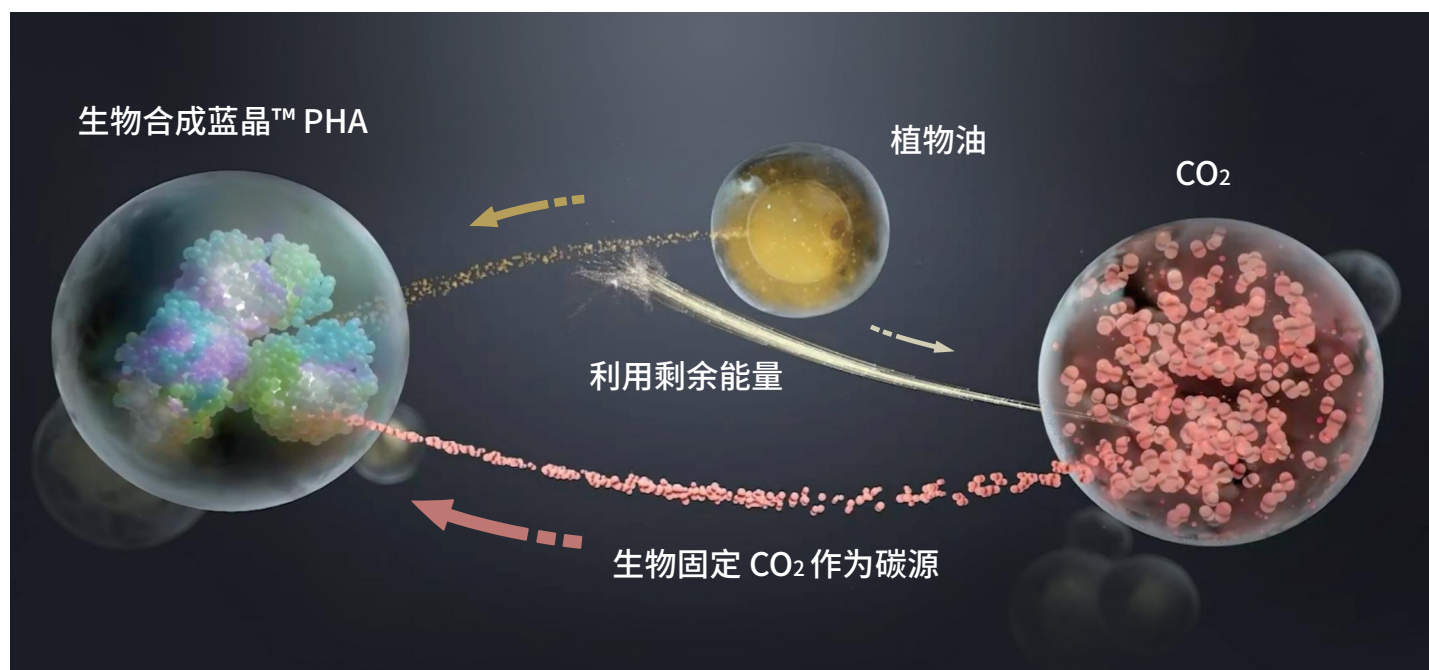


#### 食品接触合规

-  欧盟食品可接触 (EU) No 10/ 2011
-  日本食品可接触 (JP) No 233/ 1947

## ◎ 生物混动技术 Biohybrid™ —— 碳固定

蓝晶自研的突破性底层技术——「生物混动」(Biohybrid™)，实现了同时以植物油和二氧化碳为混合碳源生产蓝晶™ PHA，在显著提高产量并降低成本的同时，丰富了生物制造 PHA 的低碳特性。这项技术已经在蓝晶的中试生产中得以验证。经测算，蓝晶™ PHA 中 90% 碳原子来自于植物油，10% 来自于空气中的二氧化碳，在中试发酵罐水平的蓝晶™ PHA 产量相比出发菌株提高了 12.4%。



# BLUEPHA PHA

## ◎ Biodegradability

Bluepha® PHA is the only material that can naturally biodegrade in any environment. It is broken down by bacteria and fungi, ubiquitous in nature, and ultimately converts entirely into carbon dioxide and water.

### Certifications

#### Biodegradability

Marine OK bio-degradable TÜV AUSTRIA MARINE S2427  
Water OK bio-degradable TÜV AUSTRIA WATER S2427  
Soil OK bio-degradable TÜV AUSTRIA SOIL S2427  
Home OK compost TÜV AUSTRIA HOME S2427  
Industrial OK compost TÜV AUSTRIA INDUSTRIAL S2427

BPI COMPOSTABLE COMMERCIALLY COMPOSTABLE ONLY. FACILITIES MAY NOT EXIST IN YOUR AREA. CERT #10529623

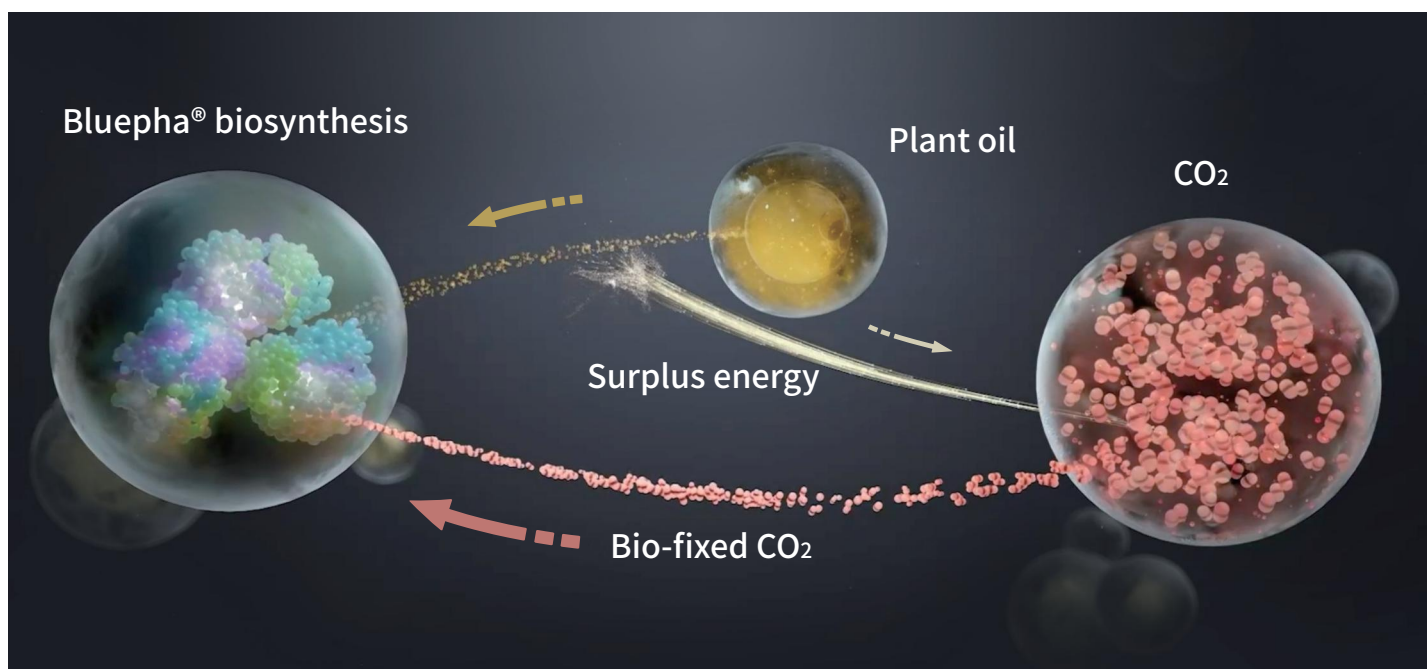
生分解性 バイオマスプラ  
海洋生分解性 バイオマスプラ

#### Food contact approval

- ✓ (JP) No 233/ 1947
- ✓ (EU) No 10/ 2011

## ◎ Biohybrid™ Technology- Carbon Fixation

Bluepha's proprietary and breakthrough technology — "Biohybrid™", enables the production of Bluepha® PHA using plant oils and carbon dioxide simultaneously as hybrid carbon sources. Not only it has significantly increased yield while reducing the cost, but also has enhanced the low-carbon characteristics of Bluepha® PHA bioproduction. The technology has been implemented at the pilot production level in Bluepha. About 90% of the carbon atoms in Bluepha® PHA come from plant oils, and 10% come from carbon dioxide. Compared to the starting strain, the Biohybrid™ strain has increased the yield of Bluepha® PHA by 12.4%.



# BLUEPHA PHA



# 蓝晶™ PHA 餐饮具系列解决方案

## Bluepha® PHA Tableware Solution

### 蓝晶™ PHA 餐饮具

#### Bluepha® PHA Tableware

蓝晶开发的注塑、吸塑专用料拥有较宽的性能调节范围、高耐热、高生物基、高光泽度等优势，可用来制造餐饮具，例如一次性刀叉勺，水杯，外卖盒，饮品盖等。可实现不同降解级别（工业堆肥，家庭堆肥）、不同外观（外形、颜色）的需求。

Developed by Bluepha, the solutions have great processing abilities, high heat resistance, high biobased content, high glossiness, etc. They can be used to manufacture food service items such as disposable cutlery, cups, takeaway boxes, and beverage lids. Different degradation levels (industrial composting, home composting) and different appearances (shape, color) can be achieved according to demands.

- ◎ **降解性能优异**  
Excellent biodegradability  
工业堆肥或家庭堆肥  
Industrial compostable & Home compostable
- ◎ **高温条件下可使用 (90 °C)**  
Suitable for hot food/drinks (90 °C)
- ◎ **刚韧平衡**  
Balanced rigidity and toughness
  - 防摔性
  - 耐弯折
  - Shatter resistance
  - Bending resistance
- ◎ **质感独特**  
Unique texture  
仿石、陶瓷质感，光泽如玉  
Imitating the textures of stone, jade, and ceramics.



# 蓝晶™ PHA 餐饮具系列解决方案

## Bluepha® PHA Tableware Solution

TABLEWARE SOLUTION

### 蓝晶™ PHA 吸管

#### Bluepha® PHA Straw

蓝晶开发的吸管专用料，可通过挤出工艺制备耐热一次性直吸管。制品不仅耐热，也是可降解耐热一次性吸管中，少数能制备半透明外观的材料方案。根据需求，可实现不同生物基含量（最高 100%）、不同降解级别（海洋降解，家庭堆肥）、不同外观（从半透明到不同颜色）的需求。

Developed by Bluepha, the solution can be used to produce disposable straws through extrusion process. The product is heat-resistant and is one of the few materials that can produce a semi-transparent appearance in biodegradable disposable straws. Different biobased amount (up to 100%), degradation levels (marine degradation, home composting), and appearances (from semi-transparent to different colors) can be achieved according to demands.

- ◎ **降解性能优异**  
Excellent biodegradability  
工业堆肥或家庭堆肥  
Home compostable & Marine degradable
- ◎ **高温条件下可使用 (85 °C)**  
Good heat resistance (85 °C)
- ◎ **高生物基 (75-100%)**  
High Biobased (75-100%)





# 蓝晶™ PHA 包装系列解决方案

## Bluepha® PHA Packaging Solution

### 蓝晶™ PHA 硬质包装

#### Bluepha® PHA Rigid Packaging

蓝晶开发的注塑、吸塑专用料拥有较宽的性能调节范围、高耐热、高生物基、高光泽度等优势，可用来制造硬质包装，例如电子产品包装、礼赠产品包装等。可实现不同降解级别（工业堆肥，家庭堆肥）、不同外观（形状、印刷、制品颜色）的需求。

Developed by Bluepha, the solutions have great processing abilities, high heat resistance, high biobased content, high glossiness, etc. They can be used to manufacture rigid packaging, such as electronic product packaging, gift product packaging, etc. Different degradation levels (industrial composting, home composting) and different appearances (shape, printing, product color) can be achieved according to demands.

#### ◎ 降解性能优异

##### Excellent biodegradability

工业堆肥或家庭堆肥

Industrial compostable & Home compostable

#### ◎ 高温条件下可使用 (90 °C)

##### Good heat resistance (90 °C)

#### ◎ 刚韧平衡

##### Balanced rigidity and toughness

- 防摔性

- 耐弯折

- Shatter resistance

- Bending resistance

#### ◎ 质感独特

##### Unique texture

仿石、陶瓷质感，光泽如玉

Imitating the textures of stone, jade, and ceramics.



# 蓝晶™ PHA 包装系列解决方案

## Bluepha® PHA Packaging Solution

PACKAGING SOLUTION

### 蓝晶™ PHA 软质包装

#### Bluepha® PHA Flexible Packaging

蓝晶开发的吹膜专用料具有良好的耐热性、优秀的韧性、高生物基含量及良好的封口性。相对较低的熔指，让蓝晶™吹膜专用料能更好的适配现有设备及吹膜工艺，吹膜制品可以广泛应用于日常生活，例如超市购物，外卖袋，奶茶咖啡袋等。可实现不同降解级别（工业堆肥，家庭堆肥）、不同外观（尺寸、印刷、颜色）的需求。

Developed by Bluepha, the blow film solution has good heat resistance, excellent toughness, high biobased content, and good sealing properties. The relatively low melt index allows Bluepha® PHA blow film solution better adapting to existing equipment and processes. Blown film products can be widely used in daily life, such as supermarket shopping bags, takeout bags, milk tea and coffee bags, etc. Different degradation levels (industrial composting, home composting) and different appearances (size, printing, color) can be achieved according to demands.

- ◎ **降解性能优异**  
Excellent biodegradability

家庭堆肥  
Home compostable

- ◎ **承重 10kg 以上**  
Weight load 10 kg above

- ◎ **不易变形、不勒手**  
Less deform, comfortable grip





# 蓝晶™ PHA 纤维纺织解决方案

## Bluepha® PHA Textile Solutions

### 蓝晶™ PHA 纤维纺织

#### Bluepha® PHA Fiber/Fabric

蓝晶开发的纤维专用料为 100% 生物基，可用来生产短纤、长丝及无纺布，其制品拥有天然的抑菌性、亲肤质感以及优异的耐热性，广泛应用于服装家纺、医疗卫材、包装等多个领域。例如帆布包、卫生用品面层、柔肤巾、购物袋等。

Developed by Bluepha, the textile solutions are 100% biobased and can be used to produce staple fiber, filament, and non-woven fabric. The products have natural antibacterial properties, skin-friendly texture, and excellent heat resistance. They are widely used in various fields such as clothing and home textiles, medical and health materials, packaging, etc, such as canvas bags, sanitary product surface layers, soft skin towels, shopping bags, etc.

#### ◎ 天然亲肤

##### Soft touch

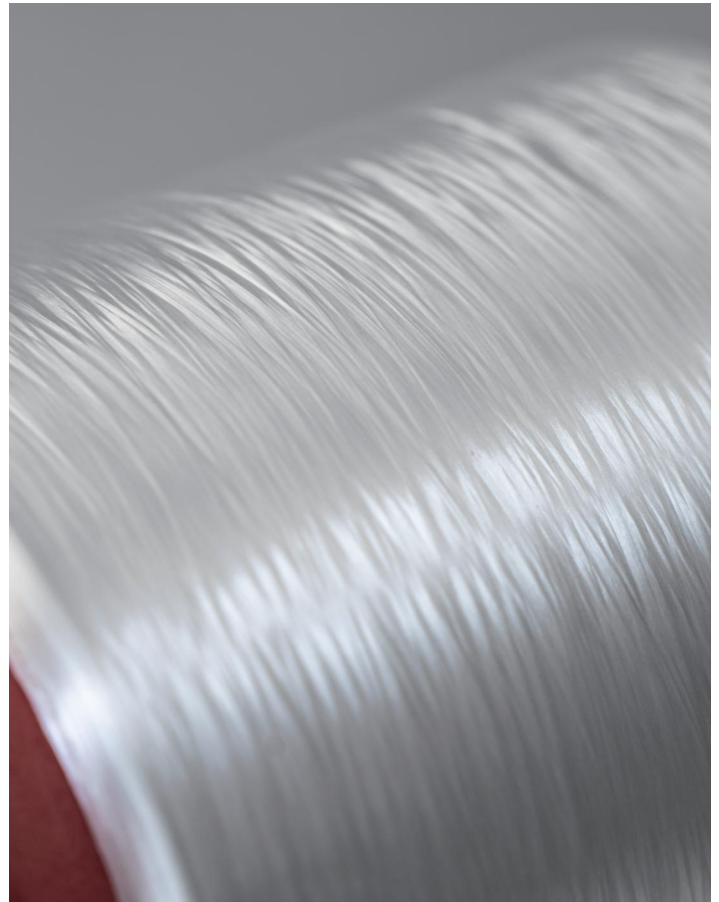
蓝晶™ PHA 纤维所制备的纺织品拥有丝滑柔软质感，其表面呈弱酸性，与皮肤 pH 值相近，天然亲肤  
Bluepha® PHA fiber has silky soft texture. Its 6.4 pH is similar to the skin's, making the fiber naturally friendly to the skin.

#### ◎ 天然抑菌

##### Natural anti-bacterial

蓝晶™ PHA 纤维抗菌率超 90% ( 遵照 GB/T20944.3-2008 )

The anti-bacterial rates of Bluepha® fiber were >90% ( GB/T20944.3-2008 )



## 纺粘无纺布

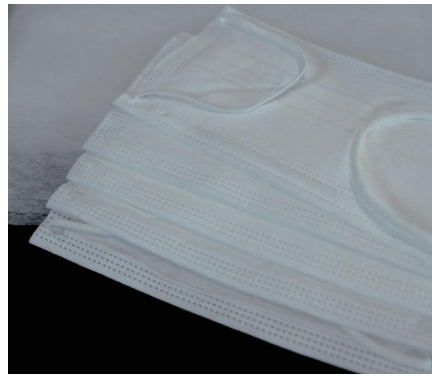
Spunbond  
non-woven fabric

- 设备适配性高
- 100% 生物基
- 可工业堆肥
- Good processability
- 100% biobased
- Industrial compostable

## 热风无纺布

Hot air  
non-woven fabric

- 天然抑菌，与皮肤 pH 值相近
- 透气性好
- 导湿性能优异
- Natural Anti-bacterial, similar to skin pH value
- Good breathability
- Good perspirability





# 蓝晶™ PHA 纸塑复合解决方案

## Bluepha® PHA Paper Coating Solution

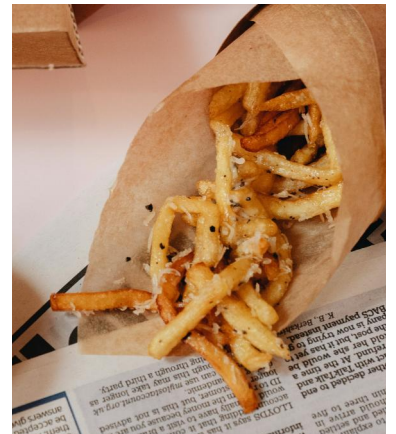
蓝晶开发的纸塑复合方案，可用于一次性纸杯、包装纸（食品、日用品）等，并实现回收再浆。基于 PHA 材料优异的耐热性、阻隔性，PHA 涂层可以应用于热饮场景中，并为纸质基材提供良好的阻水阻油性能。

Developed by Bluepha, the paper coating solution can be used for disposable paper cups, packaging paper for food and daily necessities, and achieve pulp recycling. Due to the excellent heat resistance and barrier properties of PHA, the coating can be applied in hot drink scenarios, providing good water and oil resistance for the paper substrate.

# PAPER COATING SOLUTIONS



\* 图片仅为应用参考





Bluepha

