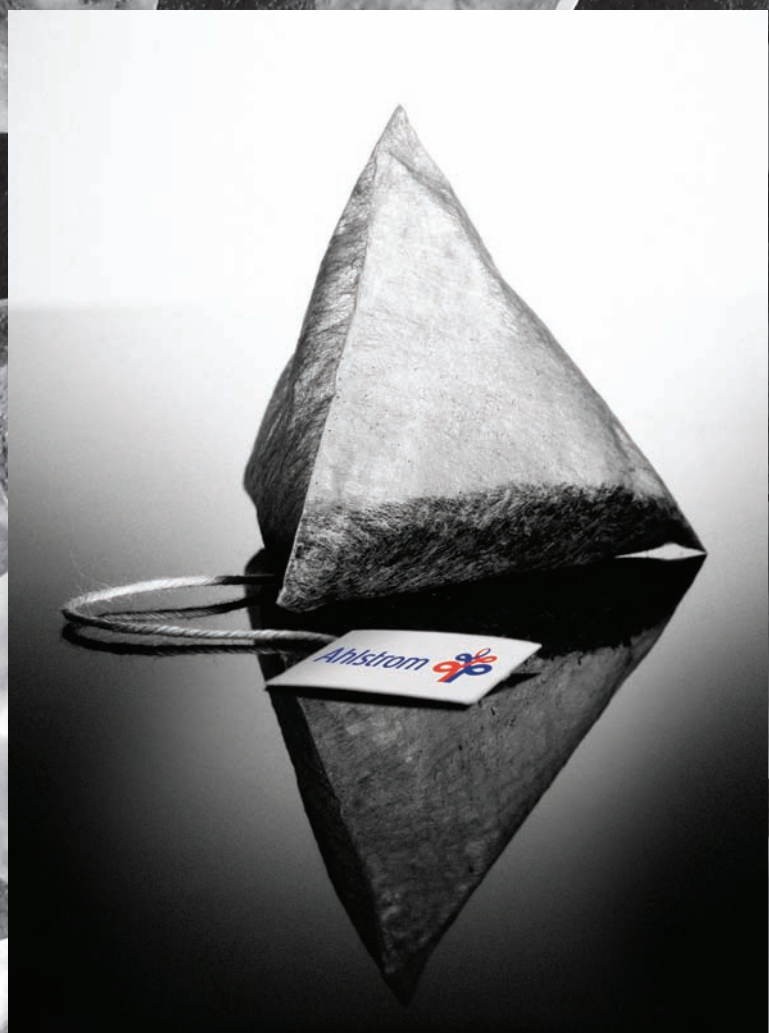


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Ingeo Fibers and Plastics: Innovation From Plants, Not Oil



The Fundamental Facts about Ingeo Fibers and Plastics — Innovation from Plants, Not Oil

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This Ingeo outfit won first prize at the Nordic Initiative Fashion Summit held in 2009 during the UN Climate Change Conference in Copenhagen. The winning design by Finland's Saara Lepokorpi featured a hand-painted jacket made with an Ingeo nonwoven by Fama Jersey and a dress made with milk fiber by Olimpias.

In December 2010, gasoline prices were at historic highs in the United States. Beginning this article on the fundamentals of Ingeo™ bioresin with the price of oil is appropriate because one of the many reasons companies specify this biobased thermoplastic is the fact that fibers and plastics made from renewable materials offer more stable pricing compared to petrochemical-based plastics.

While greater economic sustainability significantly drives the substitution of Ingeo for other thermoplastics, brands and retailers must juggle multiple factors when choosing the materials they use. In order to win the final consumer's purchase choice, it is vital to offer compelling products, which perform without compromise, and which provide solid 'green credentials'.

To address this latter point, for every pound of Ingeo substituted for PET, for example, 60 percent less greenhouse gas is emitted and about 50 percent less non-renewable energy is consumed. Decreasing dependence on fossil carbon and lowering environmental impacts contribute to the overall long-term sustainability of the enterprise. The substitution of conventional non-renewable thermoplastics with Ingeo often also complements existing natural fibers and cellulose already used in many nonwoven constructions.

MAKING FIBERS FROM PLANTS

With Ingeo, NatureWorks is the world's first and largest manufacturer of biopolymers. Today, NatureWorks operates a 140,000 metric ton annual manufacturing capacity processing facility. The NatureWorks facility in Blair, Nebraska, polymerizes lactic acid, produced via a proprietary fermentation of

sugar (dextrose), into Ingeo polylactide. NatureWorks produces and sells more than 15 different Ingeo grades each with chemistry and properties tailored to various end markets and applications. Among bioplastics, Ingeo offers a unique eco profile because of the advanced proprietary processes practiced at the Blair facility.

The production of Ingeo starts simply, with the energy from the sun that powers plant growth, using photosynthesis to convert CO₂ and water into sugars — the starting raw material for Ingeo. The plants' use of the sun's energy and CO₂ from the atmosphere significantly offset the greenhouse gas emissions and energy required to make Ingeo bioresin. This significant offset and the advanced processing proprietary to NatureWorks give Ingeo superior environmental credentials when compared to petrochemical plastics.

END-OF-LIFE SCENARIOS

An additional benefit of Ingeo is the potential for more environmentally friendly end-of-life options. In addition to standard disposal techniques such as landfill disposal, incineration and mechanical recycling, Ingeo can be cost effectively chemically recycled (feedstock recovery). Chemical recycling of Ingeo is a simple process that breaks Ingeo down into its original lactic acid through hydrolysis. The lactic acid can then be sold for industrial uses or polymerization back into Ingeo for true cradle-to-cradle reuse. An example of feedstock recovery was the hydrolysis into lactic acid of 215,000 square feet (20,000 square meters) of Ingeo-based exhibition carpet. The carpet was used at the Bella Center in Copenhagen during the 2009 UN Conference on Cli-



At the Bella Center where the Copenhagen conference was held, more than 20,000 square meters (215,000 square feet) of ultra-low carbon footprint Eco2punch® carpet manufactured by Sommer Needlepunch was installed. As described earlier in this article, Galactic used a hydrolysis process to convert the Ingeo-based carpet back to virgin lactic acid. Seen in this photo is USA President Barack Obama (center) and Russian President Dmitry Medvedev, along with other dignitaries. Photo: Jewel Samad/Getty Images

mate Change. Galactic, one of the world's largest suppliers of lactic acid, handled the Ingeo feedstock recovery process.

Ingeo food contaminated plates, knives, forks, and packaging can be industrially composted. This end-of-life scenario helps divert food and plastic waste from landfills.

APPLICATIONS

Today, Ingeo biopolymer is used in more than 40 applications, which span from fibers and nonwovens, to packaging, foodservice, films, and semi-durable products. NatureWorks holds more than 300 patents. In the international fibers industry, converters transform Ingeo into staple fibers, spunbound, meltblown, continuous filament, and spun yarn products. Below is a list of some of the company's current Ingeo fiber licensees.

Staple Fibers

DS Fibers, Belgium
FIT, USA & China
FENC, Taiwan
Huvis, Korea

Toray, Japan
Unitika, Japan
Palmetto Synthetics, USA
Trevira, Germany

Spunbound

Ahlstrom, USA & EU
Fiberweb, USA & EU
CL Nonwovens, China

Filament

Noyfil, Switzerland
Miroglio, Italy
FENC, Taiwan
FIT, USA & China
Omara, USA

The ability to tailor and tune end-use performance via a variety of additives contributed to the adoption of Ingeo in the international fibers industry and other industries. Here are a few examples of additives available today:

- Cesa®-Extend from Clariant is a chain extender yielding additional melt strength and improvements in processability
- CP-LO1 from Polyvel, Inc.

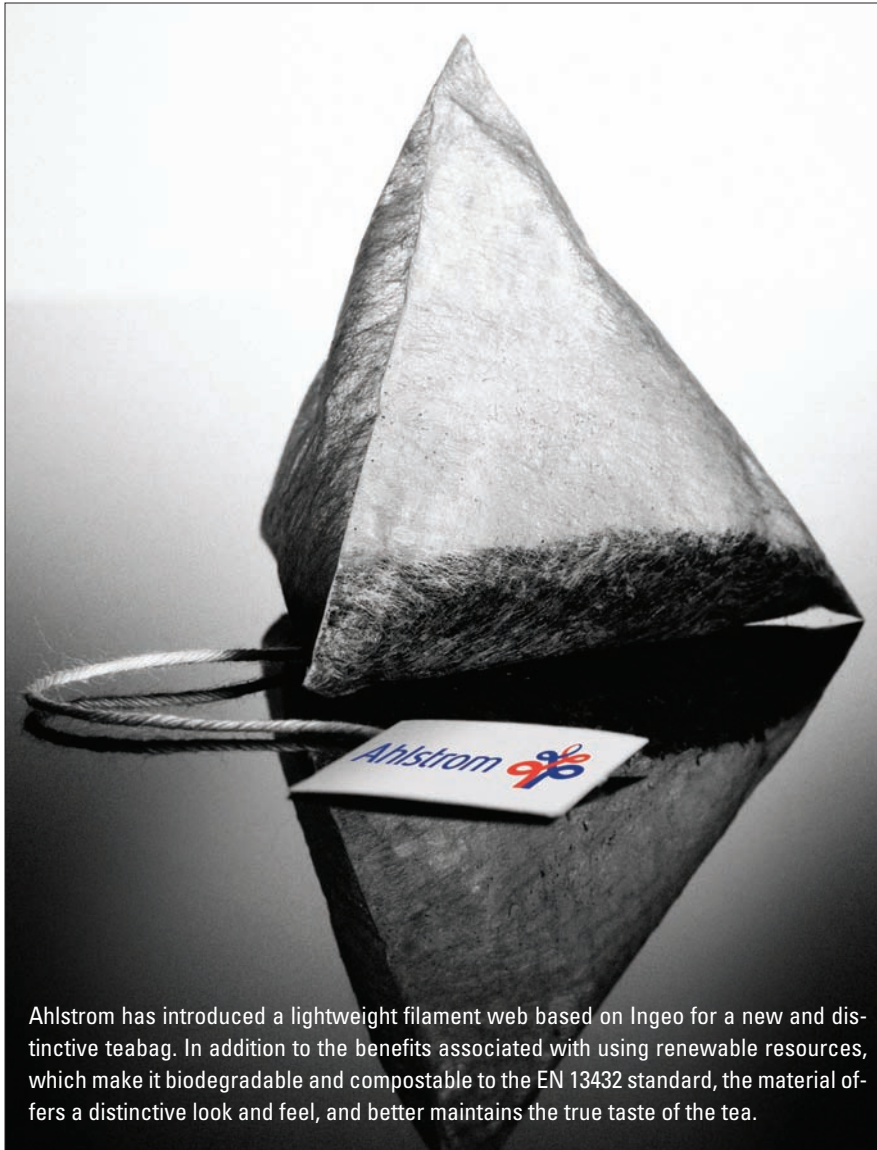
significantly improves hydrophilicity

- Ecoflex from BASF, biodegradable Co PET improves processability
- EBS (ethylene bis stearamide), a nucleating agent that offers lubrication and increased abrasion resistance, also yields hydrophobic characteristics
- Goulston Technologies provides finish treatments for a variety of fiber and nonwovens processes

PROCESSING

Ingeo bioresin can be processed on most standard machines. Like every material, processing parameters must be adjusted for the unique characteristics of the thermoplastic. It is important that drying, conveying, and receiving systems are free of all foreign polymers (PP/PE/PET/Nylon) or other contaminants. Machines should be vacuumed to ensure that dust or polymer contamination is completely removed prior to adding Ingeo. In-line drying is essential for Ingeo resins. Ingeo bioresin can be successfully dried using most standard drying systems. A moisture content of less than 50 parts per million is

SUSTAINABLE RAW MATERIALS



Ahlstrom has introduced a lightweight filament web based on Ingeo for a new and distinctive teabag. In addition to the benefits associated with using renewable resources, which make it biodegradable and compostable to the EN 13432 standard, the material offers a distinctive look and feel, and better maintains the true taste of the tea.



Ingeo pellets

recommended to prevent viscosity degradation. Ingeo should not be dried or stored hot in carbon steel vessels as corrosion may occur. A library of technical data sheets and processing guides are on the company website, www.natureworkslc.com, under the Products & Applications hotlink.

IN-DEMAND APPLICATION


Nonwoven applications such as wipes, diapers, feminine hygiene products, and filters are currently in strong demand globally because of the improved environmental profile and overall performance of these applications. Fabrics that contain 35 percent Ingeo and 65 percent viscose provide an example of performance improvements. The following

results were demonstrated when a 35/65 Ingeo-viscose fabric was compared to a 35/65 PES viscose fabric:

- The Ingeo blend showed superior performance in wicking
- Yielded greater thickness (mm) for a similar mass (g/m²)
- Demonstrated faster absorbency time
- In both cross machine direction and machine direction, Ingeo demonstrated greater elongation and tensile strength

Certain applications may also benefit from other inherent desirable attributes of Ingeo such as UV resistance, low odor retention, and excellent inherent FR properties. See company website for

detailed test data and performance sheets.

In summary, Ingeo bioresin offers stable pricing, assured supply, a smaller carbon footprint, and performance for a range of applications. It is a viable option for converters and brand owners seeking to broaden a product portfolio by offering biobased fibers and nonwovens. Additional Ingeo fiber and plastic examples can be found online in the most recent Ingeo LookBook compiled for the latest UN Conference on Climate Change. 

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