Biodegradability of wood-based cellulose fibers

World of Wipes 2017, June 12 – 15 in Nashville

Wolfgang Plasser, Shayda Rahbaran
The Lenzing Group 2016

- **Sales:** EUR 2,134.10 mn (2015: 1,976.80 mn)
- **Fiber sales volumes:** 978,000 tons (2015: 965,000 tons)
- **Staff:** 6,218 (2015: 6,127)
- **Listed at Vienna Stock Exchange, Prime Market (ATX)**
- **Major shareholders:**
  - B&C Privatstiftung >50%
  - Oberbank AG >4%

*All figures in metric tons as of December 31, 2016*
Global fiber market
Global fiber consumption 2016

- Wool: 1.1%
- Cotton: 24.3%
- Synthetic fibers: 62.7%
- Other natural fibers: 5.3%
- Wood-based cellulose fibers: 6.6%

Source: ICAC, CIFRS, TFY, FEB, Lenzing estimates
Answering the wipes industry challenge

- Taking a stand against marine litter
- Wood-based cellulose fibers
Marine litter
Media misconceptions augment uncertainty

“Surprisingly, more than half of the fibers collected contained rayon, a man-made synthetic polymer…”

National Geographic, Dec. 2014

“The wipes also might pose environmental risks, because they’re made from plastics and synthetic cellulosic fibers, some of which are non-degradable….”

Ongoing issue: industry misconception

Key requirements for any standard include that the product: ... **does not contain** plastic or **regenerated cellulose** and only contains materials which will readily degrade in a range of natural environments.

Signed by 200+ organizations in 15+ countries
What can we do?

- Educate media, influencers and the public about rayon
- Promote sustainable and biodegradable materials
### Fibers on the world market

<table>
<thead>
<tr>
<th>Protein-based</th>
<th>Cellulose-based</th>
<th>From synthetic polymers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton Bast Fibers</td>
<td>Regenerated Cellulose Fibers</td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>Lyocell</td>
<td></td>
</tr>
<tr>
<td>etc.</td>
<td>Viscose</td>
<td></td>
</tr>
</tbody>
</table>

- Federal Trade Commission definition for “Rayon” fiber:
  - A manufactured fiber composed of **regenerated cellulose**, in which substituents have replaced not more than 15% of the hydrogens of the hydroxyl groups. Lyocell is classified as a sub-category under “Rayon”.

![TENCEL](image1)
![Viscose](image2)
Cellulose - most abundant natural polymer on earth

The principle of photosynthesis

$\text{CO}_2 + \text{Photosynthesis} \rightarrow \text{Tree} + \text{O}_2$
The cellulose cycle

Photosynthesis

Disposal

Use

Wipes

Trees

Pulp

Fiber production

FSC logo

PEFC logo
Lenzing offers fibers from the renewable source wood

From wood to wipes
Proof of environmentally friendly Lenzing™ fibers and processes
Lenzing™ fibers are completely biodegradable in soil

**Biodegradability** is break down of a product by microorganisms into carbon dioxide and water, so that it can be consumed by the environment [EN 14046 (2003) or ISO 14855 (2005)].
Compostability test includes four tests

- **Chemical Characteristics**
- **Biodegradation** (Chemical degradation)
- **Ecotoxicity** (Effect on plants)
- **Disintegration** (Physical degradation)

*Source: [http://www.ows.be/lc_divisions/biodegradability-compostability-ecotoxicity-bce/](http://www.ows.be/lc_divisions/biodegradability-compostability-ecotoxicity-bce/) – the picture belongs to OWS and it is under copyright of OWS*
Lenzing™ fibers are fully compostable according to the European Norm EN 13432

- **Chemical Characteristics**: EN 13432 (2000), TS-OK-10
- **Disintegration**: EN 14045 (2003)
- **Ecotoxicity testing**: EN 13432 (2000), ASTM D 6400-04, ISO 17088

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TENCEL® branded lyocell fibers disintegrate completely in compost at an ambient temperature within 4 months.

<table>
<thead>
<tr>
<th></th>
<th>at start</th>
<th>1 week</th>
<th>2 weeks</th>
<th>4 weeks</th>
<th>6 weeks</th>
<th>8 weeks</th>
<th>10 weeks</th>
<th>16 weeks</th>
</tr>
</thead>
</table>

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Lenzing™ fibers are fully biodegradable in seawater

- **Chemical Characteristics**
  EN 13432 (2000), Cobalt: table II of T-4-93

- **Biodegradation**
  ASTM D6691 (2009): at 30°C ± 2°C, 6 months – Pass: >90% biodegradation

- **Disintegration**
  TS-OK-23 VINCOTTE: 30°C ± 2°C, 3 months - Pass: >90% disintegration

- **Ecotoxicity testing**
  Pass: <10% of Daphnia should be affected
Example for fully biodegradable moist toilet tissue

TENCEL® lyocell short cut fibers in blends with wood pulp provide fully biodegradable wetlaid/hydroentangled fabrics in a range of natural environments.

Quick disintegration  Strong in use  Biodegradable
Lenzing, your partner in wipes

- Educate the public about rayon
- Promote biodegradable products
- Lenzing offers fully biodegradable wood-based cellulose fibers in compost, landfill, water and seawater
Megatrend: sustainability is gaining in importance

Less than 1% of global water resources is available as fresh water for people

Arable land is decreasing as a result of erosion and urbanization

Oil is a finite resource with a number of negative side effects
Lenzing showcases the new sustainability strategy on “World Earth Day”

Production of TENCEL® lyocell fibers in Mobile, Alabama

Investing **USD 293 mn** to triple the capacity of plant
Thank you for your attention!