



Innovative by nature

Lenzing Fibres Performance

Lenzing
Innovative by nature

Agenda



Who is Lenzing?



Why are our Fibres sustainable?



What are the performance elements of our Fibres?

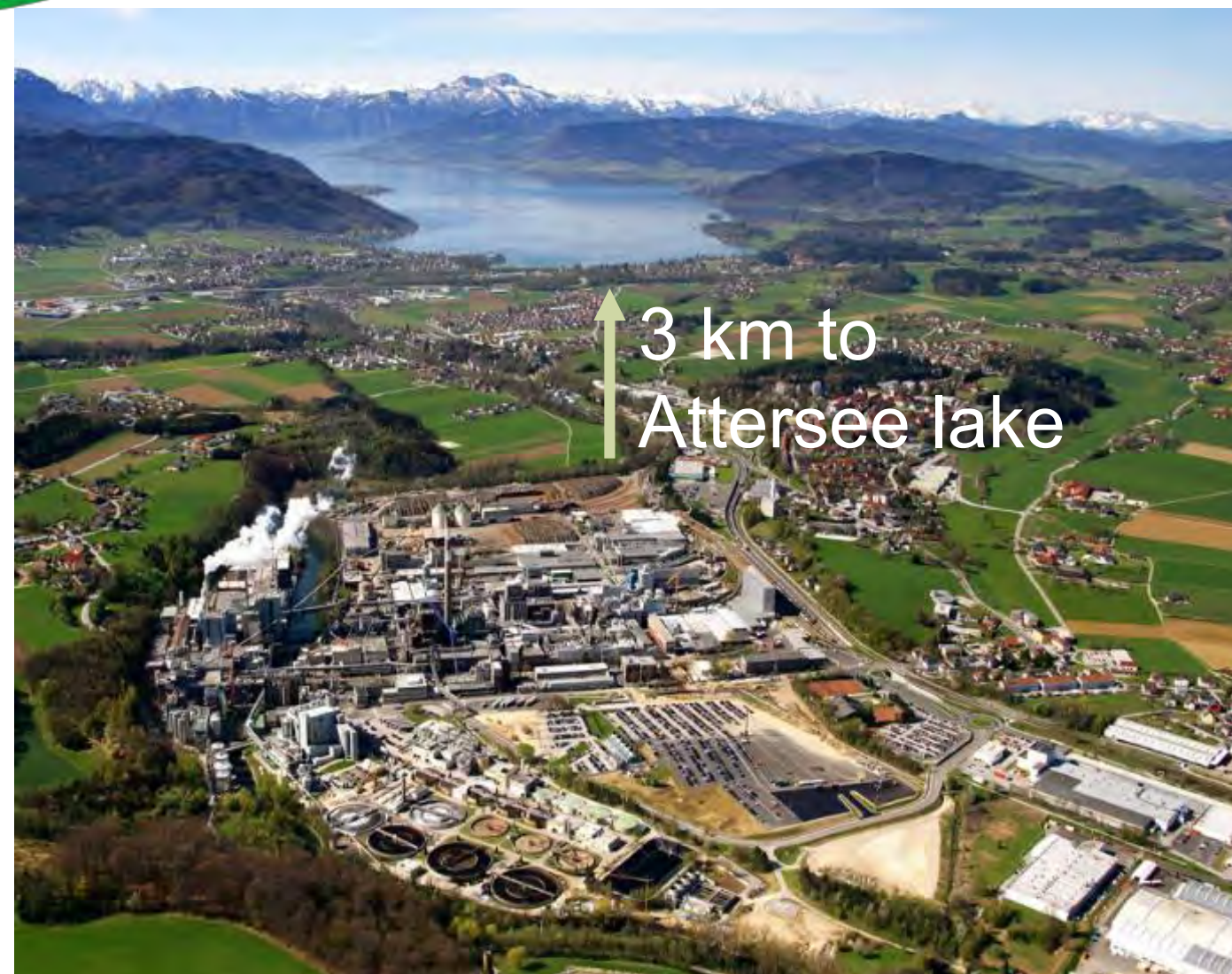


Product placements

Lenzing Introduction

who are we?

Lenzing Group – Lenzing, Austria HQ

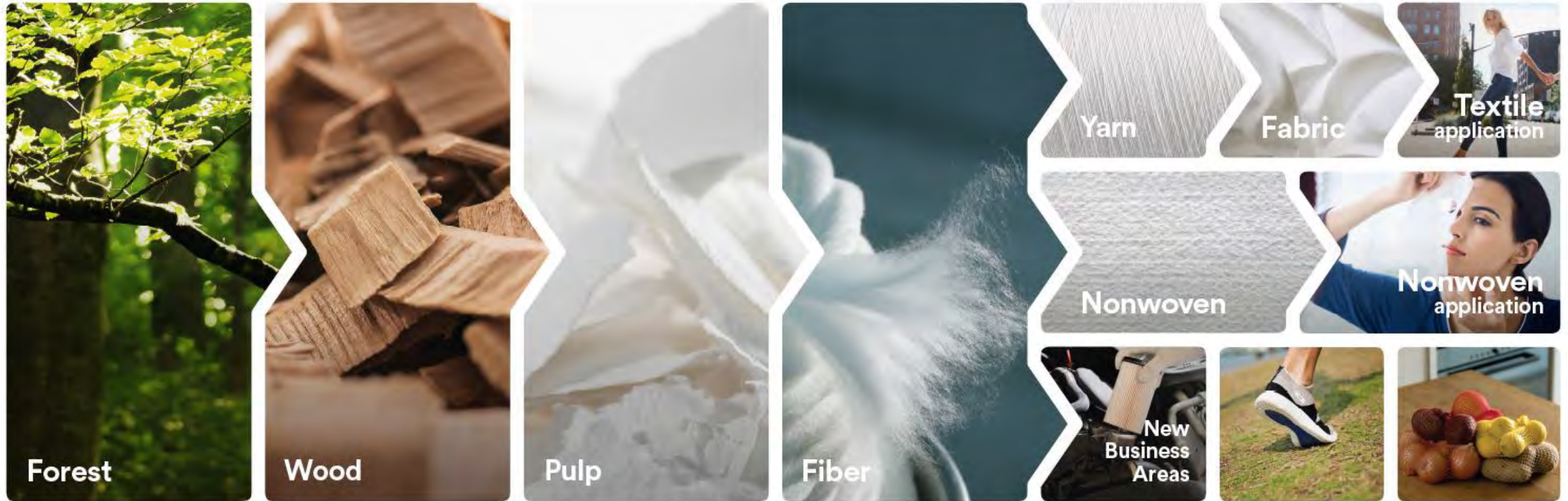


Production sites

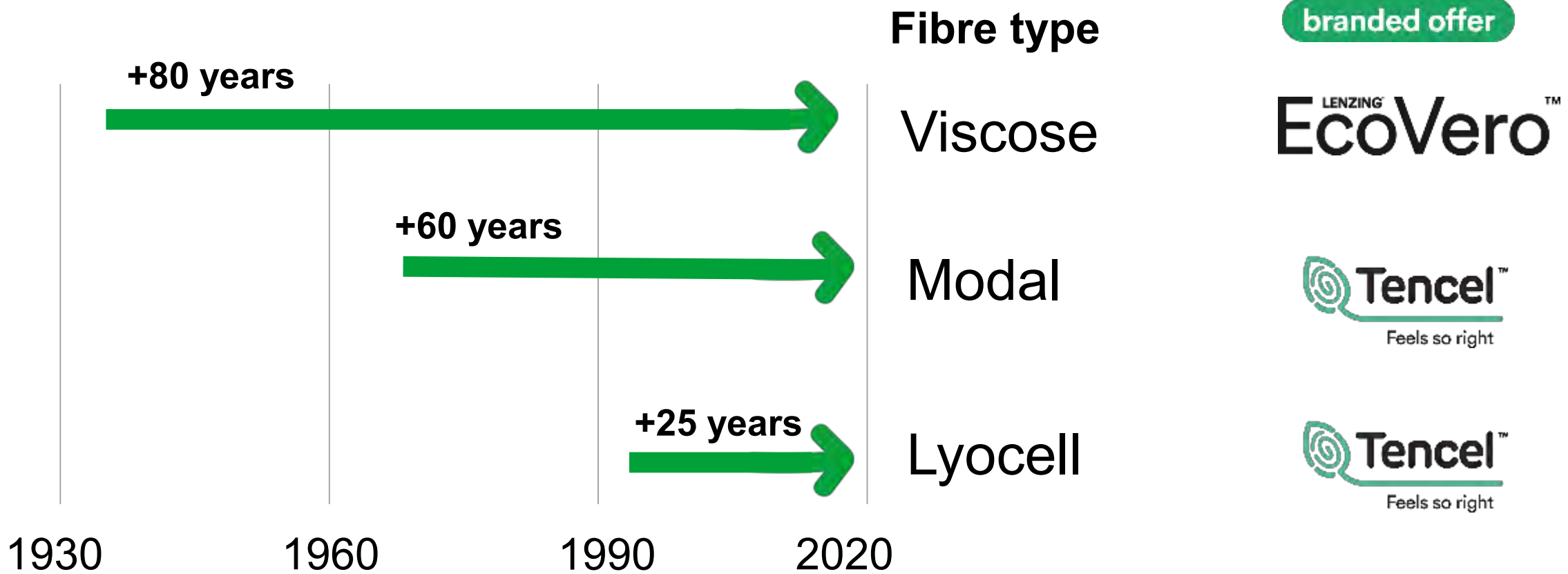


- 1: Lenzing/ Austria (Lyocell)
- 2: Heiligenkreuz/ Austria (Lyocell)
- 3. Grimsby/ UK (Lyocell)
- 4. Mobile/ USA (Lyocell)
- 5. Nanjing/ China (Viscose)
- 6. SPV/ Indonesia (Viscose)

LENZING™ Fibres produced from the raw material wood



3 Types of Lenzing Fibres in Textiles



Sustainability

why are our Fibres
sustainable?

Sustainability Credentials

A partner you can trust



CLIMATE



FORESTS



canopy

committed to:



certified by:



TrueCarbonZero



More information: <https://www.lenzing.com/sustainability/external-recognition>

TENCEL™ x REFIBRA™ Fibres

Our contribution to circular economy

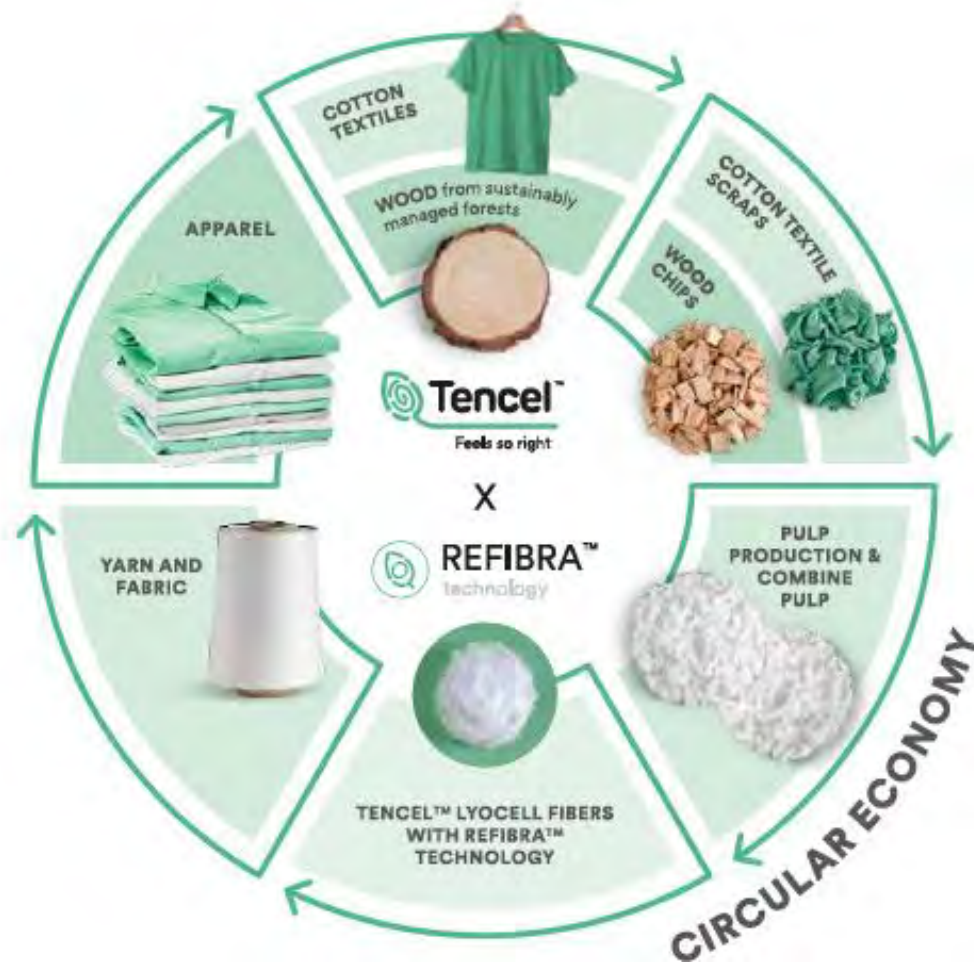


X



TENCEL™ Lyocell Fibres with REFIBRA™ technology feature up to **30% of recycled raw material content**

Lenzing's **five-year vision** is to raise the industry bar by producing Fibres with REFIBRA™ technology by having **up to 50% recycled content from post-consumer cotton textile waste** to make textile waste recycling as common as paper recycling.



What are TENCEL™ x REFIBRA™ fibres?



X



Performance

what makes our fibres so great?

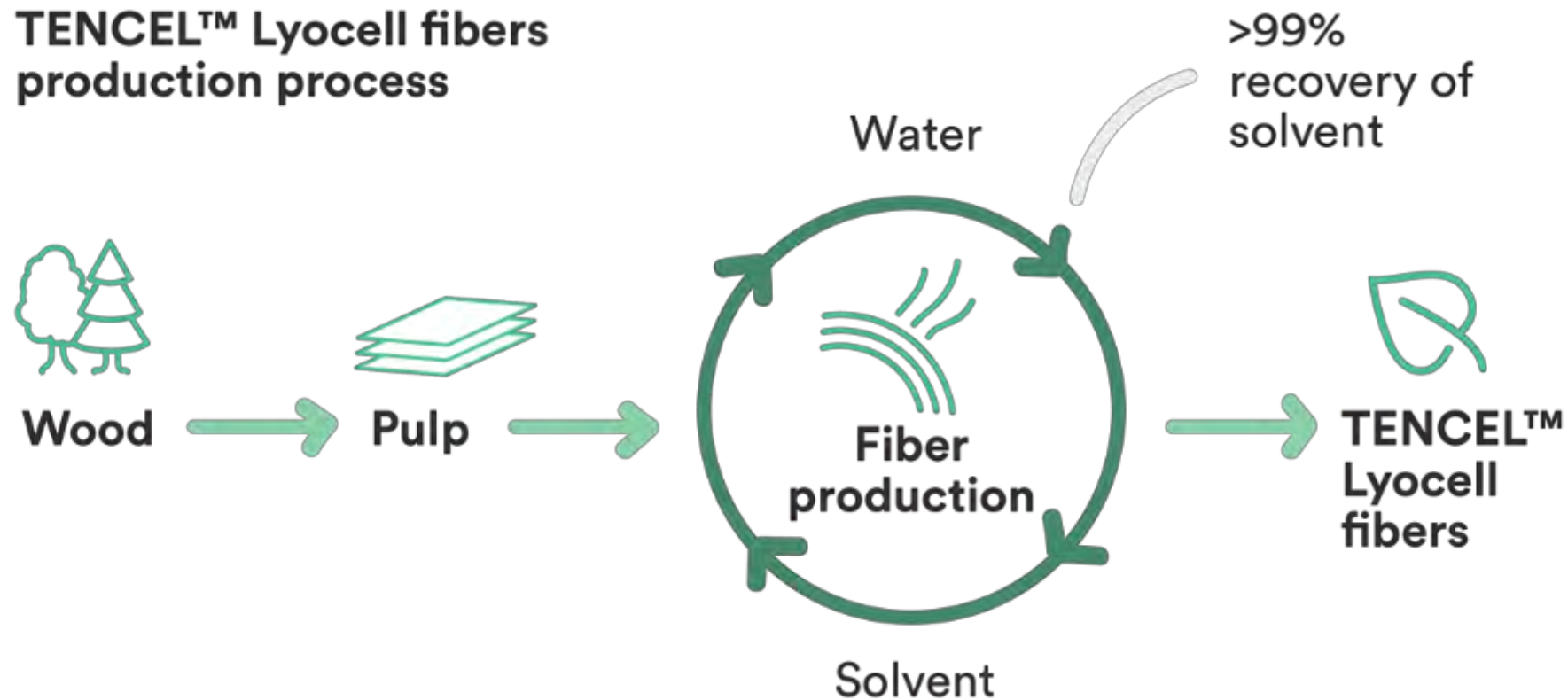
Fibre Portfolio Overview



Produced in	Austria, UK, USA	Austria	Austria, China, Indonesia
Specialties (Fibre types)	Standard, LF, A100, Refibra™, Micro	Micro, Colour, Eco-Pure, Air	ECOVERO™
Key features	Breathable. up to 30% recycled content in REFIBRA™, Identification technology (REFIBRA™)	Softer than cotton, Identification technology (Eco-Pure)	Identification technology
Blending partners	Cotton, Synthetic (PES, Acrylic, Nylon), Hemp, Kapok, etc.	Cotton, Synthetic (PES, Acrylic, Nylon)	All
Common use	Activewear, Denim, Innerwear	Innerwear, Homewear	Ready to wear
Sustainability features	Closed loop process. Carbon neutral Fibres available	EU-Eco label, low CO ₂ footprint. Made in EU. Carbon neutral Fibres available	EU- Eco label

TENCEL™ Lyocell – Production Process

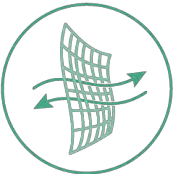
TENCEL™ Lyocell fibers production process



Key benefits for TENCEL™ Lyocell Fibres



Gentle on skin



Enhanced breathability

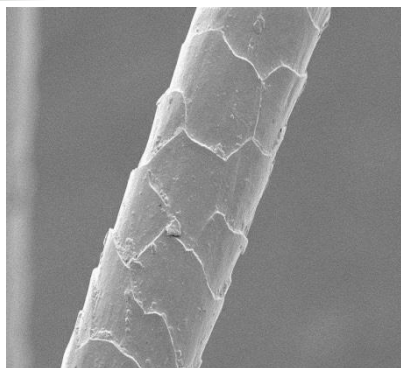


Thermal regulation

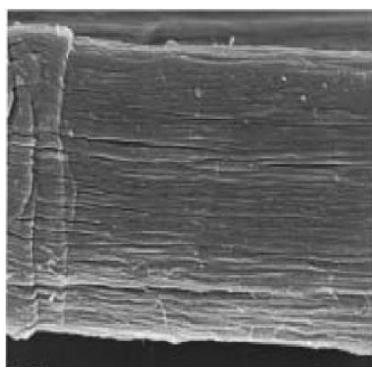


Unfavorable for bacterial growth

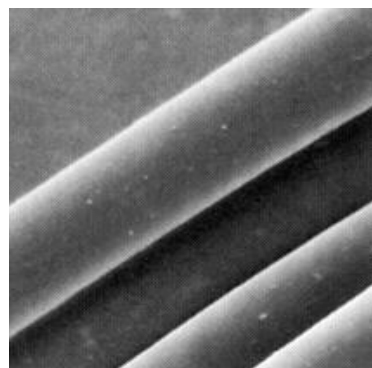
TENCEL™ Lyocell Fibres - smooth fiber surface



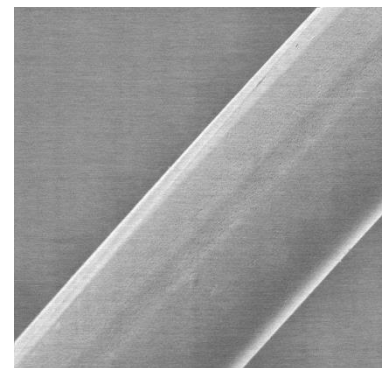
Wool



Linen



Polyester



TENCEL™ Lyocell fiber



Gentle on skin

Smooth
surface

-

-

+

+

Water
absorption

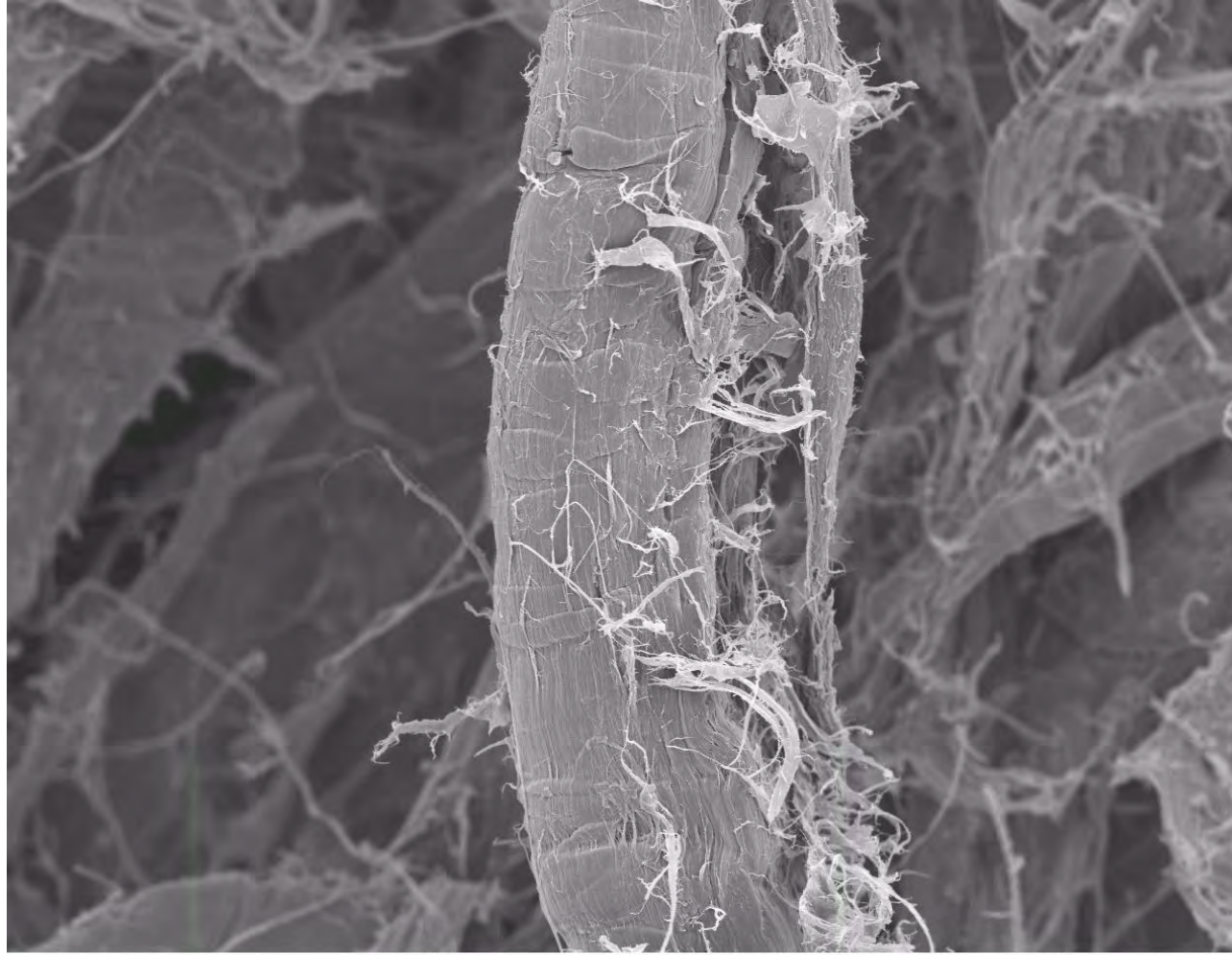
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Both fibers fibrillate

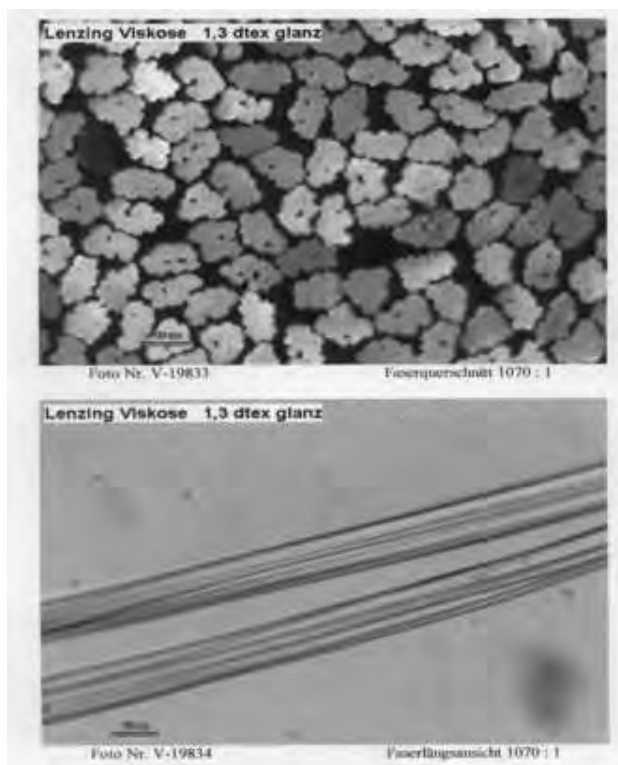


1000x

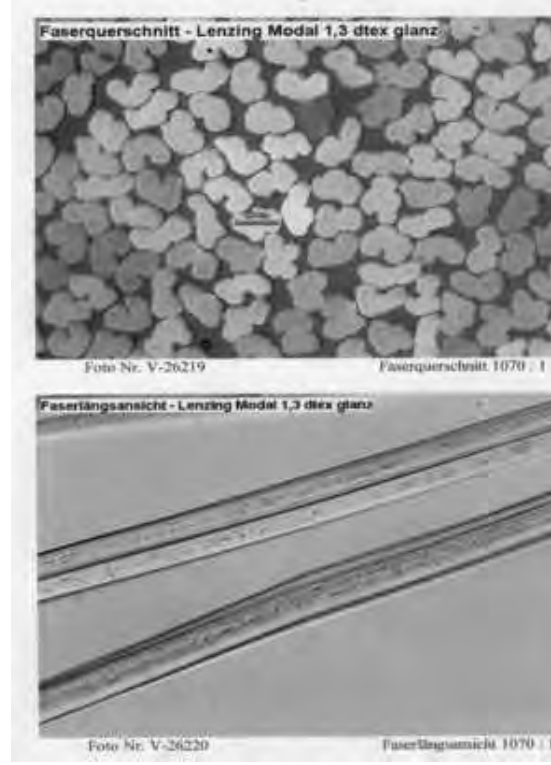
30 µm

Fiber cross section

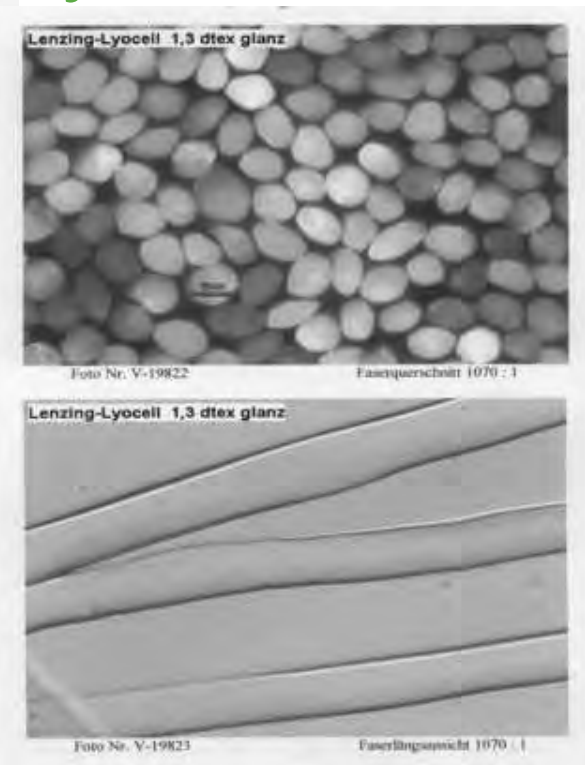
Lenzing™ Viscose



Lenzing™ Modal



Lenzing™ Lyocell

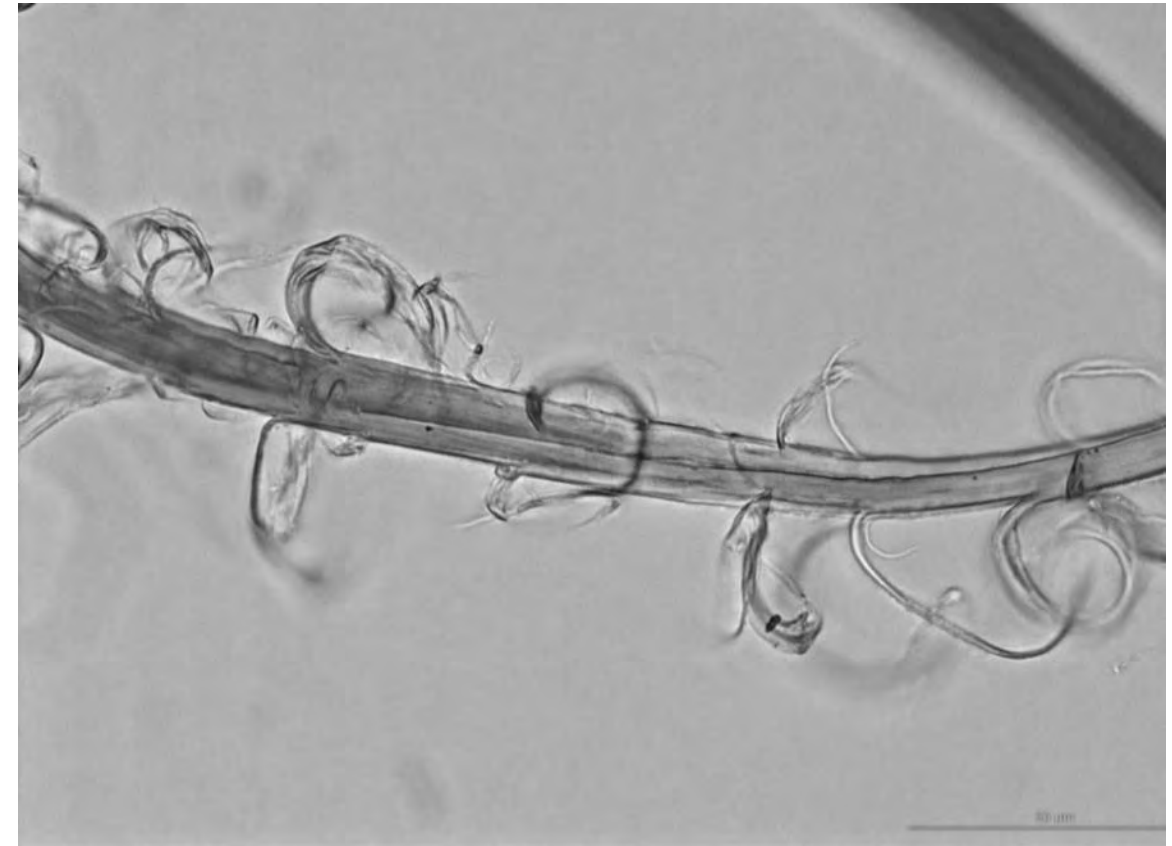
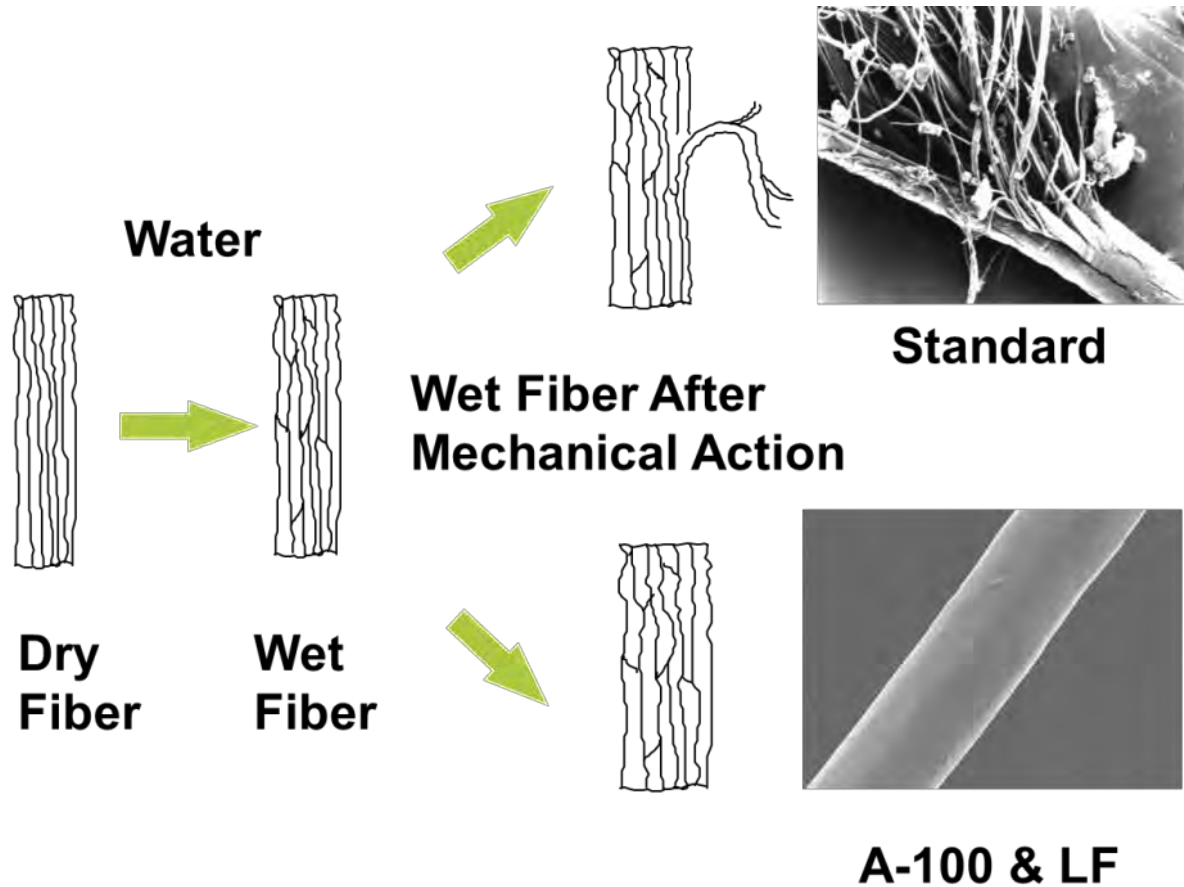


Physical fiber data

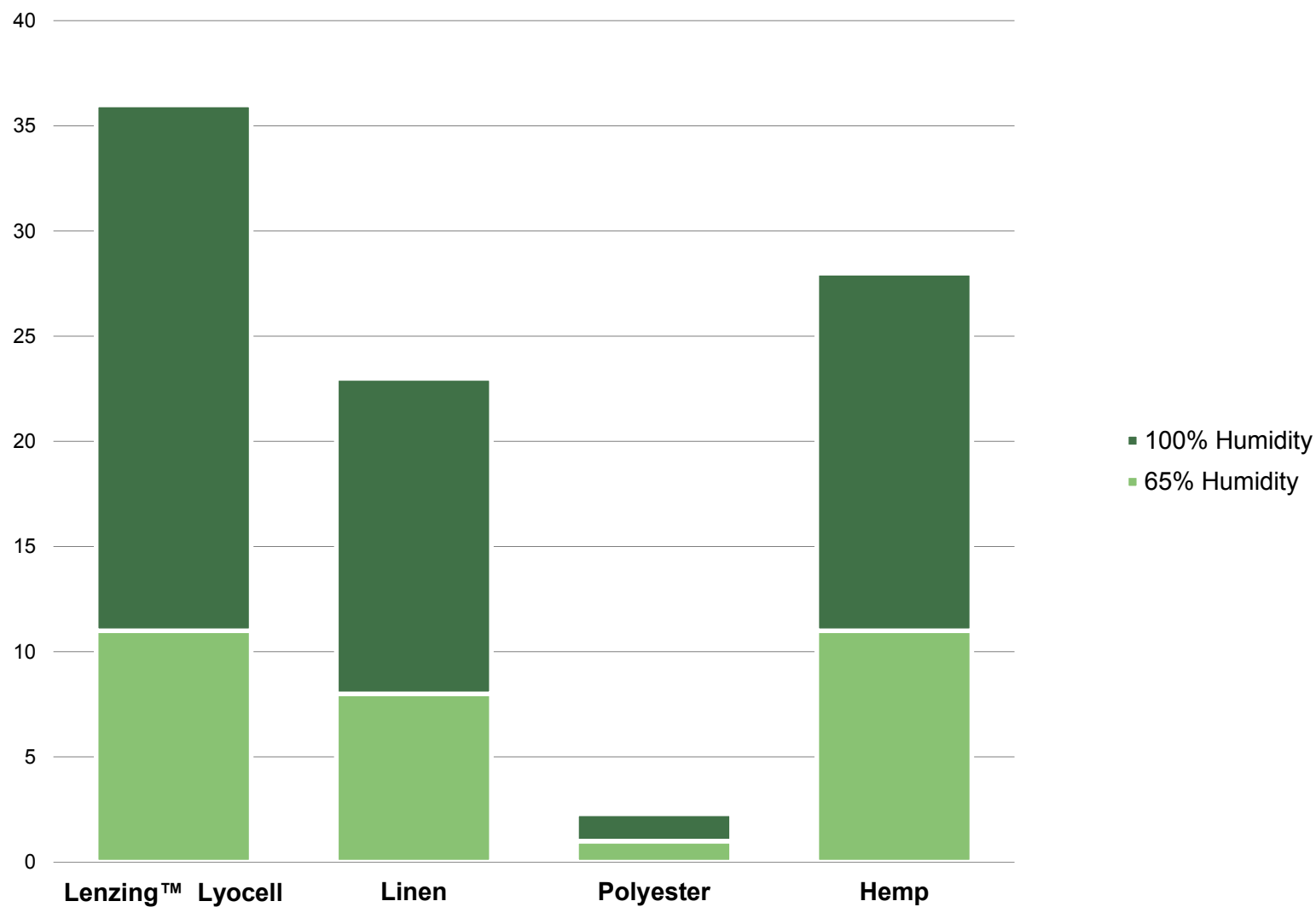
	Viscose	Lenzing™ Modal	Lenzing™ Lyocell
Tenacitiy cond. [cN/tex]	25	35	37
Elongation cond. [%]	20	13	13
Tenacity wet [cN/tex]	13	20	30
Elongation wet [%]	23	15	15
Bisfa Modulus	3	5	10
Degree of whiteness	90	89	87
Natural moisture content [%] (65% rel H)	11	11	11
Polymerisation degree DPv	430	640	850

What is fibrillation?

Standard fiber vs cross-linked fibers



TENCEL™ Lyocell Fibres – water absorbtion

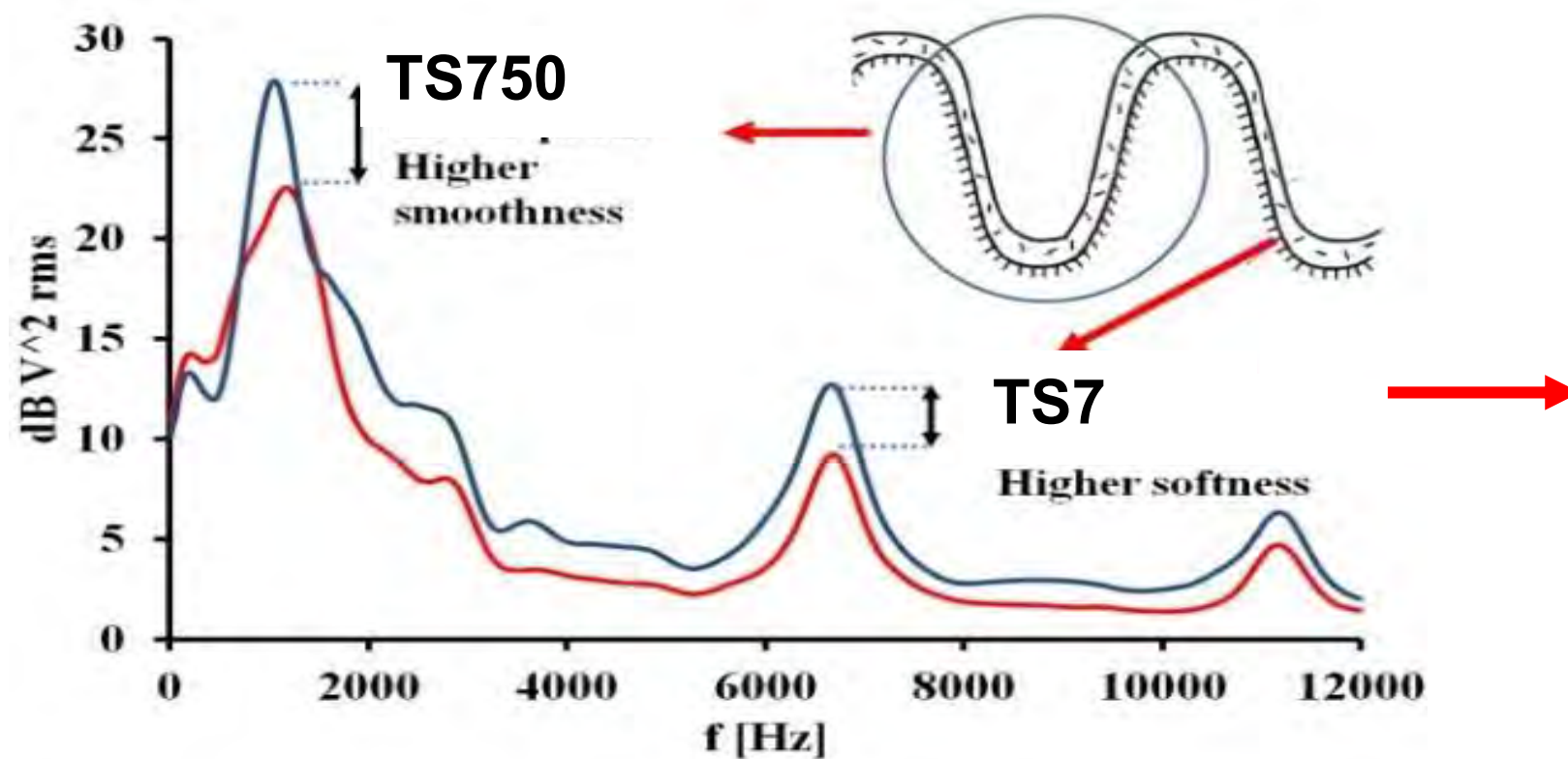


New approach: Fabric acoustics

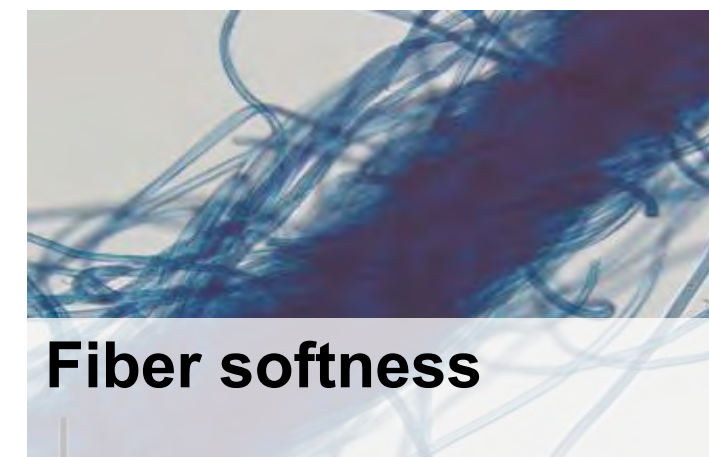


Tissue Softness Analyzer (TSA)

TSA transforms handfeel into acoustic signals



Surface smoothness

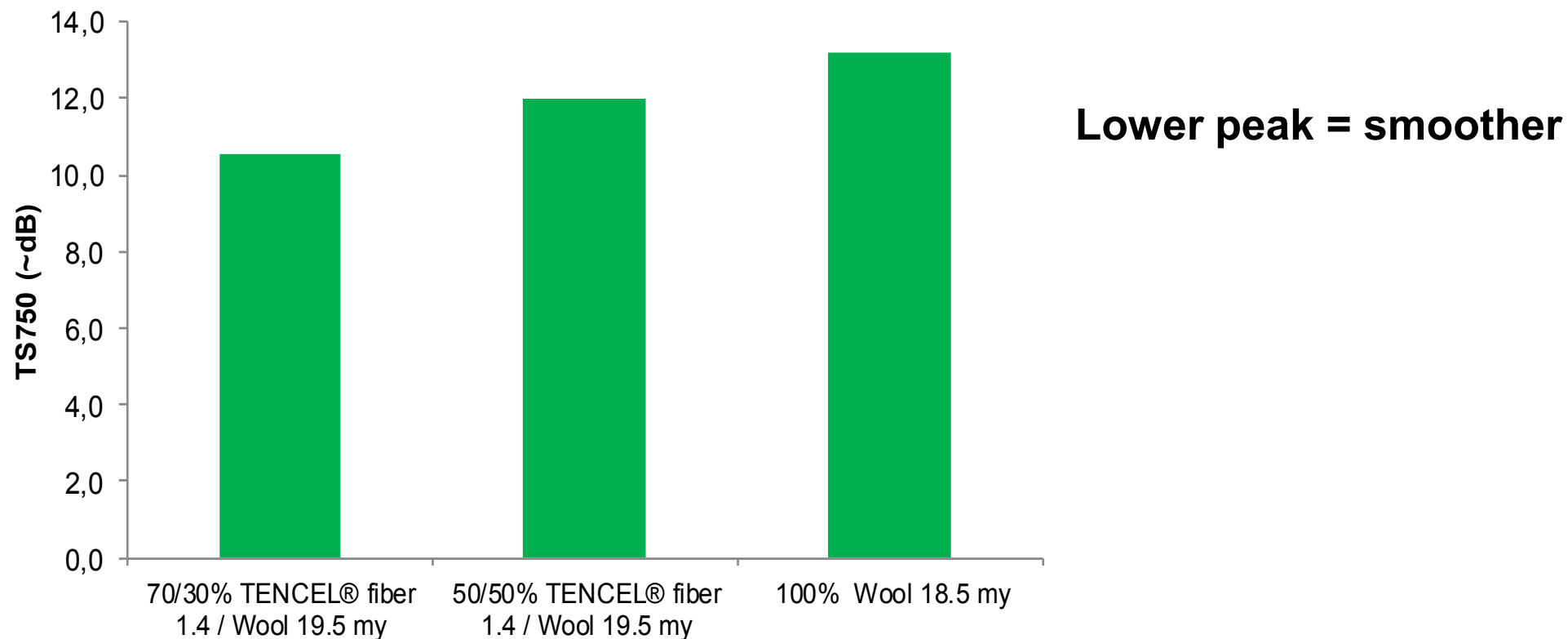


Fiber softness

The lower the noise, the softer/smoother the fabric

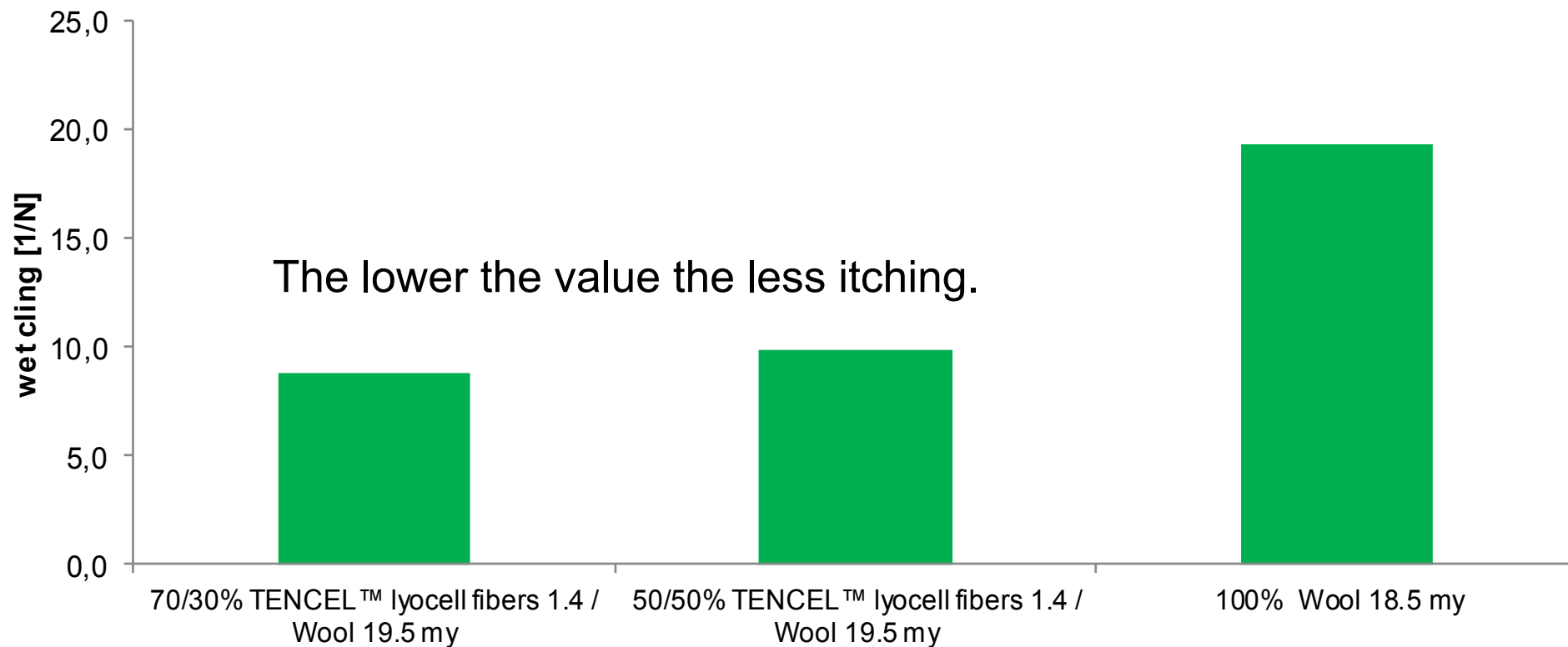
TENCEL™ fiber A100 improves smoothness

Smoothness Analyzer TS750, measured at 750 Hz



TS750 expresses „felt smoothness/roughness“, based on surface geometry/structure

TENCEL™ Lyocell Fibres reduce itching



Gentle on skin

A value higher than 16 means uncomfortable in wear (Hohenstein Institute)

Properties



enhanced
breathability

Improved Moisture management



unfavorable for
bacterial growth



contribute to
performance



thermal regulation



TENCEL™ Lyocell

POLYESTER

COTTON

TENCEL™ Lyocell Fibres are hydrophilic and hygroscopic and can absorb ~ 70% water. Water is absorbed and transported within the fiber.

Polyester Fibres are not hygroscopic and not absorbing. Only 2-3 % water can be adsorbed at the surface.

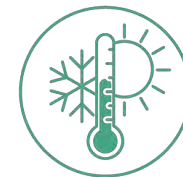


- Heat flow through the fabric is better with TENCEL™ fiber
- Better performance of top athletes with TENCEL™ fiber at high effort level

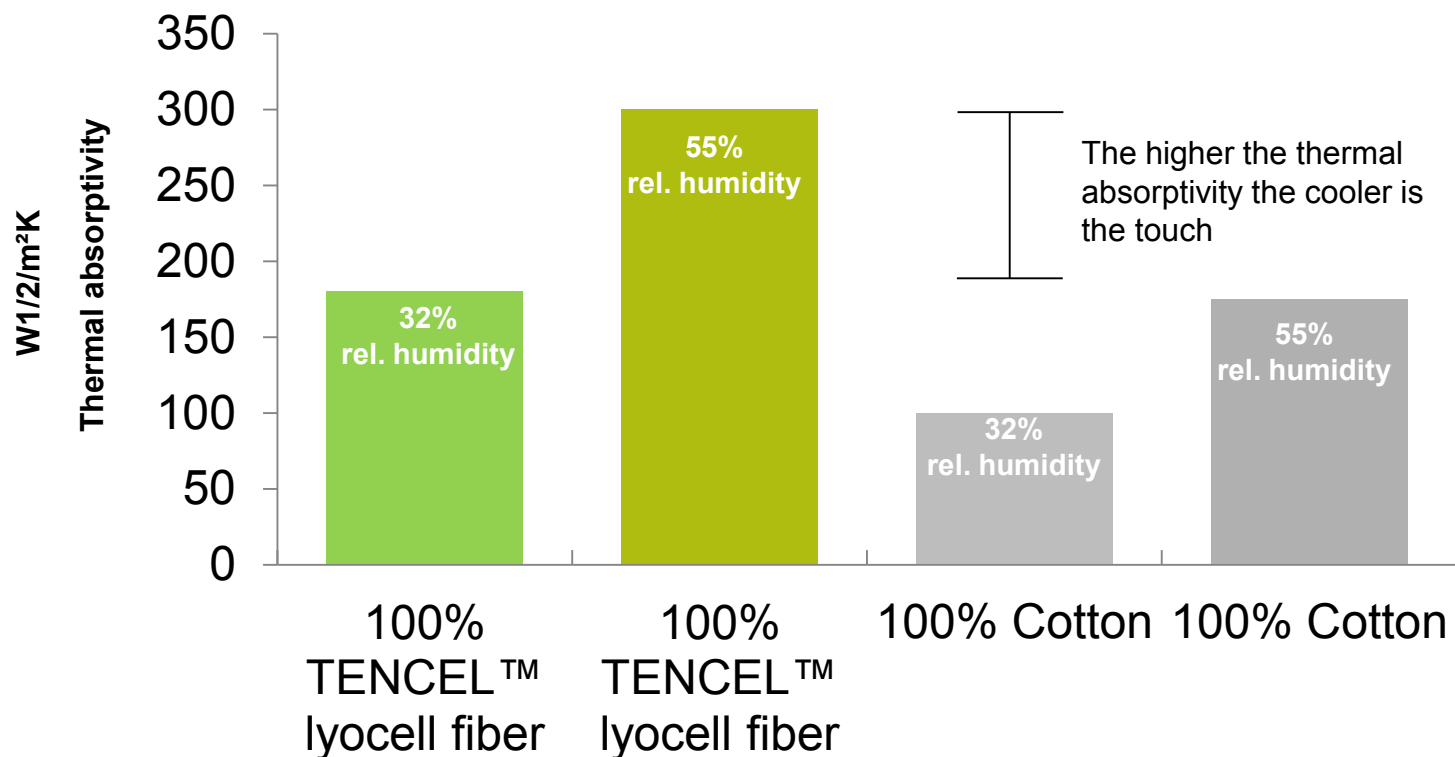
Average difference in surface temperature is $\sim 0,5 - 1 \text{ }^{\circ}\text{C}$

TENCEL™ lyocell Fibres improve thermoregulation

- TENCEL™ lyocell Fibres feel cooler than cotton
- The fiber surface remains dry even when the air humidity is high



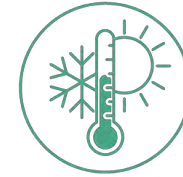
Thermal regulation



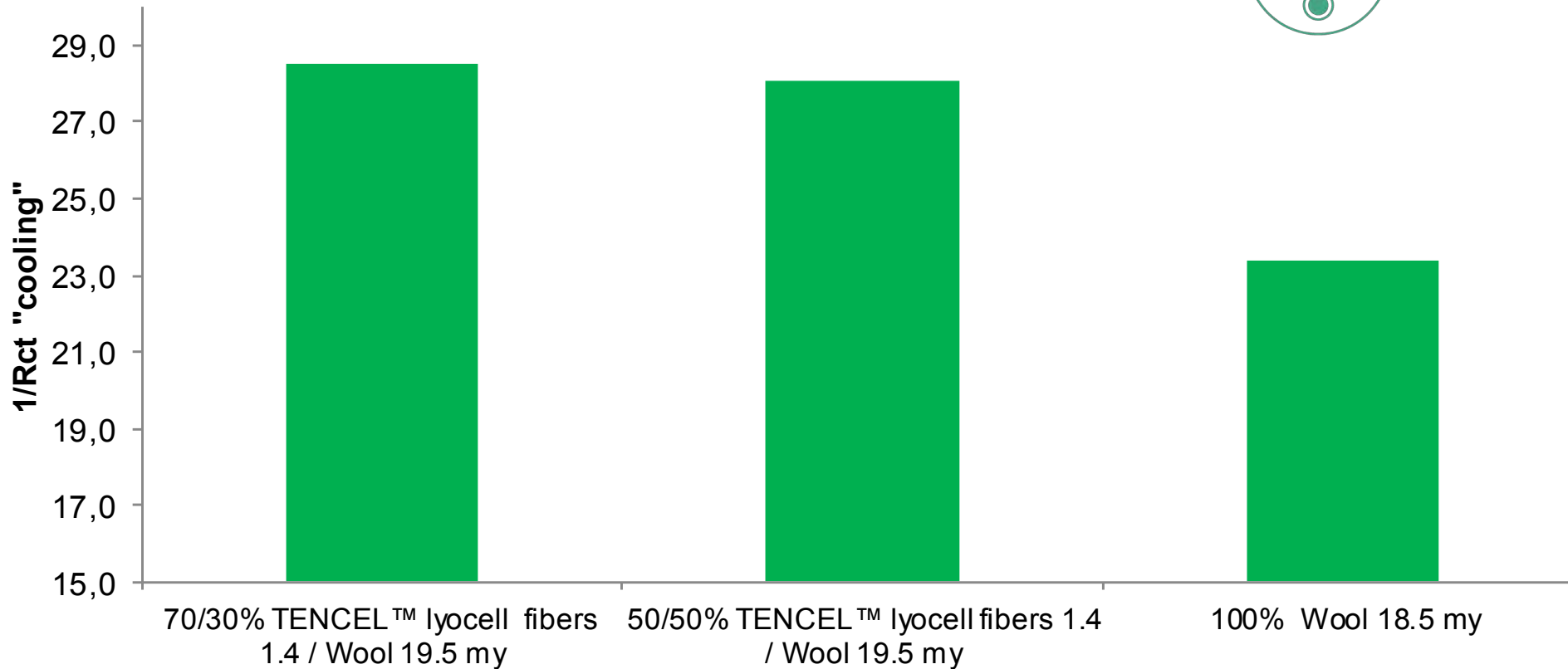
physiological advantage at low activity level in very hot and/or humid climate

TENCEL™ lyocell Fibres make the fabric 20% cooler

The higher the value, the cooler you feel.

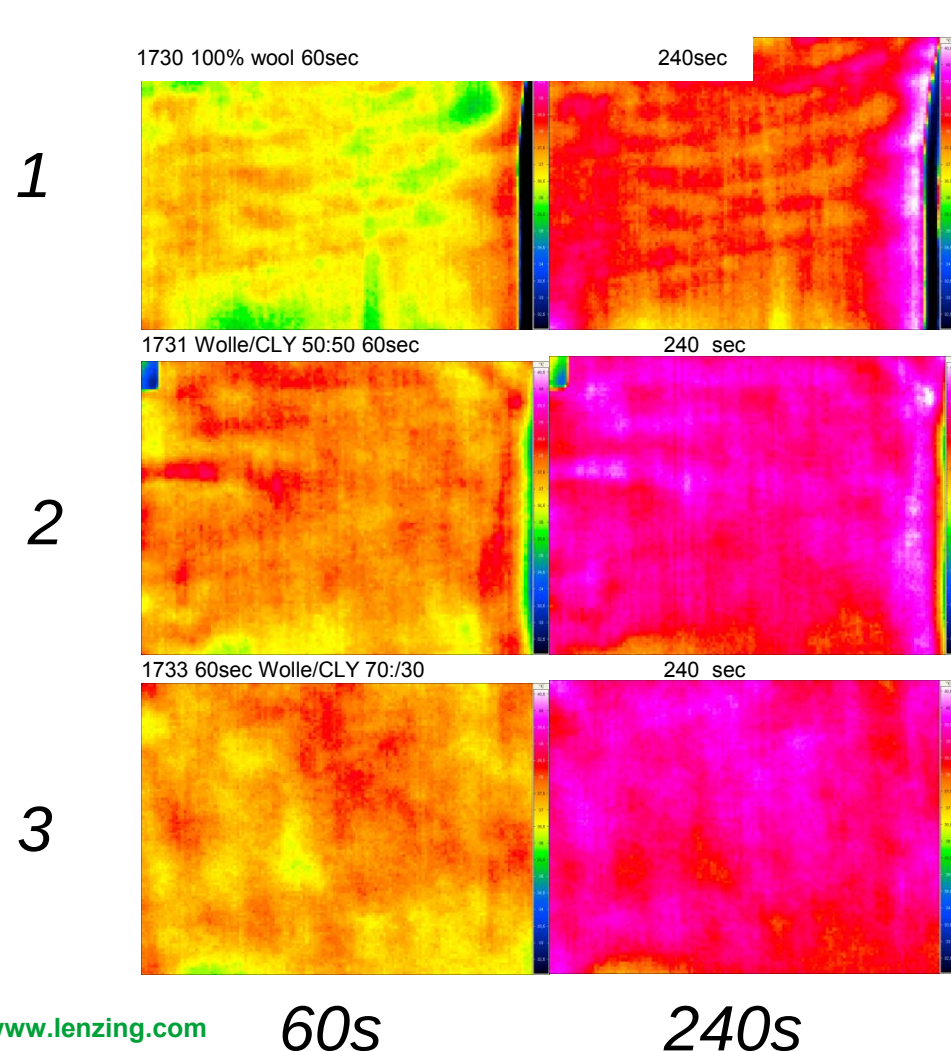


Thermal regulation



Improved thermal balancing: perfect for Activewear

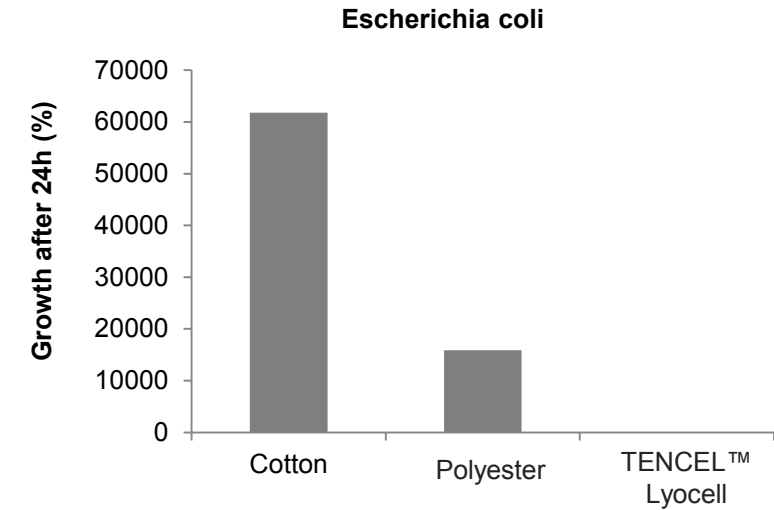
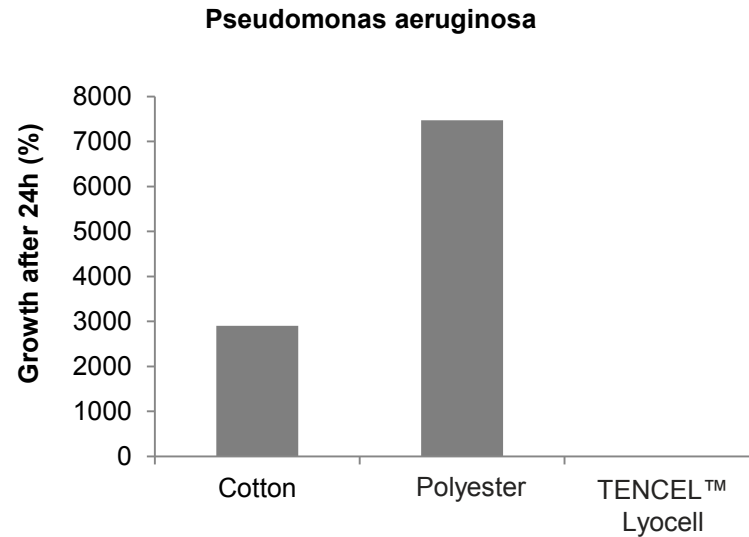
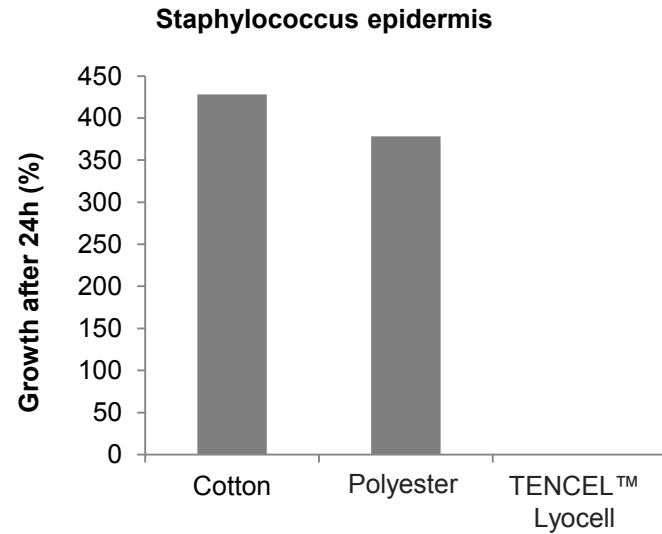
Thermal camera test show



		$\sim T^{\circ}\text{C}$
1	100% wool	38
2	50% wool, 50% lyocell	39,5
3	70% wool, 30% lyocell	39

The higher content the content TENCEL™ lyocell Fibres the more overheating of the body can be prevented

Unfavorable for bacterial growth



Through moisture management, TENCEL™ Lyocell Fibres absorb moisture efficiently, as measured by the Vapor Uptake test and Water Retention Value. In comparison to polyester and synthetics, and even to cotton, there is less available moisture formed on the surface of the fiber for bacteria to grow. Consequently, TENCEL™ Lyocell Fibres provide a less favorable environment for bacterial growth.

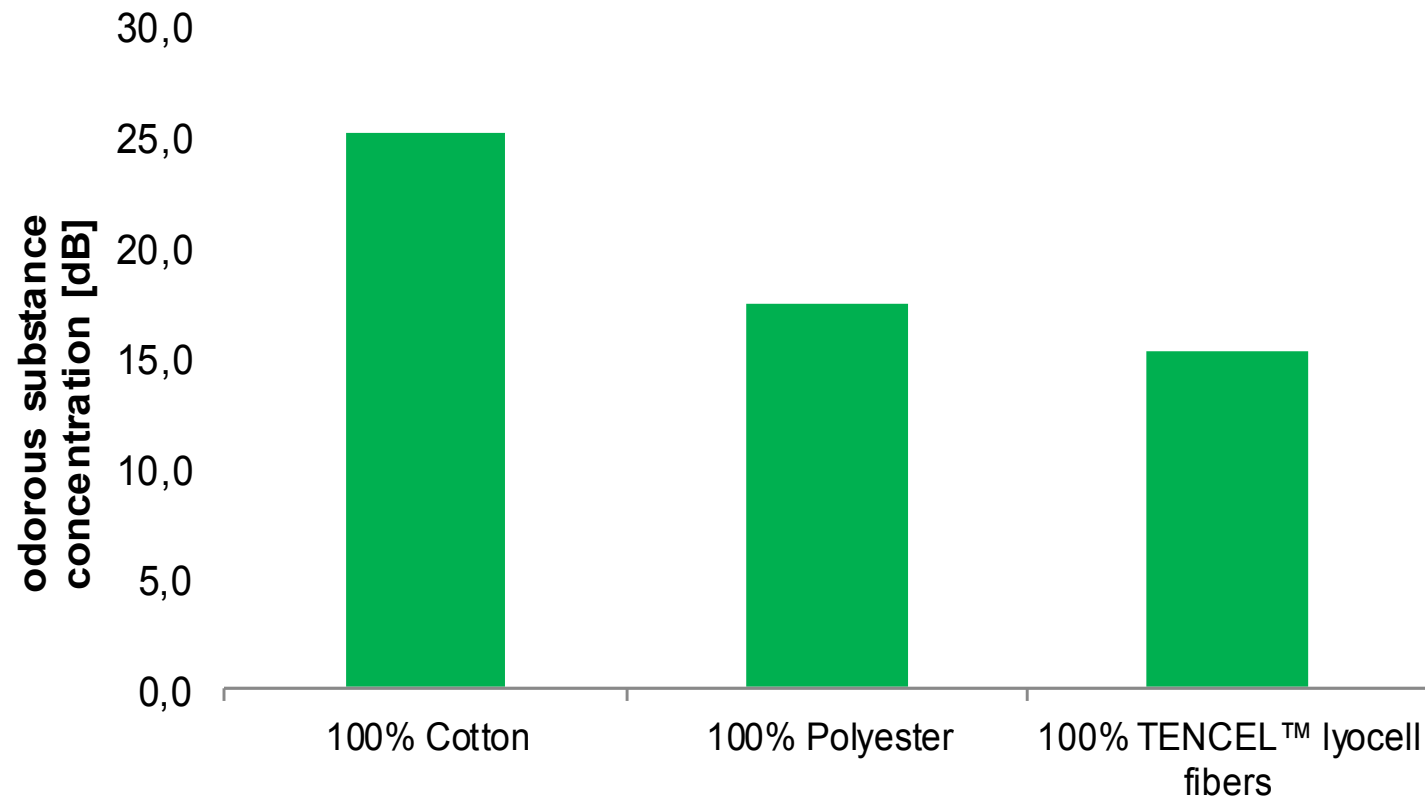
Particularly, on three of the odor-relevant bacteria types tested, (Staphylococcus epidermidis, Pseudomonas aeruginosa, Escherichia coli), a significantly lower growth rate was observed on TENCEL™ Lyocell Fibres compared to cotton and polyester Fibres under moderate humidity conditions.

Tested at Hohenstein Institut für Textilinnovation gGmbH, Germany, Report no. 18.8.6.0007

TENCEL™ Lyocell Fibres show reduced odor formation



Unfavorable for bacterial growth



- Cotton: Highest smell concentration, odor clearly perceptible (cow barn odor)
- Polyester: Very pungent odor, very uncomfortable
- TENCEL™ Lyocell Fibres: slightly perceptible, sweet and pleasant odor

TENCEL® Lyocell for better performance in Active sports

	material A	material B	material C	material D
work load	3	2	1	4
ΔT_{core}	4	2	1	3
ΔT_{skin}	1	3	2	4
T_{thermo}	1	4	2	3
evaporation	2	4	1	3
	TENCEL	PES	TENCEL blend	wPES

	material A	material B	material C	material D
water absorption	2	4	1	3
gradient analysis	1	4	2	3
drying rate	2	4	1	3
wettedness spreading	2	4	1	3
	TENCEL	PES	TENCEL blend	wPES

material A *	98% TENCEL® 2% elasthan
material B	98% polyester 2% elasthan
material C	69% polyester 29% TENCEL® 2% elasthan
material D	98% wicking polyester 2% elasthan

** 1: best material - 4: worst material

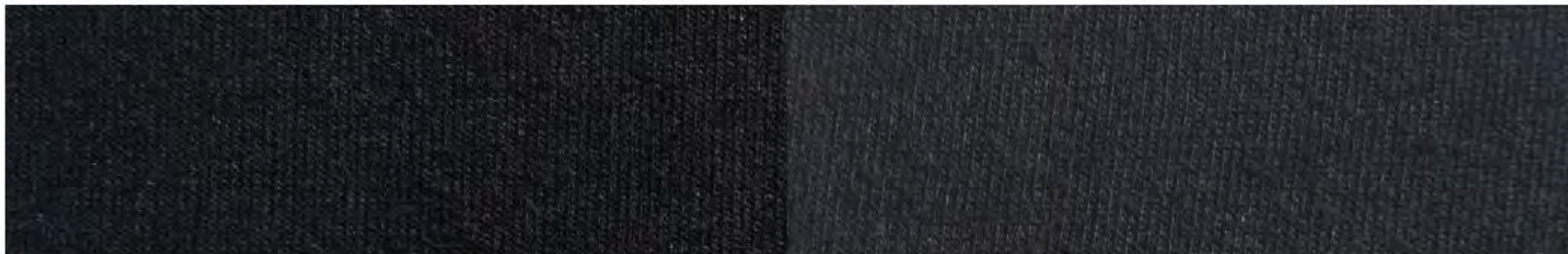
TENCEL™ Lyocell A100 – the perfect black

COLOUR RETENTION AFTER MULTI WASHING CYCLES

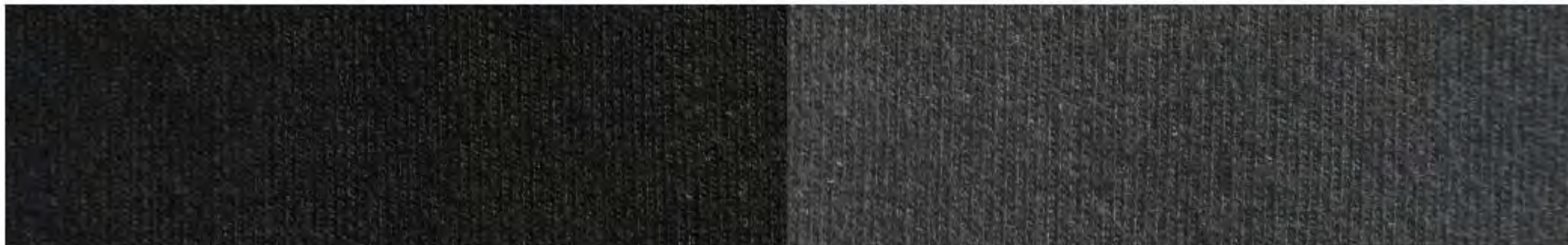
TENCEL® A100

Cotton

original



20 washes



TENCEL™ Modal x Eco Color technology

Our spun dyed fiber solution

Lower environmental impact compared with conventionally dyed fabrics*

up to
50%
water saving*



up to
50%
energy saving*



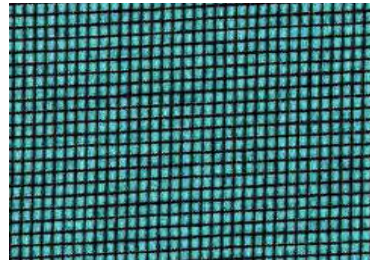
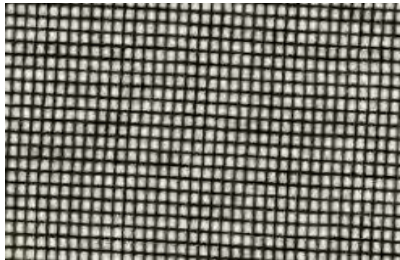
60%
less carbon
footprint*



*Source: LenzingGroup Sustainability Report 2017 Non-Financial Statement, 2017

TENCEL™ Modal x Eco Color (Black and Color)

- Color pigments are directly embedded in the fiber matrix
Different color shades available including black
- Excellent color retention - after many washes almost no change in color
- Stays soft after several washes
- Possibility to over dye for black Fibres



Trends

Fabric Development

Circular Kapok Project

What:

To create woven and knitted fabrics in 100 % cellulose fibers that have moisture management properties

Activewear properties for soft sports / athleisure and outer wear, base layer and sleep wear.

How:

Exploit the water-repellent properties of the kapok fibers (on the skin side of the fabric) to keep the skin dry combined with TENCEL™ modal (on the outside of the fabric) that absorbs the moisture/sweat and transports it away from the body.

The fiber length of kapok is very short, therefore it's necessary to blend it with another fiber for spinning. As the hydrophobic properties of the kapok decreases slightly in the dying process, we use TENCEL™ Modal Colour for a yarn blend of 20-30 % kapok and 70-80 %.

Make a fabric that can be recycled as 100% cellulose, no use of spandex or alike.



Product Placements where to find our Fibres?

Lenzing

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2020SS/F/W Activewear placements

TENCEL™ in Activewear



VAUDE
The Spirit of Mountain Sports

Lenzing
Innovative by nature



Plush Nirvana

- **SUSTAINABLE:** TENCEL Modal™ is a fiber that is produced from European beech trees harvested from sustainable



What is cool- lite™?

Silky-soft merino and TENCEL™, sourced from sustainable eucalyptus plantations, combine to create a luxurious fabric that naturally regulates your body's microclimate.



Fabric content

52% Merino Wool, 35%

TENCEL™, 10% Nylon

Jack Wolfskin



- Weight: 350 g
- NANUK DYNAMIC NATUREBLEND HEATHER: very soft, breathable, mottled, two-way stretch fleece made using recycled polyester and at least 25% TENCEL™ Lyocell fibres / NANUK DYNAMIC NATUREBLEND: soft, breathable, two-way stretch fleece made from 61% recycled polyester and at least 25% TENCEL™ lyocell fibres



- Weight: 130 g (size S)
- TENCEL SINGLE JERSEY HEATHER: very light, soft Lyocell hybrid fabric
- fastener tab for rolled-up sleeves.
- 60% TENCEL™ Lyocell 40% POLYESTER

Jack Wolfskin – midlayer jackets



64 % Polyester / 31 % TENCEL™ Lyocell / 5 % Elastan

WOMAN FIRSTLAYER EVO MERINO-TENCEL™



MERINO-TENCEL™ soft, fine touch, for sport and lifestyle, thermoregulatory through the mix of the finest merino wool and TENCEL™ fiber, from renewable raw materials.

Comfort
Fit



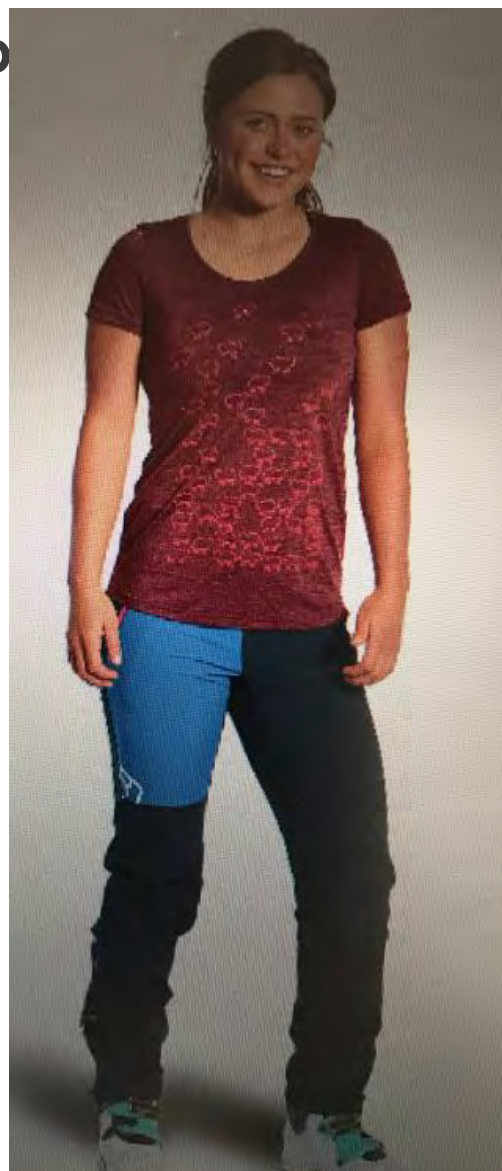
150 COOL LET IT SHEEP



NEW



ORTOVOXX IS
A PROUD
MEMBER OF **FAIR
WEAR**



MATERIAL

44 % virgin wool (MERINO) + 43 % lyocell
(Tencel™) + 13% polyamide



The Northface FlashDryXD™



- Lightweight, technical polyester/TENCEL® lyocell blend
- Reinforced stitching for durability
- Shaped hem for coverage and harness clearance
- Underarm gussets for mobility



100% sustainable blend of hemp, recycled polyester, and TENCEL™ Lyocell. The result is a vintage-like texture that radiates that effortless style we all know and want. Bonus: it even has UPF 55+ Hemp / 25 Recycled Polyester / 20 TENCEL™



STRIDE ON NATURAL MODAL RELAXED PANT

Sustainable Style

Fabric is sustainably sourced
using ethical environmental &
social practices

Breathable, ultra-soft fabric
sourced from sustainable
materials – created using a
closed loop process that saves

Vidar Sport



Men's Sport T-Shirt "Momentum,,
Batik / Tie-Dye
made of 100% TENCEL™ Lyocell

Nike – Men's functional shirt



72% Polyester, 18% Lyocell, 10% Elasthan

Nike – Women's running shirt



74% Polyester, 18% Lyocell, 8% Elasthan

Nike – Women's yoga wear



74% Polyester, 18% Lyocell, 8% Elasthan

Adidas – track suit



50 % Polyester / 30 % Lyocell / 14 % Nylon / 6 % Elastan

Vaude – midlayer jackets



59 % TENCEL™ Lyocell / 38 % Polyester/ 3 % Elastan

Jack Wolfskin – functional shirts



60 % TENCEL™ lyocell, 40% polyester

Icebreaker – functional shirts



47 % TENCEL™ Lyocell / 46 % wool / 7 % polyamide 35 % TENCEL™ Lyocell / 52 % wool / 13 % polyamide

Fjällräven – functional shirt



85 % TENCEL™ Lyocell / 15 % wool

Schöffel – functional shirts



42 % TENCEL™ Lyocell / 35 % wool / 23 % polyamide

Supernatural – functional shirts



53 % TENCEL™ Lyocell / 47 % wool

Löffler – bike shirt



53 % TENCEL™ Lyocell / 47 % wool

Tierra – midlayer jacket



53 % TENCEL™ Lyocell / 47 % wool

Mandala – yoga wear



61 % TENCEL™ Lyocell / 34 % cotton / 5% elastane

MARTINI - Women's functional shirts



67% TENCEL™ Lyocell, 8% Polyester, 5% Elasthan



100 % TENCEL™ lyocell

Fjällräven – Men's shirts



100 % TENCEL™ lyocell

Thank You

**for your
attention!**