



ENGINEERED FIBERS TECHNOLOGY, LLC

TENCEL® LYOCCELL SHORT-CUT FIBERS

Tencel lyocell is produced from purified dissolving grade wood pulp and an amine oxide solvent. The pulp is a renewable resource and is dissolved directly into the solvent, filtered and extruded through spinnerets to form continuous fibers. These fibers are then washed to recover the solvent and then dried to form a continuous tow.

The result is a pure, **100% alpha-cellulose fiber**. The long chain molecules within the fiber are arranged in a highly oriented crystalline structure, resulting in high strength, absorbency and excellent retention of mechanical properties in the wet state.

When cut into short-fibers, lyocell, either used at one-hundred percent or in a blend, processes efficiently in all **wet-laid** papermaking technologies. Crimped short-cut fibers, with their inherently open nature, process efficiently in **air-laid** applications.

In addition, lyocell can be **fibrillated** with mechanical refining to produce high surface area fibers with **submicron fibrils** that provide both mechanical binding and filtration efficiency for the production of specialty high performance papers.

Lyocell fiber is ideal for filtration applications that require highly uniform papers and for papers that are in contact with food. Lyocell can also be used for hot oil and beverage filtration and is suitable for uses defined under 21 CFR 176.170.

At the end of the product life, lyocell **biodegrades** completely during biological treatment, such as burial or anaerobic digestion, into carbon dioxide and water.

Some of the benefits of lyocell fibers are:

- High tensile strength (2x rayon dry /3x rayon wet)**
- Highly absorbent**
- High wet and dry modulus**
- Swells radially when wet**
- Easily dyeable to strong color fast shades**
- Does not melt / outperforms cotton and rayon at elevated temperatures**
- Can be oxidized and carbonized**

Comparison of Fiber Physical Properties

<i>Property</i>	<i>Units</i>	<i>Lyocell</i>	<i>Polyester</i>	<i>Rayon</i>	<i>Cotton</i>
<i>Dry Tenacity</i>	<i>g/denier</i>	<i>4.5-5.0</i>	<i>4.5-5.5</i>	<i>2.3-2.7</i>	<i>2.3-2.7</i>
<i>Elongation @ Break /Dry</i>	<i>%</i>	<i>24-26</i>	<i>15-55</i>	<i>20-25</i>	<i>7-9</i>
<i>Wet Tenacity</i>	<i>g/denier</i>	<i>3.9-4.3</i>	<i>4.5-5.5</i>	<i>1.4-1.8</i>	<i>2.8-3.4</i>
<i>Elongation @ Break/ Wet</i>	<i>%</i>	<i>16-18</i>	<i>15-55</i>	<i>23-35</i>	<i>12-14</i>
<i>Water Imbibition</i>	<i>%</i>	<i>65-70</i>	<i>N/A</i>	<i>90-100</i>	<i>44-55</i>
<i>Cellulose DP</i>		<i>550-600</i>	<i>N/A</i>	<i>250-350</i>	<i>2-3000</i>
<i>Initial Wet Modulus</i>	<i>g/denier (5% Strain)</i>	<i>250-270</i>	<i>N/A</i>	<i>40-60</i>	<i>200</i>

EFT Short-Cut Fiber Characteristics

<i>Property</i>	<i>Units</i>	<i>Availability</i>
<i>Denier</i>	<i>g</i>	<i>1.25, 1.5, 2.2, 3.0</i>
<i>Cut length</i>	<i>mm</i>	<i>0.25-25 (Precision Cut)*</i>
<i>Cross-Section</i>	<i>----</i>	<i>Round</i>
<i>Luster</i>	<i>----</i>	<i>Bright and Dull</i>
<i>Crimp Level</i>	<i>Crimp /cm</i>	<i>0 - 2.5</i>
<i>Finish</i>	<i>-----</i>	<i>Various</i>
<i>Dispensability in Water</i>	<i>-----</i>	<i>Very Good</i>

** EFT can provide precision short-cut lyocell fiber to any customer specified length*

Lyocell Short-Cut Fibers - Specialty Paper Applications

- Adhesive Substrates**
- Battery Separators**
- Cigarette Filters & Papers**
- Electrical**
- Filtration Media**
- Food Casings**
- Flushable Papers**
- Glass Fiber Binder**
- Insulation Papers**
- Medical Papers**
- Napkins, tablecloths, tissues**
- Reinforcement papers**
- Security / Banknote Papers**
- Tea Bags**