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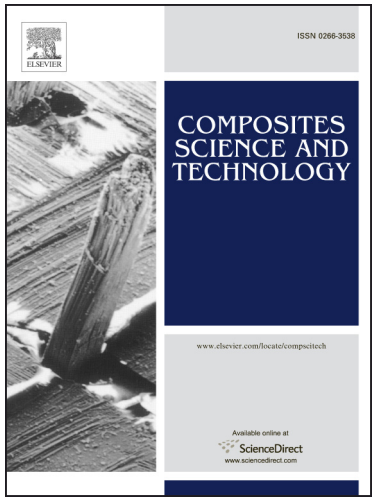


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# Plasticized polylactic acid/cellulose nanocomposites prepared using melt-extrusion and liquid feeding: Mechanical, thermal and optical properties

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## ABSTRACT

Plasticized polylactic acid (PLA) and its nanocomposite based on cellulose nanofibers (CNF) and glycerol triacetate (GTA) were prepared using a co-rotating twin-screw extruder. GTA was used as a plasticizer, a processing aid to facilitate nanofiber dispersion and as a liquid medium for their feeding. The optical, thermal and mechanical properties were characterized and the toughening mechanism was studied. The addition of GTA (20%) and CNF (1%) resulted in increased degree of crystallinity and decreased optical transparency. Furthermore, these additives showed a positive effect on the elongation at break and toughness, which increased from 2 to 31% and from 1 to 8 MJ/m$^3$, respectively. The combination of slippage of the nanofiber-matrix interface and a massive crazing effect as a result of the presence of CNF is suggested for PLA toughening. CNF were expected to restrict the spherulite growth and therefore enhance the craze nucleation.

**Keywords:** A. Nanocomposites, B. Mechanical properties, B. Thermal properties, D. Scanning electron microscopy (SEM), D. Extrusion.