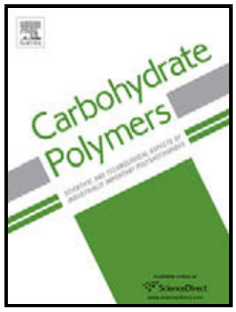

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Effect of Modified Starch and Nanoclay Particles on Biodegradability and Mechanical Properties of Cross-linked Poly Lactic Acid

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Abstract: Mechanical properties and biodegradation of cross-linked poly(lactic acid) (PLA)/ maleated thermoplastic starch (MTPS)/ montmorillonite (MMT) nanocomposite were studied. Crosslinking was carried out by adding di-cumyl peroxide (DCP) in the presence of triallyl isocyanurate (TAIC) as coagent. At first, MTPS was prepared by grafting maleic anhydride (MA) to thermoplastic starch in internal mixer. Experimental design was performed by using Box-Behnken method at three variables; MTPS, nanoclay and TAIC at three levels. Results showed that increasing TAIC amount substantially increased the gel fraction, enhanced tensile strength, and caused a decrease in elongation at break. Biodegradation was prevented by increasing TAIC amount in nanocomposite. Increasing MTPS amount caused a slight increase in gel fraction and decreased the tensile strength of nanocomposite. Also, MTPS could increase the elongation at break of nanocomposite and improve the biodegradation. Nanoclay had no effect on the gel fraction, but it improved tensile strength.

Highlights

- Full green cross-linked PLA/MTPS/MMT nanocomposite was prepared
- Modified thermoplastic starch was more compatible with PLA
- Nanoclay did not affect cross-linked PLA gel fraction but improved tensile strength
- By the addition of MTPS and nanoclay, biodegradability of composites was improved

Key words

Biopolymers, Poly(lactic acid), Chemical crosslinking, Thermoplastic starch, Nanocomposite