GOING GREEN TRAININGS

COMMUNITY TALKS

GOING GREEN TRAININGS

Advancing Sustainable Fiber-to-Fiber Recycling

19 June 2025 • 10:30-11:30 • Online

REGIO GREEN TEX

Webinar Procedures

The webinar is recorded and will be shared - in parts or entirely – with all consortium partners. By staying connected you agree to this. If you would not like to appear on the recording, please keep your camera and microphone off at all times.

Mute your microphone

Disconnect video

Type questions in the chat

Raise your hand when you wish to speak

When you are invited to speak, unmute mic and show video (if possible)

Agenda

Introduction
Charlotte Denis, Textile ETP

Advancing Sustainable Fiber-to-Fiber Recycling
Anna Edsberger, RISE

Q&A

Conclusion
Charlotte Denis, Textile ETP

Co-funded by the European Union

COMMUNITY TALKS

GOING GREEN TRAININGS

Online animation activities play a pivotal role in sustaining the engagement of SMEs within the digital ecosystem. To stimulate interaction, the RegioGreenTex Community Talks **promote the latest progresses and results of the project, and well as encouraging dialogue and knowledge sharing in the textile sector.**

The 'Going Green Trainings', a component of the RegioGreenTex Community Talks, offer advisory green support to SMEs in the textile sector, carefully tailored to address sustainability concerns. Led by experts from RISE, these webinars provide practical training across six distinct areas of sustainability.

The Going Green Trainings are part of WP4 (T4.2 Green advice/advisory support to SMEs) and are managed by RISE, with support from OVAM, Euramaterials, Citeve, Eurofins, Ateval, AEI Textils, CS-Pointex, NTT, EURATEX, and Textile ETP.

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Advancing Sustainable Fiber-to-Fiber Recycling

Anna Edsberger, RISE

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Advancing sustainable fiber-to-fiber recycling

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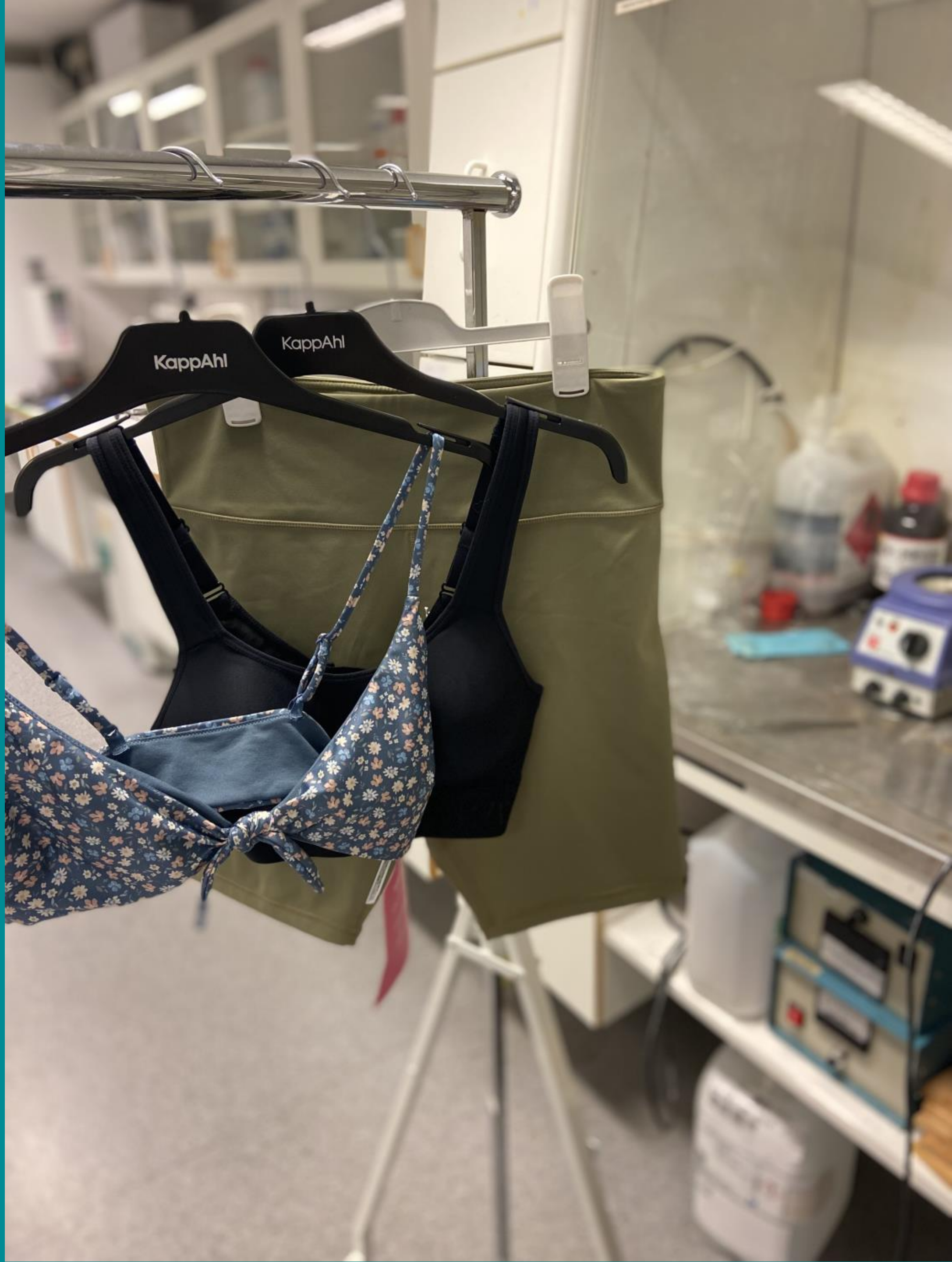


Background

Still, less than 1% of textiles are closed loop recycled.[1]

Closed loop recycling has long been predominantly mechanical but chemical recycling is rising.

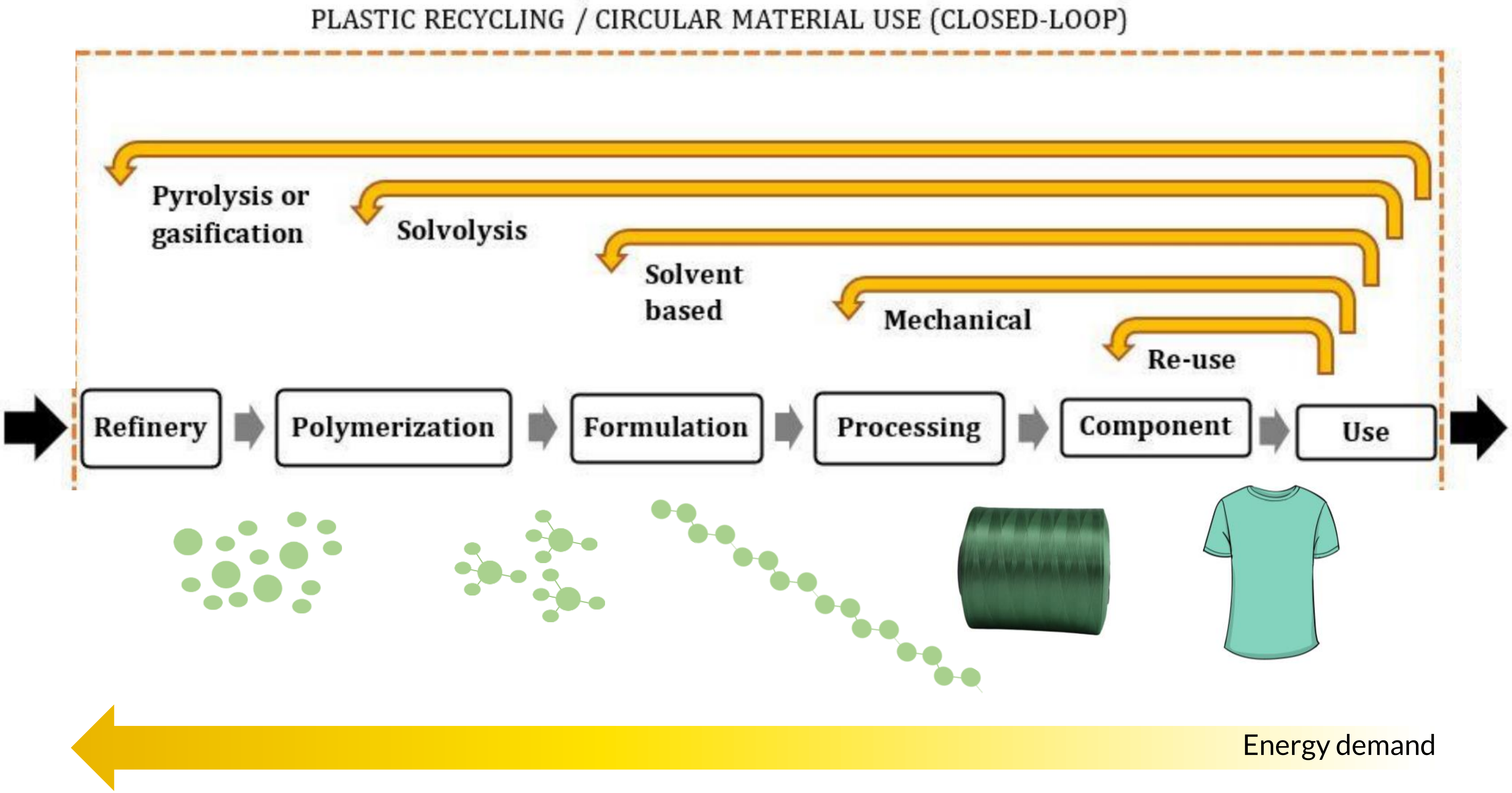
[1]Ellen McArthur Foundation 2017

Mechanical and chemical recycling

Mechanical recycling is an effective way to recycle materials of high quality (purity) to materials of similar or lower quality

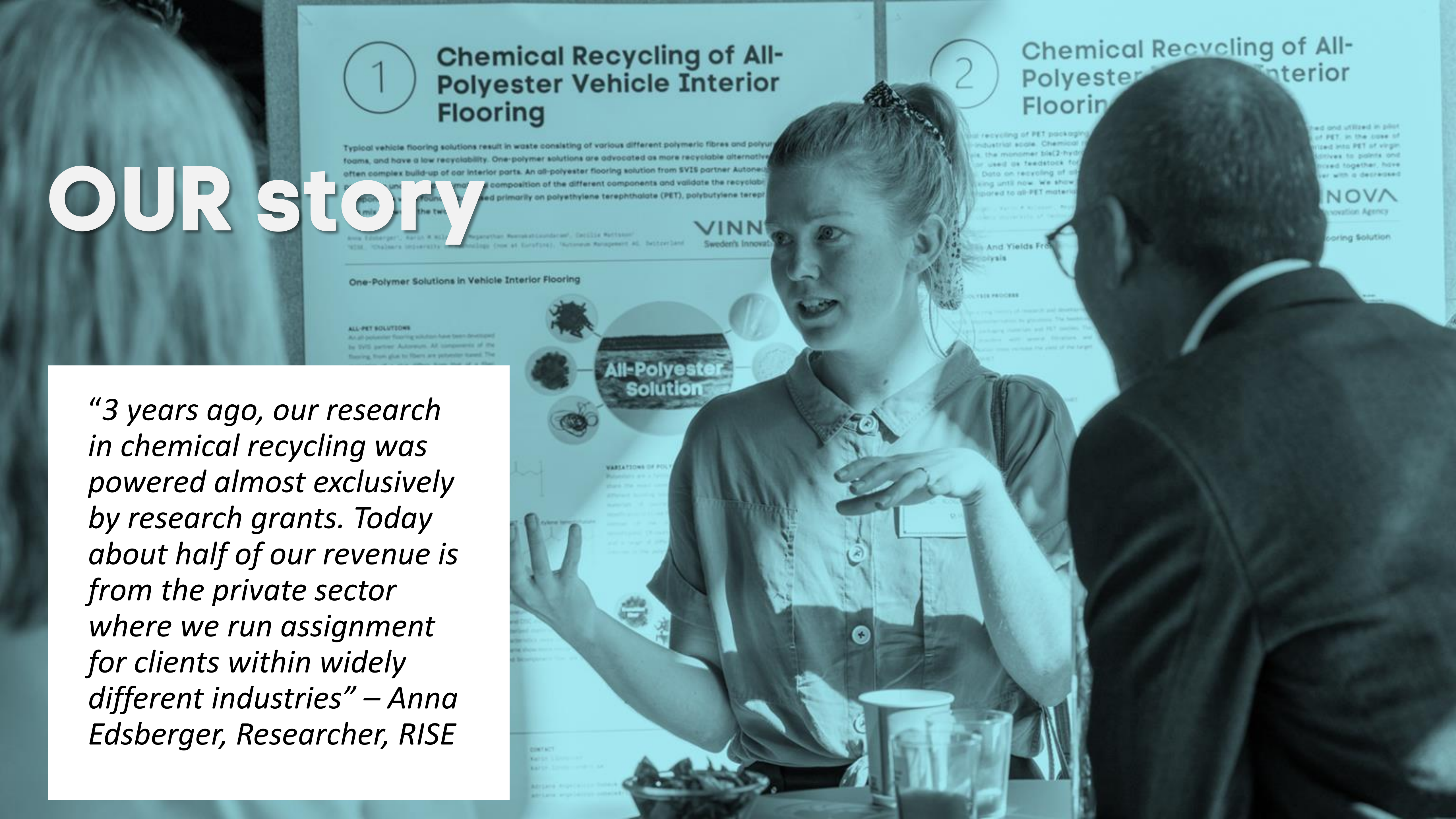
Chemical recycling is a less effective way to recycle waste of lower quality (more contaminated) into chemicals and materials of higher quality.

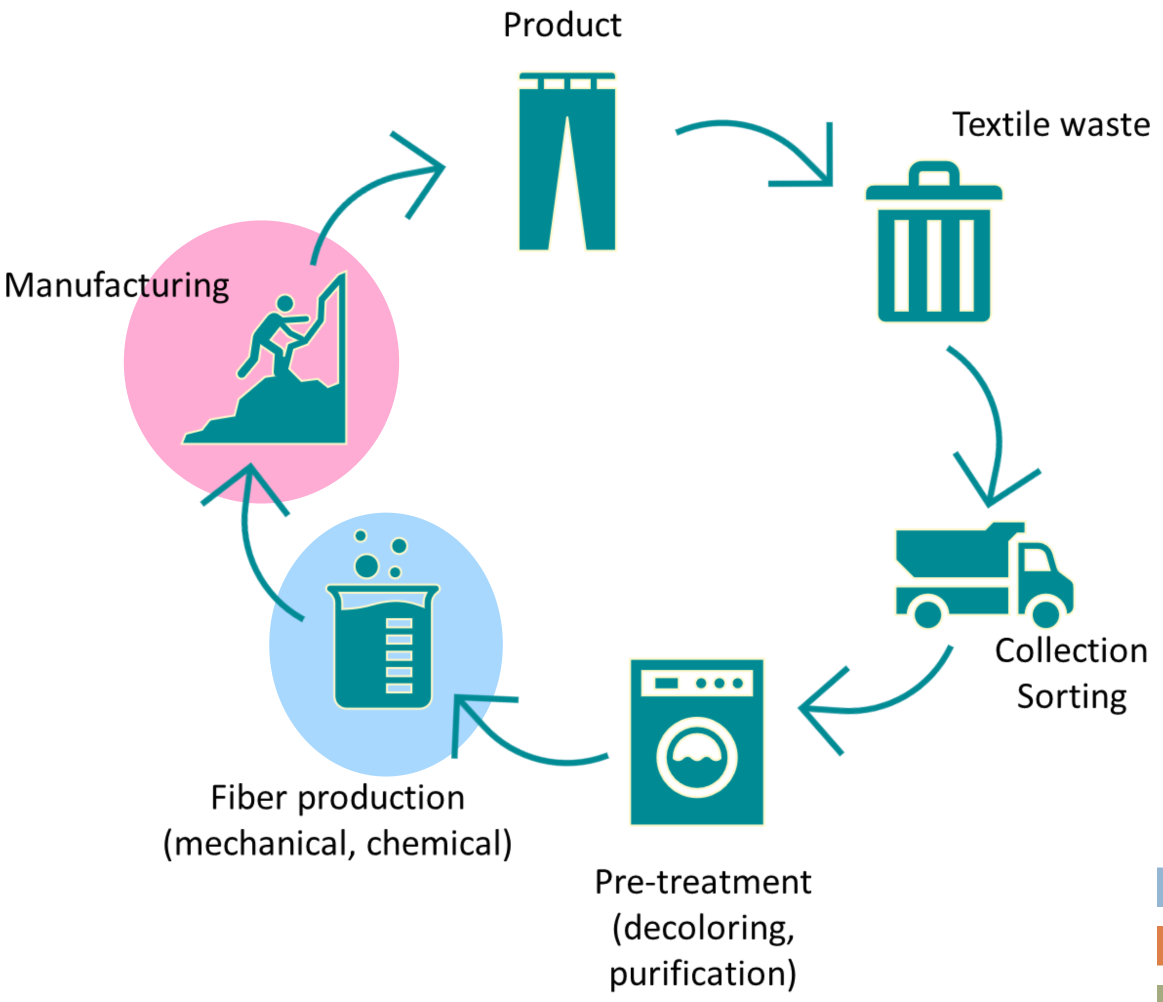
Chemical recycling can often yield a high-quality product even with a complex feedstock BUT, it involves several preprocessing and purification steps. Each step adds time, energy use and cost which reduce profit and challenges the positive climate impact from recycling.

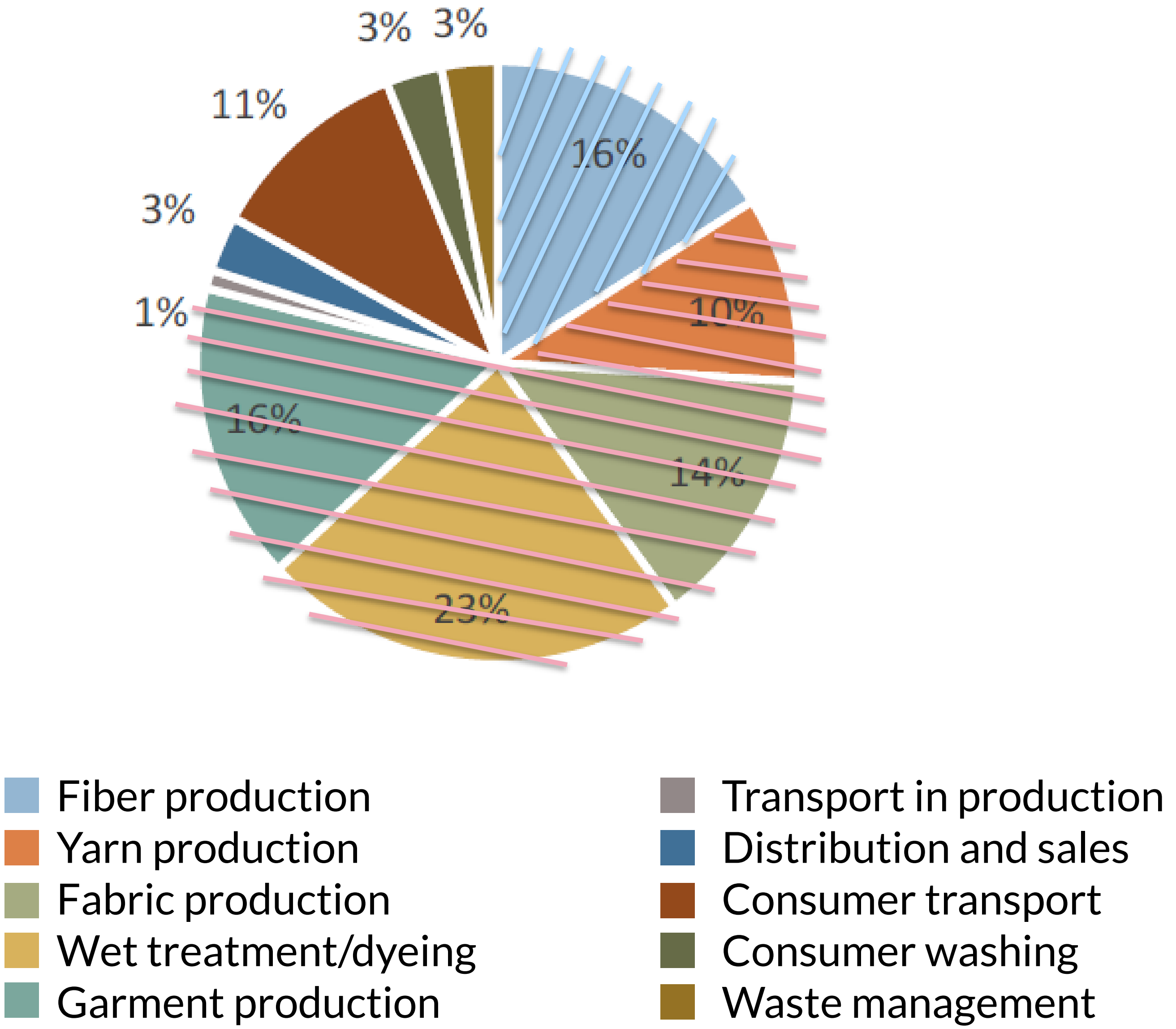

PLASTIC RECYCLING / CIRCULAR MATERIAL USE (CLOSED-LOOP)
Pyrolysis or gasification
Solvolysis
Solvent based
Mechanical
Re-use
Refinery
Polymerization
Formulation
Processing
Component
Use
Energy demand

OUR story

“3 years ago, our research in chemical recycling was powered almost exclusively by research grants. Today about half of our revenue is from the private sector where we run assignment for clients within widely different industries” – Anna Edsberger, Researcher, RISE

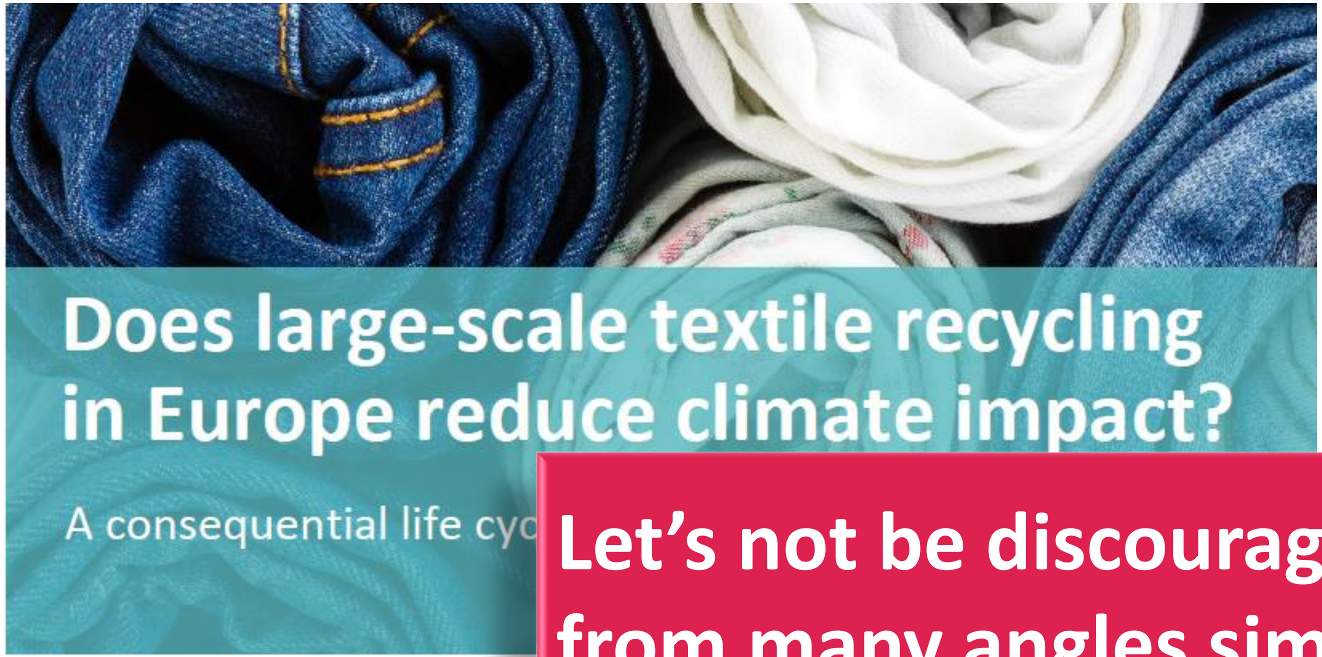






Mistra Future Fashion 2019

Let's not be discouraged, lets work from many angles simultaneously.



Shivam Gusain • 2:a
Water Engineer, Dyestuff Chemist & LCA analyst
3 v •

✓ Följer

We're stuck in a cycle where feel-good solutions are prioritized over those that actually move the needle. Billions are being funneled into textile recycling, championed as a green breakthrough, yet the numbers don't add up. For instance, applying a €300 per tonne EPR fee on the 8.5 million tonnes of fibre placed on the EU market annually would generate around €2.5 billion a year. Over a period of 2 years, that's over €5 billion, enough to produce about 2.5 million tonnes of recycled PET. But against the 70 million tonnes of PET produced annually, that's only 3.5 percent, a drop in the ocean. And in terms of climate impact, the returns are even worse. Assuming 1.5 kilograms of CO_2 saved per kilogram of recycled PET, that effort would amount to just 3.75 million tonnes of CO_2 avoided.

Now compare that with investing the same €5 billion into industrial efficiency, such as replacing old boilers or electrifying processes. At €2
upgrade 2,500 units. Each
f CO_2 per year. That's
saved annually. The CO_2
ibre recycling for the same

Let's not be discouraged, lets work from many angles simultaneously.

Assumptions:

- Increased recycling in the EU from 1% to 26%
- Predominantly chemical recycling
- Yield of chemical recycling is averaged at 65%

Conclusions:

- Savings of 1.2 mtonne CO2 eq/year
- This is an estimated 1.3% of the climate impact of textile consumption in the EU
- Other impact-reduction measures, beyond material recycling, are needed to reduce the climate impact of the textile industry

Important parameters:

- CO2 impact of the future EU energy system
- Replacement degree (is consumption of recycled fibers on top of virgin or replacing virgin)
- Climate impact of replaced fibers
- Climate impact of recycling processes

Recycling actors

Monomer recycling POLYESTER

CuRe Polyester Rejuvenation

CARBIOS

rew'n

GARBO

EASTMAN

Recyc' El!t yes we chem

JIAREN NEW MATERIALS 佳人新材料

syre

JB rPET UPCYCLING WASTE INNOVATIVELY

matterr

TEIJIN

PETER POLYESTER, RENEWED

GR3N Research. Innovation. Being.

loop INDUSTRIES

samsara eco

DePoly

Reju.

CELLULOSICS and POLYCOTTON

TEXTILE CHANGE

ONCEMORE

SaXcell

irc

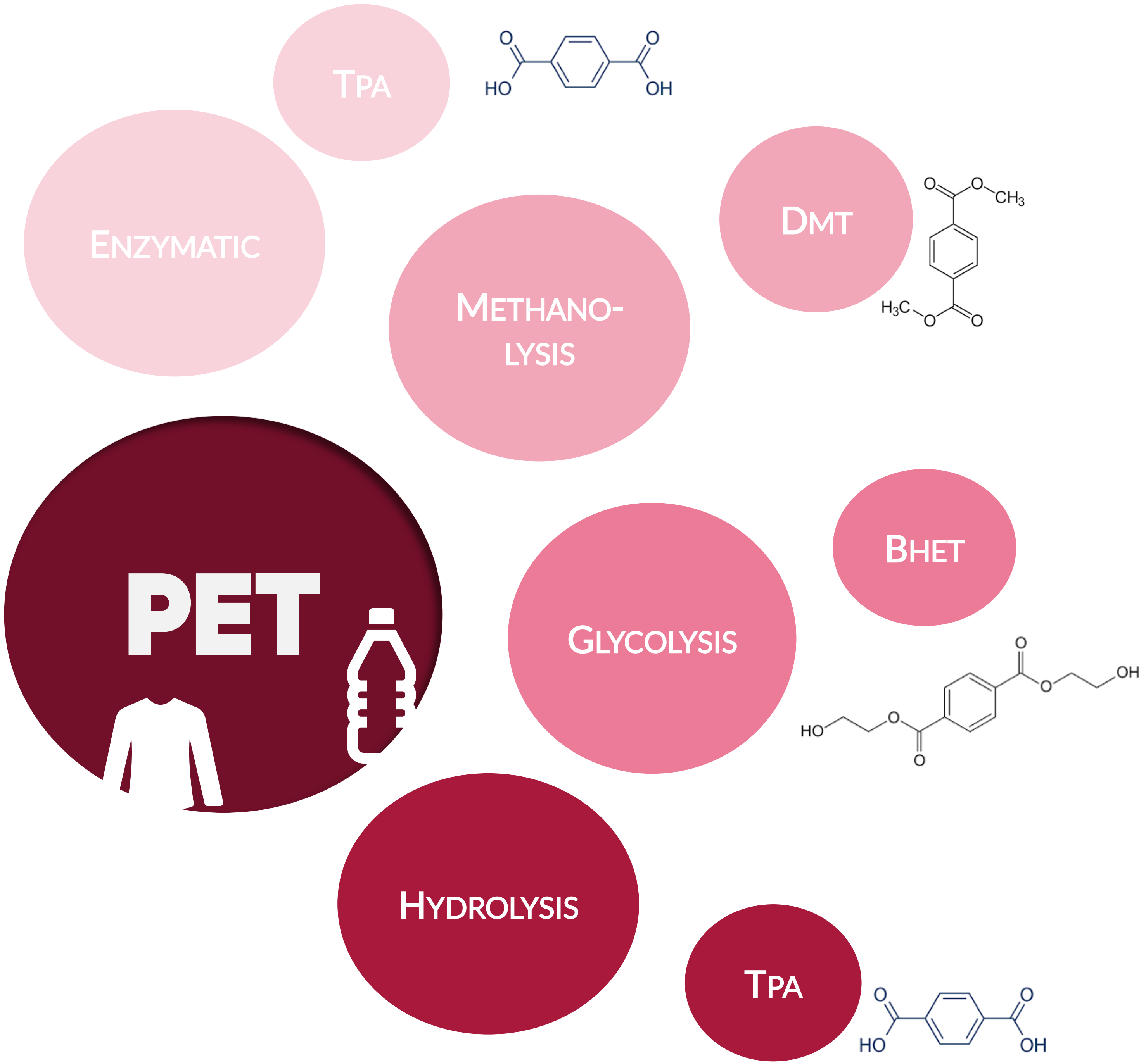
worn again technologies

CIRCULOSE®

Birla Cellulose
Fibres from nature

Monomer recycling NYLON

Polyester recycling techno-logies



GLYCOLYSIS

TEIJIN

Axens
Powering integrated solutions

rew'n

Reju.

syre

JIAREN NEW MATERIALS 佳人新材料

CURE Polyester Rejuvenation

JB rPET
UPCYCLING WASTE INNOVATIVELY

GARBO

METHANOLYSIS

EASTMAN

Recyc'Elit yes we chem

loop INDUSTRIES

ENZYMATIC

CARBIOS

samsara eco

HYDROLYSIS

DePoly

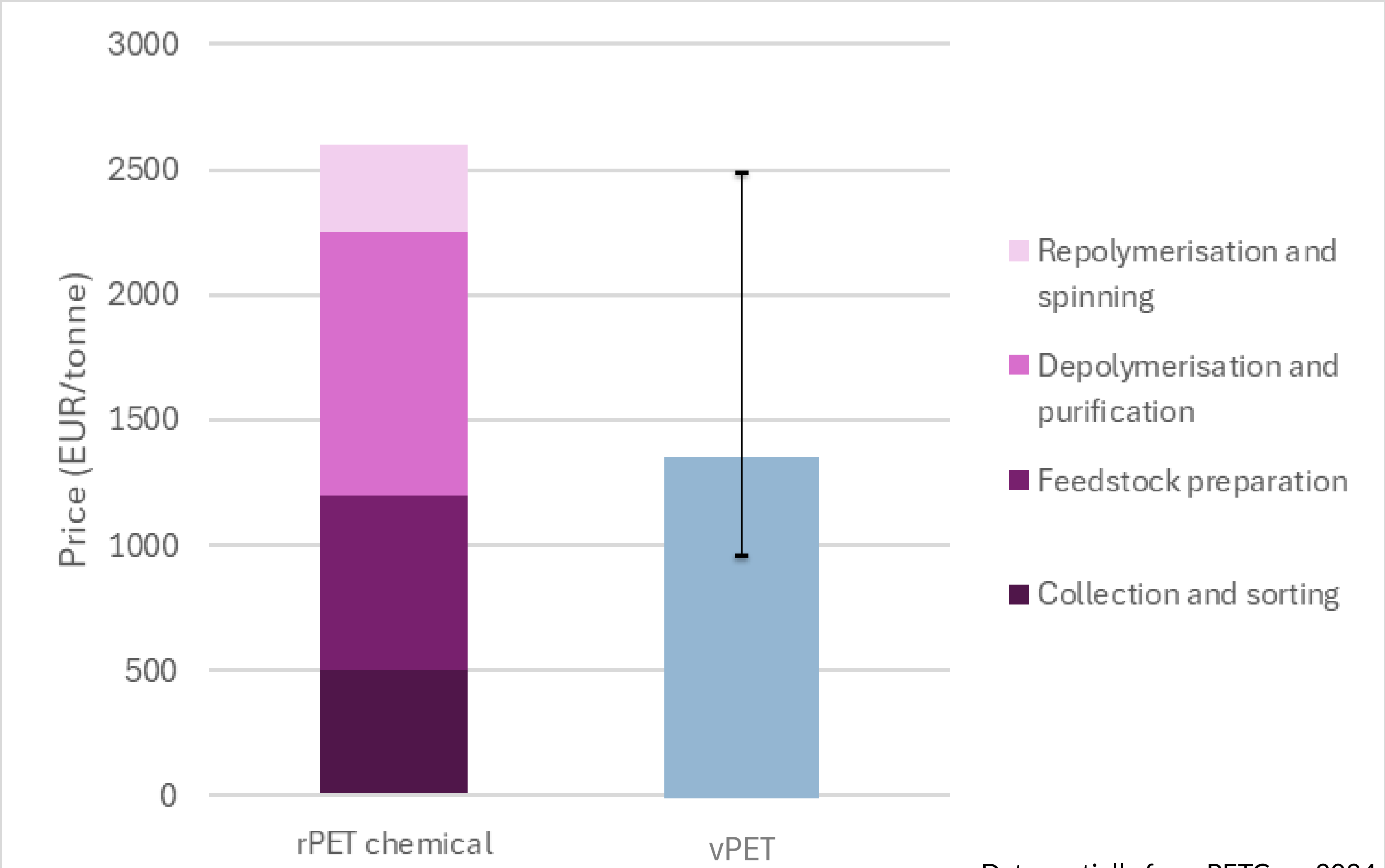
matterr

GR3N Research. Innovation. Being.

Announced industrializations

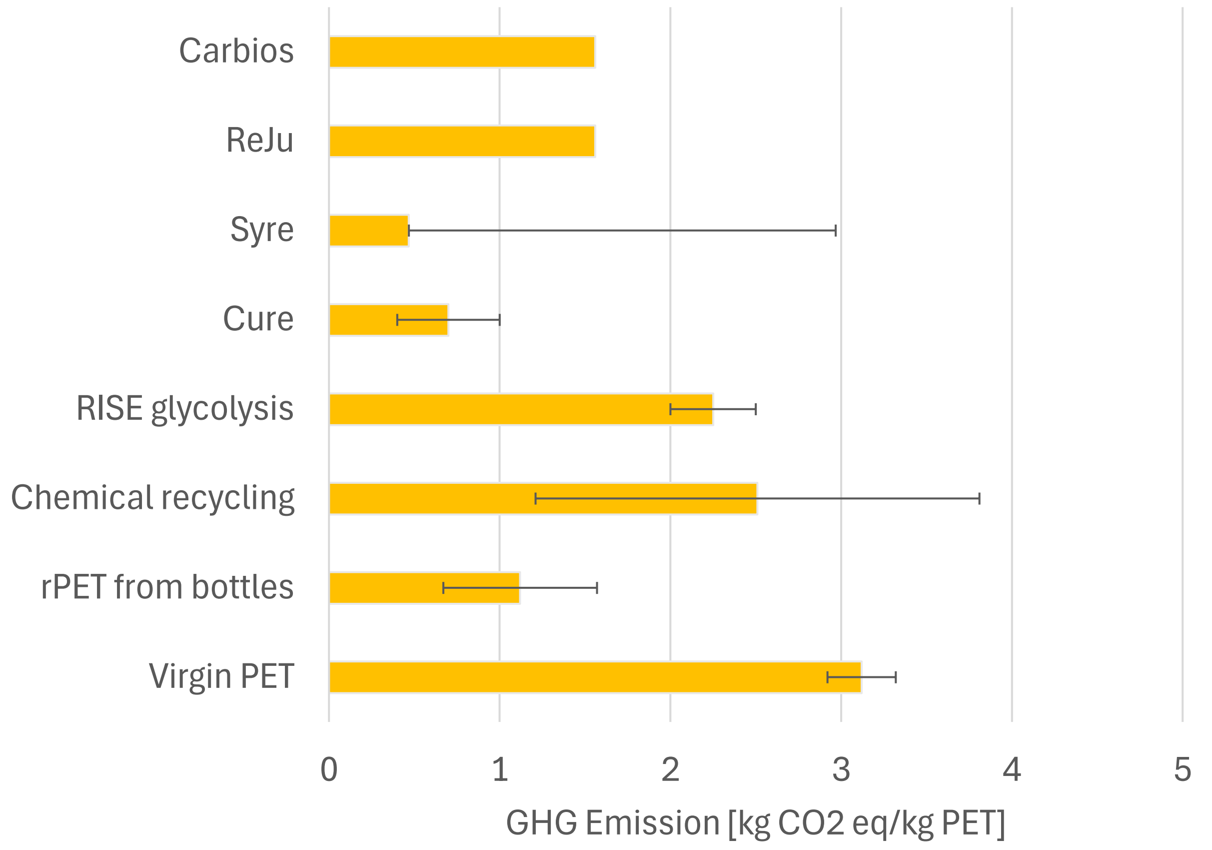
	Planned capacity (tonne/year)	Operational		Country
Syre	10 000	2025		US
Carbios	50 000	2025	Postponed to 2027	FR
Eastman Chemical	100 000+	2025	Postponed	FR
Gr3n	40 000	2027		ES
Loop Industries	70 000	2027		FR
DePoly	50 000	2027		N/A
Garbo Axens	30 000	2027		FR
Cure	25 000	N/A		N/A
TOTAL	**375 000**			

Cost of polyester filament yarns (PFY)



Data partially from PETCore 2024

Reported GHG Emissions



LCA data rarely accessible

LCA data hard to compare (different assumptions, base case etc.)

Reference data: RISE and Carbonfact.com

RISE research

Polyester

- RISE has performed research on chemical recycling of PET since 2014, starting with packaging materials
- LCA on PET from closed loop recycling of packaging indicates a 6-35% reduction in GHG emissions
- Textiles require a more rigourous pretreatment compared to packaging and shows a slightly lower yield.
- PET and comonomers (such as PBT) can be recycled together with good yield

Polycotton Blend Re:wind

- Separation och chemical recycling of blended polycotton textiles by selective depolymerization of polyester to monomers. Launched in 2017.
- Products are dissolving pulp and polyester building blocks, terephtalic acid and ethylene glycol
- A modified version of the process has been upscaled and commercialized

Funded by:

mistra future fashion

Nylon Re:Mix III

- Separation and chemical recycling of polyester, nylon, elastan blends
- Separation of nylon in ethylene glycol at moderate temperatures
- Nylon is separated but not depolymerized and barely degraded in the process.
- Method is effective for different types of nylon (PA6, PA6.6)

Funded by:
COWIfonden


Color

Color

- Disperse dyes may be extracted before depolymerization. Solvents such as DMSO, EG, ionic liquids. Large surplus of solvent needed.

- Dark colors are more difficult to extract

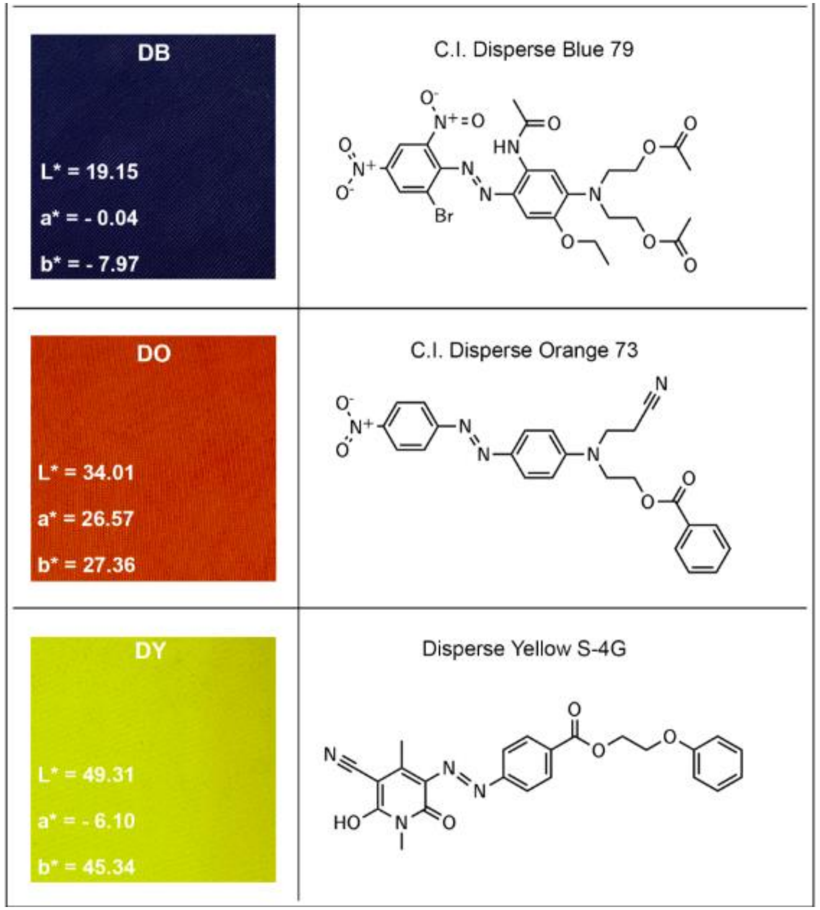
- If not extracted; disperse dyes are degraded during chemical recycling, chromophoric unit is decomposed

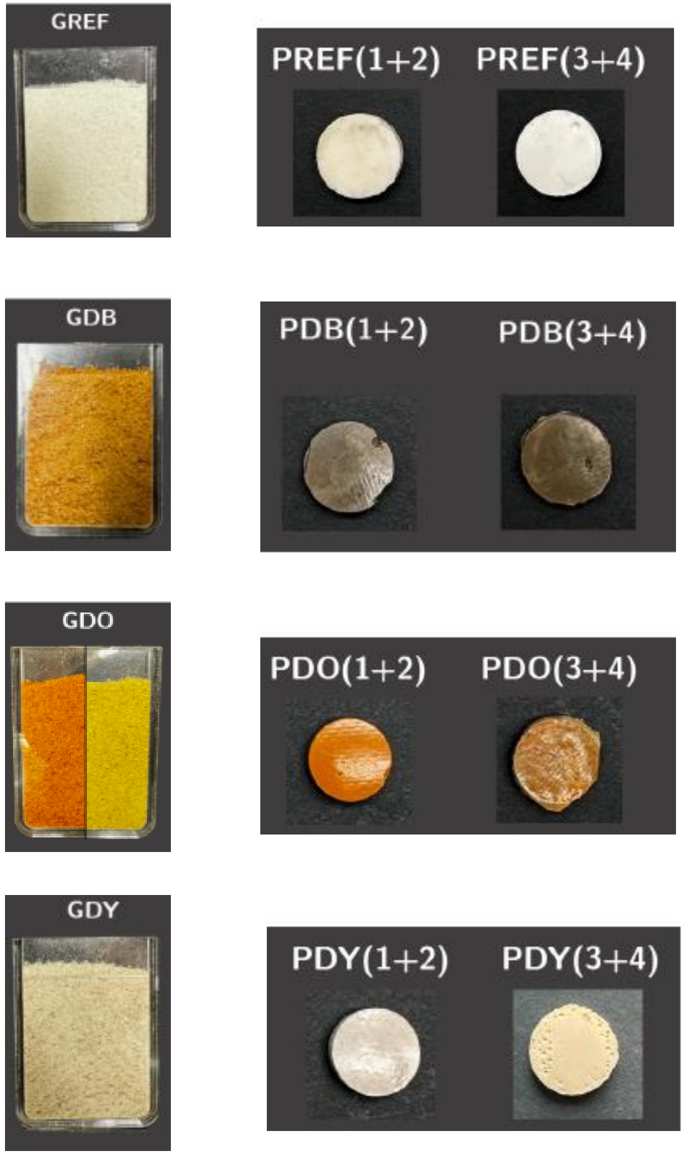
- Degraded dyes are more difficult to remove than their pristine counterparts.

- A study which compares fiber spinning of rPET from chemically recycled monomer which have been purified using (1) recrystallization vs (2) sublimation is underway. Focus is both technical performance and LCA.

Influence of dye degradation

rPET from chemically recycled BHET is discolored but can be polymerized to yield similar molecular weight to reference vPET samples

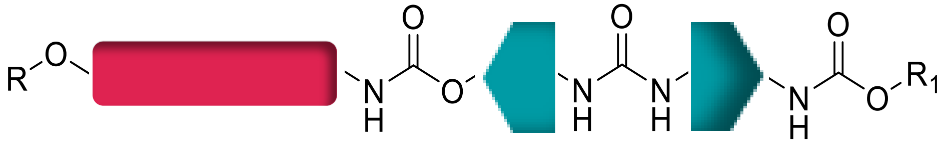




Elastane

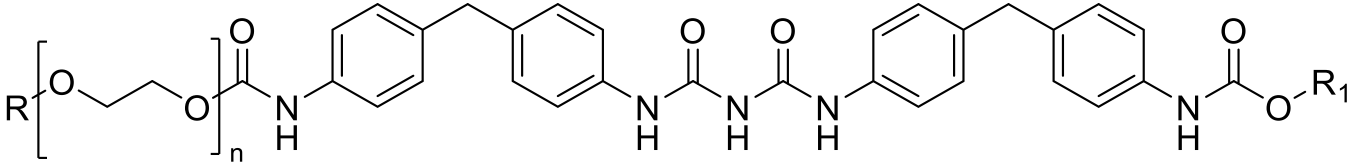
Elastane/Spandex

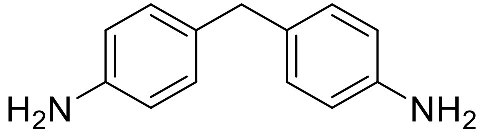
- Common cofiber, use is rapidly growing
- Typically found in proportions from 1-25% in cotton, polyester, polycotton, nylon, etc.
- Poly(urea-urethane) type of polymer



Soft segment Hard segment

4,4′-Methylenedianiline (MDA)





- MDA is a valuable, but toxic aryl amine
- Controlled degradation of e.g. polyurethane foams renders MDA as a product
- Solvolysis of polyester and nylon renders MDA as a byproduct contaminant – contaminating product as well as process streams

Analysis GC-MS

Development of a protocol to quantify MDA in reaction solution and products (monomer) with accuracy and repeatability. Target LOQ 10 ppm.

	Reaction solution	Product
Glycolysis	>100 ppm	<100 ppm
Methanolysis	<100 ppm	<100 ppm
Alkaline hydrolysis	>>100 ppm	<< 100 ppm

All-polyester solutions


All-Polyester
Solution

Recycling trials of all-polyester solutions

- Monomer recycling of PET and their copolymers by methanolysis, hydrolysis and glycolysis
- Hydrolysis and methanolysis has higher tolerance (render higher yields) for PET copolymers compared to glycolysis
- Trials of full components or individual materials, evaluation of crystallized monomers and/or monomer in solution

Road ahead

Legislative landscape

Joint initiative T2T Alliance (Syre, Circ, Re&Up, Circulose, Samsara Eco) advocate for

- Promoting T2T recycled content and recyclability as core requirements in the ESPR ecodesign requirements for textiles. Proposing mandatory inclusion of 10% of recycled content in all new textiles to be introduced by 2028, rising to 15% by 2030 and 30% by 2035.

- Supporting a textile recycling approach which includes post-industrial, pre-consumer and post-consumer waste.

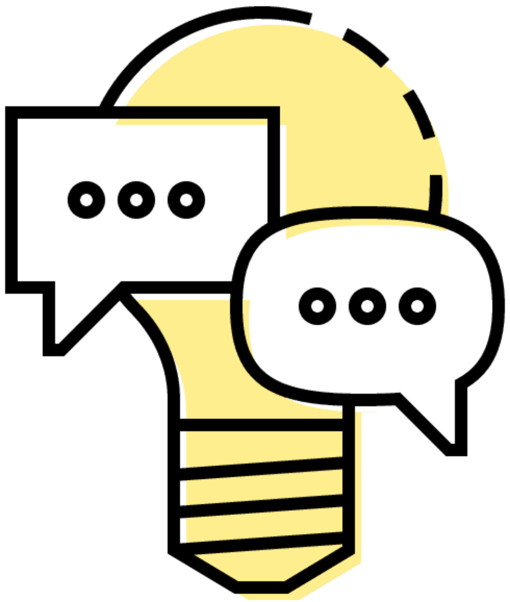
- Advocating for a wide range of verification methods for tracing recycled material

Design for recycling – guidance coupled to actual limitations of recyclers

Chemicals – chemical recycling does convert not only the target polymer but also other fibers, coating and functional chemicals applied to the textile. Monomer product typically clean, but side streams and waste-water has been detected with PFAS, acrylates, styrene, aromatic amines and others SVHC when using PC textile feedstock. Increased knowledge and awareness needed.

Summary

- Polyester chemical recycling is already happening, but more knowledge is needed on recycling of textiles and the fate of additives and fiber blends during chemical recycling
- Dye can be removed, but more scalable and economical solutions are needed.
- Dye left in the fiber is degraded, causing discoloration and, potentially, also impacting repolymerisation
- Elastane is typically degraded to toxic aromatic amines, be mindful of the safety of your process
- All-polyester solutions can be depolymerised, their yields are varying depending on the combination of polyesters and other comonomers.



Don’t hesitate to reach out if you think RISE could help your business!

Q&A

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Thank you

For more information about the RegioGreenTex Community Talks, contact: charlotte.denis@textile-platform.eu

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From Demonstration to Scale: Regional Circular Textile Innovations in Prato

19 November 2025 • 14:00-18:30 CET

Prato, Italy

Funded by the European Union