SYNTHESIS OF BIOGENIC SILVER NANOSTRUCTURES FROM ECUADORIAN PLANT EXTRACTS

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Introduction

- Nanomedicine is a discipline that deals with the application of nanotechnology to achieve innovation in healthcare (). Biologically-synthesized nanomaterials are of special interest as they display improved biocompatibility, a key characteristic for their application in the biomedical field.
- Plants, their fruits, leaves, roots, flowers are a rich source of phytochemicals, including polyphenols, tannins, and flavonoids that can be used for the green synthesis of nanomaterials.
- Silver nanoparticles (AgNPs) are one of the most studied metallic nanomaterial. AgNPs display interesting optical properties due to the Surface Plasmon Resonance (effect). In short, AgNPs can absorb light very efficiently, which in turn can be used for optical applications, as they are very cheap to produce.

Methodology

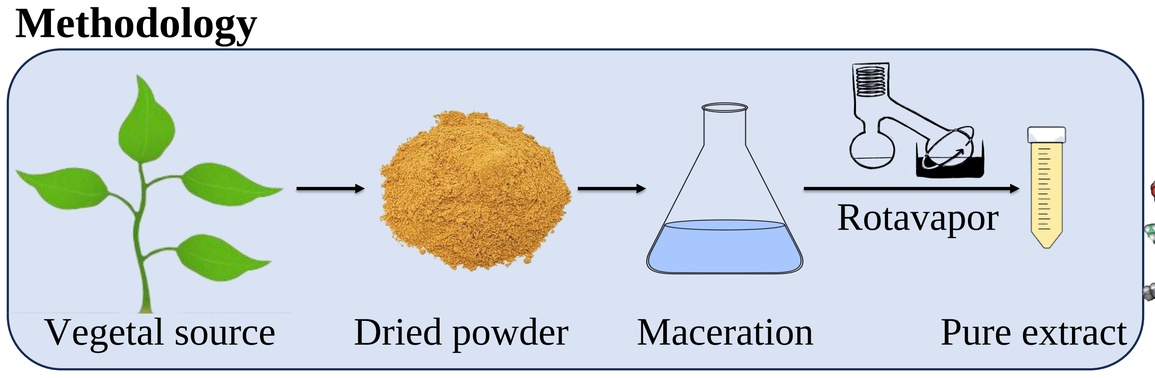

Fig 1. Schematics showing the extraction of phytochemicals

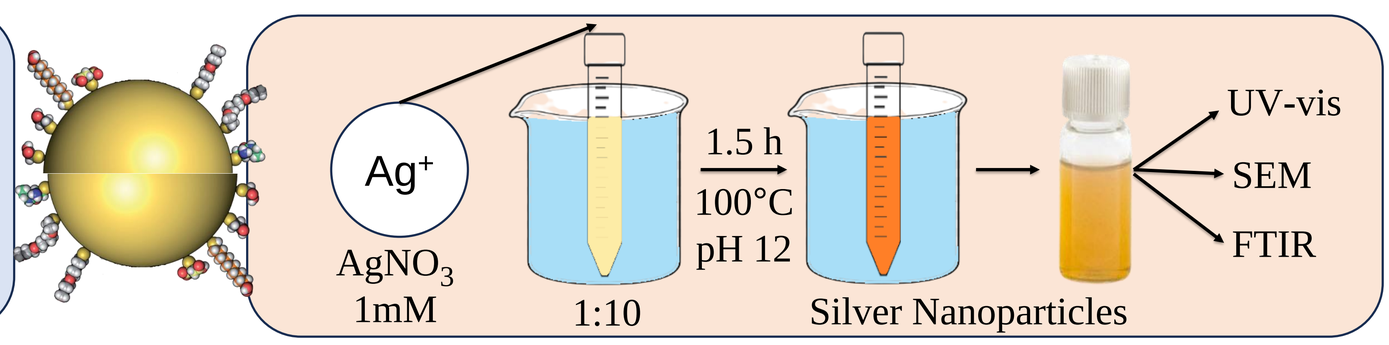

Fig 2. Schematics showing the procedure of green synthesis of AgNPs.

Results and Discussion

FTIR spectra showed a notable peak at 3324 cm-1 corresponding to -OH groups that could be attributed to the polyphenols present in the extract. The sharp band of 1639 cm-1 in the extract could be assigned to the amide I band.

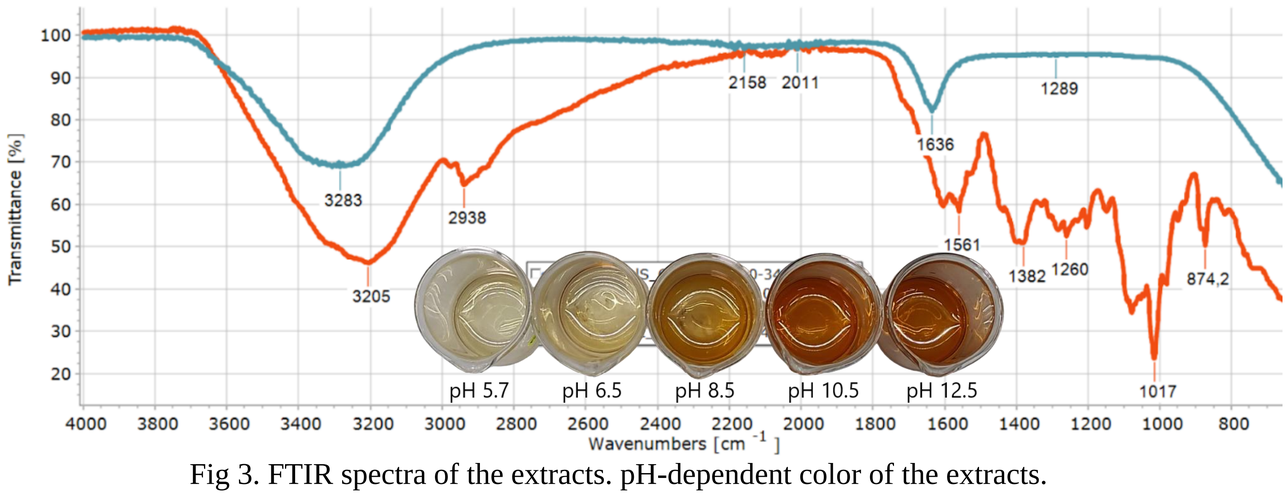

Fig 3. FTIR spectra of the extracts. pH-dependent color of the extracts.

The UV-VIS peak at 420 nm confirmed the presence of AgNPs from the start of the reaction, and the peak intensity remained unchanged after one month of storage, demonstrating the stability of the AgNPs as formed.

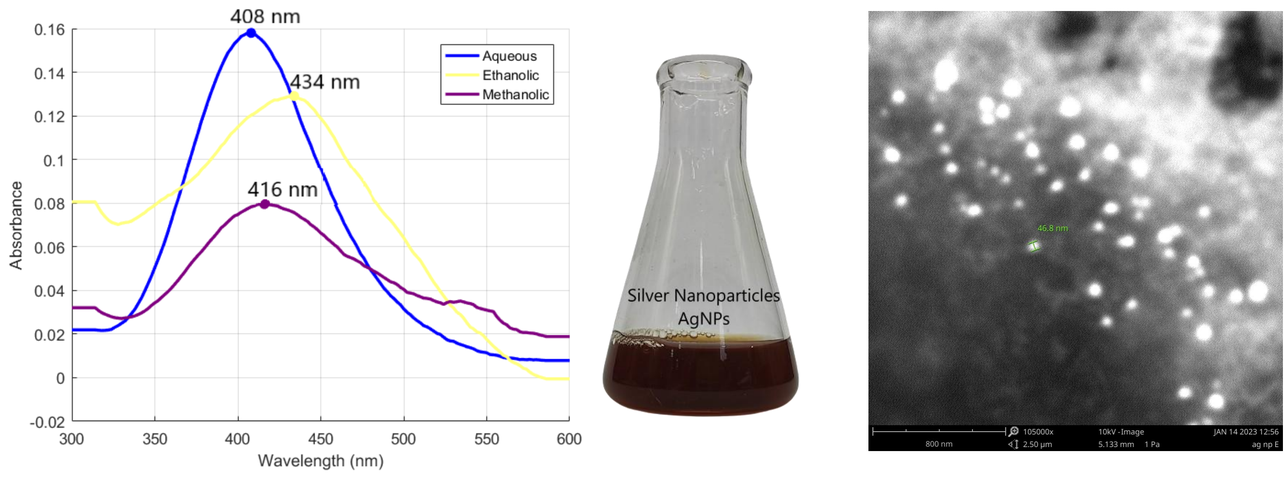

Fig 4. UV-vis spectra of the as-synthesized AgNPs. Colloidal solution of AgNPs and SEM image showing the shape and size of AgNPs

SEM analysis showed spherical nanoparticles with different sizes ranging from 40 to 100 nm. Due to the size of the AgNPs, it would be useful to perform a TEM analysis to increase the resolution of the image and to know in more detail the size and shape of the AgNPs.

Conclusions

Although visible wavelengths are necessary for normal vision, overexposure to HEV is harmful to human health. The AgNPs produced in this work show good levels of absorption of blue light. Moreover, the stability achieved here is a key characteristic for long-term applications. Therefore, the avocado-seed AgNPs produced in this work shows potential to be used in light filtration applications.

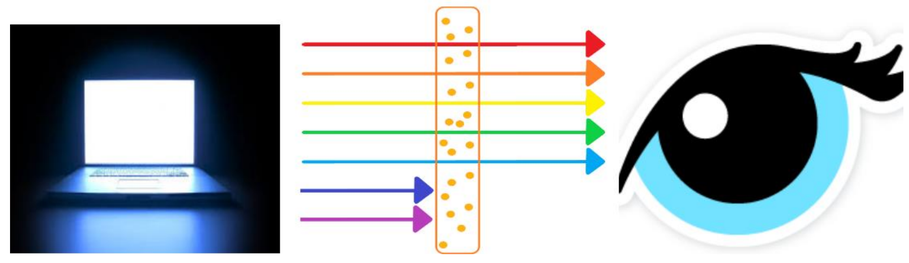

Fig 5. Proposed application. Taking advantage of AgNPs optical properties.

The phytomolecules present in the AV seed extract, such as polyphenols, tannins and flavonoids, play a vital role in the formation and stabilization of AgNPs.
Important parameters that influence biosynthesis are: 1) the preparation of the extract, 2) the temperature and time of formation of the nanoparticles, 3) the pH and 4) the concentration of the extract.

Outlook

In order to fully understand the AgNPs properties, it is very important to carry out a more comprehensive characterization of the biogenic AgNPs by other techniques. For example, Transmission Electron Microscopy (TEM) can be used to improve the resolution of the AgNPs images, Dynamic Light Scattering (DLS) can help to estimate the real size of the metallic core and the diameter of the capping agents covering the AgNPs, X-ray Photoelectron Spectroscopy (XPS) can help to estimate the chemical state, and electronic structure of the elements present in the as-synthesized silver NPs.

References

Colloids Interfaces 2022, 6, 74. **Green Chem**., 2017,19, 552-587. **R. Soc. A**, 2010368, 1333. **Philos Trans A Math Phys Eng Sci.** 2010, 368(1915):1333-83. **Results in Physics** 13 (2019) 102142. **Journal of Molecular Liquids** 368 (2022) 120638