

This bulletin is intended for use only as a tool to provide information and address issues that may pertain to transporting or shipping injection-stretch-blow molded (ISBM) bottles made from Ingeo biopolymer.

Since an Ingeo stretch blow molded bottle is a biaxial structure that has a significant amount of orientation, special handling procedures must be followed during warm weather to minimize heat distortion and shrinkage of the containers. Once any ISBM container is exposed to elevated temperatures over time, the memory in the structure will begin to drive back to its original unoriented state. This deformation can exhibit itself in the shoulder, finish, and base areas of the bottle where there is very little, if any, crystallinity.

One must be aware the effects sunlight can produce. Direct sunlight or sunlight through a skylight or window can produce enough heat to cause a significant amount of shrinkage in an ISBM bottle. One will not only need to be concerned about volume shrinkage but also bottle height, finish dimensions, and body dimensions can be affected by elevated temperatures.

A trailer or shipping container can act like a big oven when exposed to elevated temperature and/or the trailer is stored under direct sunlight. With an outside temperature of 32°C (90°F), the temperature inside a trailer can reach close to 65°C (150°F) or more, especially towards the roof of the trailer. High humidity also affects the dimensional stability of the bottles, as moisture acts as a plasticizer and could lower the heat distortion temperature of bottles.

## Procedures & Best Practices

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Special handling procedures should be followed during warm weather conditions (high temperatures and/or humidities) to help minimize volume shrinkage and distortion of the Ingeo bottles. The degree of shrinkage depends on the bottle design, stretch ratios from preform to bottle, processing conditions, and environmental storage conditions. The following recommendations will help minimize bottle deformation and loss of dimensional stability. These procedures and recommendations should also be followed when transporting and storing Ingeo preforms.

### Guidelines for Ingeo Bottles in Transit

- Park trailers in the shade and out of direct sunlight. Also, allow ventilation especially in the top of the trailer. Top hatches in the front and rear of trailers can help provide ventilation and prevent the buildup of heat in that location. Hatches should not be opened, however, if they are not protected from the elements.
- Schedule transportation in the cooler parts of the day.
- Do not load bottles on trailers that have to sit idle before leaving. Only load trailers that will leave immediately after being loaded.

### Guidelines for Unloading Ingeo Bottles

- Unload trailers immediately upon arrival. Schedule deliveries that will allow receiving personnel to immediately unload the trailers and place into the warehouse.
- Immediately move the product inside when unloading trailer that is outside. Try to unload the trailer in a shaded area. If a trailer must wait before unloading, then the rear doors should be left open and out of sunlight.
- Trailer doors should be opened as soon as possible upon arrival.
- Inspect the top layers upon receiving the trailer. *Note: Depending upon freighting terms, suppliers may not be responsible for shrinkage that takes place after the trailer has left his site.*

### Guidelines for Storing Ingeo Bottles

- Do not store empty bottles in trailers.
- Store bottles in coolest sections of warehouse away from skylights, light fixtures, windows, loading docks, and heaters.
- Avoid storing bottles under metal roofs. Allow for sufficient airspace above pallets.
- Inventory empty bottles using a “first-in, first-out” basis.
- Do not store bottles in close proximity to equipment that generates heat.
- Do not store against warehouse walls that receive most of the direct sunlight.
- Try to store bottles such that they are not close to the ceiling of the warehouse.
- Store bottles in areas with ventilation

- Do not store pallets outside where the shrink-wrap can cause the temperature to exceed ambient air temperatures.
- Maintain and monitor warehouse environment to ensure acceptable conditions.

## General & Overall Guidelines

- Common carriers and customer-supplied carriers should be informed to deliver loads immediately.
- Inform employees of proper handling procedures. Employees should be adequately trained and informed on the proper procedures and the implications of not following them correctly.
- If possible, utilize non-reversible temperature strips during summer time conditions to monitor the temperatures inside trailers. These heat strips can be attached to shipping documents such as the packing list and placed on the back unit of the last pallet loaded. The heat strips should work for a temperature ranges of approximately 45-65°C (113-150°F), read in 5-10°F increments.
- Handouts can be used to inform drivers of their responsibility and to inform them of the special precautions that must be followed to transport bottles.
- Warning labels can be used to inform drivers of the problems of exposing Ingeo bottles to elevated temperatures.

## Follow NatureWorks “Smart Care” Guidelines

Besides converters and suppliers establishing their own best practices, NatureWorks has developed suggested guidelines and check lists to ensure safe handling and storage of Ingeo based packages.

- Avoid high temperatures (below 40°C)
- Keep out of direct sunlight
- Keep it cool. Store on a lower rack.
- Handle with care

For more information on SmartCare, please visit [www.natureworkslc.com](http://www.natureworkslc.com).

## Safety and Handling Considerations

Material Safety Data (MSD) sheets for Ingeo biopolymers are available from NatureWorks LLC. MSD sheets are provided to help customers satisfy their own handling, safety, and disposal needs, and those that may be required by locally applicable health and safety regulations, such as OSHA (U.S.A.), MAK (Germany), or WHMIS (Canada). MSD sheets are updated regularly; therefore, please request and review the most current MSD sheets before handling or using any product.

The following comments apply only to Ingeo biopolymers; additives and processing aids used in fabrication and other materials used in finishing steps have their own safe-use profile and must be investigated separately.

## Hazards and Handling Precautions

Ingeo biopolymers have a very low degree of toxicity and, under normal conditions of use, should pose no unusual problems from incidental ingestion, or eye and skin contact. However, caution is advised when handling, storing, using, or disposing of these resins, and good housekeeping and controlling of dusts are necessary for safe handling of product. Workers should be protected from the possibility of contact with molten resin during fabrication. Handling and fabrication of resins can result in the generation of vapors and dusts that may cause irritation to eyes and the upper respiratory tract. In dusty atmospheres, use an approved dust respirator. Pellets or beads may present a slipping hazard. Good general ventilation of the polymer processing area is recommended. At temperatures exceeding the polymer melt temperature (typically 170°C), polymer can release fumes, which may contain fragments of the polymer, creating a potential to irritate eyes and mucous membranes. Good general ventilation should be sufficient for most conditions.

Local exhaust ventilation is recommended for melt operations. Use safety glasses if there is a potential for exposure to particles which could cause mechanical injury to the eye. If vapor exposure causes eye discomfort, use a full-face respirator. No other precautions other than clean, body-covering clothing should be needed for handling Ingeo biopolymers. Use gloves with insulation for thermal protection when exposure to the melt is localized.

## Combustibility

Ingeo biopolymers will burn. Clear to white smoke is produced when product burns. Toxic fumes are released under conditions of incomplete combustion. Do not permit dust to accumulate. Dust layers can be ignited by spontaneous combustion or other ignition sources. When suspended in air, dust can pose an explosion hazard. Firefighters should wear positive-pressure, self-contained breathing apparatuses and full protective equipment. Water or water fog is the preferred extinguishing medium. Foam, alcohol-resistant foam, carbon dioxide or dry chemicals may also be used. Soak thoroughly with water to cool and prevent re-ignition.

## Disposal

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. For unused or uncontaminated material, the preferred options include recycling into the process or sending to an industrial composting facility, if available; otherwise, send to an incinerator or other thermal destruction device. For used or contaminated material, the disposal options remain the same, although additional evaluation is required. (For example, in the U.S.A., see 40 CFR, Part 261, "Identification and Listing of Hazardous Waste.") All disposal methods must be in compliance with Federal, State/Provincial, and local laws and regulations.

## Environmental Concerns

Generally speaking, lost pellets are not a problem in the environment except under unusual circumstances when they enter the marine environment. They are benign in terms of their physical environmental impact, but if ingested by waterfowl or aquatic life, they may mechanically cause adverse effects. Spills should be minimized, and they should be cleaned up when they happen. Plastics should not be discarded into the ocean or any other body of water.

## Product Stewardship

NatureWorks LLC has a fundamental duty to all those that make and use our products, and for the environment in which we live. This duty is the basis for our Product Stewardship philosophy, by which we assess the health and environmental information on our products and their intended use, then take appropriate steps to protect the environment and the health of our employees and the public.

## Customer Notice

NatureWorks LLC encourages its customers and potential users of its products to review their applications for such products from the standpoint of human health and environmental quality. To help ensure our products are not used in ways for which they were not intended or tested, our personnel will assist customers in dealing with ecological and product safety considerations. Your sales representative can arrange the proper contacts. NatureWorks LLC literature, including Material Safety Data sheets, should be consulted prior to the use of the company's products. These are available from your NatureWorks LLC representative.

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