



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>

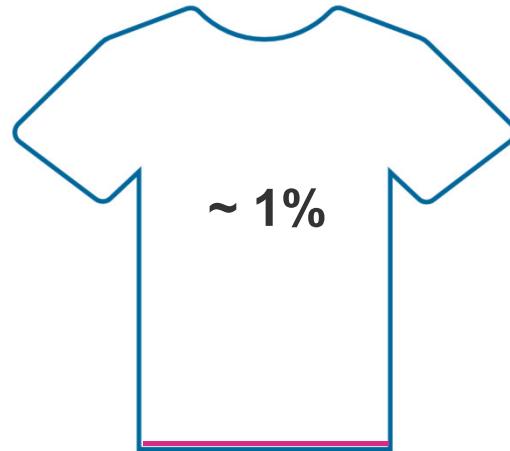
4 Harmsen, P., Scheffer, M., Bos, H. (2021). <https://doi.org/10.3390/su13179714>

5 Grüne Erde GmbH. (2023). https://www.grueneerde.com/de/magazin/haltung-und-stories/elasthan.html?ALLOW_COOKIES=FUNCTIONALITY

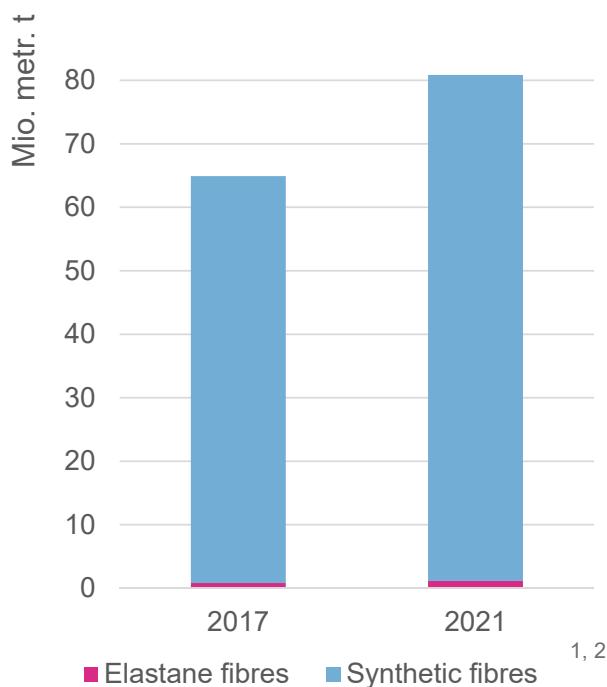
6 Mariano, N. (2022). <https://www.cottonique.com/en-at/blogs/articles/the-dangers-of-spandex>

The reality is:

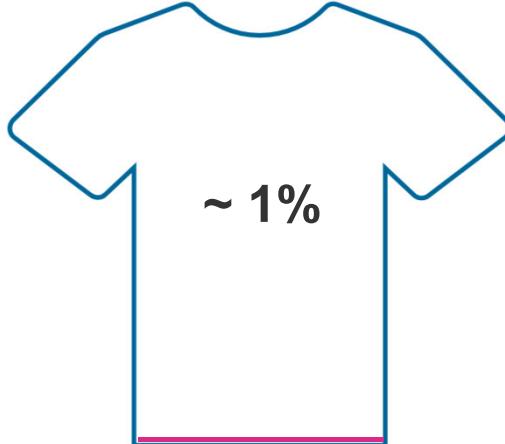
EL mass in apparel
(approx. average)



The reality is:



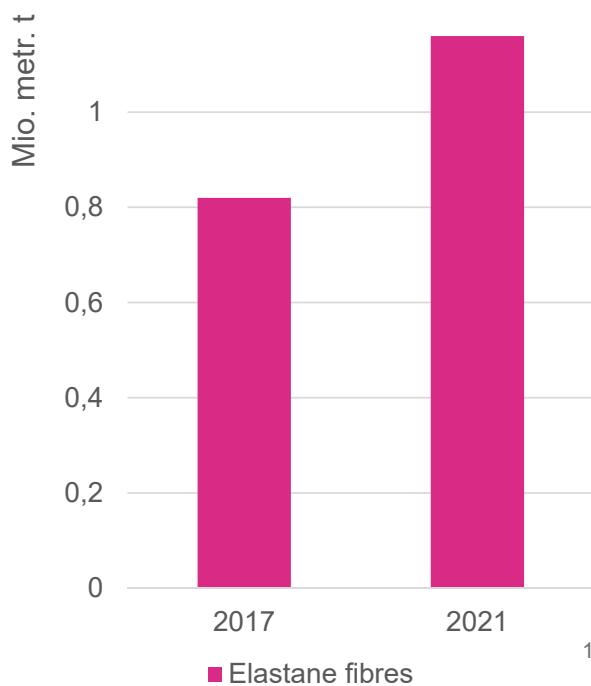
EL mass in apparel
(approx. average)



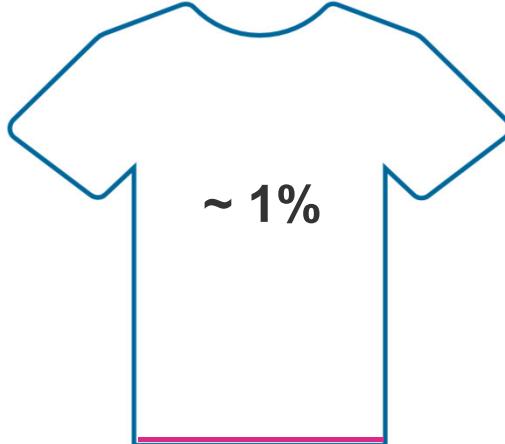
1 Textile Exchange. (2022). <https://www.statista.com/statistics/1260343/elastane-fiber-production-worldwide/>

2 Industrievereinigung Chemiefaser (2022). <https://www.statista.com/statistics/271651/global-production-of-the-chemical-fiber-industry/>

The reality is:

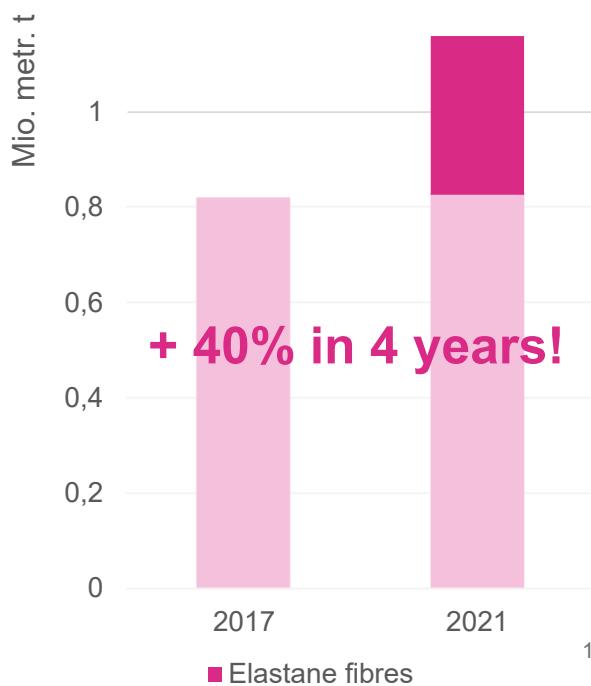


EL mass in apparel
(approx. average)

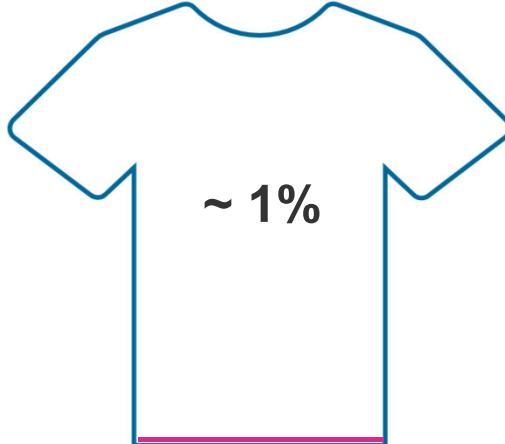


1 Textile Exchange. (2022). <https://www.statista.com/statistics/1260343/elastane-fiber-production-worldwide/>

The reality is:

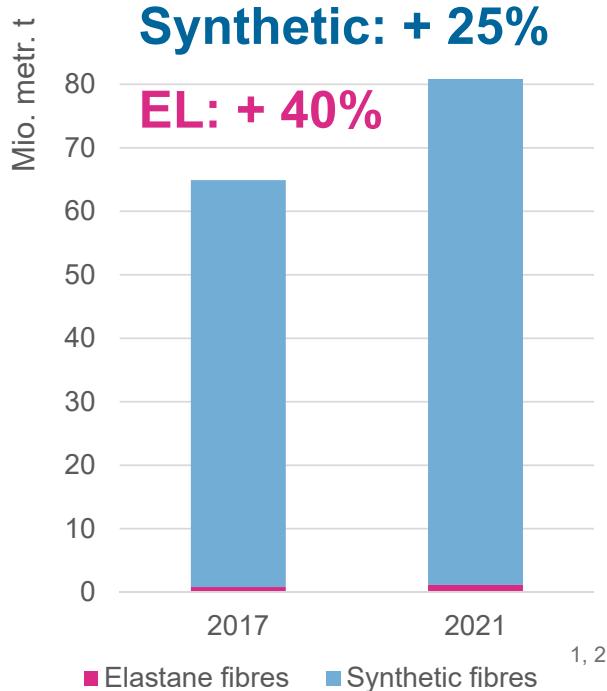


EL mass in apparel
(approx. average)

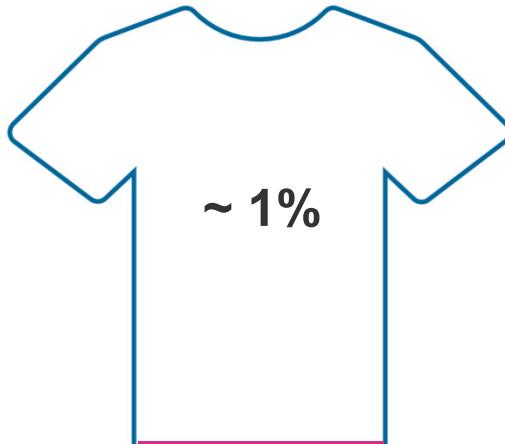


1 Textile Exchange. (2022). <https://www.statista.com/statistics/1260343/elastane-fiber-production-worldwide/>

The reality is:



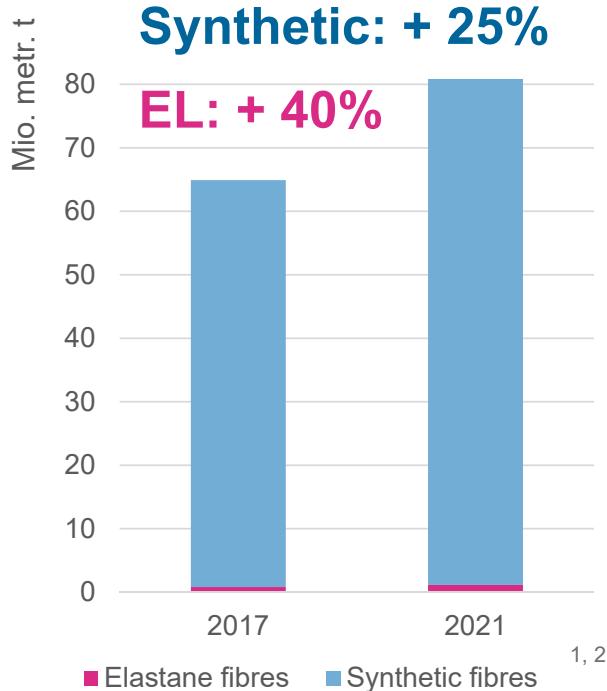
EL mass in apparel
(approx. average)



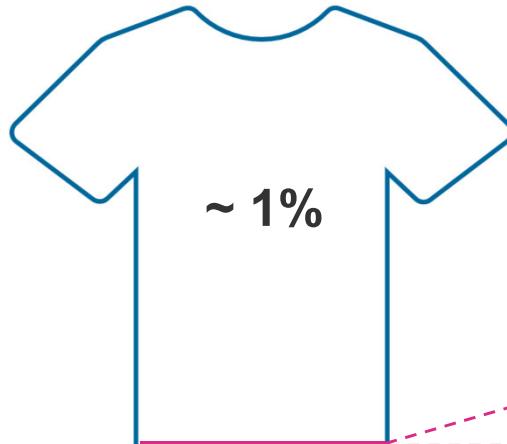
1 Textile Exchange. (2022). <https://www.statista.com/statistics/1260343/elastane-fiber-production-worldwide/>

2 Industrievereinigung Chemiefaser (2022). <https://www.statista.com/statistics/271651/global-production-of-the-chemical-fiber-industry/>

The reality is:



EL mass in apparel
(approx. average)



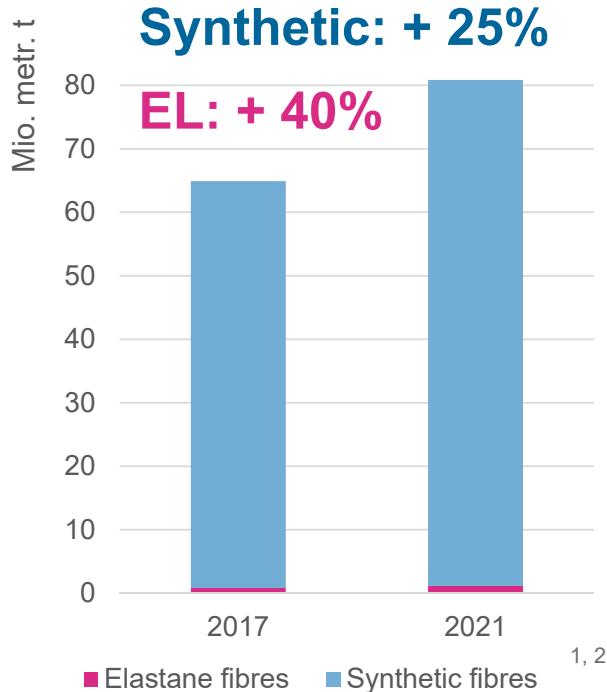
Items containing EL
(approx. average)



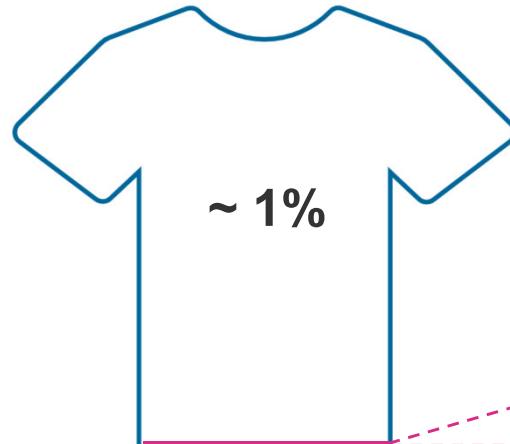
1 Textile Exchange. (2022). <https://www.statista.com/statistics/1260343/elastane-fiber-production-worldwide/>

2 Industrievereinigung Chemiefaser (2022). <https://www.statista.com/statistics/271651/global-production-of-the-chemical-fiber-industry/>

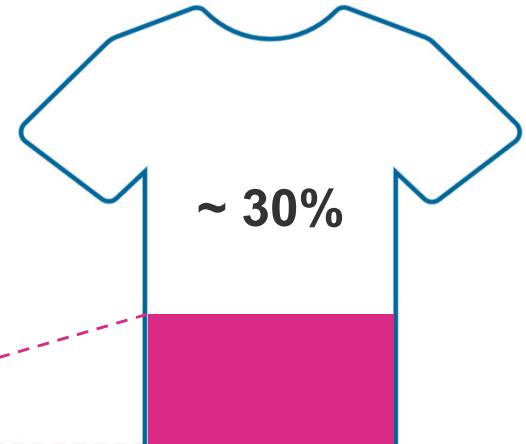
The reality is:



EL mass in apparel
(approx. average)



Items containing EL
(approx. average)



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

1 Textile Exchange. (2022).

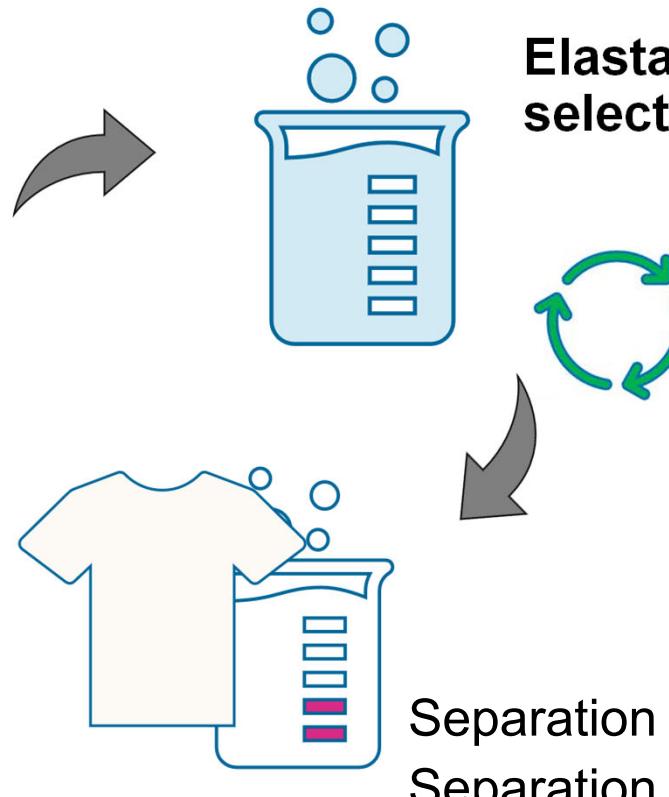
2 Industrievereinigung Chemiefaser (2022).

The solution to circularity

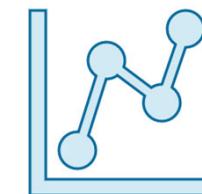
Pre-sorted end-of-life
textiles
(EL share)



Recycled
intermediate
material(s)



Elastane dissolution in a
selective solvent formulation



Solvent recovery
and recirculation

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 recycling processes
- ✓ Ambient pressure application

* PET, PA, no principle restrictions for cellulose

TECHNOLOGY OFFER

Separation Process for Elastane from Textiles

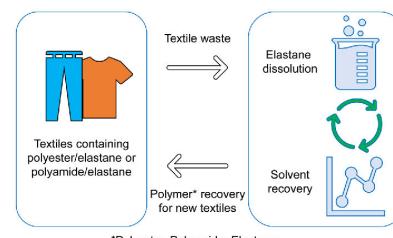
Our novel easy-to-apply dissolution process enables the separation of elastane from blended textiles that contain polyester or polyamide, allowing the recovery of both polymers for reuse in (fibre) shaping processes. This sustainable technology uses a non-hazardous solvent at ambient pressure that can 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

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.

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

INVENTORS:
Andreas BARTL
Emanuel BOSCHMEIER
Wolfgang IPSMILLER

CONTACT:

Raphael PRUCKNER
TU Wien
Research and Transfer Support
Karlsplatz 13/E058-02, Wien
T: +43 1 58801 415247
raphael.pruckner@tuwien.ac.at



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 recycling 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 turning textile waste into secondary raw materials and recovering polymers.

BACKGROUND

The 2018 amendment to the Waste Framework Directive introduced separate collection of end-of-life textile waste by January 2025. However, fibre recycling is currently not very efficient, and existing technologies struggle to incorporate different polymers during recycling, especially if they are made of different fibres. In addition, despite being just 1% of global fibre production, elastane is not recycled and poses a major challenge to textile recycling. For small amounts of elastane in a blend, the standard process of recycling is irrelevant; therefore, the separation of elastane materials is crucial for making the large number of items recyclable.

TECHNOLOGY

Our technology is based on a simple dissolution process. It is presented for textile waste consisting of elastane and either polyester or polyamide. The polymer blend is dissolved in a suitable organic solvent, combined with a small amount of water, and then separated from the elastane. The polymer products are then dried or subsequently recycled. The solvent does three-step evaporation processes to collect up to 99% of it. This is achievable at ambient pressure without catalysts, condensers, and operating parameters need to manage. It is also important to note that no dangerous substances are used ("Substance of Very High Concern" according to the EU Regulation REACH).

BENEFITS

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

WISSENS/
TRANSFER/
OST/
www.wtz-ost.at

REFERENCE:
M044/2022

APPLICATIONS:
turning textile waste into
secondary raw materials
paper recycling
polymer recycling
recovery of PET
and/or Elastane from multi-material
textiles

DEVELOPMENT
STATUS:
Proof of concept in lab;
protoype tested
INNOVATION
TOPIC:
textile recycling
multi-material recycling
polymer recycling
Polyester
Elastane

PR:
patent filed

WITNESSES:
Andrea BARBERI,
Emmanuel MEIER,
Johannes LER

CONTACT:
Rachael RUCKER
TU Wien
Rachael.Rucker@tuw.ac.at
Hegelplatz 17, 1040 Wien
T: +43 1 5880 17
Email: rucke@tuw.ac.at



Contact

Dr. Andreas Bartl
Telefon: +43 1 58801 166102
andreas.bartl@tuwien.ac.at

DI Emanuel Boschmeier
Telefon: +43 1 58801 166152
emanuel.boschmeier@tuwien.ac.at

DI Wolfgang Ipsmiller
Telefon: +43 1 58801 166151
wolfgang.ipsmiller@tuwien.ac.at

TU Wien, Institute of Chemical, Environmental,
and Bioscience Engineering
A-1060 Vienna, Getreidemarkt 9/166
www.vt.tuwien.ac.at

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 catalytic solution for separating elastane from secondary raw materials, which are often polymers that it is often a key component of future textile recycling.



BACKGROUND

The 2018 amendment to the Waste Framework Directive introduced separate collection of end-of-life textile waste by January 2025. However, fibre recycling is currently too costly for elastane, and existing technologies struggle to incorporate different polymers during recycling, especially when made of different fibres. In addition, despite being just 1% of global fibre production, elastane is recycled and forms a major stream in textile recycling. For small amounts of elastane in a given blend, the process of recycling becomes more challenging. The separation of elastane is crucial for making large amounts of elastane recyclable.

TECHNOLOGY

Our technology is based on a simple, yet effective, process to predictably dissolve textile fibres, consisting of a mixture of polyester and polyamide. The polymer is combined with elastane, and the two are dissolved in an organic solvent. Under the right conditions, the process separates the elastane from the minor elastane share. The elastane is easily separated, and the unaffected polyester/polyamide fibres are removed from the solution. The remaining solution is then purified to produce polymer products for reuse or subsequent recycling. The solution then undergoes a separation process to collect up to 99% of it. This is achievable at ambient pressure without catalysts, condensers, or other operating parameters, making it easy-to-manage. It is also important to note that the process is registered as "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

WISSENS/
TRANSFER/
OST/
www.wtz-ost.at

REFERENCE:
M044/2022

APPLICATIONS:
turning textile waste into
secondary raw materials;
apparel recycling;
polyester recycling;
recovery of PE, PP, PET
from multi-material
textiles

DEVELOPMENT
STATUS:

Technology developed in lab;
protoype tested;
Innovation
textile recycling
multi-material
recycling
polymer recycling
Polyamide
elastane

PR:
patent filed

TUWIEN
R&D
dream.BAR
Emanuel BOSCHMEIER
Johannes LER

CONTACT:
Rachael RUCKER
TU Wien
earl.rucker@tuwien.ac.at
+43 1 58801 166151
rachel.rucker@tuwien.ac.at

TU
WIEN
TECHNISCHE
UNIVERSITÄT
WIEN