Title Improvement of active packaging materials based on poly (lactic acid) carrying encapsulated antimicrobial volatiles

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Abstract

Bio-based blends made of poly(lactic acid) (PLA), an aliphatic thermoplastic polyester, and β-cyclodextrins (β-CDs), an enzymatically modified starch, are stiff and brittle due to the incompatibility which limits their applications. The same limitations are expected for bio-based antimicrobial materials created by blending PLA with inclusion complexes (ICs) which serve as a carrier for natural antimicrobial volatile, trans-2-hexenal based on β-CDs. The objective of this study was to overcome limitations by enhancing the compatibility of the carrier with PLS by using a masterbatch. The study was divided into two phases. In phase one, the interfacial adhesion of PLA and β-CDs at various ratios was investigated and the effectiveness of using a masterbatch to improve the adhesion was studied. In phase two, the masterbatch was used to develop an antimicrobial material based on a PLA/ICs blend carrying trans-2-hexenal. The use of the masterbatch significantly enhanced the compatibility between PLA and β-CDs, and improved the thermal, mechanical, optical, and barrier properties of the blends. The antimicrobial PLA/ICs-trans-2-hexenal blend has been shown to be effective against *Alternaria Solani.* The exposure of the ICs to high heat and relative humidity during processing caused a premature loss of the antimicrobial compound encapsulated in the β-CD molecules for later release, and resulted in a reduced antimicrobial activity.