Tencel—the miracle fiber

Fiona Case

You have almost certainly seen Tencel®. This new fabric is used increasingly in high-end men's and women's fashions, in brands such as Diesel, Tommy Bahama, Zara, Dockers, Gap, Liz Claiborne, Eddie Bauer and L. L. Bean. Tencel's soft feel, easy care, and "environmentally-friendly" claims have developed a loyal following as it is the answer for modern consumers who want the comfort and luxury of a natural fiber with the practicality of a man-made one.

Tencel fabric can be knitted or woven and ranges from crepes and chambrays to poplins and twills. It is durable, comfortable to wear, resistant to wrinkles, easy to clean, has little elasticity, and is very soft to the touch.

"We know that 80% of women who purchase Tencel are repeat customers," says Ellen Flynn, marketing director for Lenzing Fibers.

Tencel fiber is also used in nonwoven applications "Tencel provides differentiated product properties that are important in particular applications," says Dave Hoyland, nonwovens vice president for Lenzing Fibers, (Lenzing, Austria) now the major producer. "The material has high wet strength, a bulky aesthetic, and is extremely pure—an important attribute in medical products and high-tech applications such as in electrical papers."

What is Tencel?

What is this material? And what gives it these properties?

Tencel is a cousin to viscose rayon and cellulose acetate. All three are made of cellulose, and all three start as wood pulp. But, in the viscose and acetate processes the cellulose is chemically altered to bring it into solution; in the Tencel process (often referred to as the lyocell process) the cellulose is dissolved unchanged.

It is not particularly easy to dissolve a tree. It took the original developers, Courtaulds plc, Coventry, United Kingdom, 20 years to commercialize the process.

"The trick is to find a solvent which can be recovered from the process," says consultant Calvin Woodings, who worked for Courtaulds for many years and was the market development director for Courtaulds Lyocell (the Courtaulds brand for lyocell used in industrial applications). "The fact that the N-methylmorpholine-N-oxide (NMMO) and water solvent mixture is recovered makes the process economically viable, and leads to the high product purity."

The closed-loop solvent spinning process (more than 99.9% recovery) and the use of wood from managed forests leads to the "minimal environmental impact" claims.

The process also leads to aesthetic and performance gains. Cellulose is degraded during the viscose and acetate processes—as a result of the chemical treatment, and as a deliberate approach to reduce the viscosity of the spinning solution. During the lyocell process the molecular weight, or degree of polymerization, is maintained: the cellulose molecules in lyocell fibers are more than twice as long as those found in viscose. The dissolved polymers are able to align during the spinning process, leading to a more orientated fiber with greater crystallinity. These factors influence the strength of the fiber.

"Individual Tencel fibers have a breaking strength of 5g/denier, compared with around 3g/denier for cotton, and only 2.5g/denier for viscose," says Woodings. "This is important because it allows Tencel fabrics to withstand modern dyeing and finishing processes, and allows the final garments to be machine washed."

Challenges

The high orientation and crystallinity can also lead to fibrillation (the tendency of a fiber to develop fibrillar and microfibrillar "hairs"). This can be an advantage in non-woven applications since it increases the surface area and entanglement of the fibers.

In fabric applications, a limited amount of fibrillation produces a soft peach-skin-like feel, which is an attractive attribute of Tencel. But too much can lead to pilling (the formation of little balls of fiber on the surface of the fabric). Initially this restricted the use of Tencel in knitted fabrics, until research into the relationships between the degree of fibrillation, and processing conditions (such as the jet-hole size, the air-temperature and humidity during spinning, and the concentration of NMMO in the coagulation bath) brought the fibrillation under control.

The history

Tencel fiber was first semi-commercially produced in Grimsby, United Kingdom, and first sold commercially in Japan in the late 1980s. The initial success prompted Courtaulds to build a much larger plant in Mobile, Alabama, and to expand the Grimsby site. Akzo Nobel of The Netherlands acquired Courtaulds in 1998, combined the fibers divisions of both companies, and then demerged them as Acordis Ltd, which included Tencel.

Meanwhile, Lenzing AG built a large lyocell production site at Heiligenkreuz, Austria. In 2004 the two major manufacturers combined when Lenzing purchased the entire Tencel group of companies.

"Lenzig bought Tencel because it gives them leadership in lyocell, and the strongest position in technology," says Hoyland. "Lenzig provides strong leadership with a proven track record. This is extremely positive for Tencel."

The future

Indeed, things look positive for all aspects of the lyocell technology. Solution spun cellulose fibers are increasingly used in nonwoven applications that demand high purity and wet strength. The cellulose solution can also be cast as a film and applications are starting to emerge for lyocell film. For example, the Fraunhofer Institute for Applied Polymer Research in Germany published a report last year on the advantages of using lyocell film for making sausage skins. And Tencel clothing continues to grow in popularity.

"More than 20% of our sales are Tencel," says Norman Campo, owner of the Champlain Clothing Company in Burlington, Vermont. "Both men and women appreciate the aesthetics and the soft feel. The fabric sells itself."

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