

Man-Made Fibers in the Future

FINIX Seminar

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cellulose
textiles per capita
demand increase:

1.7 kg/a

**Cotton
growth
stagnates**

14 Mt
CELLULOSE
GAP IN 2030

A photograph of a large pile of discarded clothing and textiles at a landfill. The pile is composed of various items, including dark jackets, light-colored shirts, and patterned fabrics. In the background, a yellow excavator is visible, and a power line tower stands against a clear sky. A white circular overlay is positioned on the right side of the image, containing the text '73% of textiles landfilled or incinerated'.

73%
**of textiles
landfilled or
incinerated**

**Cotton
accounts for**

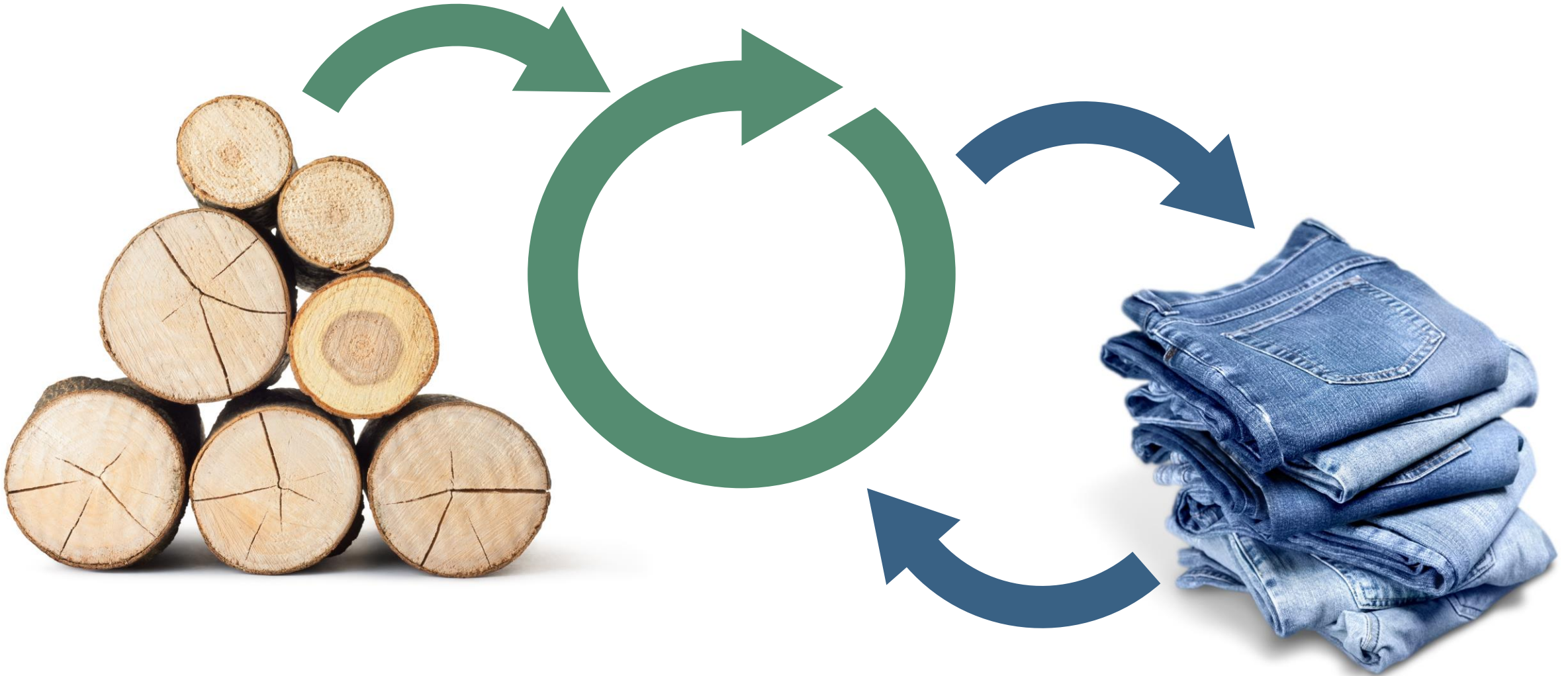
16%

**global insecticide
releases**

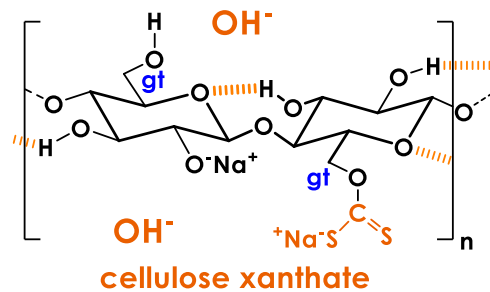
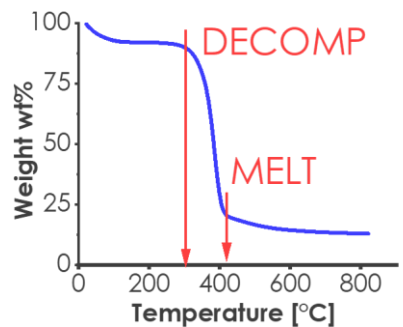
A close-up photograph of the waistband and pocket area of a pair of blue denim jeans. The jeans feature prominent gold-colored stitching. The background is a blurred, light blue-grey color.

7000 l
water for one
pair of jeans

Opportunity: Closed-Loop Man-Made Cellulose Fiber Process



How to make Cellulose Fibers?

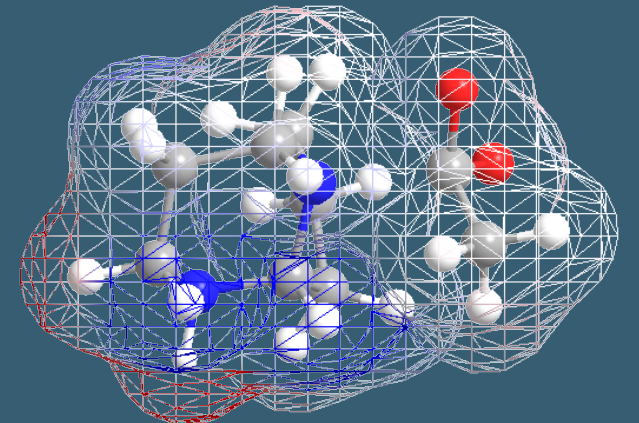


**NOT
MELTABLE**

**VISCOSE
CARBAMATE**

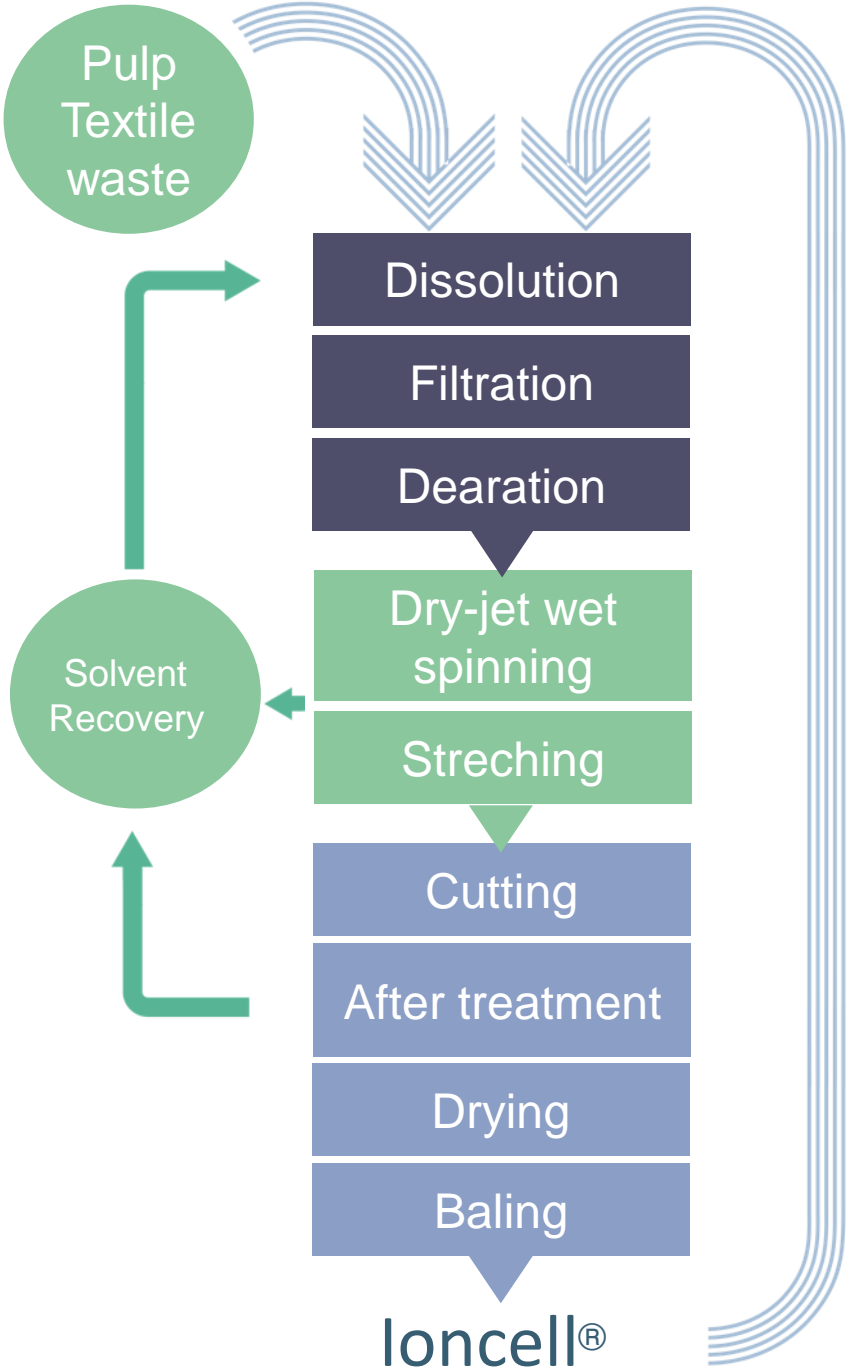
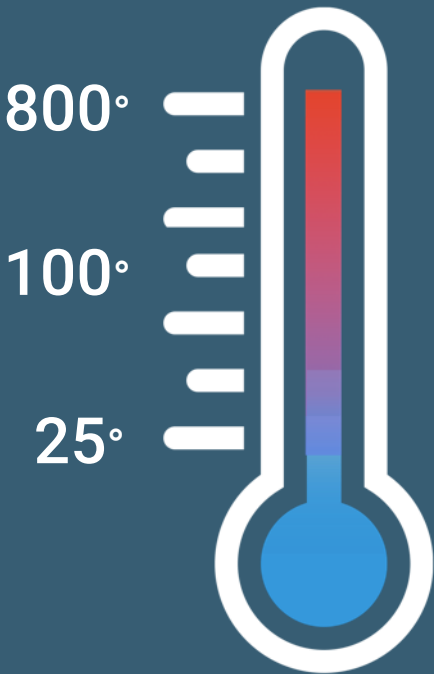
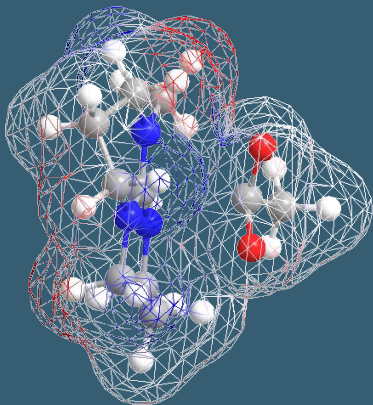
DIRECT DISSOLUTION LYOCELL

Lýein = dissolve

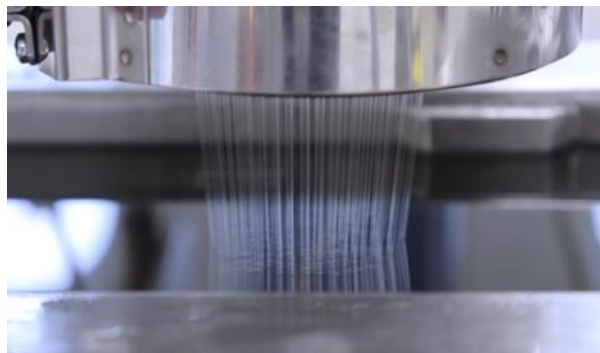


Green solvent

Ionic Liquids
are liquid salts
at $T < 100^{\circ}\text{C}$



Ioncell® *Lyocell* Process

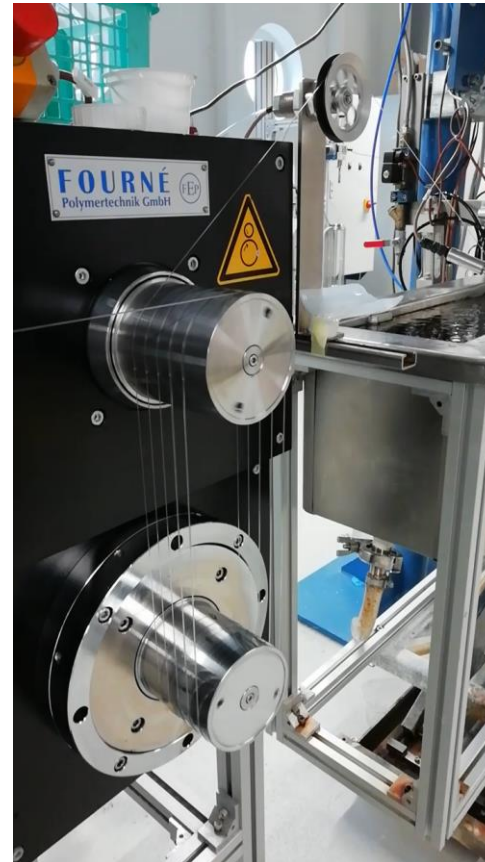


Challenges

Stable air-gap spinning



High Filament stretching



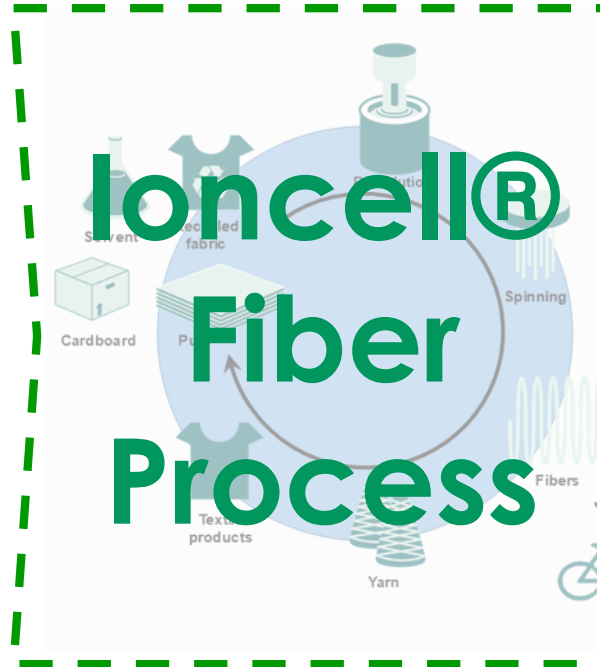
**Soft, good handle
High toughness**



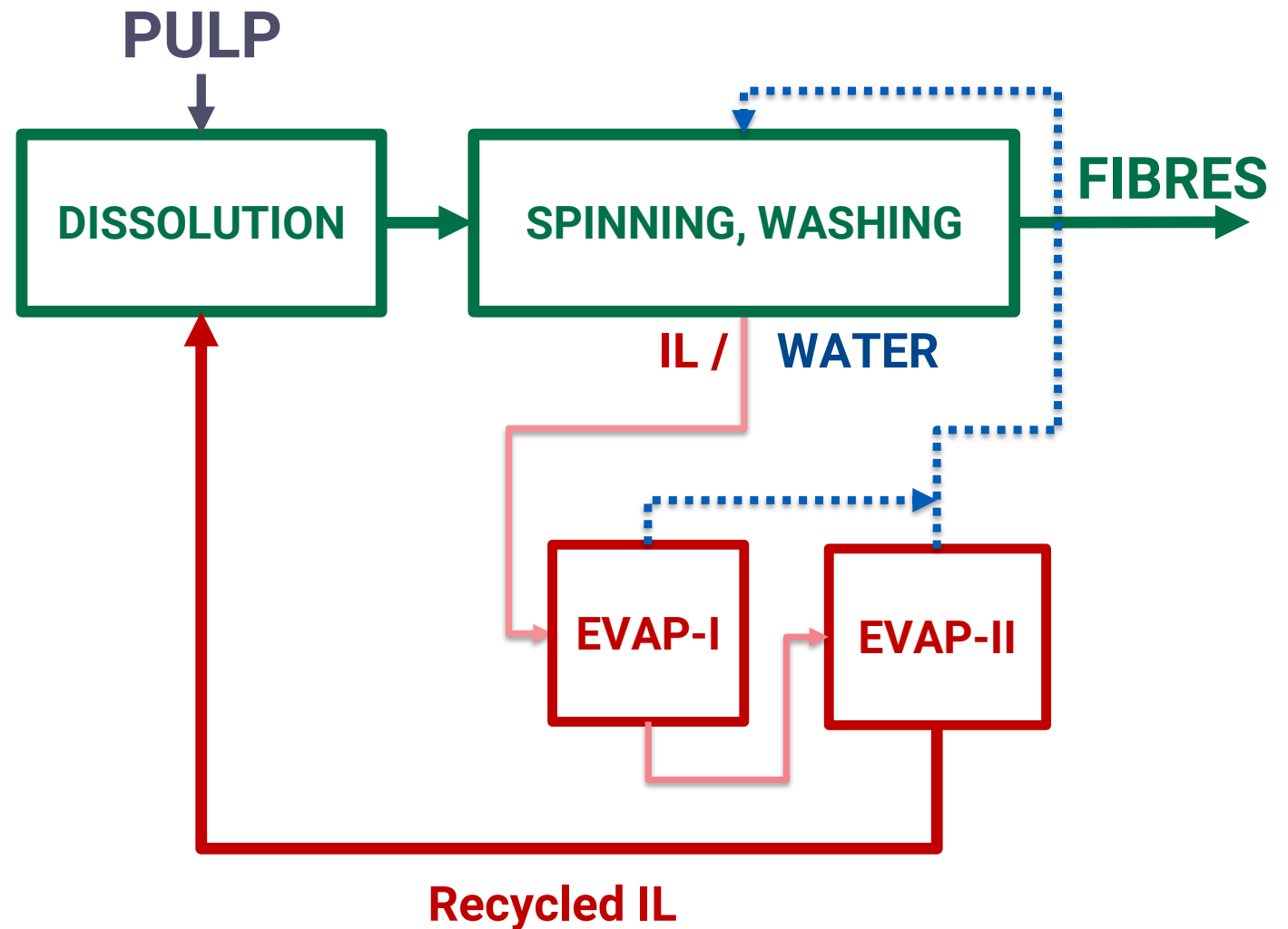
Textile fiber from Sustainably Grown Wood



Textile fiber from Textile Waste



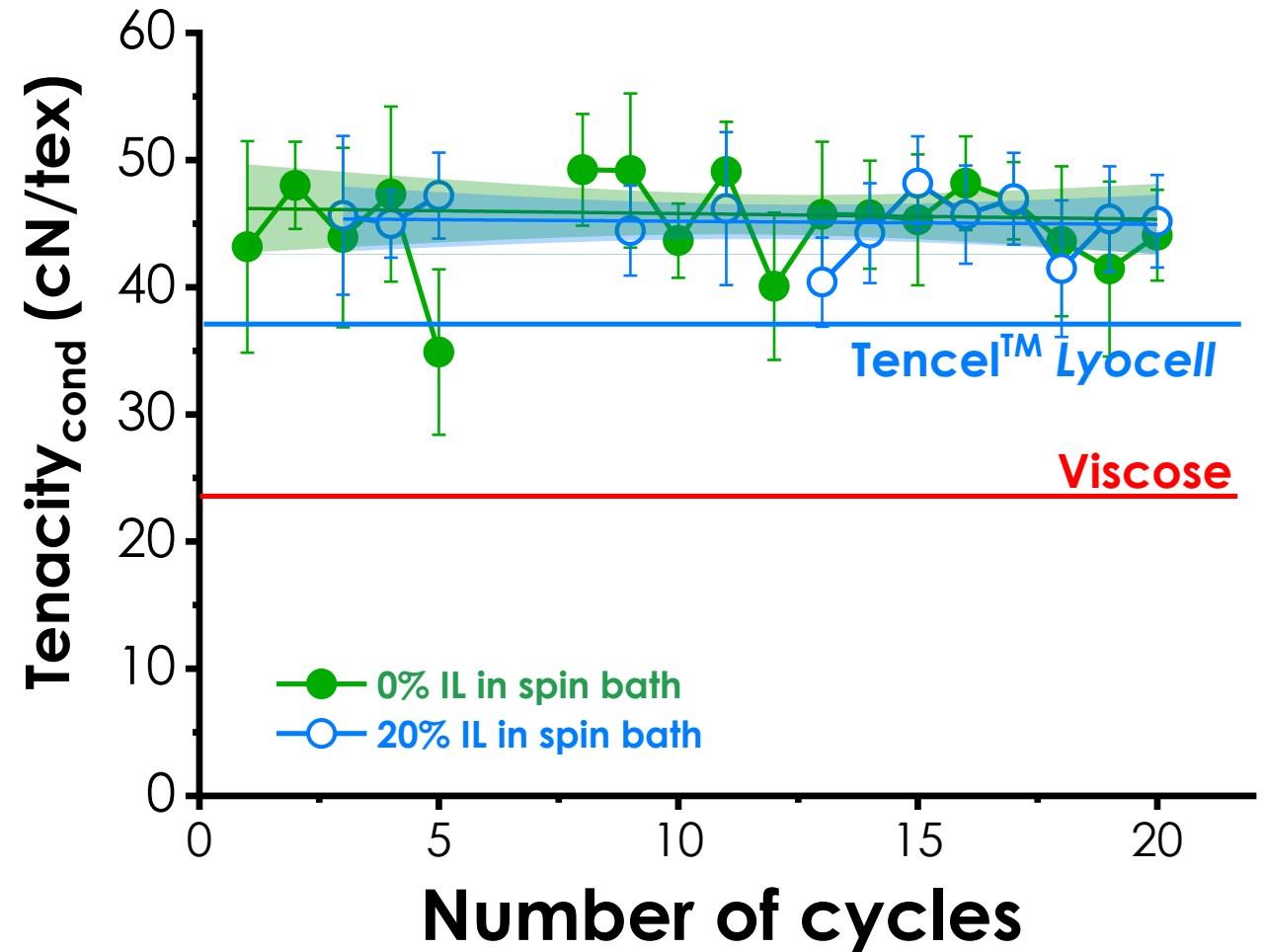
Solvent Recycling



Fiber properties
from recycle
solvent

Recycling Rate
Ionic Liquid (Lab)

>99%



Products from Wood Pulp



2014

marimekko®

Tuula Pöyhönen



2016

Fibers: Ioncell™-Team
Akino Kurosawa, MA FaCT
Fashion
Photo: Sara Riikonen



2018

Fibers: Ioncell™-Team
Design: Anna-Mari
Leppisaari
Photo: Eeva Suorlahti



2018

Fibers: Ioncell™-Team
Dress design: Emma Saarni
Textile Vesa Moilanen /Lehtik



2019

Fibers: Ioncell™-Team; Anna Semi MA
FaCT Fashion
Sofia Ilmonen MA FaCT Fashion



marimekko®



Products from Recycled Jeans

Haslinger S. et al. Green Chem., 2019, 21, 5598

Worn Jeans



New Scarf



On the occasion of
President Macron's
visit August 2018



Products from Recycled Jeans



T2C (Söktas)

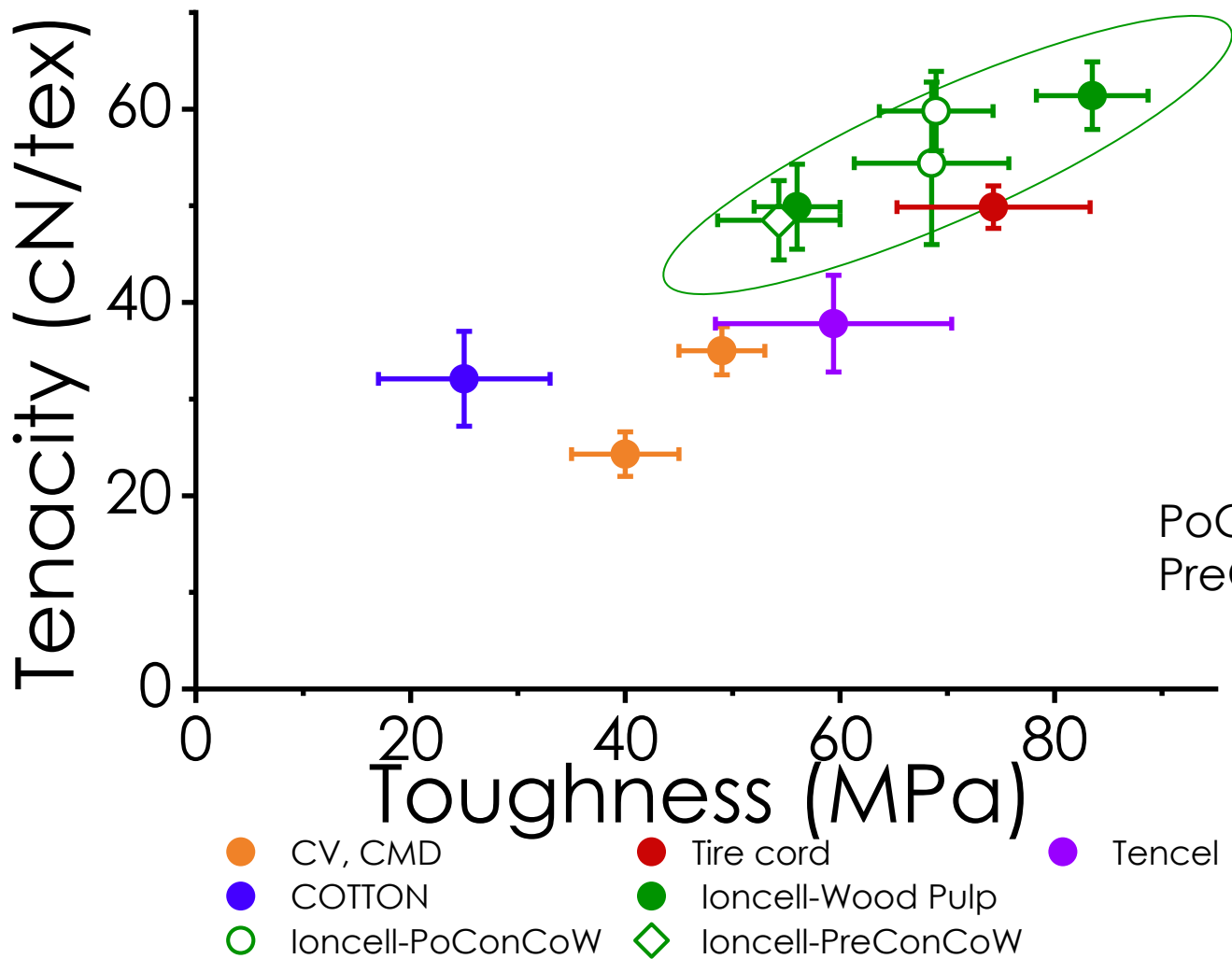


T2C (Reima)

New Fibers from old Jeans

Haslinger S. et al. *Green Chem.*, 2019, 21, 5598

Properties of loncell® fibers from Pulp and Textile Waste

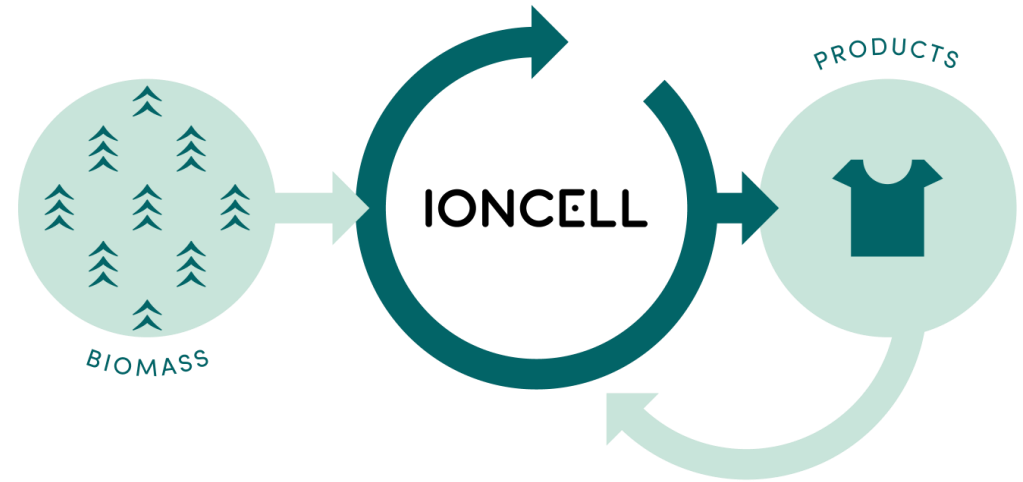


Summary of Ioncell® Fibers

Ioncell® superior to commercial Cellulose fibers in mechanical and other textile-related properties

Ioncell®
upcycles
Cotton Waste

Properties of **Ioncell®** fibers from cellulosic textile waste much better than those of **virgin Cotton fibers**

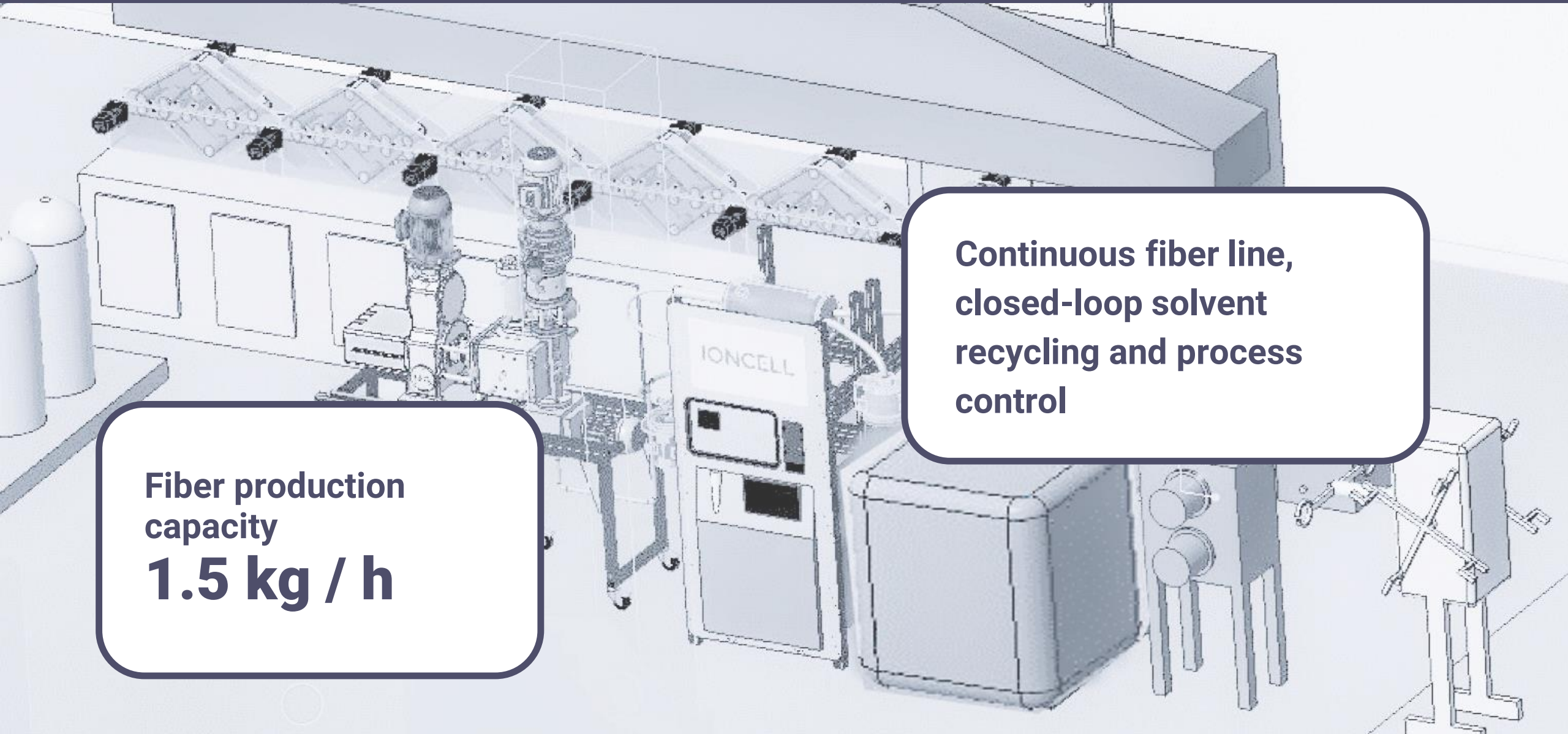


Ioncell® Pilot plant

Start-up fiber line:	1/2021
Pilot phase 1:	2021 – 2022
Pilot phase 2:	2023 – 2025

Strategy: joint process development with industrial partners

Ioncell® Pilot at Aalto Bioproduct Centre



Fiber production
capacity
1.5 kg / h

Continuous fiber line,
closed-loop solvent
recycling and process
control



Thank you!