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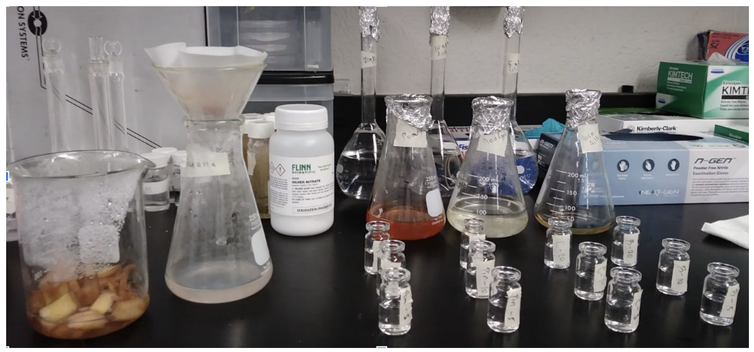
Green Synthesis of Silver Nanoparticles (AgNPs) Utilizing Fruit Wastes' Peel, Pulp, Pomace, & Silk

National Science Foundation

INTRODUCTION

- Municipal solid waste is a challenging environmental concern.
- Utilizing fruit wastes as sources of bioactive chemicals may therefore have significant economic advantages and is increasingly attractive in terms of the future environmental sustainability (Deng et al., 2012).
- Anchored to the green chemistry principles, this research is to develop and design a green approach in synthesizing silver nanoparticles (AgNPs) by utilizing the phytochemical contents of the non-edible parts (peel, pulp, pomace, & silk) of the different fruits.

MATERIALS & PREPARATION



EXPERIMENTAL DESIGN

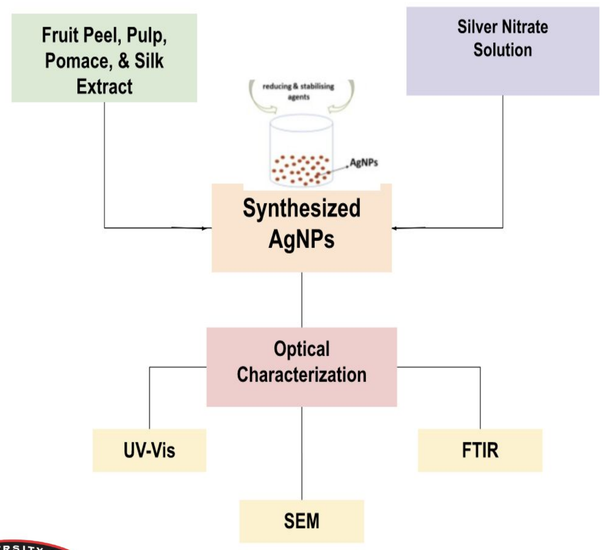
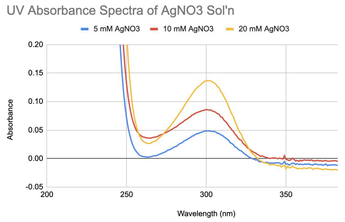
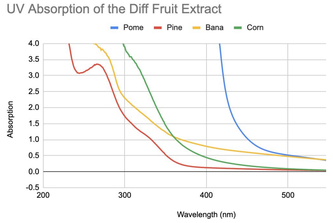


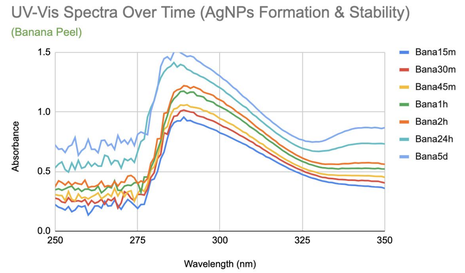
Figure 1: Green Synthesis Schematic Diagram

RESULTS AND DISCUSSION

UV-Vis Absorbance

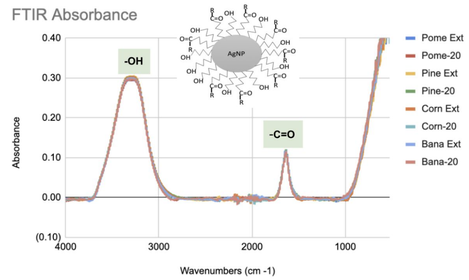




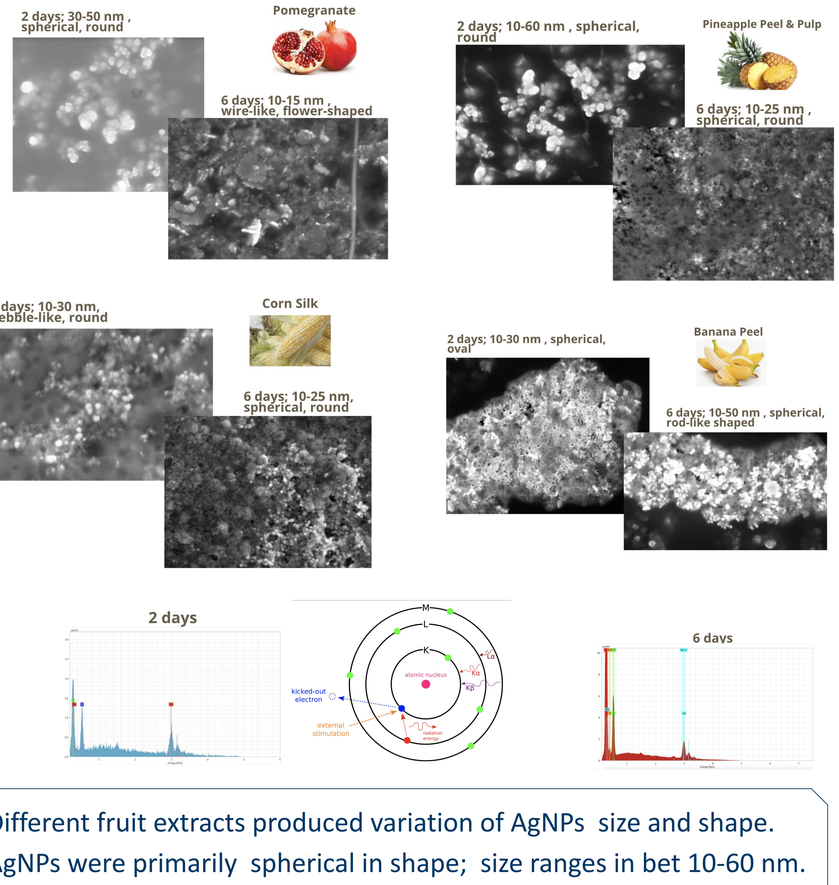


- The absorbance-concentration relationship of $AgNO_3$ is consistent with Beer-Lambert's Law.
- Different fruit extract exhibited different concentrations.
- Changes in the absorbance over time is indicative of the formation & stability of AgNPs.

FTIR Absorbance



SEM AgNPs (Fruit Extract in 20 mM $AgNO_3$)



- Different fruit extracts produced variation of AgNPs size and shape.
- AgNPs were primarily spherical in shape; size ranges in bet 10-60 nm.
- The longer the Incubation period , AgNPs gave more distinctive features.
- Green synthesized AgNPs demonstrated stability.

Green Synthesis of AgNP

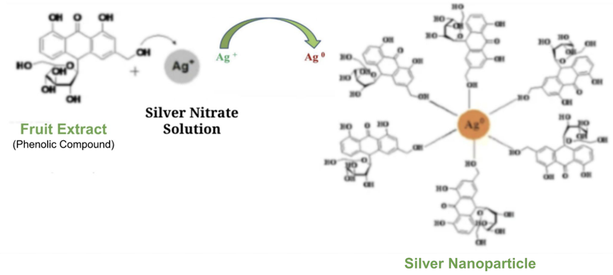


Figure 2. Green Synthesis of AgNP

CONCLUSION

- The biosynthesis of AgNPs was successfully achieved from the reaction of $AgNO_3$ and the aqueous fruit extract of the non-edible parts of pomegranate, pineapple, corn, and banana.
- Fruit wastes contain bioactive components, particularly the phenolic compounds which acted as reducing, capping, and stabilizing agents in synthesizing the silver nanoparticles (AgNPs).
- Green synthesis is fast, safer, eco-friendly, sustainable, & cost-effective.

FUTURE WORK

- Further exploration of the optimization of other synthesis parameters such as temperature, ratio, and the pH of the mixture.
- Use different parts of the plants in synthesizing other metal nanoparticles.
- Design & promote authentic inquiry-based learning project.

CURRICULUM ELEMENT

- Green Chemistry Principles
- Environmental Sustainability/Waste Management
- Integration and application of nanomaterials and natural products in the real-world problems
- Improve students' chemistry learning experiences & generate attitudinal shifts toward future sustainability

Acknowledgements: The author gratefully acknowledges Dr. Isabel Lloyd and the whole team; the Graduate Research Assistants/Radiation and Polymer Science Laboratory Team; the Maryland Energy Innovation Institute; The Materials Science and Engineering Department at the University of Maryland; Maryland Nanocenter AIM LAB; and NSF Grant DMR2149982; REU/RET Site: Summer Research Experiences in Renewable and Sustainable Energy Technology (ReSET).