Preparation and Characterisation of PBAT-Based Biocomposite Materials Reinforced by Protein Complex Microparticles

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Preparation and Characterisation of PBAT-Based Biocomposite Materials Reinforced by Protein Complex Microparticles †

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Abstract: In this work, new biodegradable composite materials based on poly (butylene adipate terephthalate) (PBAT) reinforced with zein–TiO_2 complex microparticles were prepared and characterised by electron microscopy and tensile and dynamic-mechanical tests. The composite pellets were prepared by solvent casting with different filler contents, namely 0, 5.3, 11.1 and 25 part per hundred resin (phr), to modify and modulate the properties of the final materials. Scanning electron microscopy (SEM) images showed homogeneous dispersion of the filler, without microparticles aggregation or phase separation between filler and matrix, suggesting a good interphase adhesion. According to tensile tests, Young's modulus showed an improvement in the rigidity and the yield stress presented an increasing trend, with opposite behaviour compared to other composites. Dynamic-mechanical analysis (DMA) results exhibited increasing storage modulus values, confirming a greater rigidity with a higher filler percentage. The glass transition temperature showed a slightly increasing trend, meaning the presence of an interaction between the two phases of the composite materials. Overall, the produced PBAT composites showed similar properties to low-density polyethylene (LDPE), proving to be promising and more sustainable alternatives to traditional polymers commonly adopted in agri-food fields.

Keywords: biopolymers; biocomposites; poly (butylene adipate terephthalate); protein complex; characterisation

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1. Introduction

Among materials for packaging, plastics are the most widely used, thanks to their lightness, good mechanical behaviour, barrier properties and low cost, among others [1]. Amongst traditional plastics, the most employed are polypropylene (PP), high-density polyethylene (HDPE), low-density polyethylene (LDPE), polyethylene terephthalate (PET) and polystyrene (PS), which however are not eco-sustainable due to the problems related to their end-of-life disposal [2].

In the last few decades, increasing attention has been devoted to the study and employment of bioplastics in order to reduce the environmental impact and increase sustainability. Since bioplastics generally present poorer properties when compared to traditional plastics, the realisation of composite materials represents a valid way to improve and modulate

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3XEOLVKHU
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