

# SERS-application of Ag nanoparticles synthesized from bio-extracts

**Mazur N.V.<sup>1</sup>, Smirnov O.E.<sup>2,3</sup>, Kovalenko M.S.<sup>2</sup>, Dzhagan V.V.<sup>2</sup>, Yefanov V.S.<sup>1</sup>,  
Yeshchenko O.A.<sup>4</sup>, Dzhagan V.M.<sup>1,4</sup>, Yukhymchuk V.O.<sup>1</sup>**

<sup>1</sup> V. Lashkaryov Institute of Semiconductors Physics, National Academy of Sciences of Ukraine, Kyiv, Ukraine.

E-mail: [nazarmazur@isp.kiev.ua](mailto:nazarmazur@isp.kiev.ua)

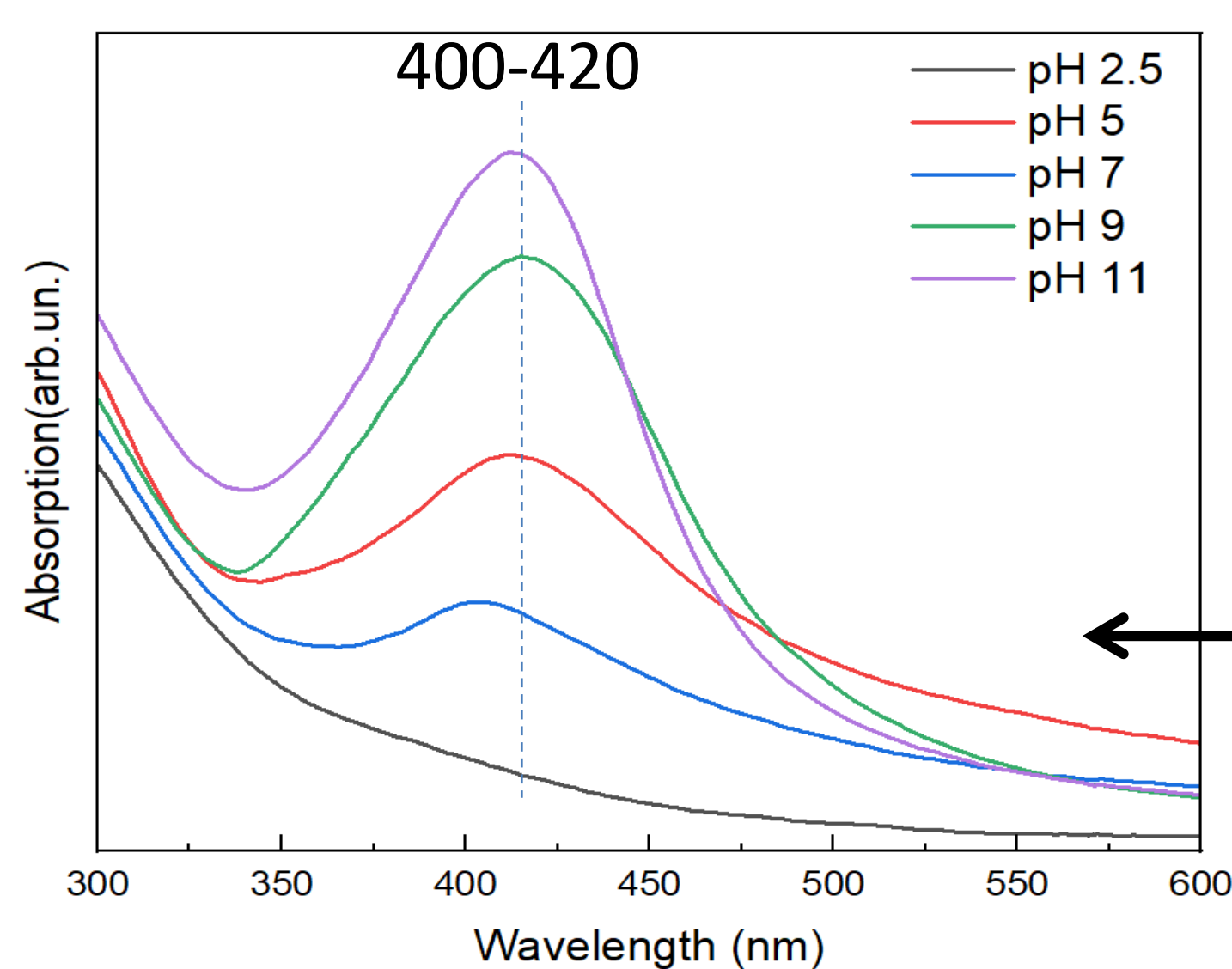
<sup>2</sup> ESC "Institute of Biology and Medicine", Taras Shevchenko National University of Kyiv, Kyiv, Ukraine

<sup>3</sup> Institute of Plant Physiology and Genetics, National Academy of Sciences of Ukraine, Kyiv, Ukraine

<sup>4</sup> Physics Department, Taras Shevchenko National University of Kyiv, Kyiv, Ukraine,

Long-standing intense research on synthesis and functionalization of Ag nanoparticles (NPs) is due to the unique combination of antibacterial, optical, electrical, and catalytic properties, stimulating various applications. Most progress is currently made in the area of anti-pathogen applications and applications based on localized surface plasmon resonance (LSPR), such as sensors and SERS-substrates (surface-enhanced Raman spectroscopy).

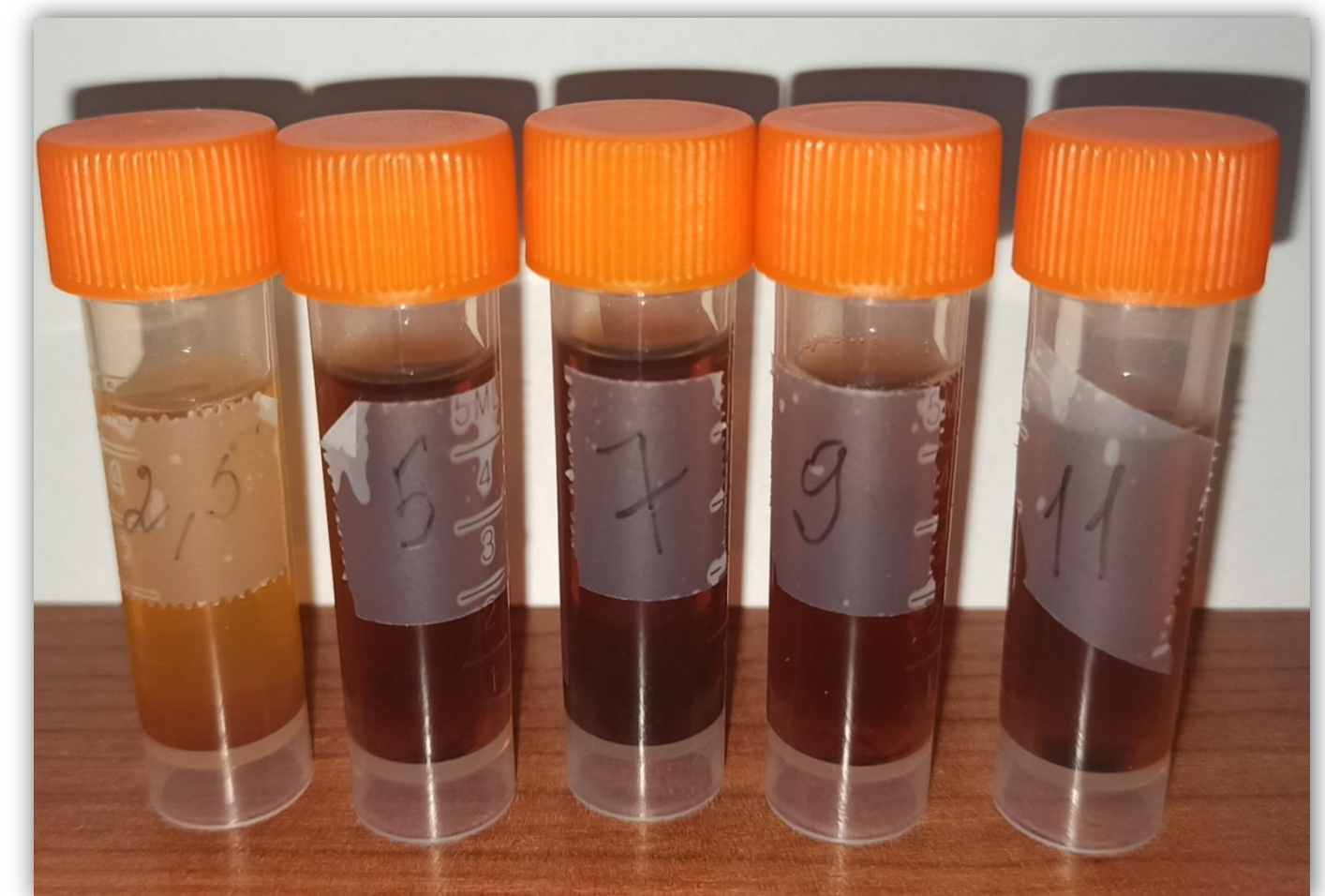
## UV-vis absorption spectra



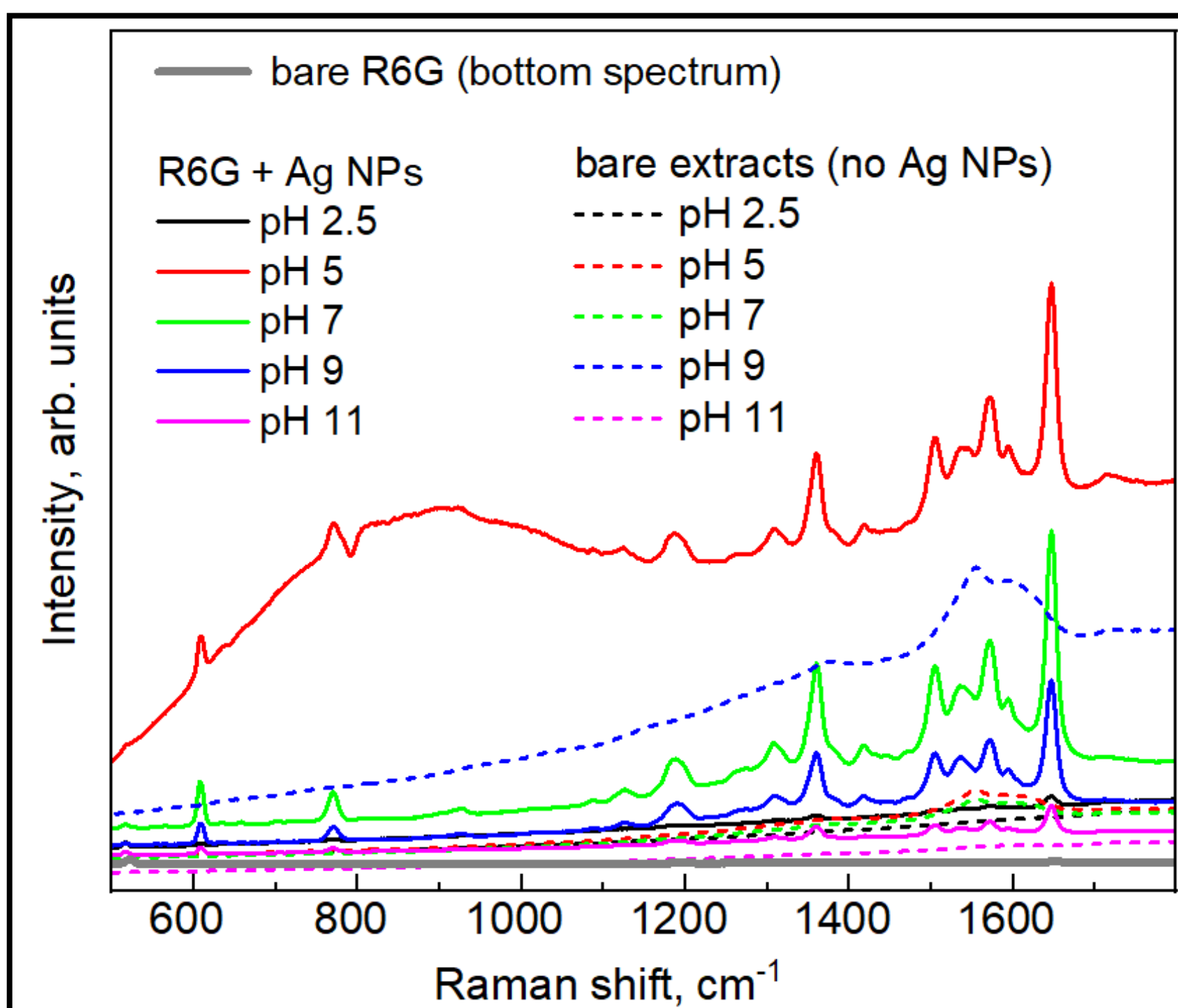
In this work, colloidal AgNPs were synthesized using aqueous extract of *Ganoderma lucidum* which is well known due to its wide applications in medicine.

Therefore these (mycosynthesized) AgNPs have an additional advantage in biomedical applications compared to AgNP synthesized by other methods.

Absorption band max ~400-420nm corresponds to **localized surface plasmon resonance** of AgNP



## Raman scattering spectra (SERS)

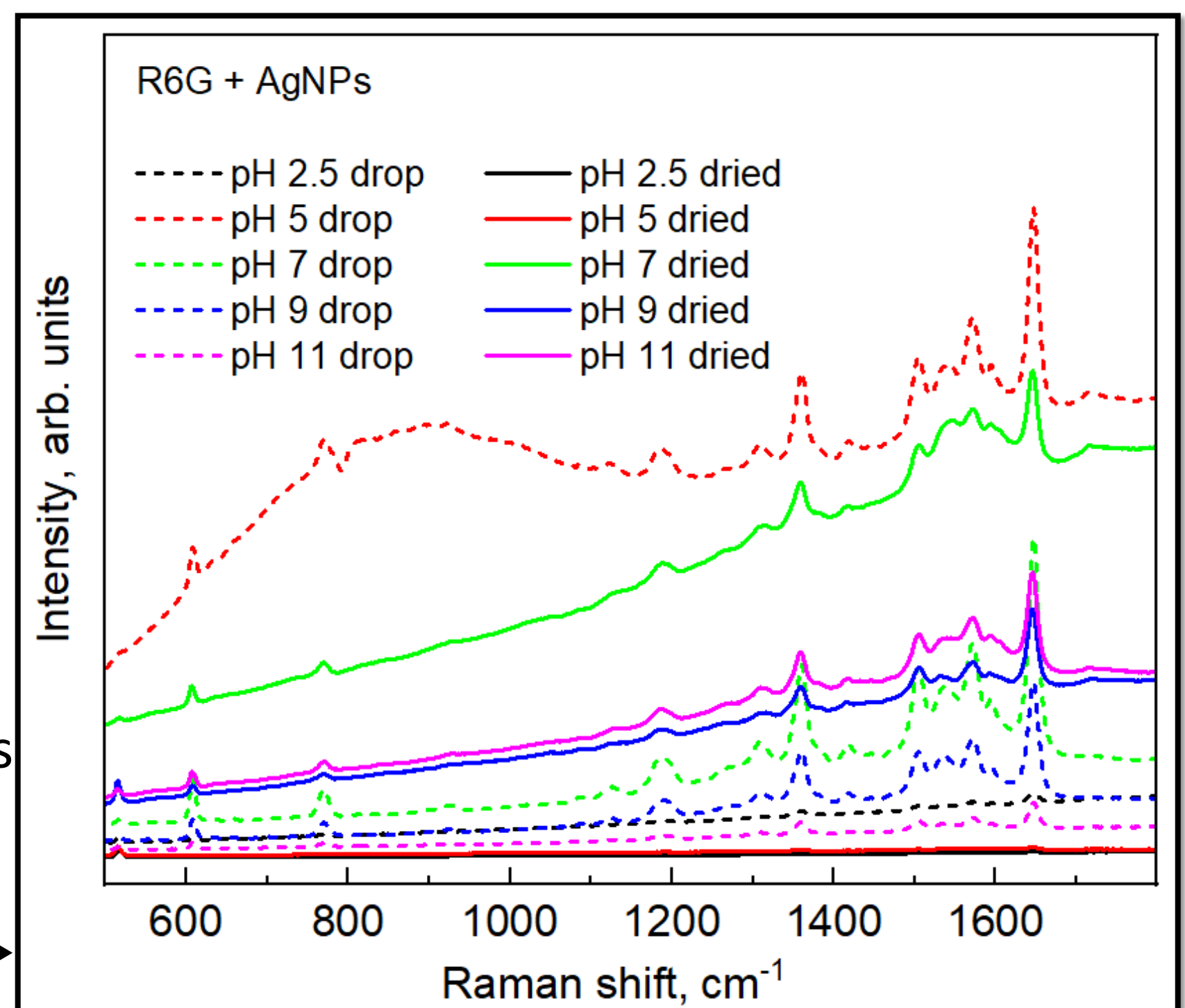


Rhodamine 6G ( $10^{-5}$  M) was used as an analyte molecule.

$\lambda_{\text{exc}} = 457\text{nm}$  – excitation into LSPR absorption band

← Comparison bare extract vs Ag NPs

Comparison solution (drop) vs dried →



## Conclusions

- Mycosynthesized Ag NPs, obtained using *Ganoderma lucidum* fruit body extract as the bioreducing and stabilizing agent, as a substrate for Surface-Enhanced Raman Scattering (SERS) were investigated.
- The NPs can be synthesized in a broad range of pH values, allowing a broad range of potential applications.
- Strong enhancement of Raman spectra of analyte (R6G) molecules indicates to a small thickness of the stabilizing layer on the Ag NP surface, which is advantageous for other applications of such NPs.
- We observe spectral effects that can be related to different adsorption geometry of the analyte molecule on the NP surface in different conditions, in particular, in solution and after drying the Ag NP/analyte composite on the substrate.

The work was funded by NRFU projects no. 2020.02/0204 (OS, VD, VY, NM) and no. 2020.02/0022 (OY).