Plasticized poly(lactic acid) with low molecular weight poly(ethylene glycol) : mechanical, thermal, and morphology properties

ABSTRACT

Poly(lactic acid) PLA was plasticized with low molecular weight poly(ethylene glycol) PEG-200 to improve the ductility of PLA, while maintaining the plasticizer content at maximum 10 wt%. Low molecular weight of PEG enables increased miscibility with PLA and more efficient reduction of glass transition temperature (Tg). This effect is enhanced not only by the low molecular weight but also by its higher content. The tensile properties demonstrated that the addition of PEG-200 to PLA led to an increase of elongation at break (>7000%), but a decrease of both tensile strength and tensile modulus. The plasticization of the PLA with PEG-200 effectively lowers Tg as well as cold-crystallization temperature, increasing with plasticizer content. SEM micrographs reveal plastic deformation and few long threads of a deformed material are discernible on the fracture surface. The use of low molecular weight PEG-200 reduces the intermolecular force and increases the mobility of the polymeric chains, thereby improving the flexibility and plastic deformation of PLA.

Keyword: Biodegradable; Blends; Plasticizer.