# GN600F 生物降解树脂吹膜加工指南

# BIORESIN BLOWN FILM PROCESSING GUIDE

## 总论

## PREAMBLE

生物降解树脂是一种聚酯复合材料，具有优良的综合性能和生物降解性能。可以制备成各种薄膜，在减少环境污染方面有广泛的应用价值。但生物降解树脂作为新材料，如何加工出性能优良的高品质薄膜，不但需要了解材料的特性，还需在工艺和加工设备等方面做比较细致的了解和准备。下面的章节主要介绍生物降解树脂的特性以及加工工艺，设备要求和后续处理等，适用于初次吹制生物降解薄膜的加工厂工程技术人员、业务员等。

Bioresin is compound polyester. It has excellent synthesisability and biodegradability. Film grades can be processed to packaging products to meet different application requirements. Our products have strong impact on the reduction of environmental pollution. To make high quality film, we need to understand the material characteristics as well as meticulous preparation in the respects of technology and machinery. Below chapters mainly focus on bioresin performance and processing technology, types of equipments required and the handling after processing. This guide primarily is prepared for the engineers and technicians who first time process biodegradable film.

## 1、 材料特性说明

## MATERIAL CHARACTERISTICS

生物降解树脂是一种多元共聚酯，分子量在 20 万以上，挤出加工黏度相对较大，有一定的结晶性和取向性，熔点在 120—150 度，对热敏感，加工温度范围比较窄。生物降解树脂是亲水性聚合物对水分的影响比较大。

Bioresin, a copolyester, has molecular weight above 2,000,000. So, the viscosity in extrusion processing is comparatively higher than other materials. Bioresin has unique crystallinity and orientation performance; the melting temperature is between 120 to 150 ºC.; and sensitive to heat, so the processing temperature window is comparatively narrow. Bioresin is hydrophilic polymer, Therefore, water has much influence on bioresin.

## 2、 加工前准备

## PROCESSING PREPARATION

2.1 生物降解树脂储存和包装

2.1 Bioresin Packaging and Storage Condition

吹膜级生物降解树脂经过熔融挤出造粒后成为颗粒，每包 25 公斤，纸塑复合袋包装。堆放

生物降解树脂的仓库必须干燥通风，颗粒不得与土壤、污水等接触。储存温度尽可能保持常温，并尽量避免低温条件下冷凝的水汽，储存时间可以在 2 年以上。

Bioresins are pelletized after melting extrusion and packed in 25kg laminated paper and plastic bags. The dry and ventilated warehouse is required for bioresin storage and it should be no direct contact with soil and water. Bioresin can be stored for over two years if the warehouse is in room temperature, dry and no condensation

2.2 干燥

Drying

一般情况下没有开封的生物降解树脂颗粒在加工前不需要进行额外干燥，但如开封时间比较长或环境过于潮湿或有比较多的冷凝水汽则需要在加工前进行干燥，干燥工艺为 90 度 2-4 小时。

In normal condition, if the bag sealed properly, bioresin does not need drying before the processing. If a bag is open for long and stored in a damp condition, resin need to be dried before the processing. Drying temperature is 90 C. Drying period time should be 2 to 4 hours

2.3 相容性及设备清理

Compatibility and Purging

生物降解树脂与传统聚烯烃塑料如 LDPE，HDPE 等不相容，在进行吹膜加工前需对含其他塑胶材料的吹膜机进行清理，清理过程可采用如下步骤：

Bioresin is incompatible with LDPE and HDPE. Therefore, the machine needs to be purged thoroughly before processing. The procedure is as below:

2.3.1 拆卸机器设备，清理螺杆、炮筒、模头等残留物料，清理完毕生物降解树脂可在设定温度下直接吹膜成型

2.3.1. Dismantle the machine and clean the residues in the screws, barrels and die head. Afterwards, bioresin can be processed at the temperature profile set.

2.3.2 用低熔点 LDPE 在原设定温度下冲洗挤出机，之后降低到 140—160 度，加入生物降解树脂进行冲洗.

Purge the machine with low melting point LDPE in normal temperature, afterwards; reduce the temperature to 140 – 160 C and continue to purge the machine with bioresin.

2.3.3 LDPE 被生物降解树脂冲洗干净后降低温度到 120—150 度，根据挤出塑化情况调整挤出温度

After LDPE is purged out completely by bioresin, the temperature should be reduced to 120 - 150 C, and then the machine is ready to process bioresin. The temperature can be adjusted in accordance with the condition of bioresin plasticising.

2.3.4 如因设备老旧难以冲洗干净，请采用步骤 2.3.1 清理设备

By referring 2.3.1 to carry out purging, if the machine is very old.

2.3.5 加工完生物降解树脂如需换料生产聚烯烃可直接升温到 170 度用 PE 冲洗即可，尽量不要在高温下停留太长时间以免生物降解树脂热降解.

If you need to process polyolefin after the bioresin processing, you can increase the temperature whenever you need to 170 C to purge bioresin out with PE. Please note do not let bioresin stay in the machine in high temperature for too long. Otherwise, bioresin will be degraded 。

2.4 着色

Colouring

生物降解树脂有良好的着色性能，可以直接混入以可降解树脂为基材的色母料或色粉

It is easy to colour bioresin by adding biobased master batch, either pellet or powder form.

**3、加工工艺设定**

**Processing Profile Setting**

3.1 温度设定

Temperature Profile Setting

**生物降解树脂是热敏性材料，温度的设定是生物降解树脂吹膜加工最大的影响因素之一。**不同的螺杆构型、长径比和物料所需要的加工温度不同，螺杆构型比较强的如屏障型螺杆则塑化所需温度较低，传统渐变型螺杆所需温度较高，长径比长的温度较低，长径比短的所需温度则比较高。一般而言，根据生物降解树脂的熔点和塑化状态设定的温度范围在 120—150 度之间。

Bioresin is sensitive to temperature. So temperature setting is the key to a success of film processing. The processing temperature profile is defined by the structure of screw profiles, L/D ratio and the type of die design. For instance, screen screw requires lower temperature than others due to high shearing rate it generates. However, the traditional screw and short L/D ratio needs higher temperature. Generally, according to bioresin plasticising condition the processing temperature is between 120 C and 150 C.

3.2 螺杆转速

Screw Speed

螺杆转速依塑化程度而定，一般在 25-45Hz 左右(额定 50Hz)，转速过慢则塑化不良，产量过低。

Screw speed should depend on the melting condition, 25 to 45Hz in normal situation.(rated 50Hz).

3.3 吹胀比

Blow Ratio

生物降解树脂的吹胀比受模头和风环的影响比较显著，一般而言吹胀比越大，纵横向强度越好，建议的吹胀比在 3：1—4:1 之间有比较好的综合性能。

In bioresin processing, air ring and die head defines blow ratio. Blow ratio determines film mechanical properties. The bigger blow ratio, the better MD and TD strength will be better. Normally, we recommend the best blow ratio for bioresin is between 3:1—4:1.

**4、 后续处理**

**Additional Process**

5.1 电晕处理

Corona Treatment

生物降解树脂为极性聚合物，未处理表面电晕指数在 38 左右，可满足一般印刷，如印刷要求高，可在吹膜加工时适当加电晕处理。

Bioresin is polar polymer. Without corona treatment, dyne rate is about 38, which normally is enough for general printing. If special high quality printing requirement, Corona treatment should be taken place at the film extruder.

5.2 热封性

Heat Sealing

生物降解树脂热封温度在 180 度—240 度之间，可根据实际生产进行调整，热封强度较高。

Bioresin heat sealing temperature is between 180℃ and 240℃ depend on the machine, you should adjust the temperature during processing. Bioresin has quite good heat sealing strength.

5.3 印刷性

Printability

能满足普通印刷（单色、多色铜板印刷等）

Biodegradable film can be printed for general usage (single colour or multi colour cooper plate printing)

**5、 注意事项**

**Cautions**

6.1 温度

Temperature

温度控制（包括设备温控精度、温度设定、摩擦剪切热等）对生物降解树脂有重要而关键性影响。熔体温度超过 200 度将难以吹膜成型，超过 260 度将开始热降解，分子链断裂，物料变稀，出现冒烟、自由流淌以及刺鼻气味等现象。对皮肤、眼睛、咽喉等产生不适感，更多信息请仔细阅读 MSDS

Temperature control (including machine temperature control, temperature settings, shear heat, etc.) is critical for bioresin processing. It will be difficult to form a bubble, if the melting temperature is higher than 200 C. Above 260 C, the molecule chains will break. Bioresin becomes thin liquid and degrades. More information please refer to MSDS.

6.2 停留时间

Residence Time

物料在炮筒内的停留时间不宜过长，一般在 150 度不超过 30 分钟，在 170 度不超过 10 分钟，停留时间过长容易造成物料分解等现象。

The residence time of bioresin in screw barrel should not be longer than 30 minutes at the temperature 150℃, and no longer than 10 minutes at 170 ℃. If it is longer than that, bioresin degrades.

6.3 相容性

Compatibility

生物降解树脂与传统聚烯烃塑料不相容，因此残留的聚烯烃塑料容易堵塞生物降解树脂的流动造成出料不匀，滞留分解等现象，必须清理干净才能正常生产。

Bioresin is incompatible with legendary polymers. Therefore, the residue of polyolefin in the machine will cause blockage. Therefore, purging is very important before film processing.

6.4 边料处理

Left over handling

生物降解树脂正常生产产生的边料可以破碎后回收利用，不能回收的可堆肥降解。已经热降解及与聚烯烃塑料混合的物料不能继续使用。

In normal production condition, bioresin left over can be recycled after being shredded. Unrecyclable bits can degrade in landfill or compost site.

**6、 生物降解树脂吹膜常见问题和处理措施**

Common issues in Bioresin Processing and Solutions

7.1 出料不匀

Uneven extrusion

原因：生物降解树脂物料流动性不好，口模杂料堵塞，口模间隙调节不当,模头温度过低

Causes: Bioresin flowability is not very good, contamination and blockage at hopper, die gap is not right., Die temperature too low

措施：提高物料流动性，清理模头，调整口模间隙，提高模头温度

Solutions: To improve resin flowability; to clean the hopper; to justify die gap, increase die temperature

7.2 膜泡不稳

Unstable Bubble

原因：薄膜温度过高，冷却效果不良，牵引速率不匹配，风速过大或不均匀

措施：降低挤出温度，提高风环冷却效果，调整牵引速度，调整风环

Causes: Film temperature is too high, as cooling is ineffective, incorrect line ratio; uneven air

blowing speed and volume. ambient temperature fluctuations

Solutions: To decrease extrusion temperature, to increase air ring efficiency, to justify line speed and regulate air ring.

7.3 破膜

Film Web Split

原因：温度过低塑化及出料不良，杂料残留

Causes: Temperature is too low so plasticising is not completed, residue contamination

措施：提高挤出温度和模头温度，清除杂料

Solutions: To increase extrusion temperature; clean the residue

7.4 收卷不齐

Uneven Winding

原因：厚薄不匀，冷却不当，收卷张力不当

Causes: Uneven gauge, inefficient cooling, rolling force incorrect

措施：调整厚薄度，提高冷却，调整收卷张力

Solutions: To justify gauge control setting, improve cooling efficiency, to justify rolling force

7.5 晶点过多

spots

原因：杂料未清理干净，塑化不良

Causes: Residue contamination, uncompleted plasticising

措施：提高塑化温度，清理杂料，更换滤网

Solutions: To improve plasticising, to clean residue and change filter

8.1 回收利用

Recycling

正常生产过程产生的未污染的边角料可以破碎后再回收利用，按一定比例添加到薄膜料中或造粒后用于别的领域

Uncontaminated production scrap or trim, after being shredded, can be put back to production at certain percentage or repelletized for some other applications.

8.2 生物降解

Biodegradation

受污染、与传统塑料混合、热降解等无法回收利用的生物降解树脂可以集中进行工业堆肥、与有机垃圾一起填埋等处理

Bioresin, which is contaminated or mixed with other conventional plastics or degraded, cannot be recycled but can be composted in industrial compost or buried landfill with organic waste.