

# Bluepha® Processing Guide-Sheet and film extrusion

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## INTRODUCTION

This processing guide describes the processing of Bluepha® pellets for film and sheet extrusion applications that can be accomplished using conventional extrusion equipment. Typical applications include film rolls, food packaging, disposable packaging, label films, bank/gift cards, etc. Processing of these PHBH resins can usually be done on existing, conventional extrusion equipment.

Sheet/film extrusion is a versatile process with many possibilities in process and formulation. The information given in this processing guide is for reference only and the customer is advised to optimize the process to find the optimal process conditions for the formulation and equipment used.

## STORAGE CONDITIONS

It is recommended to store Bluepha® resin in their original packaging at temperatures below 50°C and away from direct sunlight.

The supplied Bluepha® resin are typically semi-crystalline.

## TYPICAL Bluepha® RESIN PROPERTIES

Table 1: Typical physical properties of Bluepha® and Bluepha® compounds suitable for extrusion

Item	Unit	Result				
		BP330	BP350	Compound A	Compound B	Compound C
Application examples	-	Sheet and film extrusion	Sheet and film extrusion	Sheet and film extrusion	Sheet and film extrusion	Sheet and film extrusion
Density	g/cm <sup>3</sup>	1.22	1.20	1.20	1.21	1.22
Melt Index (165°C/5kg)	g/10mins	3-5	3-5	4-6	3-5	2-4
Melting Point (T <sub>m</sub> )	°C	149	139	137	147	135
Glass Transition Temperature (T <sub>g</sub> )	°C	1	-2	-1	2	-2
DTUL	°C	115	86	83	110	73
Flexural Modulus	MPa	1600	640	810	1700	700
Charpy Notched Impact Strength	kJ/m <sup>2</sup>	2.5	5.5	6.0	2.7	8.0

※Please contact Bluepha for the information of compound A, compound B and compound C

## DRYING

Bluepha® resins are supplied in sealed barrier packaging with a maximum moisture content less than 5000 ppm. It is recommended to control the moisture content to less than 1000ppm before processing. Moisture can cause hydrolysis of Bluepha® resin during the melt process, resulting in reduced mechanical performance in the final product.

Bluepha® resins can be dried using most conventional drying systems. Blast drying oven or vacuum drying oven is preferred to use in the drying step. It is highly recommended to check the actual moisture content after drying, the Karl-Fischer or Brabender Aquatrac method can be used. In case other additives are added to the formulation, the moisture content of the additives should also be tested and dried if necessary.

The Bluepha® resin should be processed as soon as possible after drying and preferably stored under an inert (Nitrogen) atmosphere to prevent absorption of moisture. Starting at 200ppm, the moisture variation under atmospheric conditions is shown in Fig. 1.

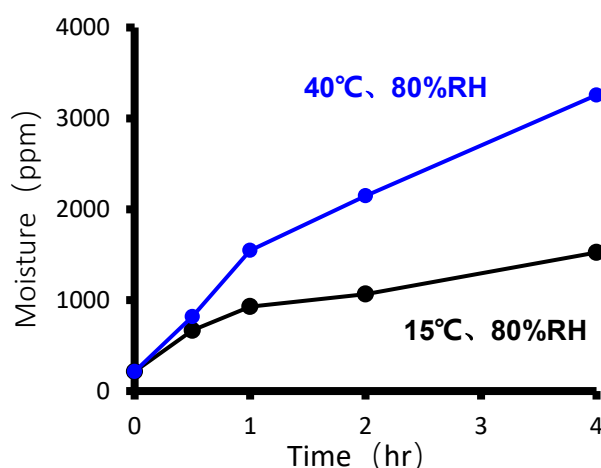


Fig.1 Moisture absorption curve of Bluepha®

Refer to Table 2 for the drying conditions using the blast drying oven. Please note that the drying temperature should not be higher than 80°C, otherwise there is a risk of adhesion of Bluepha® resin.

Table 2. Typical Bluepha® drying conditions

Parameter	BP330	BP350
Drying time	4-6 hours	4-6 hours
Air temperature	60-80 °C	60-80 °C

Under laboratory conditions, Bluepha measured the relationship between drying time and moisture content of different grades of Bluepha® at 60°C, as shown in Figure 2.

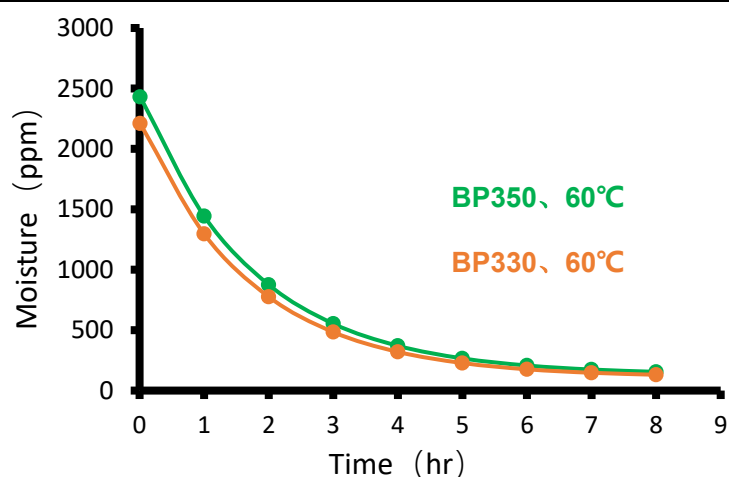


Fig. 2. Drying time and moisture content curve

## EXTRUDER USAGE PROCESS

Before introducing Bluepha®, the extruder needs to be well cleaned and purged to prevent cross contamination from other polymers. Also, make sure that the feeding and blending equipment in the material preparation steps (before the materials and additives enter the extruder) is extensively cleaned to avoid contamination by dust and other polymers. The purging procedures below are recommended for removing other polymers when processing Bluepha®.

1. Check if the extruder has been used with other polymers. To prevent starting up the machine with nonmolten material, the extruder should be set at a temperature above the processing temperature of the other polymers or Bluepha® used before.
2. Purge the system with PBAT, PBS or PE which has similar MFR to Bluepha®, followed by purging with the Bluepha®.
3. Set the temperature of the extruder to the processing temperature of the Bluepha®.
4. Before starting the process, check if the Bluepha® resin are contaminated.
5. At completion of the process, it is recommended to clean the system again with purging compound to remove the remaining Bluepha® material. Check the recommendations of the supplier of the purging material for the right clean conditions.

After completion of the run, Bluepha® must be removed from the whole system. Bluepha® will degrade slowly over time and cause corrosion of the equipment.

## EXTRUDER SETUP AND TEMPERATURE PROFILE

When processing the Bluepha® resins or compounds, if specific functions are required, corresponding additives (e.g. anti-static, anti-block, color concentrates, plasticizer, etc.) or masterbatch mixes can be added and processed.

Bluepha® can be processed in conventional extruders. A single-screw extruder with  $24 < L/D < 32$  is

recommended, typical extrusion conditions for Bluepha® are shown in Table 3.

Table 3. Typical extruder temperature conditions for processing Bluepha®

Parameter	Unit	BP330	BP350	Compound A	Compound B	Compound C
Feed zone	°C	20-40	20-40	20-40	20-40	20-40
Melt zone	°C	120-140	120-140	120-140	120-140	120-140
Mixing & conveying	°C	140-165	140-165	140-165	140-165	140-165
Die head	°C	140-165	140-165	140-165	140-165	140-165

## SHEET AND FILM EXTRUSION

Sheet extrusion can be performed on conventional film blowing equipment, and a high pressure film blower is recommended for the process. To avoid cross contamination by other polymers, the extruder and auxiliary equipment need to be purged and cleaned before and after Bluepha® extrusion.

BP350, Compound A, Compound B and Compound C are recommended for film cast extrusion.

BP330, Compound B are recommended for film cast extrusion.

The cold roll temperature of the extrusion equipment needs to be set in the range of 40-60°C. Too low or too high temperature will cause the film or sheet to stick to the cold rollers, resulting in poor quality film or sheet. Air knives and high pressure electrodes can be set between the film and the cold roll to improve the flatness of the film.

## STORAGE AND TRANSPORTATION OF Bluepha® PRODUCTS

It is recommended to store Bluepha® film products in its closed, original moisture-blocking packaging at a storage temperature below 50°C. Store in a ventilated and cool warehouse, avoid direct sunlight and prevent moisture.

The use of sharp tools is strictly prohibited during loading and unloading. It is not allowed to be exposed to sunlight or rain during transport, and it is prohibited to mix with sand, broken metal, toxic substances, corrosive substances and inflammable and explosive substances.

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