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Report on

Juliana Vanessa Cardoso Azevedo's thesis

entitled

**Manufacturing of Blends based on Biopolyesters and Polylactides:
Process-induced Structure and Properties**

by

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Juliana Azevedo's PhD thesis addresses a currently hot topic in the field of packaging polymers as there is a need to substitute crude oil based thermoplastic films by biodegradable polymer alternatives to fight environmental pollution mainly in terms of micro-plastics. Her approach is to optimize the commercially available PBAT PLA blend M Vera®B05029 from BIO-FED (REF) for film blown extrusion by modifying it with chain extending cross-linkers (CECL). This is challenging as such modifications are typically connected to cross-linking reactions that increase the mean molecular masses of the blends and worsen their bio-disintegration behavior of the blown films.

The results of Juliana Azevedo's research work are represented in a PhD thesis having 113 pages. It includes a good overview over the state of research in the field of PBAT PLA blends. The key results were already published in three publications accepted by peer reviewed journals (P1, P2 and P3), 2 further publications were submitted to peer reviewed journals where they are in the review process at the moment.

Juliana Azevedo has chosen 4 chemically different CECL and compounded them with REF providing 5 different PBAT PLA blends for film blown extrusion – REF, V1 to V4. In order to analyze the effects of the CECL on REF, she designed and performed the investigation in a clear and logic manner. At first, she film blown extruded films having the standard BUR = 2.5. These films were investigated in the **first step** with respect to the effects of CECL on mechanical and thermal properties of the films, paper 1, as well as on structure development during film blown extrusion, paper 2. The results show that the CECL altered significantly both properties and structures of the films compared REF. Furthermore, all films exhibited a pronounced anisotropy of properties and structure between extrusion direction and transverse direction. In the **second step** the films were subjected to carefully performed bio-disintegration tests in compost soil for both 8 weeks at 30°C (below T_g^{PLA}) and 7 days at 60°C (above T_g^{PLA}). They showed that pronounced disintegration occurred only at 60°C, and that the remaining films were hardly degraded with respect to their molecular masses. This may mean that “mechanical” disintegration has to happen prior to molecular degradation requiring large surface areas for bio-attack, paper 3. A nice add-on is that Juliana Azevedo successfully applied a simple linear bio-disintegration kinetics model to the data at 60°C.

A weak point in all 5 papers is that there is no estimation of the data accuracy applying error tracing.

Furthermore, it would have been good to clarify and to precise in the discussion the reasons for choosing these 4 CECLs, and how can they in principle react with PBAT and PLA, respectively.

To summarize it can be said: Juliana Azevedo presents in her PhD thesis interesting approaches how to design the properties of multiphase polymer systems with respect to the desired application. Congratulations to the good thesis which I recommend to be accepted.

With best regards,

Prof. Dr. Johannes Steinhaus
Vice Dean and Professor in Materials Science