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Synthesis of PLLA-based block copolymers for improving melt strength and toughness of PLLA by in situ reactive blending

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ABSTRACT

Low melt strength and toughness of poly(L-lactide) (PLLA) limited its large-scale application. In this work, a facile method was proposed and demonstrated to a feasible route to solve these problems. A series of PLLA-based block copolymers PLLA-*block*-poly(butylene succinate)-*block*-PLLA (PLLA-*b*-PBS-*b*-PLLA), and chain extender (PLLA-*block*-poly(glycidyl methacrylates))$_3$ (PLLA-*b*-PGMA)$_3$ were synthesized and used for the improvement of the melt strength and toughness of PLLA by in situ reactive blending. The structure and composition of the copolymers were confirmed by nuclear magnetic resonance spectra, infrared spectra and gel permeation chromatography. The elongation at break increased from 4.2% for PLLA to 234% for the blend containing 40% block copolymer and 5% chain extender, and remarkably maintained their strength. Rheological analysis showed that the blends exhibited the strong strain-hardening behavior. Measurements of the linear viscoelastic properties of the melt blends suggested that the chain extender promoted the development of chain branching. DSC data showed that the crystallization was not perfect after addition of PLLA-*b*-PBS-*b*-PLLA and (PLLA-*b*-PGMA)$_3$ compared with

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