



# Green synthesis of silver nanoparticles incorporated in alginate hydrogels using olive leaf extract as the reducing agent and crosslinker



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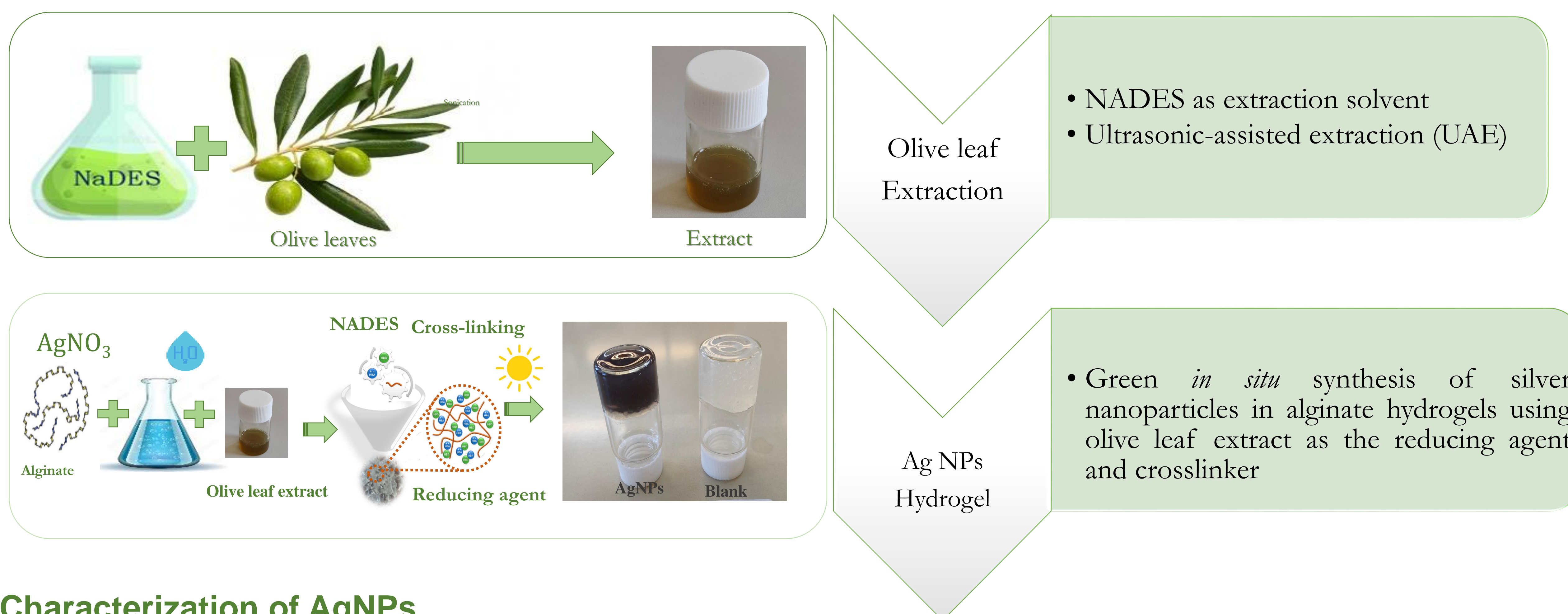
## Introduction

Silver nanoparticles (AgNPs) have been successfully utilized in biomedicine due to their antibacterial and antimicrobial activity. Green synthesis of nanoparticles using biological resources such as plants, bacteria, algae, and fungi is becoming a popular method for researchers. The phytochemical-mediated synthetic approach is a clean, effective, non-toxic, and environmentally-friendly viable approach for silver nanoparticle synthesis, to combat the problems associated with physical and chemical routes.

## Results & Discussion

### Green *in situ* synthesis of AgNPs within alginate hydrogel

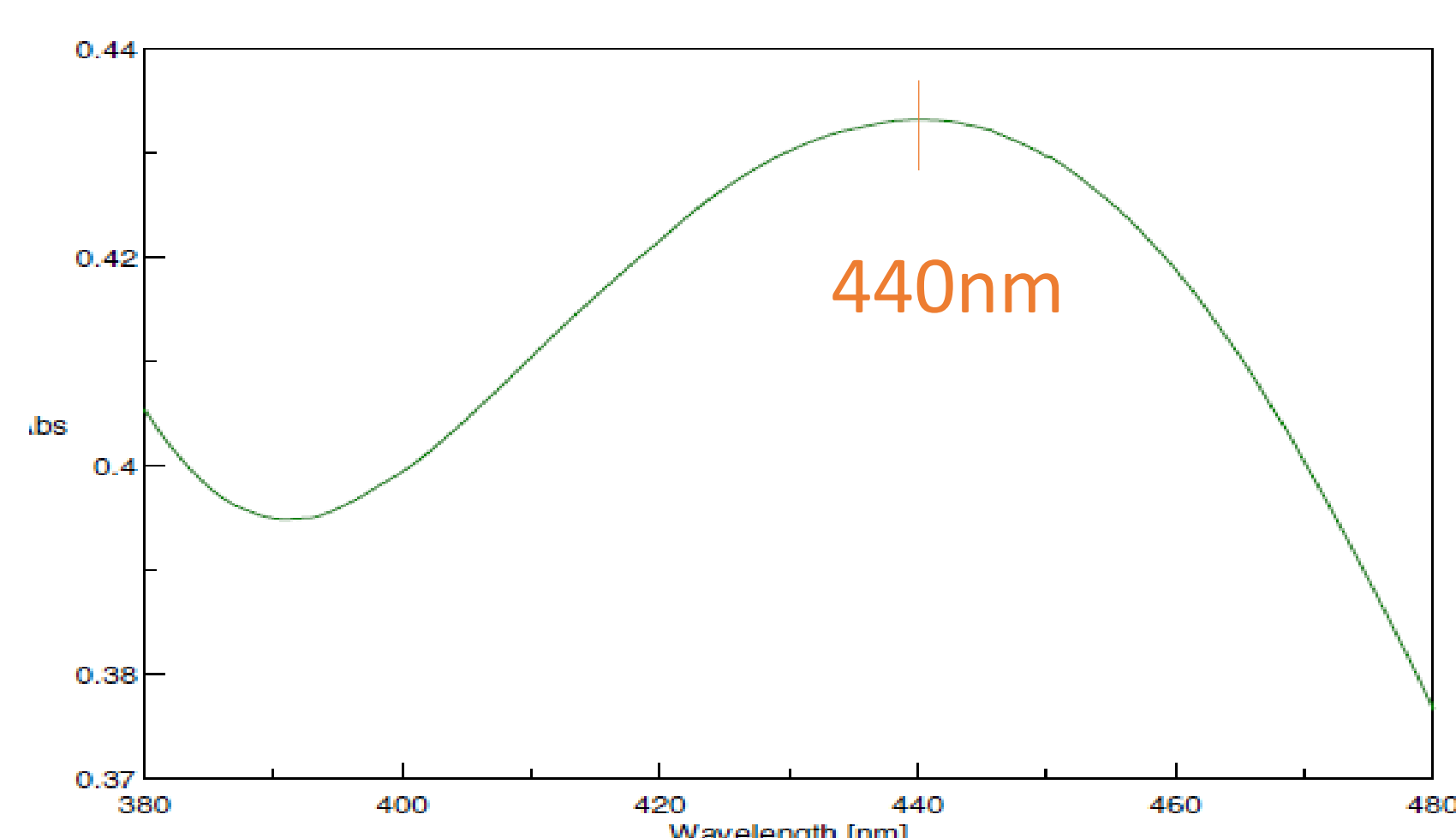
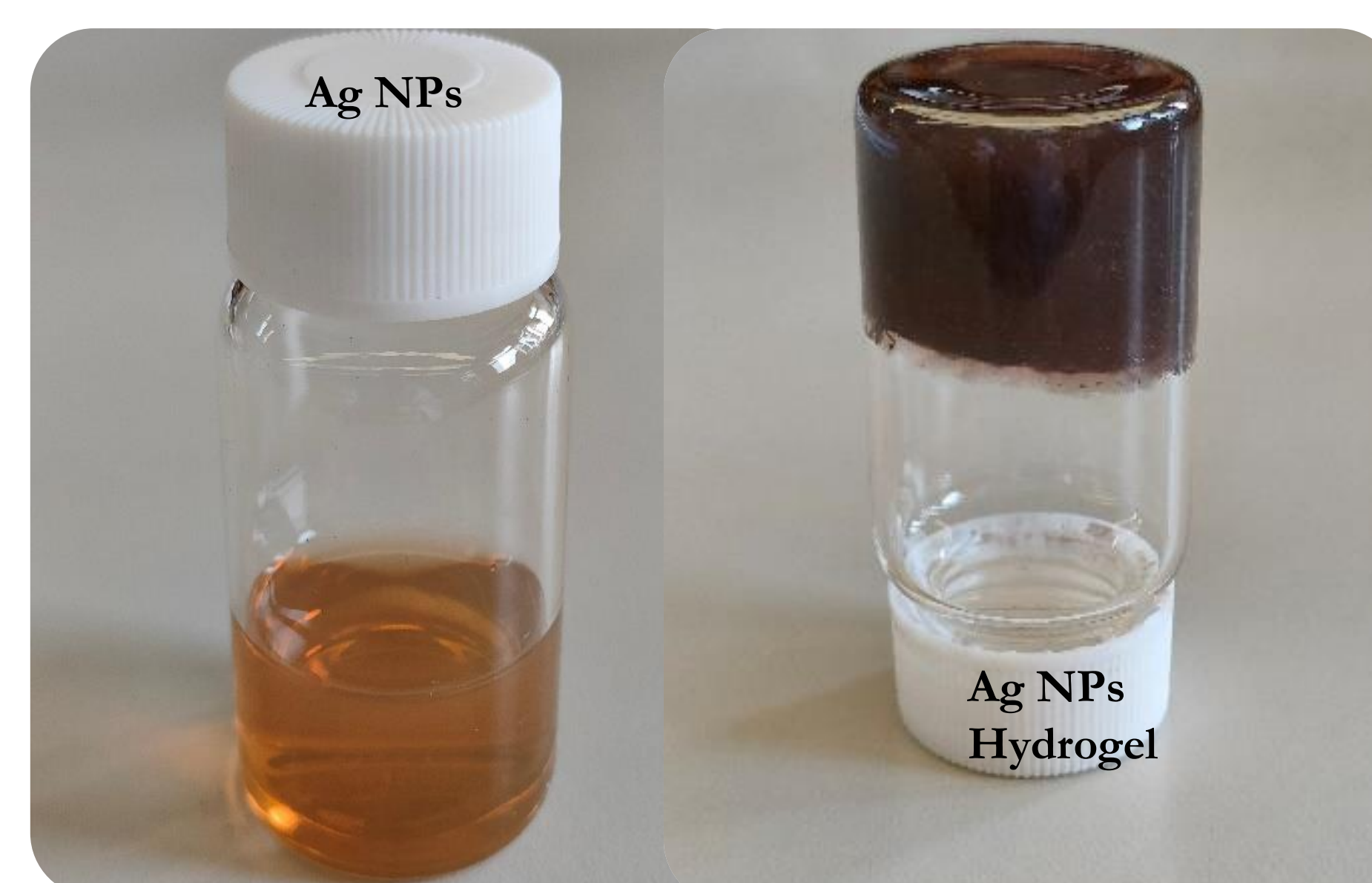
- ✓ **Natural Deep Eutectic Solvents (NADES)** were used as **extraction solvents**, in order to obtain an extract with high antioxidant activity, as **reducing agent** and as **crosslinker** for the formation of hydrogels



### Characterization of AgNPs

- ✓ The AgNPs were characterized using **DLS** and **UV-Vis spectroscopy**

Sample	Size (nm)	Polydispersity Index (PDI)	ζ-potential (mV)
AgNPs	76.8±4.5	0.493 ±0.097	-20 ±1.4
AgNPs Hydrogels	290.2±7.0	0.251±0.013	-36.9±0.9



The AgNPs were characterized by Ultraviolet-Visible (UV-Vis) spectroscopy exhibiting a peak at **440 nm** which was consistent with the spectra of **spherical AgNPs** within the wavelength range of 380–450 nm

## Conclusions

- ✓ **Olive leaf biowaste** was extracted using a **NADES** consisting of **glucose and lactic acid**
- ✓ The **extract** efficiently acted as the **reducing agent** for the formation of silver nanoparticles in alginate hydrogels in the presence of **visible light**
- ✓ This approach does not require the addition of a **crosslinking agent** because this role is fulfilled by the **NADES**
- ✓ The **formation of silver nanoparticles (AgNPs)** is monitored by recording the UV-Vis absorption spectra for surface plasmon resonance (SPR) peak at 440 nm
- ✓ The **zeta potential** and **PDI** values of AgNPs indicate increased **stability** of the AgNPs in the hydrogel matrix
- ✓ The photo-induced phytomediated ***in situ* synthesis of AgNPs** within a hydrogel is a **highly promising, economical and environmentally friendly** method for the preparation of multifunctional materials