SK Chemicals

SKYGREEN JN200

Glycol Modified Copolyester Resin

Processing Guidelines for Injection Moulding

CONTENTS

SK Chemicals R&D Center, 600, Jungja-1-dong, Chanan-ku, Suwon-si, Kyungki-do 440-745, Republic of Korea
Tel: +82 (31) 2408354, Fax: +82 (31) 2451192

INTRODUCTION TO SKYGREEN JN200

SKYGREEN JN 200 is the Glycol Modified Copolyester resin manufactured by SK Chemicals for injection moulding application. SKYGREEN JN200 offers excellent clarity, toughness, and processability.

This document contains recommendations concerning the processing. The recommendations are given in good faith, but due to wide variations in both processing equipment and product design it is not possible here to provide accurate information for any particular situation. To discuss any particular manufacturing process the customer is invited to contact the SK Chemicals Technical Service Team, details of which are contained at the end of this document.

What is SKYGREEN JN200 which is Glycol Modified Copolyster Resin?
SKYGREEN JN200 is an amorphous copolyester produced by the reaction of terephthalic acid (TPA) with ethylene glycol (EG) in which a certain amount of the ethylene glycol is replaced with cyclohexane dimethanol (CHDM) – see Fig 1. The addition of CHDM prevents crystallisation, leading to improved processability combined with outstanding toughness, clarity and chemical resistance.

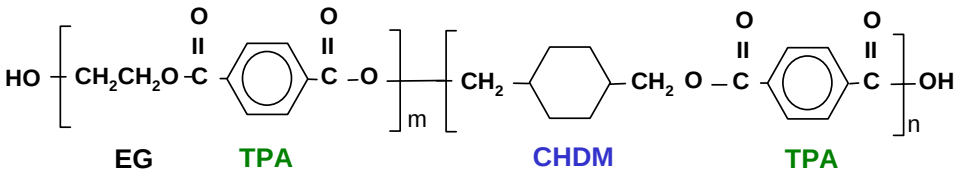

Fig. 1 - SKYGREEN JN200

SK Chemicals R&D Center, 600, Jungja-1-dong, Chanan-ku, Suwon-si, Kyungki-do 440-745, Republic of Korea
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DATA SHEET

Preliminary Data Sheet of SKYGREEN JN200

Property	Test Method	Unit	Injection Moulded Property (ASTM Method) Typical Values
Physical			
Specific Gravity	**ASTM D792**	**-**	**1.23**
Mechanical			
Tensile Strength @ Yield 50mm/min (2 inch/min)	**ASTM D638**	**MPa (kgf/cm^2)**	**53 (540)**
Tensile Strength @ Break 50mm/min (2 inch/min)	**ASTM D638**	**MPa (kgf/cm^2)**	**44 (450)**
Elongation @ Break 50mm/min (2 inch/min)	**ASTM D638**	**%**	**340**
Flexural Strength 1.27mm/min (0.05 inch/min)	**ASTM D790**	**MPa (kgf/cm^2)**	**67 (685)**
Flexural Modulus 1.27mm/min (0.05 inch/min)	**ASTM D790**	**MPa (kgf/cm^2)**	**1800 (18400)**
Izod Impact Strength, Notched @ 23 ^{o}C(73 ^{o}F)	**ASTM D256**	**J/m(kgf · cm/cm)**	**NB**
Thermal			
Heat Distortion Temperature @ 0.455 MPa(66 psi)	**ASTM D648**	**^{o}C (^{o}F)**	**74 (165)**
Optical			
Haze (250 micron film)	**ASTM D1003**	**%**	**< 1.0**
Total Transmittance (250 micron film)	**ASTM D1003**	**%**	**90**

- The data listed here is preliminary data sheet of product. Therefore this sheet should not be used to establish specification limits or used alone as a basis for design. This information is not intended as a warranty of any kind. Customers must make their own representative test and assume all risks of use, whether used alone or in combination with other products. SK Chemicals assumes no obligation or liability of any advice furnished by it or results obtained with respect to these products. All warranties of merchantability for a particular purpose or use are excluded and disclaimed.

PROCESSING

SKYGREEN JN200 can be successfully processed using conventional injection moulding equipment. The following information contains some general processing guidelines for SKYGREEN JN200 in order to obtain the best quality product.

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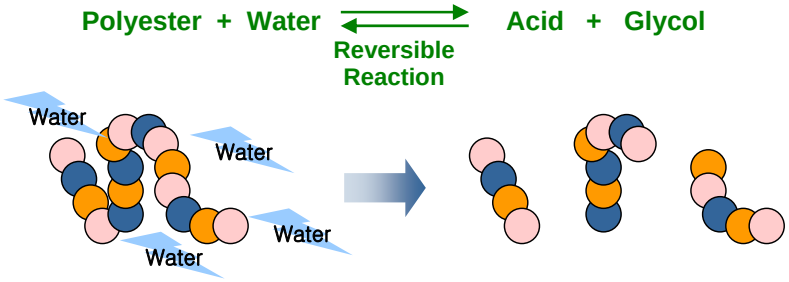
DRYING

SKYGREEN JN200 has a tendency to absorb atmospheric moisture, which can cause hydrolytic degradation during processing. This results in a decrease in molecular weight of the resin and in a reduction of the physical properties of the final product.



In order to avoid this degradation, SKYGREEN JN200 should be sufficiently dried to a moisture level of less than 600 parts per million (ppm) before processing. The drying operation is most efficiently performed by using a commercially available recirculating, dehumidified hot air drying system similar to that shown in Fig 3. Further details of suppliers of suitable drying equipment can be obtained from the SKYGREEN Technical Service Team.

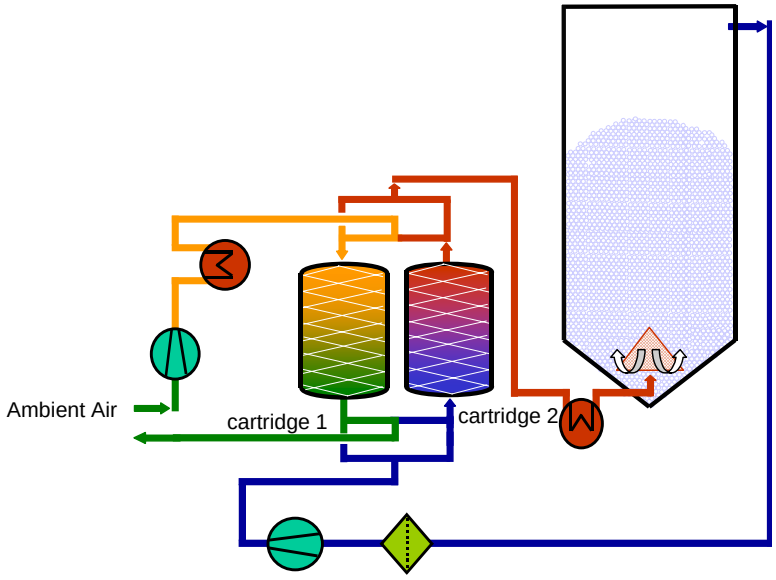


Fig. 3 – Typical drying system

SKYGREEN JN200 is loaded into the drying hopper where heated, dehumidified air is passed through the material. The moisture extracted from the granules in the drying hopper is absorbed by the desiccant cartridge 2. At the same time, the desiccant in cartridge 1 is regenerated. Once the desiccant in cartridge 2 becomes saturated the drying operation is changed to cartridge 1 whilst cartridge 2 is then regenerated.

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The optimum drying conditions for SKYGREEN JN200 are as follows:

Drying Temperature	74°C (165°F)
Drying Time	4 to 8 hours
Air Flow of Dry Air	> 0.065 m^3/min per kg/h (1cfm per lb/h)
Dew Point of Dry Air	< -30°C (-20°F), preferably -40°C (-40°F)
Residual Moisture Content	<0.06% (600 ppm)
Drying Hopper Capacity	6 to 8 times extruder output per hour
Height/Diameter Ratio	> 2:1, 3:1 is better for plug flow
Insulation	Insulate well to improve energy efficiency
Monitoring	Inlet Air Temperature & Dew Point

Insufficient predrying is the most common cause of processing problems such as:

- Molecular weight (I.V) reduction of the polymer and degradation of any additives.
- Adverse effect on the colour of the final product.
- Difficult control of processing parameters such as melt pressure, rheology, and power consumption.
- Bubbles and silver streaks.

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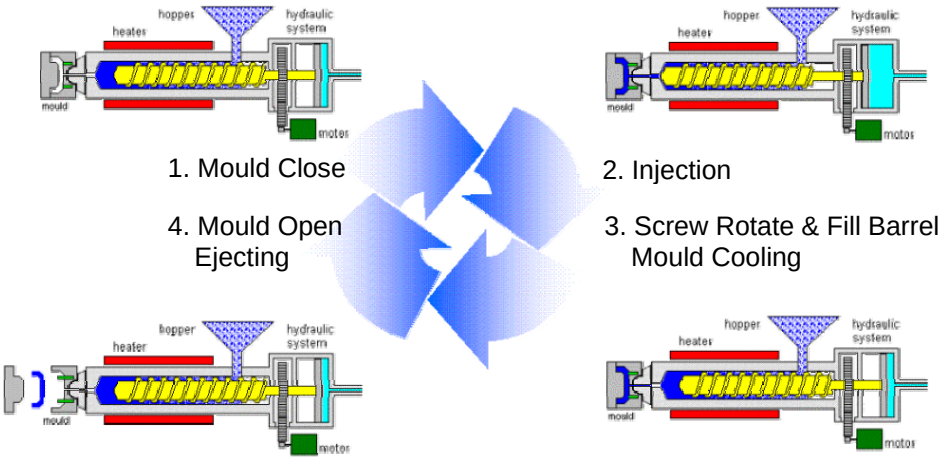
INJECTION MOULDING

Moulding Cycle
Following figure is typical moulding cycle of thermoplastics for injection moulding.

Fig. 4 – Typical Injection Moulding Cycle



Screw design
General-purpose screws show good performance for SKYGREEN JN200 processing

- Screw type: General purpose screw type
- L/D: 18:1 to 20:1
- Compression ratio: 2.5:1 to 3.5:1
- Ring-type non-return valve preferred.

General Guideline

Injection Speed	Slow to medium speed
Screw Speed	Low screw speed of 50-100 rpm
Cushion Size	Minimum cushion size (3-13mm)
Decompression	To minimise drooling
Back Pressure	0.3-1MPa (50-150psi) is sufficient to give uniform metering & remove air entrapment.
Hold Pressure/Time	To eliminate sink mark or voids, but avoid overpacking
Purge	Virgin SKYGREEN is the most effective material. Don't use PE, PP or purging compound.

Temperature Control

- Water cooling of feeding is needed to prevent feeding problems.
- Mould Temperature: 15 to 40^{o}C (60 to 105^{o}F).
- Temperature control of the mould & sprue bushing is an advantage.
  - Reduces cycle time.
  - Reduces warpage & residual stress.
  - Increases the ejection efficiency

Typical Setting Temperature

Temperature	Mould	Cylinder	Nozzle
^{o}C	15 - 40	255 - 265	260 - 265
^{o}F	60 -105	490 - 510	500 - 510

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TROUBLESHOOTING GUIDE

Black Specks
• *Possible Solutions*
– Be sure runner is streamlined.
– Check the mould for blocked / adequate venting.
– Check for contaminated material, particularly if regrind is being used.
– For a long cycle time, decrease rear barrel temperature.
– Increase melt temperature and purge to loosen degraded resin.
– Reduce screw speed

Brittleness
• *Possible Solutions*
– Be certain material has been dried to processing.
– Over dried material too could be a problem.
– Check and lower melt temperature.
– Overpacking could be a problem.
– Adjust injection pressure and mould temperature

Bubbles
• *Possible Solutions*
– Be certain material is dry.
– Check for blocked vents.
– Increase feed zone temperature.
– Increase mould temperature.
– Increase hold / pack time.
– Increase injection pressure.
– Increase the number of vents.
– Minimize or eliminate suck back.
– Note: Bubbles and voids are two different problems.

Burns
• *Possible Solutions*
– Add radius to sharp corners.
– Check residence time of polymer in the barrel.
– Decrease injection pressure and speed.
– Increase gate dimensions.
– Use a lower compression ratio screw.
– Vent the runner system.

Discolouration
• *Possible Solutions*
– Be certain material is dry.
– Check material and containers for contamination.
– Decrease residence time. Shorten overall cycle.
– Decrease screw speed.
– Examine heater bands and control for malfunctions.
– Reduce nozzle temperature.
– Reduce melt temperature.
– Reduce back pressure.

Excessive Shrinkage
• *Possible Solutions*
– Check gate location and relocate as needed.
– Check for worn check valve assembly, barrel or screw.
– Decrease gate land length to improve cavity packing.
– Increase injection hold time and/or pressure.
– Increase cooling time.

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Flash

• Possible Solutions

Product:
– Review projected area vs. clamp pressure.
– Reduce melt temperature.
– Be certain material is dry.

Mould:
– Adjust clamp pressure to maximum for that mould / pressure combination.
– Balance cavities to within 90% of fill.
– Reduce fill speed.
– Check mould support.

Part Sticking

• Possible Solutions

In Cavity:
–Reduce mould temperature.
–Increase cooling time.
–Check for mechanical causes (limited draft, undercuts).

On Core:
– Reduce injection pressure.
– Reduce mould core temperature.
– Decrease cooling time.
– Check for mechanical causes.

Sink Marks

• Possible Solutions

– Check gate location and relocate as needed.
– Check for worn check valve assembly, barrel or screw.
– Decrease gate land length to improve cavity packing.
– Increase injection hold time and/or pressure.
– Increase cooling time.

SKYGREEN TECHNICAL SERVICE

Should you require any further technical information or assistance please do not hesitate to contact a member of the SKYGREEN Technical Service Team – contact details below:

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