Separation process for elastane from textiles

Emanuel Boschmeier
PhD Candidate
emanuel.boschmeier@tuwien.ac.at
Motivation

- Elastane (EL) acts a contaminant in textile recycling processes
- Separation of EL necessary

State-of-the-art:
- Mainly hazardous solvents used in current patents and literature
- No industrial viable process at the moment
Motivation

EL mass in apparel
(approx. average)

~ 1%

Items containing EL
(approx. average)

~ 30%
Scope

- Successful separation of elastane from textile waste
- Process development and demonstration
- Not hazardous
- PET and PA66 unaffected by the process
Background of elastane

- Also known as spandex or LYCRA®
- Elastic fibre with high elongation of 200 - 600%
- 1.2 million ton produced in 2021
- Used in a variety of textiles
- Elastomer degrades under thermal exposure
Approach

- Textile have a large surface and low specific density
- Tearing textile apart is unfavoured
- Selective solvent to a specific fibre
- Major fibre need to stay unchanged

PET/EL textile in SEM (COXEM EM-30 plus, South Corea) © TU Wien
### Patent recherche

- **targeted method: solvent-based**
- different solvent mixtures at different ratios
- most of the patents not feasible – proof in our laboratory

### Scientific publications

- **targeted method: solvent-based**
- 5 publications dealt with EL separation in the past, mainly DMF and DMAc or thermal method
- in 2023: 2 publications on EL-separation!
Elastane separation process

- Sustainable technology
- **not-hazardous solvent**
- ambient pressure
- 99% solvent recovery
- **PET and PA66 stays unchanged**, proof with
  - SEM
  - DSC
  - TGA
  - ATR-FTIR
Characterisation of recovered polymers

Scanning electron microscopy (SEM)

Left: PET weave contaminated with EL residues. Right: pure PET (COXEM EM-30 plus, South Korea)

© TU Wien
Characterisation of recovered polymers

- Differential scanning calorimetry (DSC)
- Thermogravimetric analysis (TGA)
Characterisation of recovered polymers

- Principle component analysis (PCA) of spectroscopic measurements (ATR-FTIR)
Opportunities

• For the first time, PET/EL and PA66/EL textiles are recyclable!

• PET and PA66 a feedstock for new textiles

• Future sustainable process
Technology 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

Why not risk a look! →
Thank you for your attention

The SCIRT project has received funding from the Horizon 2020 Programme under grant agreement n°101003906.

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