Introduction of Wanhua PBAT product

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PBAT business

Capability

At present, the PBAT capacity of Meishan base is planned to be 180000 T / A, and the plant offstage I with 60000 T / A is expected to be put into operation in Q3, 2021

Product chain

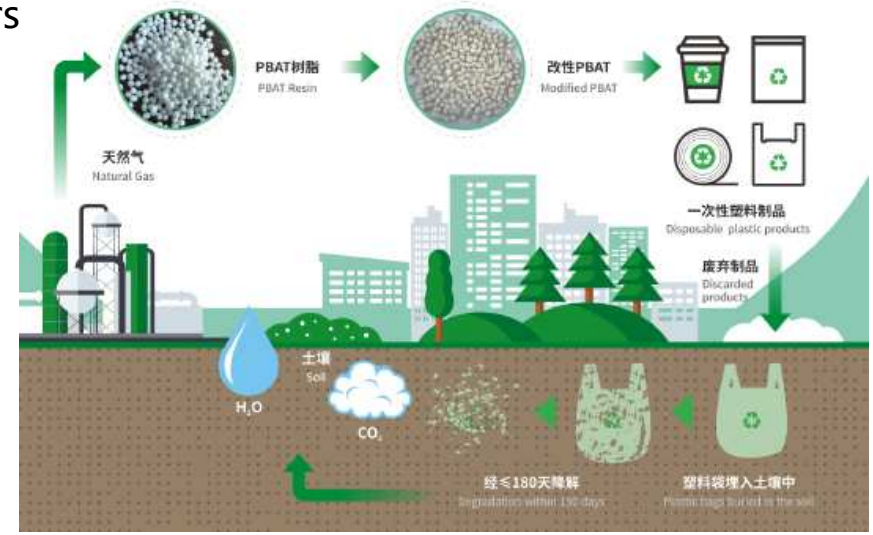
Taking natural gas as the source, supporting upstream BDO (Meishan 100000 t / A + Yantai 100000 t / a) to provide customers with stable and high-quality products.

Natural → BDO → PBAT resin

Waneco® PBAT grade

- **T16**: MFR=3~5
- **T66**: MFR=18~20

Under composting conditions, PBAT resin can be decomposed into carbon dioxide, water and other small molecules by microorganisms within 180 days. It does not produce any toxic residues and is friendly to the environment.



Brief introduction of PBAT

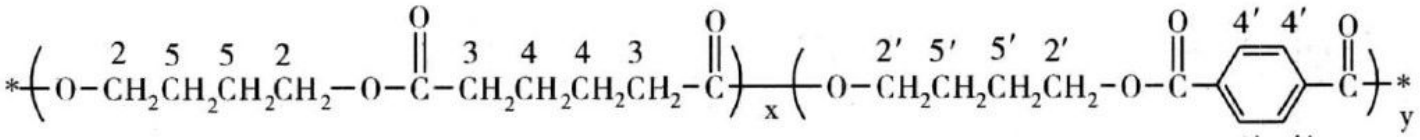
PBAT (Polybutylene terephthalate adipate)

Raw material

- 1,4-butanediol （BDO)
- adipic acid （AA)
- terephthalic acid （PTA)

PBAT Resin

Molecular formula：



Property of PBAT:

- Good biodegradability: compostable, with a degradation rate of more than 90% after 180 days;
- High elongation: suitable for membrane bag direction;
- Good toughness: it can be used to compounding PLA .

Introduction of product

- Wanhua chemical adopts a one-step (tackifying) synthesis process, with the support ofthe upstream raw material BDO, to provide customers with high-quality and stable PBAT products.

WANECO® T16 Technical Data

Property	Test standard	Test condition	Unit	Typical value
MFI	ISO 1133	190℃/2.16Kg	g/10min	3-5
Melting point	DSC	-	℃	110-130
Water content	-	-	%	<0.1
Acid value			mol/t	<40
Density	ISO 1183	-	g/cm³	1.20-1.25
Shore hardness	ISO 868	-	-	>30
Vicat A/50	ISO 306	50℃/h;10N	℃	>80

WANECO® T16 25μm Typical value of blown film

Property	Test standard	Test condition	Unit	Typical value
Tensile strength(25μm)	ISO 527	200mm/min	MPa	>35
Strain at break（25μm）	ISO 527	200mm/min	%	>500
Light transmittance（25μm）	ASTM D1003	25μm	%	>85

Recommended drying conditions: 80 ℃, 4H; Blow molding temperature: 150-170 ℃.

Excellent biodegradability

Degradable shopping bags (before composting)

Biodegradable shopping bag (30 days)

- Wanhua PBAT has excellent biodegradability. After 30 days of composting treatment, the degradable shopping bag is obviously broken.

Application

Shopping plastic bag

Express bag

Garbage bag

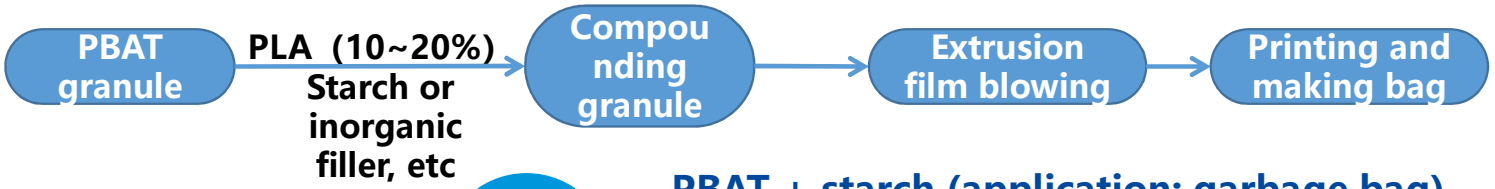
Disposable tableware

Film

Paper cup coating

PBAT application - Degradable plastic bags

Manufacturing process



PBAT + starch (application: garbage bag)

Advantages: low cost, fast degradation speed and biological basis

Disadvantages: low strength, moisture absorption and low service life

PBAT + inorganic filler (application: garbage bags, express packaging)

Advantages: low cost, medium strength

Disadvantages: low service life and low strength

PBAT + PLA (application: supermarket and store packaging)

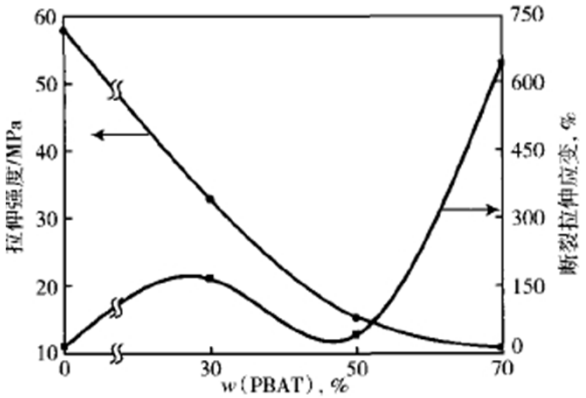
Advantages: high strength, wide appearance, bio based

Disadvantages: high cost

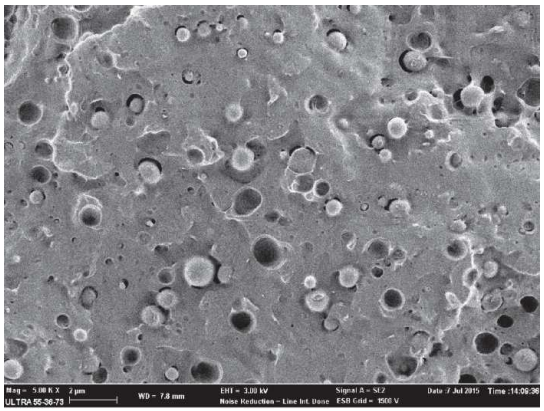
PBAT application——PLA compounding

Manufacturing process

PLA granule + PBAT talc → Compounding granule → Injection molding



Effect of PBAT content on tensile properties of PLA / PLA blends



Electron microscope of PBAT and PLA / PLA blend

- PBAT is used to compounding PLA, which can effectively improve the brittle and cracking characteristics of PLA;
- Due to the crystallization behavior of PLA directly affects the properties, the difficulty of compounding is to find a suitable compatibilizer to make PBAT evenly distributed without affecting the crystallization of PLA;
- The application of PLA is expanded, so that PLA can be expanded to engineering plastics, with great market potential.

PBAT Application-film

Manufacturing process

PBAT granule → PLA、PPC Inorganic filler → Compounding granule → Extrusion film blowing → Winding

PBAT+PLA	• Advantages: long induction period • Disadvantages: high cost, poor gas barrier
PBAT+PPC+PLA	• Advantages: low cost, good gas barrier • Disadvantages: poor heat resistance and fast degradation

➢ Problems: 1) high cost; 2) Several performances are not up to standard; 3) The degradation is too fast and the induction period is short;

➢ Maintain attention: it needs to be promoted by the government and combined with product development with better performance.

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