

Synthesis of poly (3-hydroxybutyrate-co-4 hydroxybutyrate)/chitosan/silver nanocomposite material with enhanced antimicrobial activity

Abstract

This work aims to shed light in the fabrication of poly(3-hydroxybutyrate-co-44%-4-hydroxybutyrate)[P(3HB-co-44%4HB)]/chitosan-based silver nanocomposite material using different contents of silver nanoparticle (SNP); 1-9 wt%. Two approaches were applied in the fabrication; namely solvent casting and chemical crosslinking via glutaraldehyde (GA). A detailed characterization was conducted in order to yield information regarding the nanocomposite material. X-ray diffraction analysis exhibited the nature of the three components that exist in the nanocomposite films: P(3HB-co-4HB), chitosan, and SNP. In term of mechanical properties, tensile strength, and elongation at break were significantly improved up to 125% and 22%, respectively with the impregnation of the SNP. The melting temperature of the nanocomposite materials was increased whereas their thermal stability was slightly changed. Scanning electron microscopy images revealed that incorporation of 9 wt% of SNP caused agglomeration but the surface roughness of the material was significantly improved with the loading. Staphylococcus aureus and Escherichia coli were completely inhibited by the nanocomposite films with 7 and 9 wt% of SNP, respectively. On the other hand, degradation of the nanocomposite materials outweighed the degradation of the pure copolymer. These bioactive and biodegradable materials stand a good chance to serve the vast need of biomedical applications namely management and care of wound as wound dressing.