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Preparation and Properties of Biodegradable Poly(lactic acid)/Poly(butylene adipate-*co*-terephthalate) Blend with Epoxy-functional styrene acrylic copolymer as Coupling Agent

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Abstract –Poly (lactic acid) (PLA) and poly (butylene adipate-co-terephthalate) (PBAT) were melt blended in the presence of epoxy-functional styrene acrylic copolymer (ESA) by twin-screw extrusion. Only 0.5 wt% ESA can greatly increased the tensile toughness and tensile strength of the blend. But the blend is still a two-phase system and the addition of ESA enhanced the interfacial adhesion between PLA and PBAT. Rheological results revealed that ESA increased the storage moduli (G'), loss moduli (G'') and complex viscosity of the blends at nearly all frequencies and the decreased shear-thinning tendency of the blends also implied improved melt stability during processing.

Poly (lactic acid) (PLA) is a kind of linear aliphatic polyester derived from biomass through bioconversion and polymerization and poly (butylene adipate-co-terephthalate) (PBAT) is an aliphatic-aromatic copolymer. They are both environmentally biodegradable and are regarded as good substitutions for general purpose plastics. So the two fully biodegradable polymers have been considered as a complementary blender for each other. However， as a two-phase system, the incompatibility between PLA and PBAT especially at interfaces is still an unfavorable factor. In this study, PLA was melt blended with PBAT in the presence of epoxy-functional styrene acrylic copolymer (ESA) by twin-screw extrusion. The physical properties, phase morphology, thermal properties, and melt rheological behavior of the blends were investigated by tensile tests, scanning electron microscopy (SEM), differential scanning calorimetry (DSC) and advanced rheology expended system (ARES). With 0.5 wt% ESA, the tensile toughness and tensile strength of the PLA/PBAT blend was greatly increased. SEM micrographs revealed that better miscibility and more shear yielding mechanism were involved in the toughening of the blend. DSC results indicated that the blend is still a two-phase system in the presence of coupling agent and the addition of ESA was found to enhance the interfacial adhesion between PLA and PBAT. Rheological results revealed that the addition of ESA increased the storage moduli (G'), loss moduli (G'') and complex viscosity of the blends at nearly all frequencies. The decreased shear-thinning tendency of the blends in the presence of ESA also implied improved melt stability during processing.

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