

FABRICATION OF POLYCAPROLACTONE (PCL) GRAPHENE NANOCOMPOSITES BY SOLUTION INTERCALATION

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ABSTRACT

Polycaprolactone (PCL), a biodegradable polymer with poor properties, such as low glass transition temperature, low mechanical property and high permeability, restrict to use in wide range of applications. In this study, PCL hybrids with different weight percentage of graphene nanofiller by solution intercalation technique and investigated their performance in photodegradation, chemical degradation and barrier properties. PCL/graphene nanocomposite was fabricated by using chloroform as solvent and characterized by Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD) and Field Emission Scanning Electron Microscopy (FESEM). The characterization results revealed that nanocomposites with 0.01 wt% and 0.05 wt% of graphene show better exfoliation and intercalation with PCL matrix. Weathering test was carried out by using Accelerated Weathering Tester to indicate the photodegradable properties of nanocomposite. The result shows that the additional of graphene to PCL matrix will not affect the initial photodegradable ability of PCL. Chemical degradation test conducted by using 10% hydrochloric acid and 10% sodium hydroxide. PCL with 0.05 wt% of graphene possessed the best chemical resistance towards acid and basic conditions. Water vapour permeability test was used to predict the barrier properties. All nanocomposite samples show significant improvement in reduce the permeability especially the addition of 0.05 wt% graphene is able to reduce up to 80% of PCL permeability. PCL reinforced with graphene nanofiller at 0.05 wt% loading show a better improvement in all tested properties, while nanocomposite with 0.10 wt% of graphene presented poorer result due to the agglomeration of graphene.

Keywords: Polycaprolactone (PCL); Graphene; Solution intercalation; Degradation; Permeability