

Title: Antimicrobial Activity in Polymeric Films with Different Concentrations of Silver Nanoparticles

Authors: Sabrina da Costa Brito^{ab*}, Joana D. Bresolin^b, Kátia Sivieri^a, Marcos David Ferreira^b

Institution: ^a Universidade Estadual Paulista “Júlio de Mesquita Filho” (UNESP), Rodovia Araraquara Jaú, Km 01, Araraquara, SP, 14800-903, Brasil

^b EMBRAPA Instrumentação, Rua XV de Novembro, 1452, Caixa Postal 741, São Carlos, SP, 13560-970, Brasil

Abstract:

Microbiological contamination may occur during post-harvest or during the processing of fruits and vegetables, resulting in changes in the nutritional, sensory quality and risk of foodborne illness, therefore, technological innovations in efficient packaging with the purpose of optimizing the prevention of microbiological contaminations is an important option for food safety and reducing food losses. In this context, characterization and evaluation of the antimicrobial effect of low-density polyethylene (LDPE) films incorporated with silver nanoparticles (AgNPs) in different concentrations, 1.50, 15.00 and 75.00 parts per million (ppm), was performed in this research. The films were characterized by Scanning Electron Microscopy, Fourier-Transform Infrared Spectroscopy, X-Ray Diffraction, Thermogravimetry, and Differential Scanning Calorimetry. It was observed, through these analyzes that AgNPs addition into LDPE did not influence the physicochemical and thermal properties of the studied films. The antimicrobial activity of the films was evaluated through Direct Contact and Shake Flask assays in Gram-positive bacteria *Staphylococcus aureus* and Gram-negative *Escherichia coli*. According to the results, the addition of AgNPs into LDPE promoted antimicrobial properties against the microorganisms studied at the lowest concentration, 1.50 ppm, although more remarkably for Gram-negative bacteria (71.29%) than for Gram-positive bacteria (53.71%), besides that, through the Shake Flask assays it was verified that nanostructured films helped in reducing the bacterial growth rate, as observed in the decrease of the bacteria concentration at the stationary phase and the extension of lag phase (hours). These results suggest that LDPE films added with AgNPs have the potential for use in food packaging, contributing significantly to the quality and safety of food.

Keywords: Polyethylene, Silver Nanoparticles, Antimicrobial, Food Packaging.

Development Agency: The authors thank CAPES for granting the master's degree and Unesp and Embrapa for the support of this project.