



## Ingeo™ 6500D for Softer, Biobased Nonwoven Hygiene Applications

Ingeo 6500D combines Ingeo PLA with PHACT™ PHA in one product delivering a new solution for softer, biobased nonwoven applications, offering a softer feel and improved tensile strength over generic polylactic acid (PLA). This solution can be combined with our hydrophilic fibers coating technology, which delivers enhanced fluid management with improved strike-through, re-wet, and run-off for better comfort on skin.

The strength and softness of this new material offers processing efficiency improvements over generic PLA, processing similarly to polypropylene in spunbond conversion. Ingeo 6500D processes smoothly through spinning equipment, for increased efficiency and cost savings.

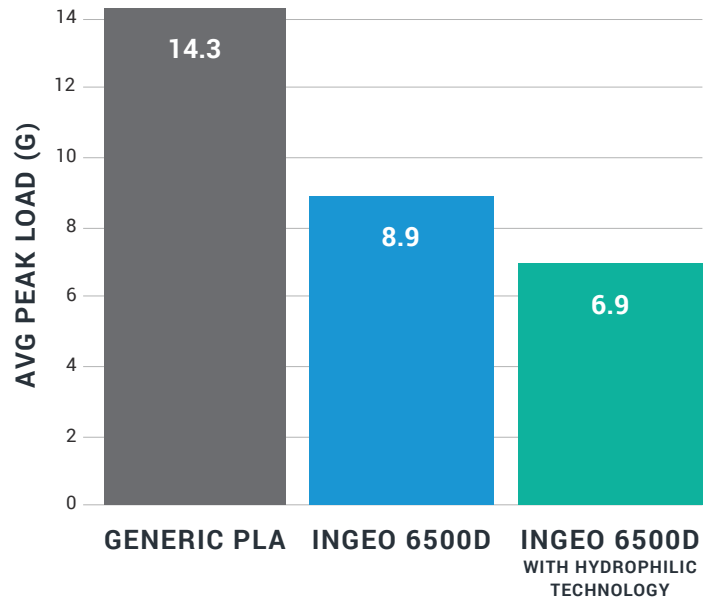
As Ingeo is a renewably sourced, low carbon, biobased material with proven environmental benefits, its use in nonwoven hygiene applications meets the growing demand from brands and consumers for more sustainable materials.



**ingeo**™  
by NatureWorks

## Significant Improvement in Softness with Ingeo 6500D

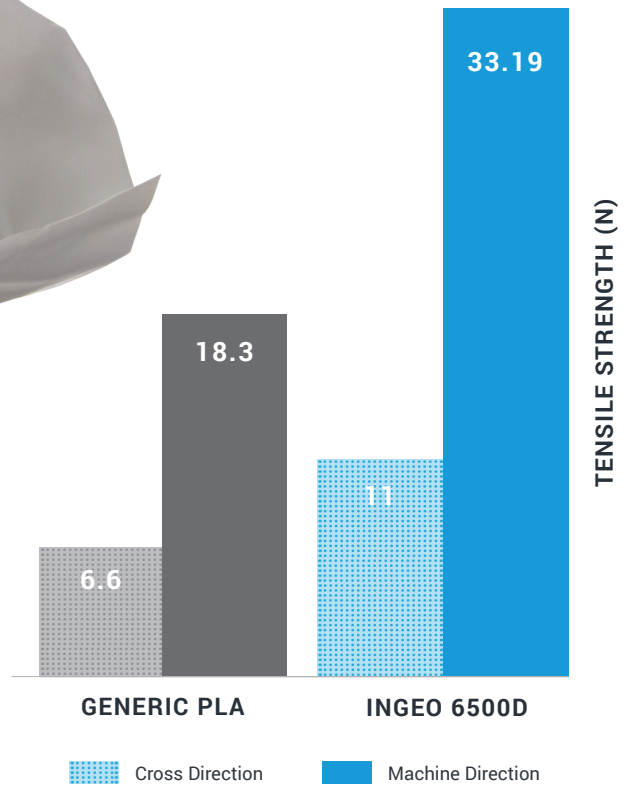
Ingeo 6500D can improve the softness of spunbond nonwovens by up to 52% over nonwovens made with generic PLA.



*Based on HOM testing with 100 gram weight, 1/4" slot width, and 8x8 sample specimen. Handle-o-meter model number 211-300*

## Improved Tensile Strength Over Generic PLA Spunbond

The tensile strength of Ingeo 6500D offers a stronger material for a range of nonwoven applications, including diapers and wipes. Additionally, the strength of the material offers ease of processing for converters, being strong enough to process through the machine at a single speed without tearing or sticking to the calender wheels.



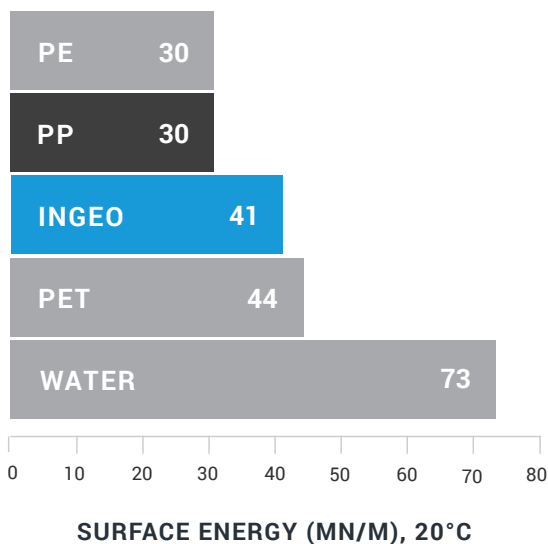
*20 gsm spunbond nonwoven*

## Combine with Hydrophilic Fibers Technology for Improved Strike-through, Re-Wet, and Run-Off

The absorbent hygiene product industry is innovating to create lighter, thinner products with improved skin health benefits. Ingeo nonwovens combined with tailored topical treatments developed in partnership with Goulston, improve fluid management, durability, and breathability.

- Surface energy can be tailored via the topical treatments designed specifically for Ingeo nonwovens, enhancing fluid management with improved strike-through, re-wet, and run-off metrics.
- Improved permanence / durability reduces the amount of topical treatment needed for nonwovens and reduces wash-off.
- Reduced aging maintains fluid management performance and increases shelf life of hygiene products.
- Improved breathability due to Ingeo's higher water vapor transmission rate.

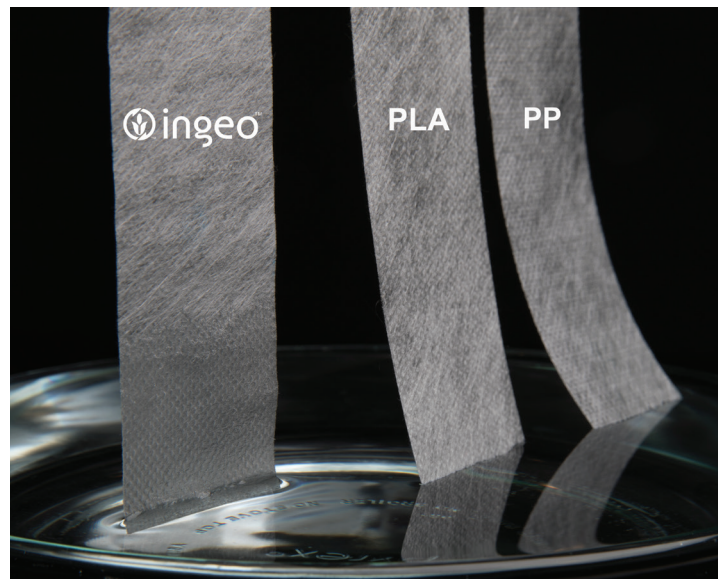
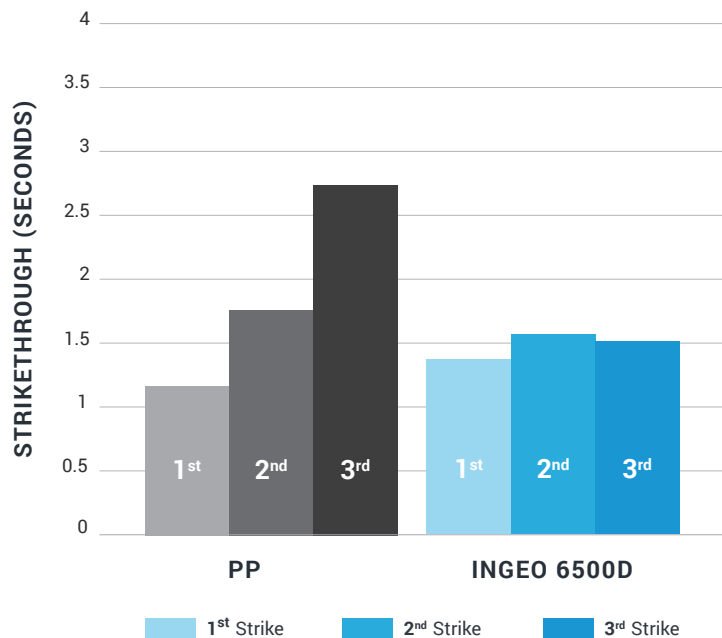
**Surface energy is tailored via the topical treatment designed specifically for Ingeo nonwovens enhancing fluid management properties.**



PERFORMANCE	TYPICAL PP <sup>2</sup>	INGEO 6500D <sup>1</sup>
Finish-on yarn [%FOY]	0.6 wt. %	0.4 wt. %
Strike-through [over 3 results]	1.8–2.3 sec.	1.4–1.6 sec.
Run-off [%]	0%	0%
Re-wet [grams]	0.21 / 0.25 g	0.15 g
Wash-off / Surface tension reduction [0.9 wt. % NaCl = 73.1 dynes/cm]	32.8 dynes/cm	62.4 dynes/cm

1. 15 gsm spunbond modified with Goulston Lural PL-15231-25  
2. 14 gsm spunbond modified with Goulston Lural PP-15163

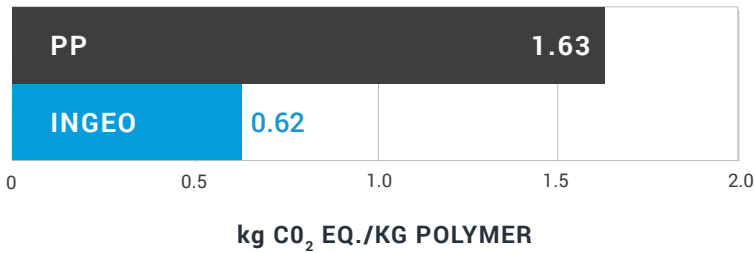
### Ingeo nonwovens require less finish to achieve wash-off metrics superior to polypropylene





# A Renewable, Low Carbon Alternative to Fossil-based Nonwovens

**Ingeo has a 62% smaller carbon footprint than PP**



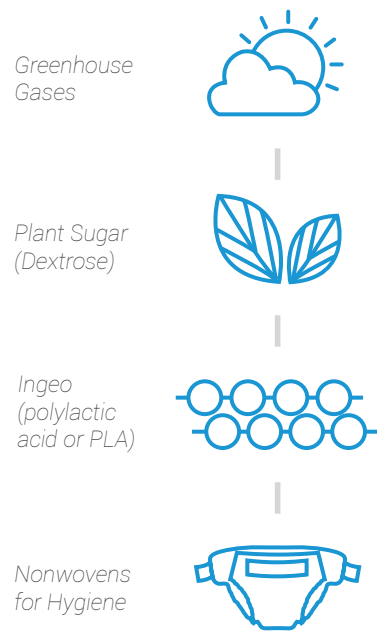
*Ingeo data from Life Cycle Inventory and Impact Assessment data for 2014 Ingeo™ Polylactide Production. Industrial Biotechnology, Vol 11, No. 3. Pgs 167-180. June 2015*  
*Data on EU PP production from Plastics Europe.*

Ingeo biopolymer has a carbon footprint two thirds smaller than polypropylene from the manufacturing alone, offering a low carbon alternative to petrochemical-based industry incumbents.

## How Ingeo is Made

Today, we use plants to capture and sequester CO<sub>2</sub> 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.

It took some real innovations to bring these new materials to market, but today we partner with companies around the world to transform Ingeo into a wide-range of innovative products like coffee capsules, tea bags, coatings for paper, diapers, and 3D printed applications.



Driven by curiosity and obsessed with science, NatureWorks meets the challenges of our partners and a changing world creating more responsible high performance materials for a more sustainable future.

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 2025.

NatureWorks is jointly owned by PTT Global Chemical and Cargill.