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EVALUATION OF THE POTENTIAL OF BIOPLASTIC INCORPORATED WITH NANOMATERIALS AS PACKAGING WITH ANTIMICROBIAL ACTIVITY

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INTRODUCTION

The use of conventional plastics in packaging raises environmental concerns. Starch-based bioplastics are sustainable alternatives but have limitations like low mechanical strength and high moisture affinity. Incorporating silver nanoparticles (AgNPs) can enhance their properties and provide antimicrobial activity. This study evaluated the incorporation of AgNPs in starch-based bioplastics for potential application in active packaging.

MATERIAL AND METHODS

Bioplastics were developed from cassava starch, while AgNPs were synthesized using macroalgae extract as a reducing agent. Films with different AgNP concentrations (0, 10, 20, and 30% v/v) were created via the casting method and characterized using UV-Vis spectrophotometry, scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), and biodegradation tests in soil. Antimicrobial activity against phytopathogenic fungi was assessed in vitro. Statistical analysis involved ANOVA and Tukey's test ($p < 0.05$).

RESULTS

Spectrophotometric analysis confirmed AgNP formation with peaks at 432 nm. SEM showed fewer and smaller cracks in films with AgNPs, enhancing their structure. FTIR revealed no changes in the bioplastic's main chemical bonds. Biodegradation tests indicated full decomposition within 35 days, with slightly slower rates for films with AgNPs. Only films with 10% AgNPs showed the highest efficacy in inhibiting fungal mycelial growth.

CONCLUSIONS

The incorporation of AgNPs enhanced the structural properties of starch-based bioplastics, reduced cracks, and provided significant antimicrobial effects, especially in films with 10% AgNPs. The materials maintained acceptable biodegradation standards, making them promising for sustainable active packaging by combining functionality and environmental benefits.

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