Naturally Advanced Paper Coatings for Food Serviceware

Ingeo™ coatings for paper and paperboard are revolutionizing the world of sustainable food serviceware. Using Ingeo biopolymer in extrusion coating applications meets the growing demand from brands and consumers for biobased, low carbon materials that fit into expanding industrial composting and paper recycling infrastructure.

Coatings made from Ingeo are produced from annually renewable resources, just like the paper fiber – providing performance serviceware that is a safe, natural, and sustainable alternative to plastics made from non-renewable petrochemical resources.

NatureWorks provides Ingeo grades designed for extrusion coating on paper and paperboard suitable for food contact applications. Ingeo provides excellent adhesion, melt strength for neck-in edge stability, and heat seal performance in an extrusion coating line, and can achieve higher line speeds than previously seen with generic biopolymers.

ingeo™
by NatureWorks

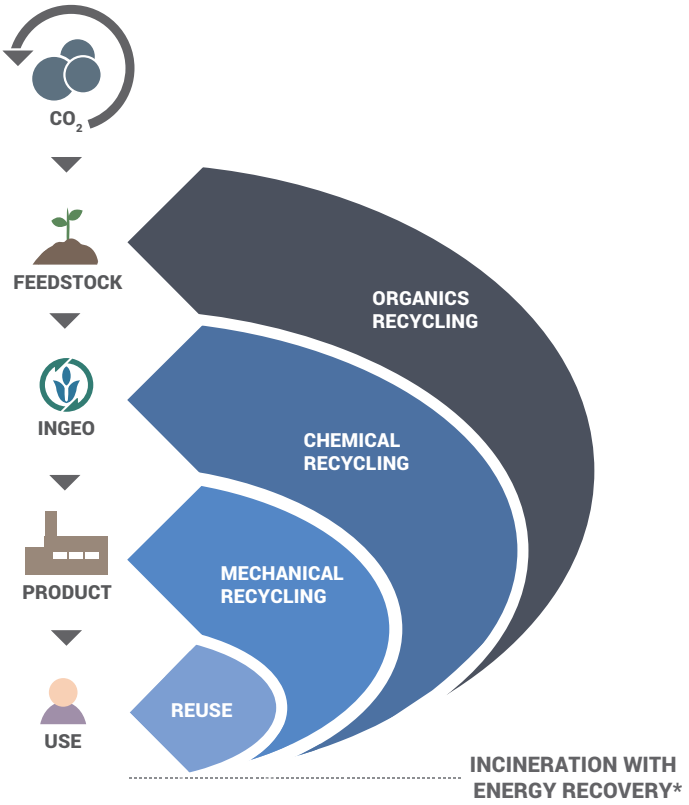
Product Health & Safety for People and Planet

NatureWorks didn't stumble into sustainable materials. We built our business on the idea that the natural world works better. We designed every stage of Ingeo's production for environmentally conscious practices that create a safe, performance biomaterial without compromise.

When used as a food packaging material, Ingeo is fully compliant with long-standing global legislation for food contact requirements in both the United States and Europe. However, we not only meet government regulatory requirements, we go one step beyond by having third-party organizations like the Center for Environmental Health, Clean Production Action, and the Cradle to Cradle Products Innovation Institute provide their own assessment and certification.

GreenScreen Platinum Certification certifies safe ingredients and preferred chemistry of Ingeo

NatureWorks is the first material manufacturer to achieve the GreenScreen Certified Standard Platinum level of certification. This third-party certification ensures materials used for products like coatings for paper food serviceware products as well as cutlery, cups, and containers are designed with inherently safer materials.Importantly, GreenScreen verifies the absence of per- and polyfluoroalkyl substances (PFAS) as well as thousands of other chemicals of concern in Ingeo biopolymer.



*only if other options are unavailable

Certified as compostable and recyclable

Until now, coated paper packaging products have typically relied on fossil-based hybrid structures of mixed materials that are poorly recycled, not compostable, not fully sourced from renewable materials, and that are not capable of fitting into food waste diversion schemes designed to produce quality compost products.

New paper coatings made with Ingeo enable food serviceware to be used through industrial composting or paper recycling infrastructure.

COMPOST

Compostable packaging for organics recovery if food soiled

BPI® COMPOSTABLE

RECYCLE

Fiber recovery if paper-based and clean

recyclable

passes WMU standard
www.wmich.edu/pilotplants

New research on Ingeo for extrusion coatings shows process optimizations can double output and triple line speeds

NatureWorks and Sung An Machinery (SAM) partnered to investigate process optimization when using Ingeo™ for extrusion coatings. Testing was conducted at the SAM Extrusion Coating Lab, and initial results show that implementing changes to control melt temperature are the key to increasing both output and line speeds.

	OUTPUT AT 75RPM			LINE SPEED		
	LDPE	INGEO		INGEO		
SCREW DESIGN	Output (KgPH) / Temp °C	Output (KgPH) / Temp °C	% increase over typical screw design	% increase over typical screw design	% increase when reducing die lip gap	% increase by edge encapsulation and no change in die lip gap
Single Flight Double Mixer High Shear Design **Typical Extrusion Coating Design**	50 / 324	78 / 252	-	-	30%	-
Melt Barrier Flight Single Mixer Moderate Shear Design **Compromise Extrusion Coating Design**	66 / 314	107 / 253	37%	31%	-	-
Melt Barrier Flight Single Mixer Low Shear Design **Specialty Copolymer Extrusion Coating Design**	64 / 304	119 / 249	53%	43%	86%	102%
Melt Barrier Flight Single Mixer Ultra Low Shear Design **Modified Copolymer Extrusion Coating Design**	-	145* / 252	86%	-	197%	-

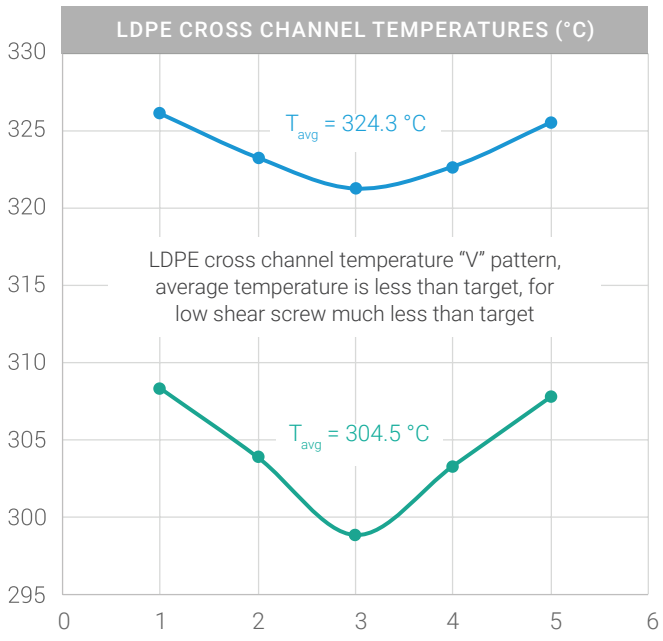
**Increased screw speed to 100RPM due to low temperatures found with ultra low shear screw*

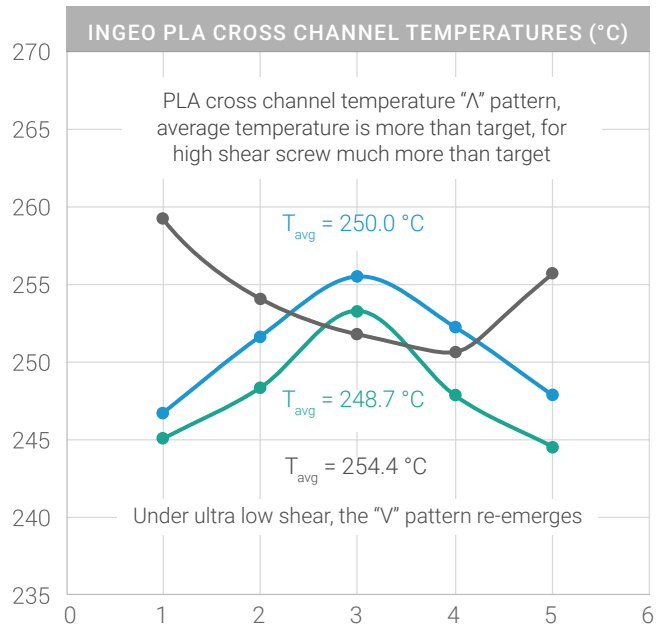
Recommendations for optimizing processing when applying extrusion coatings with Ingeo

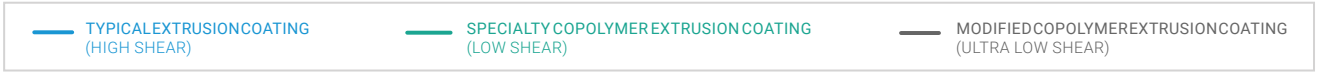
- Use a low shear/low temperature screw design
- Minimize the die lip gap
- Include dedicated edge encapsulation extruder
- Keep melt temp. <250 °C

Differing melt temperature profiles should drive design changes that can increase extruder output at acceptable temperatures

- What is good for a low viscosity thermally stable polymer (LDPE) is not good for a high viscosity thermally sensitive polymer (PLA).
- Measuring temperature only at channel edge does not accurately reflect mid-channel melt temperatures. With Ingeo, the true melt temperature is likely hotter than edge measurements indicate.



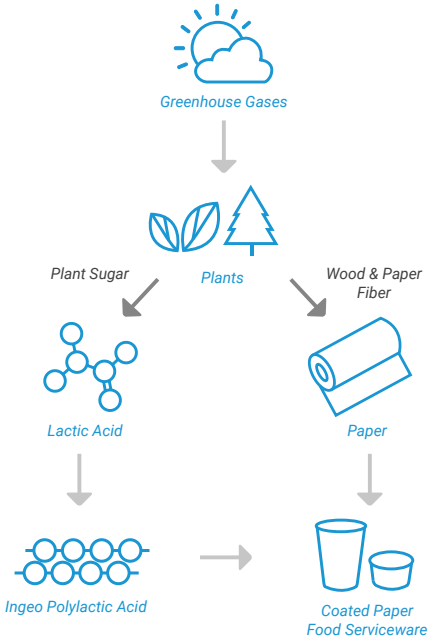




How is Ingeo made?

Today, we use plants to capture and sequester CO_2 transforming it into long-chain sugar molecules. We ferment those sugars to make lactic acid, the same chemical produced by our muscles after some hard exercise. This lactic acid is the building block of the whole range of advanced materials we call Ingeo.

We believe that environmental stewardship and performance products go hand in hand. Ingeo and paper are the complementary biobased materials of the future that close the loop for coated packaging in the circular bioeconomy.



Certified Biobased

Ingeo biopolymer is certified as biobased and made directly from annually renewable resources carrying the Vinçotte OK biobased and USDA BioPreferred certifications.

OK biobased | TÜV AUSTRIA ★★★★ S0149

USDA CERTIFIED BIOBASED PRODUCT PRODUCT 100%

These certifications are based on the biobased content of Ingeo which can be determined through radiocarbon dating according to ASTM D6866 (Standard Test Method for Determining the Biobased Content of Natural range Materials Using Radiocarbon and Isotope Ration mass Spectrometry Analysis).

Certified Sustainable Feedstocks

Industry and consumers have come to expect sustainability certifications like the Forest Stewardship Council's well established FSC certification for paper fiber, which ensures products come from responsibly managed forests. A similar scheme is available for the Ingeo component of your food serviceware through International Sustainability and Carbon Certification (ISCC Plus), a European-based 3rd party certification scheme certifying the sustainable production of renewable raw materials, including the certification of the chain of custody. This means that every component in the package (the paper and the plastic), whether a cup, plate, or bowl, can be certified as 100% sustainably sourced.

ISCC International Sustainability & Carbon Certification

NatureWorks' headquarters and advanced biopolymers research and development facility is located in Plymouth, MN. The full portfolio of Ingeo™ biopolymers are manufactured at a 150,000 MT/yr production facility in Blair, NE with a new 75,000 MT/yr fully integrated manufacturing complex under construction in Thailand, expected to be completed in 2026.

NatureWorks is jointly owned by PTT Global Chemical and Cargill.

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