

Effect of ZnO Nanoparticles on Tensile and Viscoelastic Properties of Poly(3-Hydroxybutyrate-Co-3-Hydroxyhexanoate) Nanocomposites

I. Berrabah¹, N. Dehouche^{1,*}, M. Kaci¹, C. Henry Deguines², C. Delaite²

¹ *Laboratoire des Matériaux Polymères Avancés, Campus Targa-Ouzemmour, Université de Bejaia, 06000, Algeria, 2012ismailberrabah@gmail.com, nadjat.dehouche@univ-bejaia.dz, mustapha.kaci@univ-bejaia.dz*

² *Laboratoire de Photochimie et d'ingénierie Macromoléculaires (LPIM), 3b rue Alfred Werner, 68093 Mulhouse cedex, France, charles-henry.deguines@uha.fr, christelle.delaite@uha.fr*

Keywords. bio-nanocomposites, poly(3-hydroxyButyrate-co-3-hydroxyHexanoate), zinc oxide nanoparticles, viscoelastic properties, tensile properties

Abstract.

PHAs have recently attracted considerable interest for a variety of applications ranging from medicine, tissue engineering and agriculture to nanocomposites and packaging [1]. The main limitations of PHAs to extend their industrial applications are mainly high thermal sensitivity and low mechanical resistance. To overcome these drawbacks, poly(3-hydroxybutyrate-co-3-hydroxyhexanoate) (PHBHHx) has been developed as a block copolymer with ductile nature and wider processing window compared with other PHAs [2]. On the other hand, the incorporation of inorganic nanoparticles is an efficient strategy to enhance the properties of polymer materials. In this paper, tensile and viscoelastic properties of PHBHHx/ZnO nanoparticles (NP) nanocomposites prepared by melt compounding at 1.5; 3 and 6 wt.% were investigated. Through a study of the comprehension of structure-properties relationships with respect to filler content, the optimized PHBHHx/ZnO composition was determined. The study revealed that the incorporation of ZnO-NP led to improved tensile and viscoelastic properties overall the composition range, being however, much higher at 3 wt.%. Nevertheless, the increase in both modulus and $\text{Tan}\delta$ observed at 3 wt.% was detrimental to flexibility and toughness compared with PHBHHx and PHBHHx/ZnO filled at 1.5 wt.%.

1. A.M. Diez-Pascual. *Int. J. Comp. Meth. and Exp. Meas.* 5, 2017, 713–722

2. N. Dehouche, C. Idres, M. Kaci, I. Zembouai, S. Bruzard. *Polym. Degrad. Stab.* 175, 2020, 109131.