

Effect of synthesis temperature on the size of ZnO nanoparticles derived from pineapple peel extract and antibacterial activity of ZnO–starch nanocomposite films

ABSTRACT

This research investigated the effect of synthesis temperature on the size and shape of zinc oxide (ZnO) nanoparticles (NPs) synthesized using pineapple peel waste and antibacterial activity of ZnO NPs in starch films. Zinc oxide NPs synthesized at different temperatures were characterized by Fourier transform infrared spectroscopy, X-ray diffraction analysis, field-emission scanning electron microscopy, energy-dispersive X-ray spectroscopy, and transmission electron microscopy. Micrographs of ZnO NPs synthesized at 28 and 60 °C showed that synthesis temperature affected the sizes and shapes of ZnO NPs. The non-heated (28 °C) condition resulted in NPs with diameters in the range of 8–45 nm with a mixture of spherical and rod shapes, whereas the heated (60 °C) condition led to NPs with diameters in the range of 73–123 nm with flower rod shapes. The ZnO–starch nanocomposite films incorporated with 1, 3, and 5 wt.% ZnO NPs were prepared via a film casting method. The antibacterial activity of the films against Gram-positive and Gram-negative bacteria was investigated using the disc diffusion method. The results showed an increase in the inhibition zone for Gram-positive bacteria, particularly *Bacillus subtilis*, when the concentration of ZnO NPs incorporated in the film was increased from 1 to 5 wt.%.

Keyword: Pineapple peel; Synthesis temperature; ZnO NPs; Starch; Nanocomposite films