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Smart Solutions For A Sustainable World

Process Notes for making NuPlastiQ /HDPE films using BiologiQ's NuPlastiQ Resins

BiologiQ's NuPlastiQ based film resins and Masterbatches can be used to make monolayer film or layers of a co-ex film with NuPlastiQ content from 15% to 35% on most standard HDPE blown film equipment. This Process Note highlights key procedures and information that we use to make quality film.

NuPlastiQ Masterbatch and Mixing Details

Film that is blown with BiologiQ's NuPlastiQ and HDPE is typically made from a NuPlastiQ Masterbatch that is further down blended during the film blowing stage. The Masterbatch typically contains:

50% BiologiQ NuPlastiQ GP
50%HDPE (including compatibilizer)

This Masterbatch is then further down blended for the monolayer film or co-ex layer during film blowing as follows to arrive at the indicated final NuPlastiQ GP to HDPE ratios in the film or co-ex layer:

Final Film Layer Ratio	Masterbatch	Additional HDPE
15% NuPlastiQ GP / 85% HDPE	30% MB	70% HDPE
25% NuPlastiQ GP / 75% HDPE	50% MB	50% HDPE
35% NuPlastiQ GP / 65% HDPE	70% MB	30% HDPE

Notes:

1) The Final Film Layer Ratio above represents the percentage of NuPlastiQ GP in a monolayer film, or in the layer containing NuPlastiQ in a co-ex film.
2) If a fully diluted resin is used in lieu of a Masterbatch (ie 25% NuPlastiQ / 75% HDPE), no further down blending is required during film blowing.

Machine Configuration & Setup

Most standard HDPE film blowing equipment, including "high stock lines" can be used to blow film from resin containing NuPlastiQ. BiologiQ has successful direct experience with monolayer equipment that has the following characteristics:

Screw Diameter	55 – 80 mm (strong mixing elements preferred but not required)
L/D Ratio	38 – 45
Die Gap	~1.2 mm
Die Diameter	80 mm
Typical Blow Up Ratio	3.0 – 5.0
Screen Pack	80 - 100 mesh
Chilled Air	Highly recommended
Extruder Degassing	Not required

Notes:

1) Films made with NuPlastiQ are slightly more sensitive to process conditions (such as die gap and blow up ratio) than are traditional PE films. While we find a BUR of approx. 2.5 is optimum, the best ratio for your equipment can be determined by ensuring the MD and TD strengths are essentially equivalent.

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2) NuPlastiQ + HDPE resin Masterbatches are made with HDPE resins that may or may not contain Slip and Anti-Block additives. No additional Slip or Anti-block is added when the Masterbatch is compounded. It has been observed that adding additional slip is usually necessary to maintain a similar COF as the base resin. It is the responsibility of the manufacturer to add any additional Slip and/or Anti-Block as may be required for the intended application during film processing. In addition, Slip tends to bloom somewhat more slowly when NuPlastiQ is present. We recommend measuring COF after at least 72 hours.
3) It is normal for our bio-based NuPlastiQ resin to outgas (smoke with a slight smell) during processing. This does not affect the final film quality or performance. Note: starch based films will typically have a slight odor if starch is contained in the outer layers.

Startup Procedure

1) Clean or replace the Screen Packs before starting. NuPlastiQ based resins will act as a purge agent when introduced to the equipment, so gels and other defects might be experienced if the screen packs are not clean when NuPlastiQ is introduced.
2) Initial settings for the Film Extruder Process Temperature profile may be set as follows – adjustments to the profile may be needed depending on process equipment and base resins (all temperatures °C):

Zone	C1	C2	C3	C4	C5	AD	D1	D2
Set Temperature	185	185	185	185	185	188	190	190

3) Start with 100% HDPE and establish a stable bubble.
4) Introduce the required blend of Masterbatch and Base Resin to the extruder to obtain a film with the desired NuPlastiQ GP content (eg for 25% NuPlastiQ GP– use 50% MB + 50% additional HDPE).
5) After the initial introduction of the resin blend, and during the transition, adjust the extruder RPM, the Line Speed, Take up Reel Speed, Winder Speed (and any other typical parameters) to obtain the bubble stability, width and film thickness desired.
6) Start and maintain the film winder as normal.
7) On shutdown, it is recommended to purge the film extruder with 100% HDPE. Leaving any starch based resin (like NuPlastiQ) in the extruder during shutdown and startup may cause it to burn and delay normal startup on the next use.

Resin Storage

1) BiologiQ resins (including Masterbatches) containing NuPlastiQ GP should be stored in a cool dry environment until ready for use.
2) Maintain the inner package seal until ready for use.
3) After use, and if useable resin remains, remove as much air as possible and re-seal the packaging. Resin should be used within 1 year of manufacture and/or within 6 months of first opening.
4) If a good seal is not maintained, or the resin gathers moisture, drying may be required. Dry according to:

	NuPlastiQ GP	NuPlastiQ Masterbatch
Temperature	40°C	60°C
Time	8-12 hours	8-12 hours