

Tim Åström¹, Anna Edsberger², Zengwei Guo²,
Richard Sott² and Ulrika Nilsson¹

¹*Stockholm University, Stockholm, Sweden*

²*Research Institutes of Sweden, Mölndal, Sweden*



Towards a safe and sustainable recycling of elastane-containing textiles

ABSTRACT

The consumption of household textiles within the European Union (EU) is estimated to be 26 kg/citizen¹, and the global textile industry is rapidly expanding. Fast-fashion is a global challenge influenced by dynamic consumer demand for fashion trends. This introduces novel chemicals, e.g., dyes and other functional chemicals that are not yet regulated, making it hard to predict the chemical content in garments. This might diminish the overall lifespan of a garment, for example, if the colour easily fades during laundry. The amount of textile waste is also increasing, nearly 7 million tonnes in 2022 within the EU, of which 26% of the separately collected textile waste was subjected to incineration or landfilling². The environmental burden is not just related to consumption, but also to the Waste Framework Directive³, which suggests that household textile waste should be recycled before being incinerated or deposited in landfills. Thus, the hypothesis for this study is to test an alternative recycling strategy for worn-out textile apparel, aiming to develop a safe and environmentally sustainable methodology. This is evaluated by removing elastane from textiles through partial degradation, without a substantial release of health-hazardous impurities from the elastane polymer backbone. Preliminary results indicate that the dissolution of elastane does not release any detectable molecules and thus provides a safe means of removing elastane from garments. Low levels of elastane-related substances have, however, been observed following a partial depolymerization. In conclusion, the methodology may offer a promising alternative to recycle worn-out textiles via an efficient elastane removal of second hand fashion.

Keywords: Fast-fashion, Textile recycling, Sustainability, Efficiency, Elastane removal

BIOGRAPHY

1. Textiles in Europe's circular economy.
<https://www.eea.europa.eu/en/analysis/publications/textiles-in-europes-circular-economy>
(accessed 2026-01-17).
2. ETC CE Report 2025/7 Measuring Europe's textiles circularity – through the lenses of the EEA Circularity Metrics Lab. Eionet Portal. <https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-report-2025-7-measuring-europe2019s-textiles-circularity-2013-through-the-lenses-of-the-eea-circularity-metrics-lab> (accessed 2026-01-17).
3. Directive - 2008/98 - EN - Waste framework directive - EUR-Lex. <https://eur-lex.europa.eu/eli/dir/2008/98/oj/eng> (accessed 2025-03-30).

Acknowledgements: The authors gratefully acknowledge BioSusTex for financial support for this project