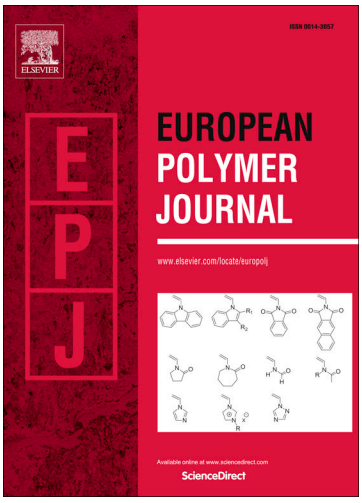

Poly(lactic) acid (PLA) and starch bilayer films, containing cinnamaldehyde, obtained by compression moulding

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Poly(lactic) acid (PLA) and starch bilayer films, containing cinnamaldehyde, obtained by compression moulding

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ABSTRACT

Bilayer films from thermoplastic starch and cast amorphous PLA were obtained by compression moulding, incorporating or not cinnamaldehyde in the PLA layer. Films were characterized as to their microstructure and barrier, tensile and optical properties, as well as thermal behaviour, X-Ray diffraction pattern and FTIR spectra. Bilayers using semicrystalline PLA, instead of starch, were also analysed for comparison purposes. Despite the lower ratio of cast PLA sheet in the bilayer assembly (about 1/3 of the film thickness), a great improvement in tensile and water vapour barrier properties was achieved with respect to the net starch films, the films maintaining high transparency and oxygen permeability as low as starch films. When cinnamaldehyde was included in the cast PLA sheet, films became thinner due to the losses of the volatile active during processing, but the improvement in barrier properties was maintained, with lower mechanical resistance. Thermal analyses revealed diffusion of cinnamaldehyde or low molecular weight compounds from cast PLA layer to the adhered sheets (starch or semicrystalline PLA) which contributed to plasticizing the amorphous regions and affected crystallization pattern of PLA, as also revealed by the X-Ray diffraction patterns. The obtained results offer an interesting option to obtain high barrier-highly resistant active films from thermoplastic starch and amorphous PLA, including cinnamaldehyde as active compound.

Key words

Bilayer films, starch, poly(lactic) acid (PLA), cinnamaldehyde, tensile properties, barrier properties.

1. INTRODUCTION

Although petroleum-based plastics are still extensively used in the food packaging area, they represent one of the biggest environmental issues as regards the exhaustion of natural resources and the accumulation of non-biodegradable materials. The development of more ecological alternatives, reducing the amount of materials used for packaging or recycling are necessary to respond to this environmental problem. In this sense, bioplastics, that are either biodegradable or bio-based polymers, represent an adequate alternative. Although biopolymers do not exhibit excellent functional properties in terms of mechanical performance, thermal stability or barrier properties, they have been the subject of an increasing number of studies for the purposes of improving them, thus obtaining a functionality comparable to that of petrochemical plastics. One of the most promising biopolymers is poly(lactic) acid since it exhibits many advantages; it is biodegradable, renewable and biocompatible and has