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Formulation and Evaluation of Biodegradable Edible Coating from *Pleurotus ostreatus* Polysaccharides Integrated with Green-Synthesized Silver Nanoparticles for Postharvest Preservation

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INTRODUCTION & AIM

Background

Postharvest spoilage of fruits and vegetables leads to 30–50% losses globally due to moisture loss, microbial decay, and poor packaging [1,2].

Edible coatings made from natural biopolymers are gaining attention as eco-friendly alternatives to synthetic plastics [3].

Mushroom polysaccharides (from *Pleurotus ostreatus*) exhibit excellent film-forming, antioxidant, and antimicrobial properties, making them ideal candidates for coating development [4,5,6].

Innovation

Integration of food-safe silver nanoparticles (AgNPs) into mushroom-based matrices enhances mechanical strength, water barrier properties, and antibacterial activity.

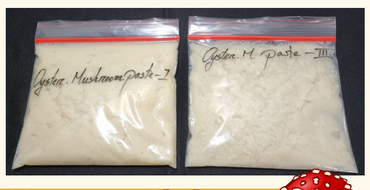
Applying these coatings on crops like tomato and guava can significantly extend shelf-life and preserve nutritional and sensory quality compared to uncoated or plastic-wrapped samples.

Aim of the Study

This study aims to develop an eco-friendly, mushroom-based edible coating enriched with food-safe nanoparticles to extend the postharvest shelf-life of fruits and vegetables by providing a biodegradable, antimicrobial, and nutrient-preserving alternative to synthetic plastic packaging.

METHODOLOGY

01 Extraction of Mushroom Polysaccharides



02 Synthesis of Food-Safe Nanoparticles (AgNPs)

03 Film Characterization

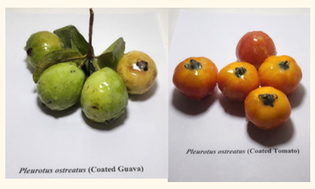
04 Coating Application on Fruits

05 Storage & Shelf-Life Study (14 Days)

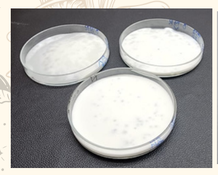
06 Sensory & Nutritional Quality

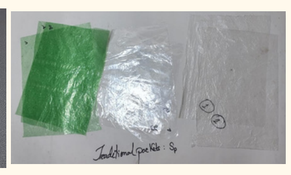
07 Comparison with Conventional Packaging

VS



08 Biodegradability & Safety Tests





VS

09 Statistical Analysis & Result Interpretation

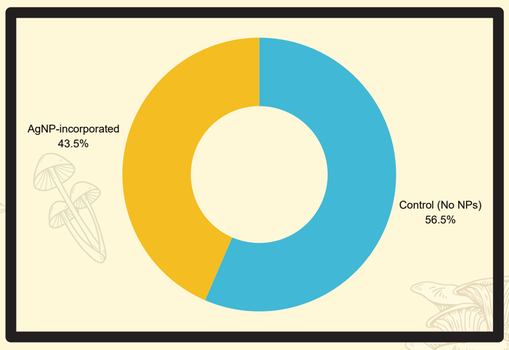
RESULTS

The mushroom-based polysaccharide extract produced a clear, viscous film-forming solution. Coatings dried uniformly into smooth, flexible films.

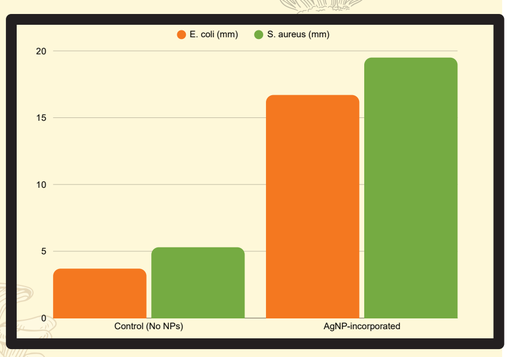
Pure polysaccharide films were transparent but brittle, whereas nanoparticle-incorporated films were more opaque and elastic.

Silver nanoparticles (AgNPs) were successfully synthesized and incorporated into the mushroom-based matrix. UV–Vis showed a ~420 nm peak, XRD confirmed crystalline AgNPs, and SEM revealed uniform nanoparticle dispersion without agglomeration.

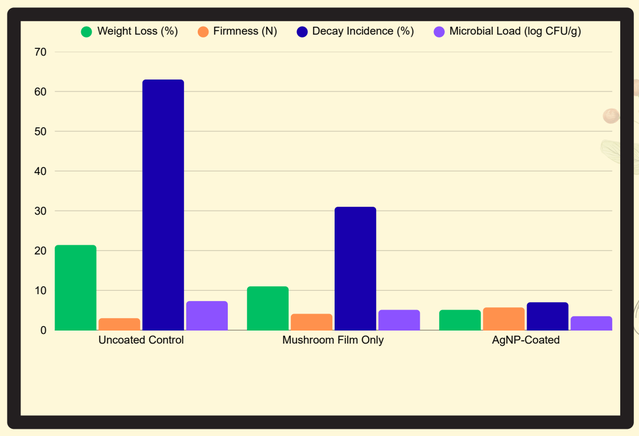
Mechanical and Barrier Properties of Films



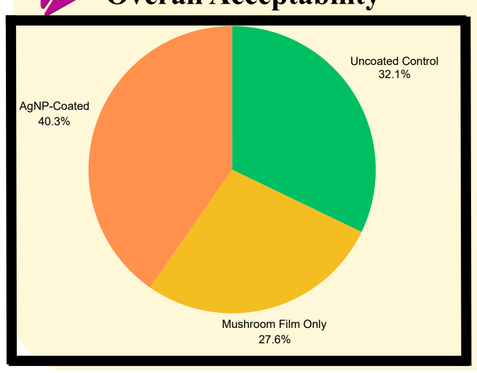
Antimicrobial Activity (Zones of inhibition in mm)



Shelf-Life Evaluation on Day 14 (Tomatoes & Guavas)



Overall Acceptability



Comparison with Conventional Packaging

Packaging Type	Decay Incidence (%)	Microbial Load (log CFU/g)	Sensory Score
Polyethylene Wrapped	23	6.6	4.6
Mushroom + AgNP Film	7	1.6	8.2

CONCLUSION

Mushroom (*Pleurotus ostreatus*)-based edible coatings incorporated with silver nanoparticles (AgNPs) effectively enhanced mechanical strength, barrier, and antimicrobial properties. When applied to tomatoes and guava, the coating significantly reduced weight loss, decay, and microbial load while preserving firmness, nutrition, and sensory quality. Compared to polyethylene packaging, the films showed superior preservation and biodegradability, demonstrating strong potential as a sustainable, food-safe alternative for postharvest shelf-life extension.

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