





Strain-Modification of PLA-based Fibres by Blending and Reactive Extrusion

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Results & Discussion

The aim of this work was to modify the *flexibility and* elongation of PLA (polylactic acid) for their application as textile fibers. PLA was blended with more elastic materials, such as **PBS** (polybutylene succinate) and **TPU** (thermoplastic polyurethane). Additionally, different peroxides and chain extenders were added by reactive extrusion for further modification.



1 Dicumyl peroxide (DCP)

- 2 Trigonox 301
- **3** Triallyl isocyanurate (TAIC)
- **4** Succinic anhydride
- **5** Joncryl

The viscosity of the compounds, produced by reactive extrusion, was determined with a plate-plate shearing rheometer. Temperature was hold constant at 190°C for 30 min. The blends, which were modified with peroxides, showed a decrease in viscosity with time, indicating an ongoing radical degradation of the material. After adding a stabilizer, the viscosity stayed constant.



After melt spinning, the fibers were characterized by tensile testing. The highest elongation for PLA/PBS fibers (107%) was obtained by modification with Joncryl. The high elongation of **PLA/TPU** fibers could be further increased to **193%** by radical crosslinking (Trigonox) followed by the addition of a stabilizer.

PLA blends were produced with PBS and TPU and further modified by reactive extrusion. Afterwards, fibers were produced by **melt spinning**:



Conclusion



Blend: **PLA/PBS (60/40)** 100% biodegradable and 60% bio-based.

Improvement of elongation for all modifications!

Blend: **PLA/TPU (90/10)** 90% bio-content.

Without stabilization:

PLA/PBS and PLA/TPU blends were modified by reactive extrusion using peroxides and chain extenders. The elongation for PLA/PBS fibers could be almost doubled by the additives Joncryl, Trigonox and TAIC. PLA/TPU fibers showed an initial high elongation of 106%, which could be even further increased to 193% by adding an organic peroxide and a stabilizer.

Reduction of elongation!

With peroxide and stabilizer: 106% (blend) → 193% (mod.)

Acknowledgement

The authors are grateful for financial support from the Austrian Research Promotion Agency (FFG) for the project "BioModFiber" in the scheme "Produktion der Zukunft".

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