PJ7) Poly(3-hydroxybutyrate-co-3-hydroxyvalerate)/Graphene Oxide Nanocomposite Films: Thermomechanical Properties, Oxygen Tranasmission Rates, and Hydrolytic Degradation

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1. Introduction

Poly(hydroxylalkanoates) (PHAs) produced as internal carbon and energy storage materials by bacteria grown under nutrient-limited growth conditions are biodegradable polymers based on renewable resources. Besides being enzymatically degradable, PHAs possess good mechanical properties that are often compared favorably to petroleum–based thermoplastics. Among PHAs, poly(3-hydroxybutyrate) **(**PHB) is the most studied. Even though the physical properties of PHB are very close to those of polypropylene (PP), brittle nature and the narrow thermal processing window of PHB limit its application. To overcome these drawbacks, poly(3-hydroxybutyrate-*co*-3-hydroxyvalerate) (PHBV) was developed. Also, PHBV nanocomposites containing functionalized graphenes showed improved crystallinity, significantly enhanced conductivity and acceleration of the bio-disintegration process in compositing conditions. The change in the surface morphology and weight of PHBV/graphene oxide (GO) nanocomposite films with hydrolytic degradation time was examined**.**

2. Materials and Methods

Graphite oxide (GO) was synthesized from graphite powder by the modified Hummers method. For the preparation of PHBV/GO nanocomposite films, GO was dispersed in chloroform with stirring for 12 h, followed by ultrasonication for 30 min. PHBV was dissolved in chloroform at 60°C with stirring for 2 h. GO Solution was poured into the PHBV solution, and stirring was continued for 2 h. Then, the mixture was sonicated for 30 min to make a well dispersed suspension and cast.

3. Results and Discussion

In this study, poly(3-hydroxybutyrate-*co*-3-hydroxyvalerate) (PHBV)/grapheme oxide (GO) nanocomposite films containing various content of GO were prepared using solution casting method. The effect of GO content on Young's modulus and dispersion of GO in PHBV matrix was investigated. Also, the thermomechanical properties, oxygen transmission rates and hydrolytic degradation of PHBV/GO nanocomposite films were studied. The addition of 5 wt% GO into PHBV improves the Young's modulus by 38% and decreases thermal expansion coefficient by 29%. The improvement can be mainly attributed to good dispersion of GO and interfacial interactions between PHBV and GO. Furthermore, PHBV/GO nanocomposite films show good oxygen barrier properties. Hydrolytic degradation of PHBV/GO nanocomposite films took place more slowly with increasing GO amounts. Therefore, the rates of hydrolytic degradation of PHBV can be controlled using GO. PHBV/GO nanocomposite films have potential applications in packaging films.