USE OF METALLIC AND BIMETALLIC NANOPARTICLES AS CONSTITUENTS OF ACTIVE BIO-BASED FILMS

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Body

The use of bio-based packaging materials containing metallic and bimetallic nanoparticles is relatively modern technology. In this sense, the food packaging industry has been investigating biological and renewable resources that can replace petroleum-based materials to reduce the environmental impact and at the same time, include new functionalities using nanotechnology. Therefore, the main objective of this work was to develop bio-based poly-lactic acid (PLA) films with Zinc (Zn) and Zinc-Iron (Zn-Fe) nanoparticles (NPs), deposited by magnetron sputtering, and evaluate their effect on the structural and functional properties of the films when the NPs are oxidized to be exposed at 60 % and 96 % relative humidity (RH). The morphology and elemental analysis of the samples were determined by scanning (transmission) electron microscopy (SEM and STEM), and Inductively Coupled Plasma (ICP). The structure of the PLA was monitored before and after NPs oxidation by Fourier transform infrared spectroscopy (FTIR) analysis, and the antimicrobial and color assays were performed by using the zone of inhibition (ZOI) test and a Minolta colorimeter, respectively. Finally, the films were correlated in terms of the deposit conditions, Zn or Zn-Fe concentrations, and thickness.

The results revealed PLA films with different morphologies, compositions, and sizes of Zn or Zn-Fe NPs. The samples showed a significant antibacterial and antifungal activity against *E. coli, P. aeruginosa, P. fluorescens, S. aureus,* and *A. niger*, and changes of color and opacity for the samples with the smaller thickness when stored at 95 % relative humidity. On the other hand, when the Fe in the films increases, the luminosity of the films decreased as well as their antibacterial activity when compared to the films with pure Zn. Hence, these findings are relevant to the food packaging field since intelligent and active films with multiple properties can be developed.

Palavras-chave : packaging materials