STUDYING THE THERMAL BEHAVIOUR OF BIOPOLYMERS

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ABSTRACT

Biopolymers are currently receiving a great deal of interest in a large variety of research fields and have attracted great attention, not only in academia, but also in industry. Among the range of biopolymers, poly(lactic acid) (PLA) have been extensively studied as a suitable replacement for commercial, petroleum-based counterparts. PLA is a biodegradable and biocompatible polymer that can be obtained from renewable resources. The ease of processing, its stiffness and good strength makes this polymer a promising material to compete with non-degradable commodity plastics. PLA is a well-defined thermoplastic and will hydrolyse into natural, harmless products and the shelf-life is reasonably good for single-use packaging applications.[1] However, the major drawback, is the low rate of crystallization and low crystallinity compared to other commodity thermoplastics. Various methods for improving the crystallization kinetics from the melt have been reported in literature.[2, 3]

This research focusses on the behaviour of biopolymers in solution. Solution crystallization analysis by laser light scattering (Scalls) was used as main analytical tool to investigate the solution phenomena (crystallization and dissolution) of PLA. Binary blends of poly(L-lactic acid)(PLLA) and poly(D-lactic acid)(PDLA) resulted in the formation of stereocomplex crystals which acted as nucleation sites for PLA homocrystallites.[4] Addition of PDLA also influenced the surface morphology of solution-casted PLLA/PDLA films. Small additions of poly(butylene succinate)(PBS), an additional biodegradable and biocompatible polymer, proved to be another sufficient method for enhancing the crystallization kinetics of PLLA.

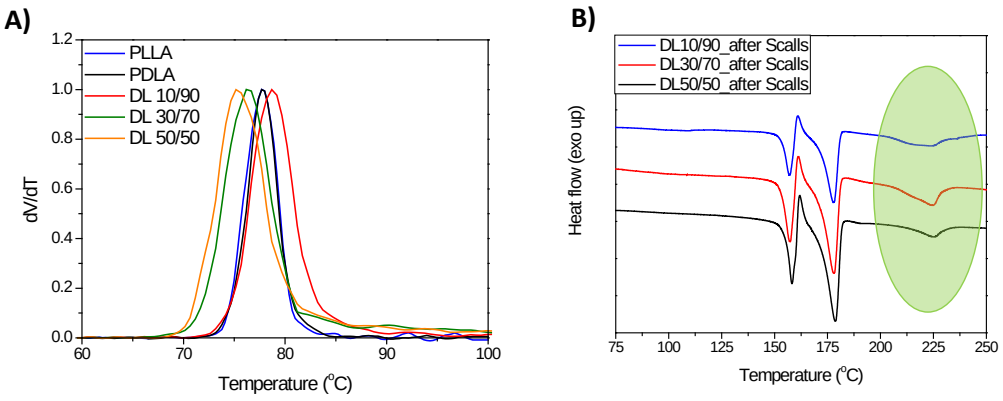

Fig. 1: A) Scalls crystallization profiles and, B) DSC thermograms of various PLLA/PDLA blends

References:

[1] Garlotta, D. *Journal of Polymers and the Environment*, **2001**, 9, 63-84.
[2] J. Sun, H. Yu, X. Zhuang, X. Chen, X. Jing. *Journal of Physical Chemistry B*, **2011**,115, 2864-2869.
[3] J. Narita, M. Katagiri, H. Tsuji. *Macromolecular Materials and Engineering*, **2011**, 296, 887-893.
[4] Robertson, D. D., Neppalli, R., van Reenen, A. J. *Polymer Testing*, **2014**, *40*, 79-87.