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Polypropylene Matrix Enriched With Silver Nanoparticles From Banana Peel Extract For Antimicrobial Control Of E. coli and S. epidermidis To Maintain Fresh Food

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Abstract : Nanotechnology, a relatively new scientific field, addresses the manipulation of nanoscale materials and devices, which are governed by unique properties, and is applied in a wide range of industries, including food packaging. The incorporation of nanoparticles into polymer matrices used for food packaging is a field that is highly researched today. One such combination is silver nanoparticles with polypropylene. In the present study, the synthesis of the silver nanoparticles was carried out by a natural method. In particular, a ripe banana peel extract was used. This method is superior to others as it stands out for its environmental friendliness, high efficiency and low-cost requirement. In particular, a 1.75 mM $AgNO_3$ silver nitrate solution was used, as well as a BPE concentration of 1.7% v/v, an incubation period of 48 hours at 70°C and a pH of 4.3 and after its preparation, the polypropylene films were soaked in it. For the PP films, random PP spheres were melted at 170-190°C into molds with 0.8cm diameter. This polymer was chosen as it is suitable for plastic parts and reusable plastic containers of various types that are intended to come into contact with food without compromising its quality and safety. The antimicrobial test against Escherichia coli DFSNB1 and Staphylococcus epidermidis DFSNB4 was performed on the films. It appeared that the films with silver nanoparticles had a reduction, at least 100 times, compared to those without silver nanoparticles, in both strains. The limit of detection is the lower limit of the vertical error lines in the presence of nanoparticles, which is 3.11. The main reasons that led to the adsorption of nanoparticles are the porous nature of polypropylene and the adsorption capacity of nanoparticles on the surface of the films due to hydrophobic-hydrophilic forces. The most significant parameters that contributed to the results of the experiment include the following: the stage of ripening of the banana during the preparation of the plant extract, the temperature and residence time of the nanoparticle solution in the oven, the residence time of the polypropylene films in the nanoparticle solution, the number of nanoparticles inoculated on the films and, finally, the time these stayed in the refrigerator so that they could dry and be ready for antimicrobial treatment.

Keywords : antimicrobial control, banana peel extract, E. coli, natural synthesis, microbe, plant extract, polypropylene films, S.epidermidis, silver nano, random pp
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