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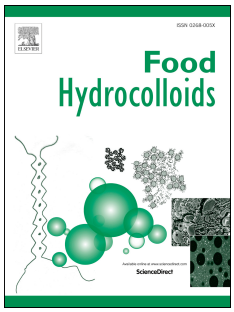

Obtaining antimicrobial bilayer starch and polyester-blend films with carvacrol

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Obtaining antimicrobial bilayer starch and polyester-blend films with carvacrol.

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Abstract

Bilayer films using polyester blends (P) and starch (S) were obtained and characterized, incorporating carvacrol as active compound. Carvacrol was incorporated by spraying it between melt blended and compression moulded sheets or through its incorporation into the chloroform P solution used to obtain P cast films. Different PLA-PHBV ratios (75:25 and 65:35) were tested, with and without 15 wt.% of PEG1000, whereas the 75:25 ratio with PEG was only used for cast sheets, based on its better overall properties. Mono and bilayers were characterised as to their tensile and water vapour barrier properties and thermal behaviour. Release kinetics of carvacrol in different food simulants and in *in vitro* antibacterial activity against *Listeria innocua* and *Escherichia coli* were also analysed. Incorporating carvacrol by spraying it between the polyester and starch sheets was not effective at retaining the compound in the bilayers. However, the incorporation of carvacrol into cast P films, and the subsequent formation of bilayers with the S sheets, was highly effective at providing practically total carvacrol retention. These active bilayers exhibited highly improved tensile and water vapour barrier capacity with respect to the S monolayer (87% reduction in WVP, 840% increase in elastic modulus) and inhibited the growth of *L. innocua* and *E. coli* from both P or S contact sides of bilayers, depending on the internal diffusion of carvacrol through the bilayer and its adequate release of the compound into the culture medium.

Keywords: starch; polylactic acid, polyhydroxybutyrate-co-hydroxyvalerate, carvacrol, packaging properties, antibacterial properties.

1. Introduction

With society's growing concern for the environment and the great dependence on fossil fuels for plastic production, there is a need to find suitable environmentally-friendly solutions to the outbreak of plastic-based packaging. In this context, bio-based and biodegradable polymers such as polylactic acid (PLA) and polyhydroxyalkanoates (PHAs) have emerged as suitable