

## Biodegradable Polymers for Green Composites

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### Abstract

Polymer composites are essential materials due to their advantages on light weight and good physical and mechanical properties. The applications of polymer composites to aircraft, automotive, electric and electronic parts are significantly valuable to the plastic industry. The matrixes of composites are mostly made from petroleum-based polymers such as polyesters, polycarbonate, nylon and acrylonitrile-butadiene-styrene (ABS). However, those polymers are durable to degradation which resulted in environmental problems from their composite wastes. Therefore, biodegradable polymers and natural fibers are attractive materials for environmental friendly composites. Poly(lactic acid) is a biodegradable polymer having good mechanical property. But the application of PLA as a polymer matrix for composite materials has been limited due to its brittleness and low heat distortion temperature. We have studied two process of PLA modifications; synthesis of PLA and polymer blends and reinforce with natural fibers. For the PLA synthesis, the modification of direct polycondensation of L- and D-lactic acid was reported. The synthesized poly(L-lactic acid) (PLLA) and poly(D-lactic acid) (PDLA) showed high enantiomeric stereoisomers which could be further prepare to the stereocomplex PLA. The scale-up of direct polycondensation of L-lactic acid was studied for pilot plant process establishment. For the polymer blends for property modification we have studied the blending of PLA with biodegradable polymers including poly(3-hydroxybutyrate) (PHB), poly(3-hydroxybutyrate-co-valerate) (PHBV), poly(butylensuccinate) (PBS), poly(butylensuccinate-co-adipate) (PBSA). Those polymer blends were reinforced with natural fibers such as jute, kenaf and bamboo fibers (BF). To modify the property of the biodegradable polymer blends we studied the effects of addition of additives including poly(ethylene glycol) (PEG) and talcum to the blends. The effect of PEG as plasticizer on glass transition temperature (T<sub>g</sub>) of polymer components in the polymer blend was reported. The nucleation effect of talcum on PLA crystallinity and improvement of thermal property was reported.

**Keywords:** Biodegradable polymers, poly(lactic acid), green composite, natural fibers.