Separation Process for Elastane from Textiles

Andreas Bartl, Emanuel Boschmeier, Wolfgang Ipsmiller

Elastane is good, is bad…

„Elastane – The Wonder Fibre“ [1]

„Sustainable stretch – Is recyclable elastane the future?“ [2]

„What is elasthane, and is it sustainable?“ [3]

“Recycling elastane, being a polyurethane and polycondensation polymer, is a challenge. At present, no methods are available on a pilot or demo scale.” [4]

„We bid farewell to spandex“ [5]

„The Dangers of Spandex“ [6]

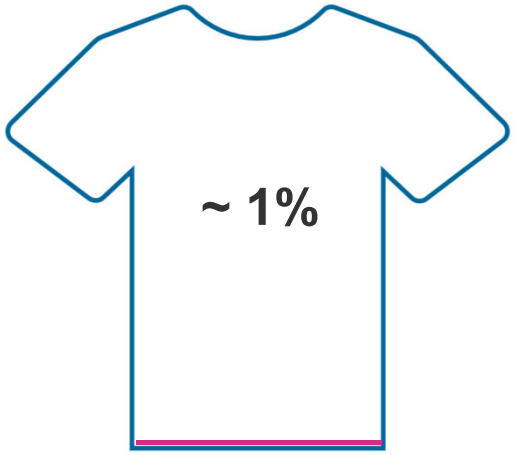
EL
PUE
Lycra
Dorlastan
Elastan
Elaspan
Creora
Linel
Spandex
Stretch
.. [5]

1 AWTA Ltd. (2012). https://awta.com.au/index.php/en/component/edocman/elastane-fact-sheet/download
2 Schmidt, S. M. (2021). https://fashionchangers.de/nachhaltiger-stretch-ist-kreislauffaehiges-elastan-die-zukunft/
3 Lebby, S. (2022). https://www.treehugger.com/what-is-elastane-and-is-it-sustainable-5116805
4 Harmsen, P., Scheffer, M., Bos, H. (2021). https://doi.org/10.3390/su13179714
5 Grüne Erde GmbH. (2023). https://www.grueneerde.com/de/magazin/haltung-und-stories/elasthan.html?ALLOW_COOKIES=FUNCTIONALITY
6 Mariano, N. (2022). https://www.cottonique.com/en-at/blogs/articles/the-dangers-of-spandex

The reality is:

EL mass in apparel

(approx. average)



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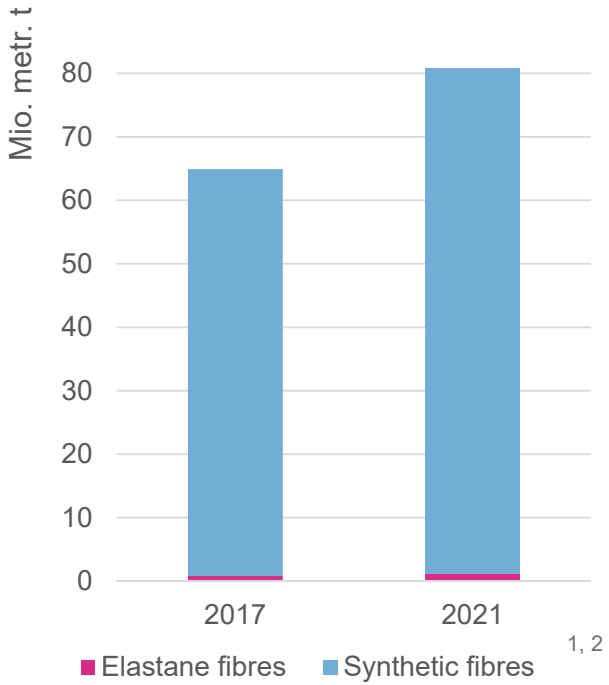
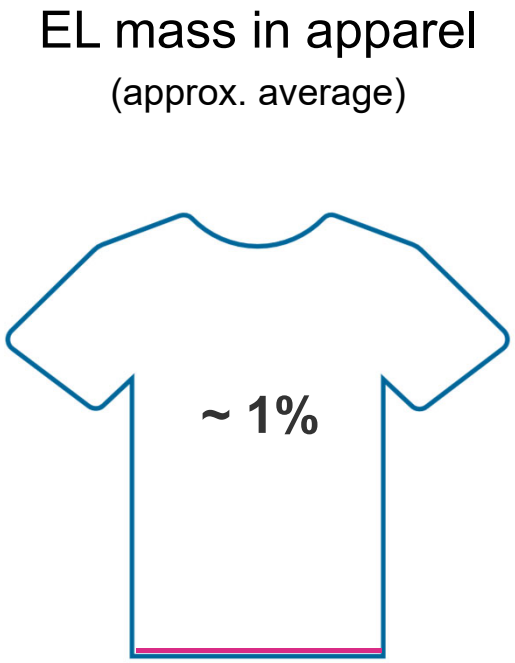


1, 2



1 Textile Exchange. (2022). https://www.statista.com/statistics/1260343/elastane-fiber-production-worldwide/
2 Industrievereinigung Chemiefaser (2022). https://www.statista.com/statistics/271651/global-production-of-the-chemical-fiber-industry/

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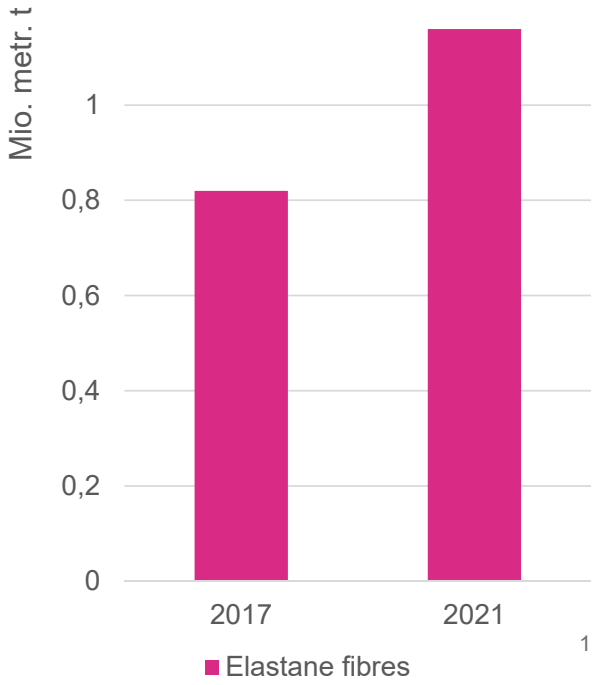

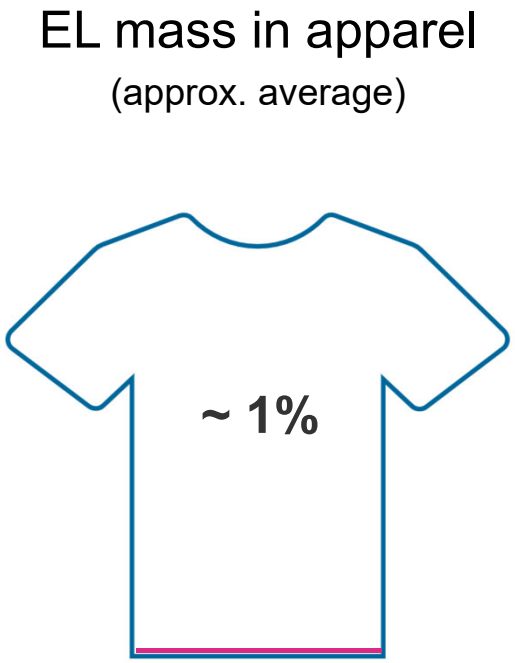

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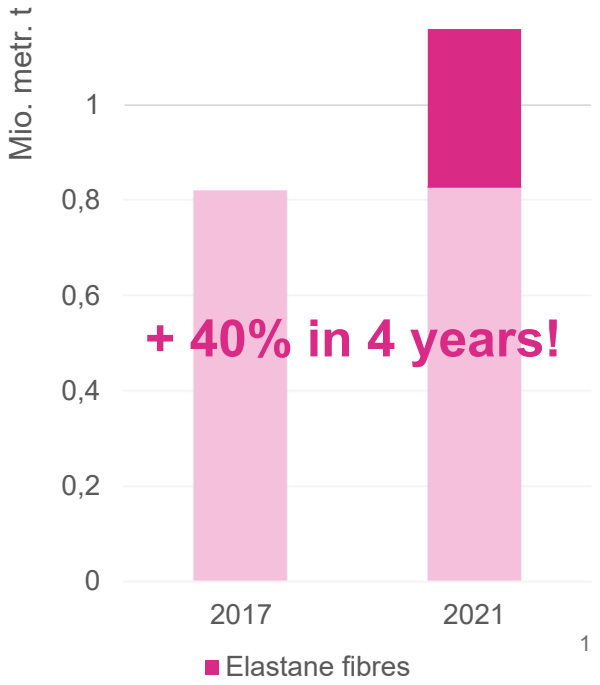

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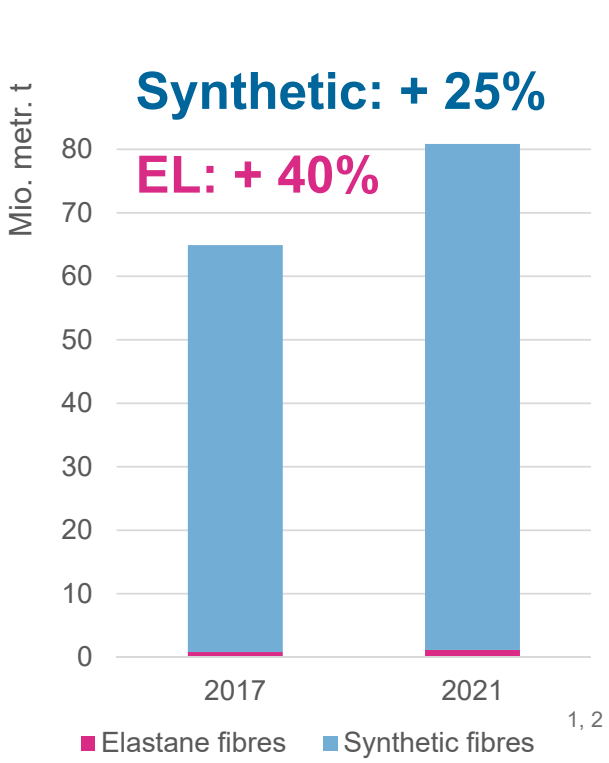

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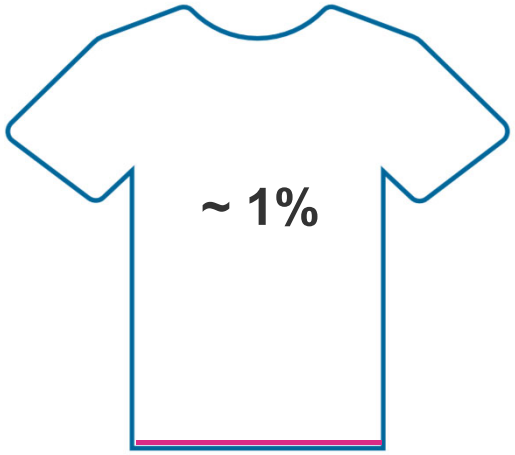

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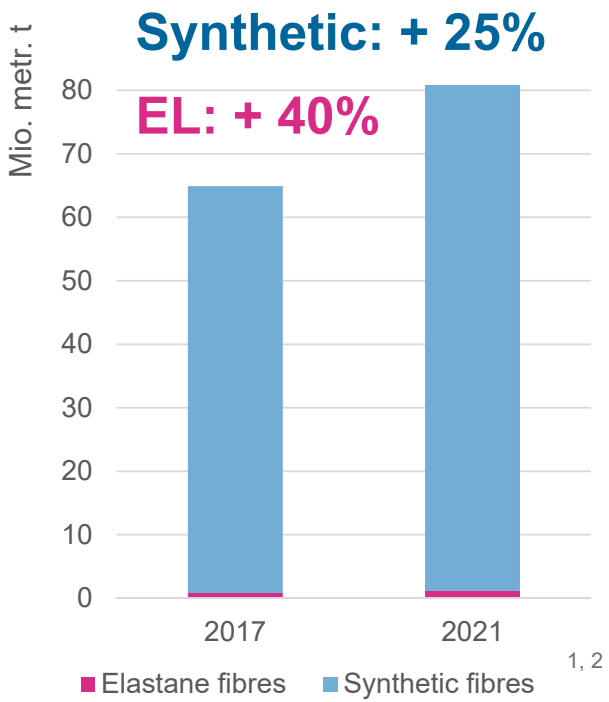

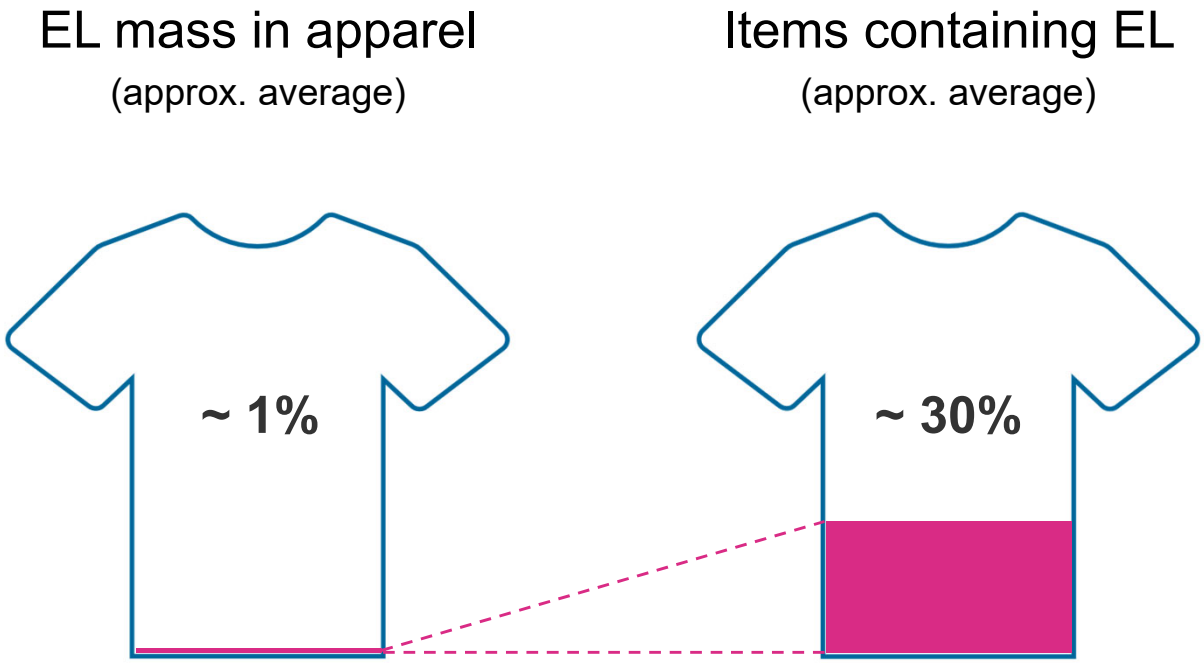

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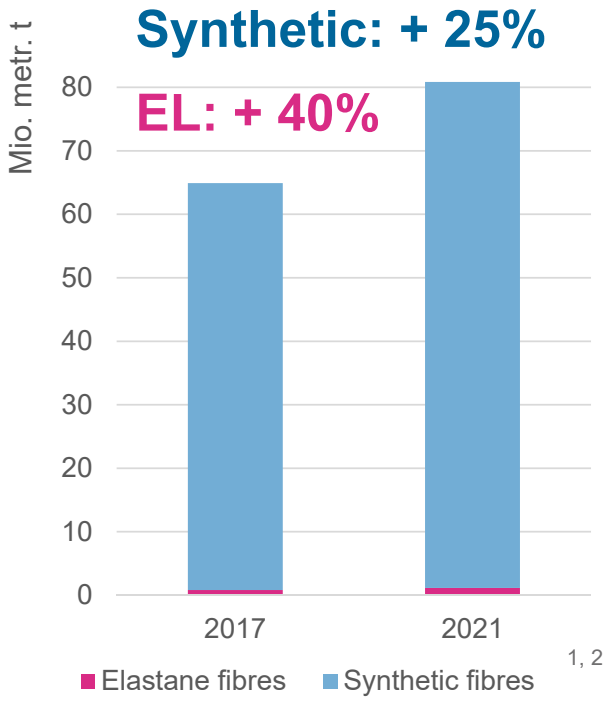
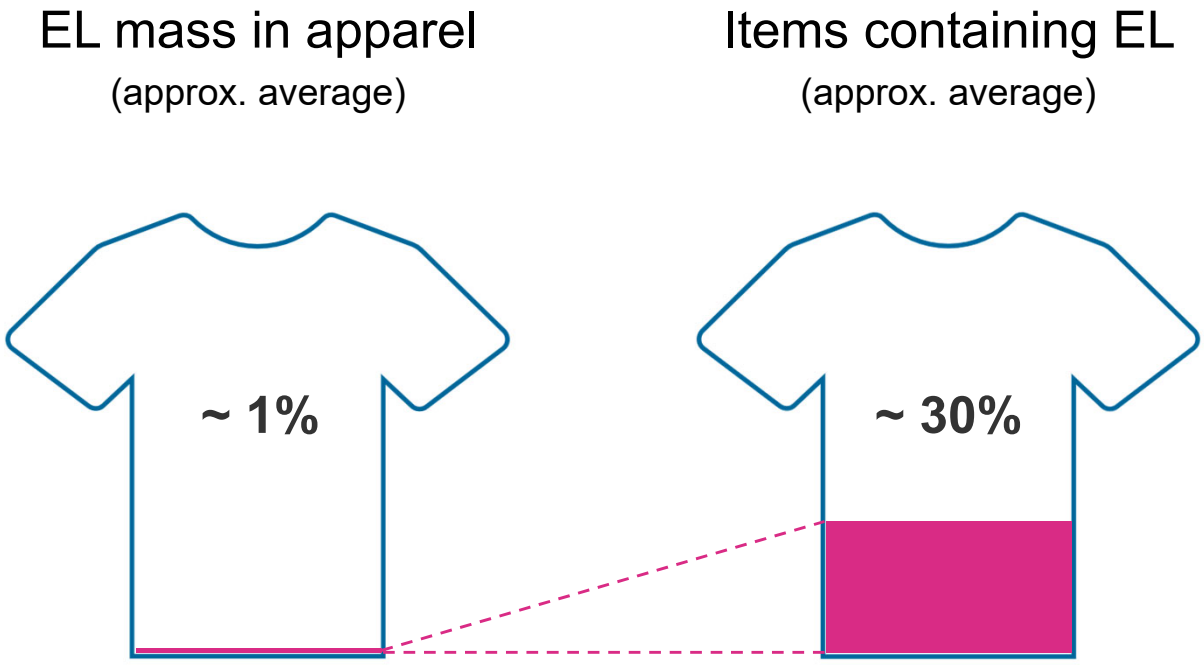




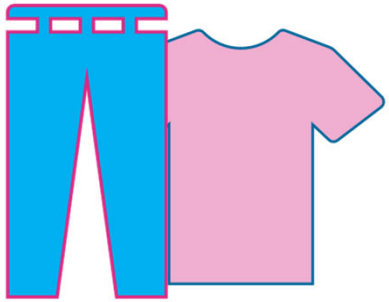
300 kg/t „contaminated“ items of considerable variability in elastane content!

1 Textile Exchange. (2022).
2 Industrievereinigung Chemiefaser (2022).

The solution to circularity

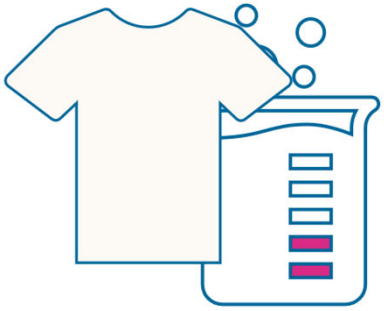
Pre-sorted end-of-life textiles

(EL share)



Elastane dissolution in a selective solvent formulation

Solvent recovery and recirculation



Recycled intermediate material(s)

Separation of unaffected fibres/fabrics *,

Separation of elastane polymer

* PET, PA, no principle restrictions for cellulose

Our offer

Benefits in a nutshell

- ✓ Low process complexity, easy scale-up
- ✓ Non-hazardous solvent formulation, solvent can be recycled
- ✓ No additional catalysts or additives needed
- ✓ Compatible with conventional textile recylcing processes
- ✓ Ambient pressure application

* PET, PA, no principle restrictions for cellulose

TECHNOLOGY OFFER

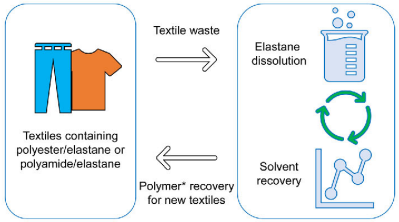
Separation Process for Elastane from Textiles

Our novel easy-to-apply dissolution process enables the separation of elastane from blended textiles that contain polyester or polyamide, allowing the recovery of both polymers for reuse in (fibre) shaping processes. This sustainable technology uses a non-hazardous solvent at ambient pressure that can be almost completely recovered during the process, ensuring low costs. The new process offers a practical and scalable solution for converting textile waste into secondary raw materials and recovering polymers, making it a potential key cornerstone of future textile recycling.

BACKGROUND

The 2018 amendment of the Waste Framework Directive requires the introduction of a separate collection of end-of-use textiles in the EU by January 2025. However, fibre-to-fibre recycling is currently not widely established, and existing technologies struggle with the incompatibility of different polymers during processing, especially for textiles made of different fibre materials. Despite being responsible for just 1% of global fibre production, elastane is widely used and poses a major challenge for textile recycling: Even small amounts of elastane in a textile can render the entire product non-recyclable. Therefore, the separation of elastane from these materials is crucial for making a large number of fabrics recyclable.

TECHNOLOGY



*Polyester, Polyamide, Elastane

Our technology treats pre-sorted end-of-life textiles, consisting of polyester or polyamide combined with elastane, with a selective organic solvent. Under defined process parameters, the minor elastane share is gently separated, and the unaffected polyester or polyamide fibres are removed from the reaction solution. After washing and drying, the pure polymer products are ready for subsequent recycling. The solvent goes through a purification process and can be recovered up to 99%. Full yield is achievable at ambient pressure without catalysts or conditioners, and the operating parameters are easy-to-manage. It is also important to note that the used solvent is not listed as a "Substance of Very High Concern" under the EU Regulation REACH.

BENEFITS

- Easy scale-up, low process costs
- 99% recovery of the non-hazardous solvent
- Compatibility with conventional textile recycling processes

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003906.

WISSENS/ TRANSFER/ OST/

www.wtz-ost.at

REFERENCE:
M044/2022

APPLICATIONS:
turning textile waste into secondary raw material, apparel recycling; polymer recovery; recovery of rPET, rPA, rEL from multi-material textiles

DEVELOPMENT STATUS:
proof of concept in lab-scale; prototype testing

KEYWORDS:
textile recycling, fibre-to-fibre recycling, polymer recovery, Polyester, Polyamide, Elastane

IPR:
AT patent filed

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