

RECYCLING OF POLYESTER AND COTTON FROM PET/CO BLENDS

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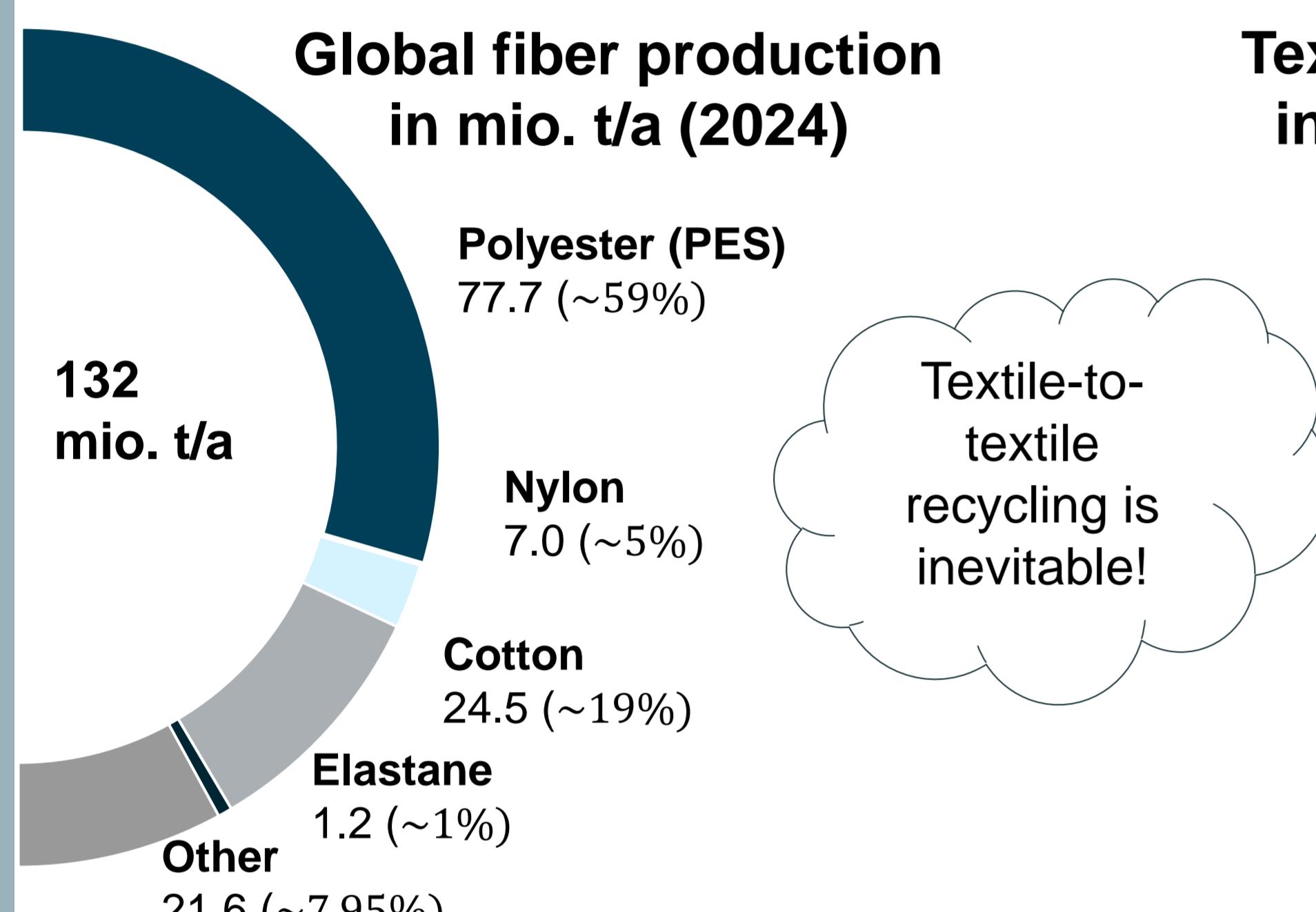
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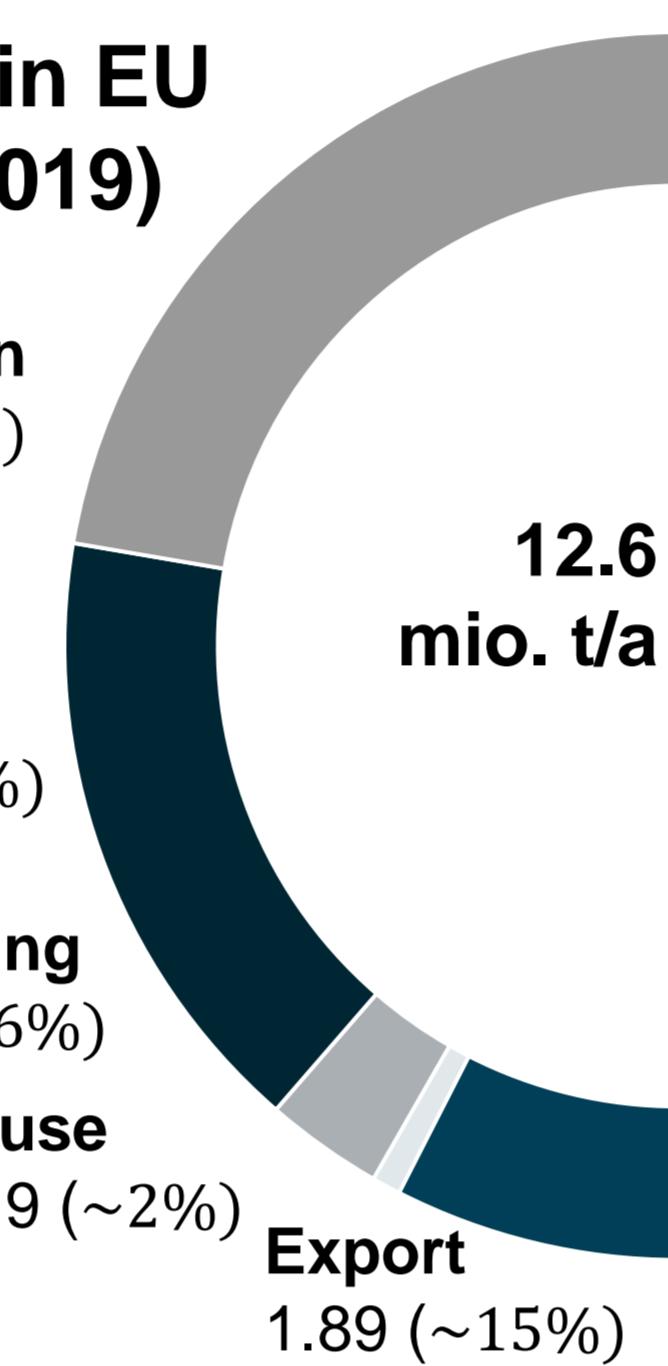
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Fiber Production and Textile Waste^[1,2]



Textile waste in EU in mio. t/a (2019)



Textile-to-textile
recycling is
inevitable!

EU Waste Framework Directive 2025
2025
No waste disposal of textiles
via household waste

EU Textile Strategy
2030
All kinds of textiles have to
be recyclable

Research Project „TheKey“

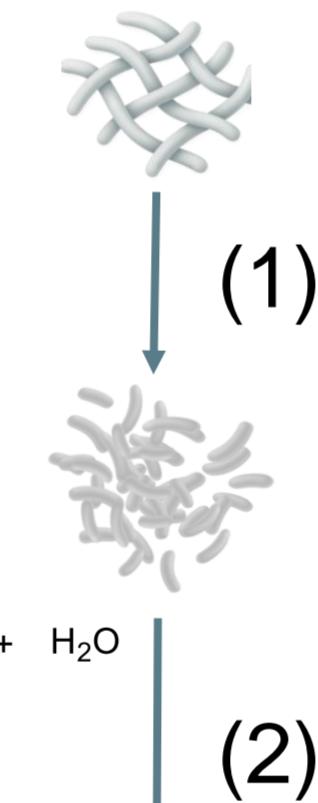
- Chemical recycling of PES from PET/CO mixed-fiber textile into high purity TA monomer
- Additional recovery of cellulose foreign-fiber
- Recycling of monomers obtained from alkaline hydrolysis in PET synthesis for the production of new fibers and textiles
- Development of feedstock specifications for selecting the most ecologically and economically advantageous recycling paths



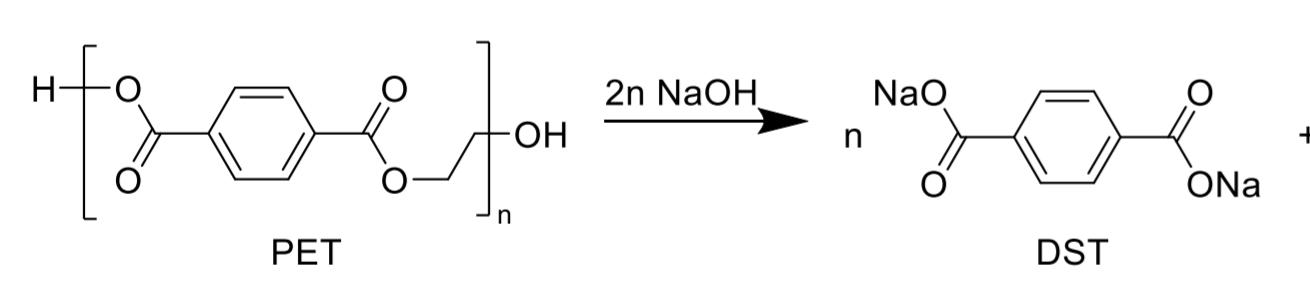
Experimental Approach

PET/CO blends in ratios of 85/15, 65/35, and 50/50

(1) Shredding + Compaction



(2) Alkaline hydrolysis of polycotton



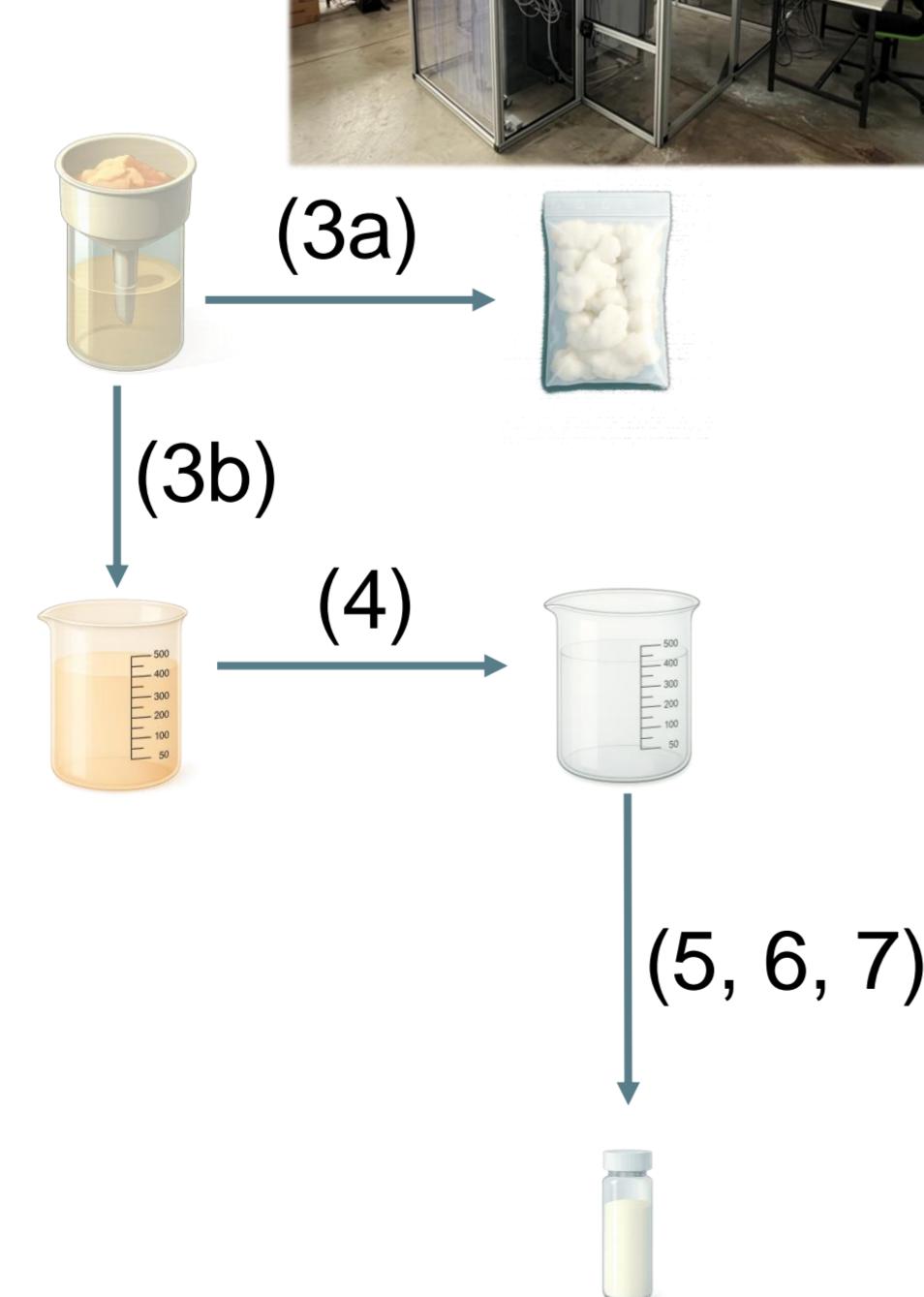
Process conditions:
120 °C – 160°C, NaOH:PET 1:2.1,
40 rpm⁻¹



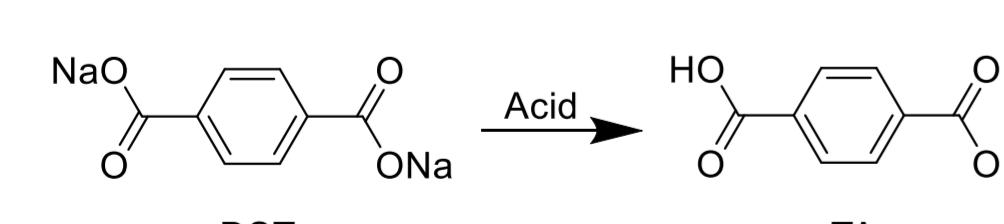
(3) Filtration

- Filter cake (cotton pulp)
- DNT solution

(4) Neutralization and adsorption
for 24 hours



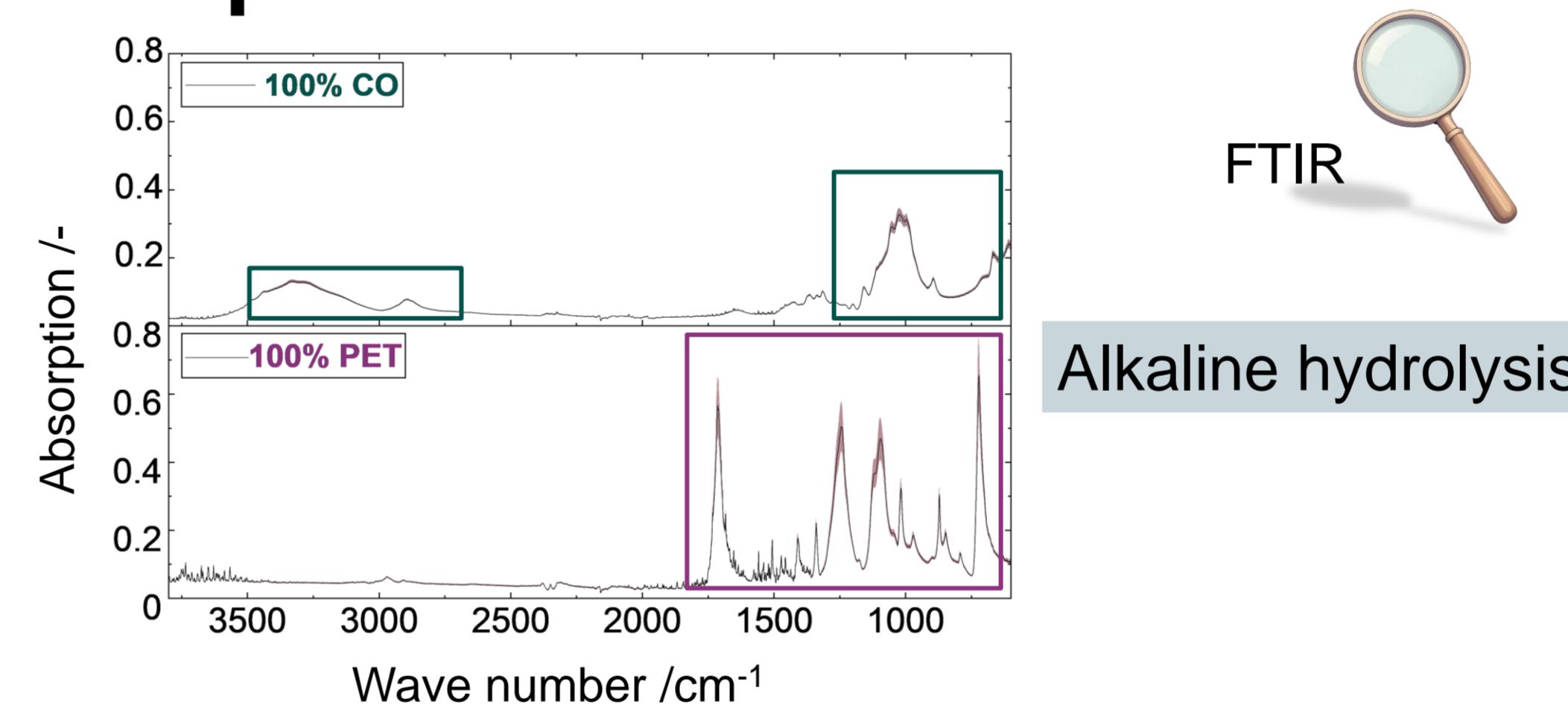
(5) Precipitation



(6) Solid/liquid separation

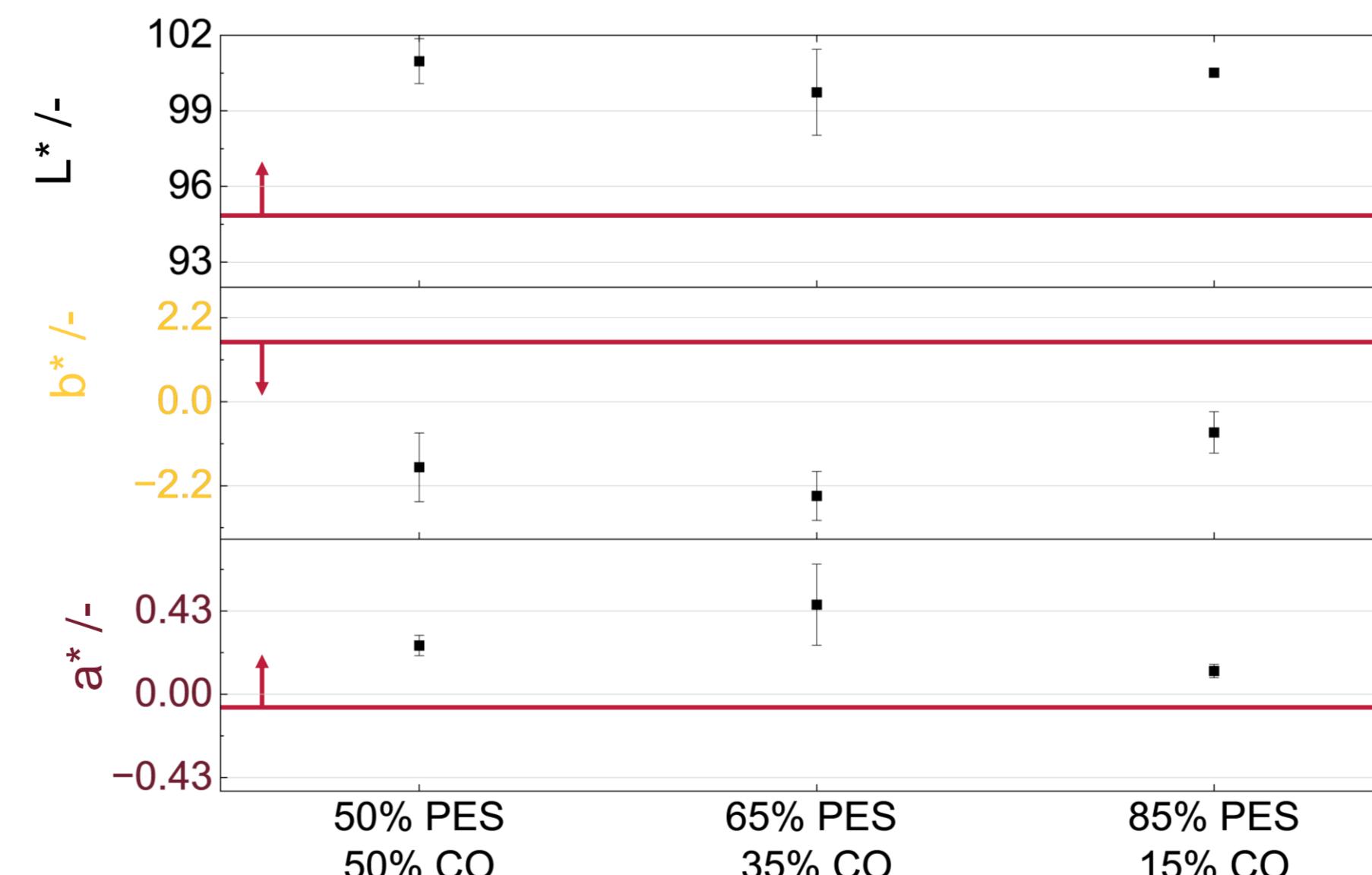
(7) Drying

Pulp: Condition of cotton

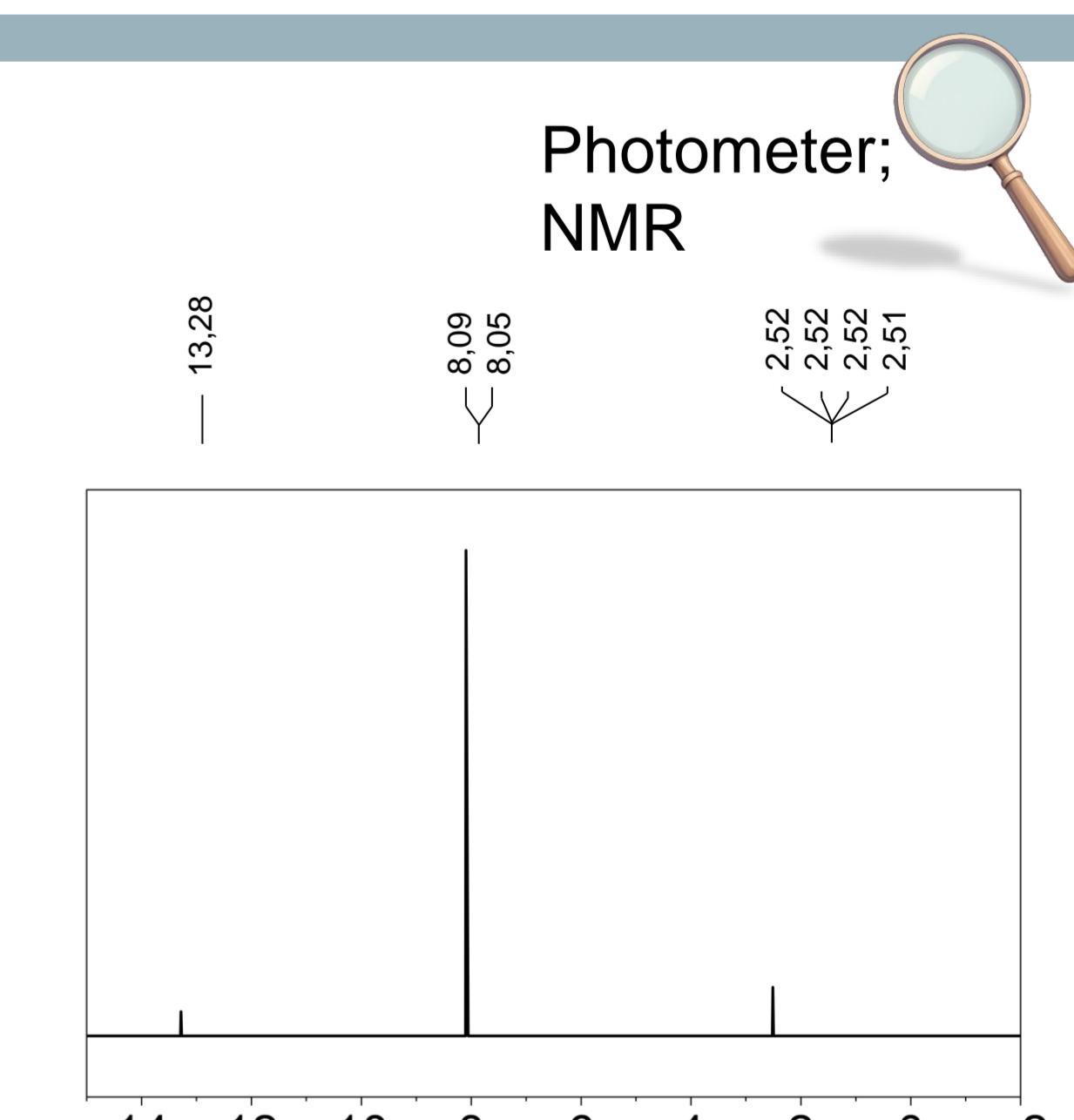


- Reduced cotton wavelength signals → degradation of cotton fibres
- Hardly any detectable PET → almost complete depolymerisation in alkaline hydrolysis

Terephthalic Acid (rTA): Purity



- No relevant colour residues
- Meets purity requirements and industry specifications for purified terephthalic acid



- ¹H-NMR signals assigned to DMSO (13.2, 2.5 ppm) and TA (8.0 ppm)
- No impurities detected

Conclusion

- Alkaline hydrolysis enables recycling of PET/CO blended textiles
- Initial screening successfully completed
- Resulting terephthalic acid meets industrial requirements
- Reduced PET content in filter cake indicates high degree of depolymerisation

Outlook

- TGA for residual mass determination of PET and cotton in filter cake
- Transfer from batch to continuous processing with selected parameters

References

- Textile Exchange, Materials Market Report, 2025
- European Commission, Joint Research Centre, Huygens, D., Foschi, J., Caro, D. et al., Technoscientific assessment of the management options for used and waste textiles in the European Union, Publications Office of the European Union, 2023