

Surface-enhanced Raman spectroscopy of endosulfan pesticide on silver nanoparticle films fabricated by convective self-assembly

Norway grants

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ABSTRACT

The protection of water resources has been identified as top priority by the European Commission. Pesticides are among the most hazardous chemicals, resistant to environmental degradation, requiring strict monitoring. Surface-enhanced Raman spectroscopy (SERS) is one of the most versatile analytical techniques for the detection of chemicals at ultralow concentration, due to enhancement of the otherwise weak Raman scattering of molecules by coupling to plasmonic nanostructures. Here we report our results concerning the SERS characterisation of α -endosulfan (α -ES) pesticide on the surface of colloidal silver nanoparticle (AgNPs) films prepared by convective self-assembly (CSA). The chemically synthesized AgNPs and the assembled films are characterized by Uv-Vis spectroscopy and electron microscopy. SERS measurements of α -ES on bare or functionalized AgNPs are explored and analyzed in correlation with DFT calculations. These results constitute a step towards the development of dual SERS-electrochemical sensors for detection of pesticides in surface waters.

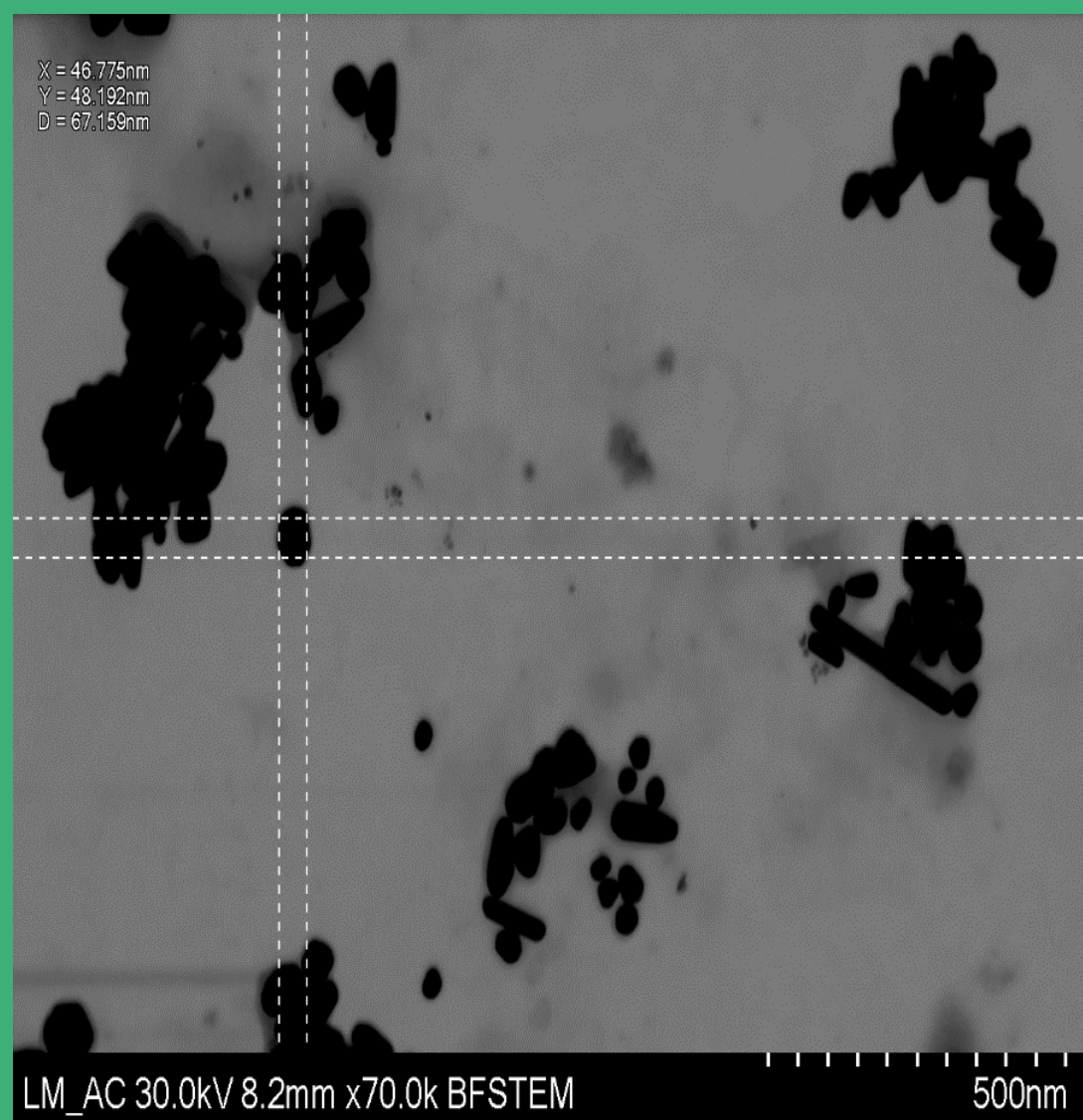
MATERIALS AND METHODS

I.1 Synthesis of colloidal Ag nanoparticles

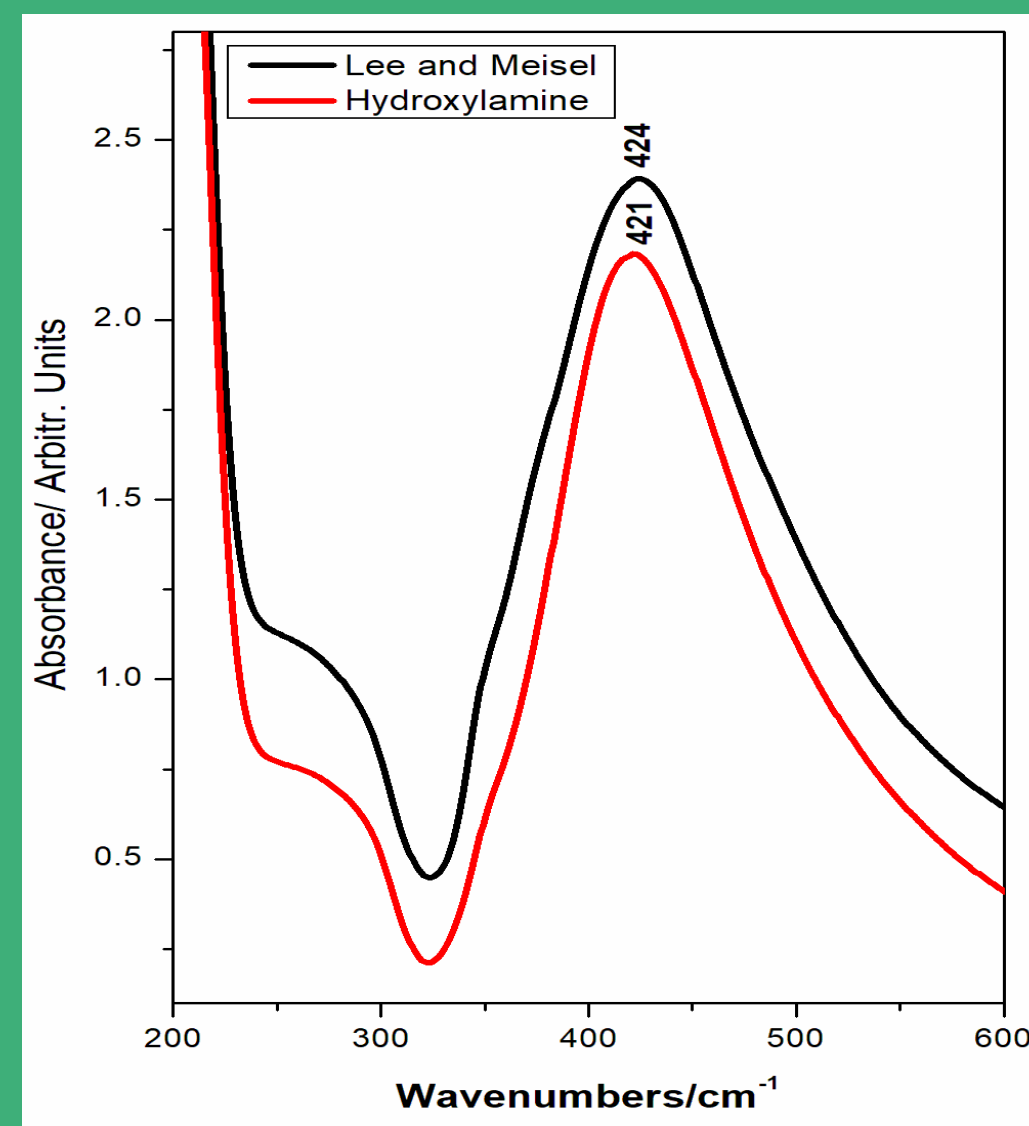
I.2 AgNP films by convective self-assembly (CSA)



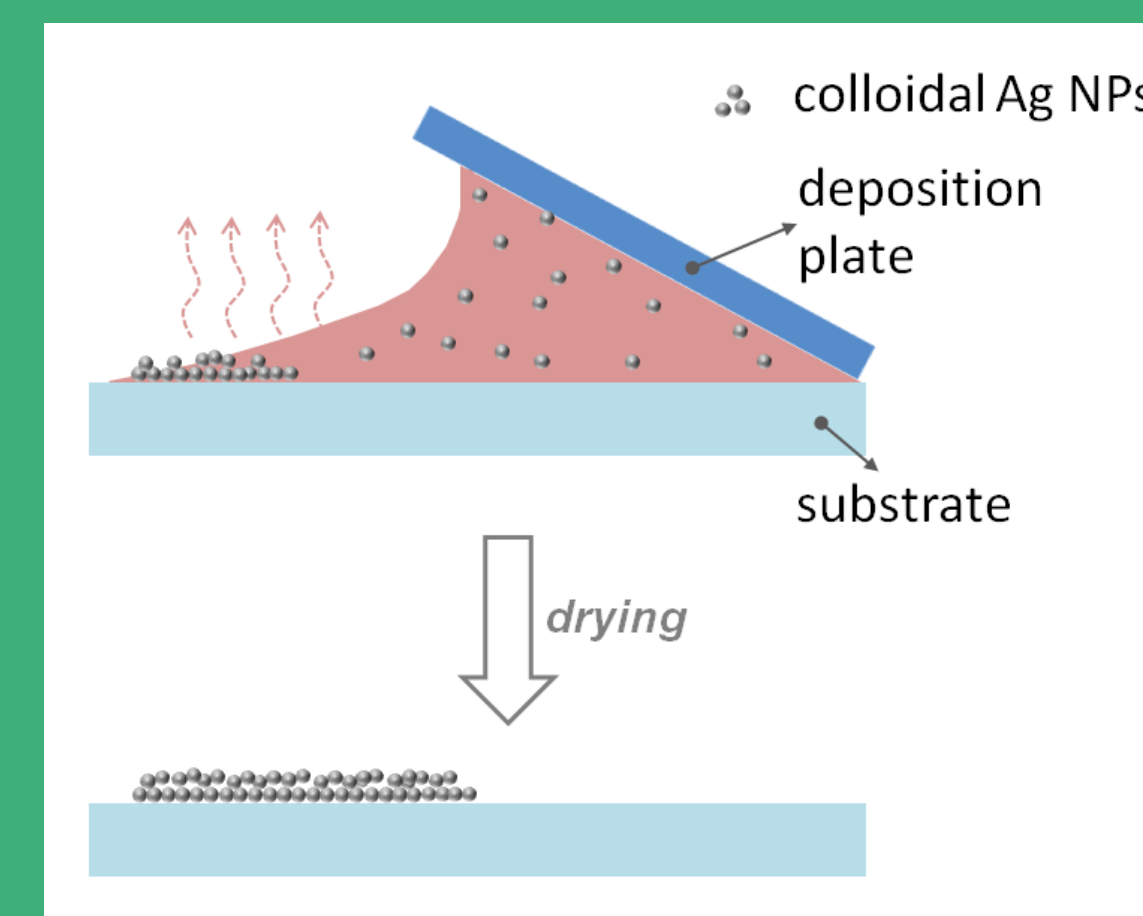
Grey suspension indicating successful nanoparticle formation.



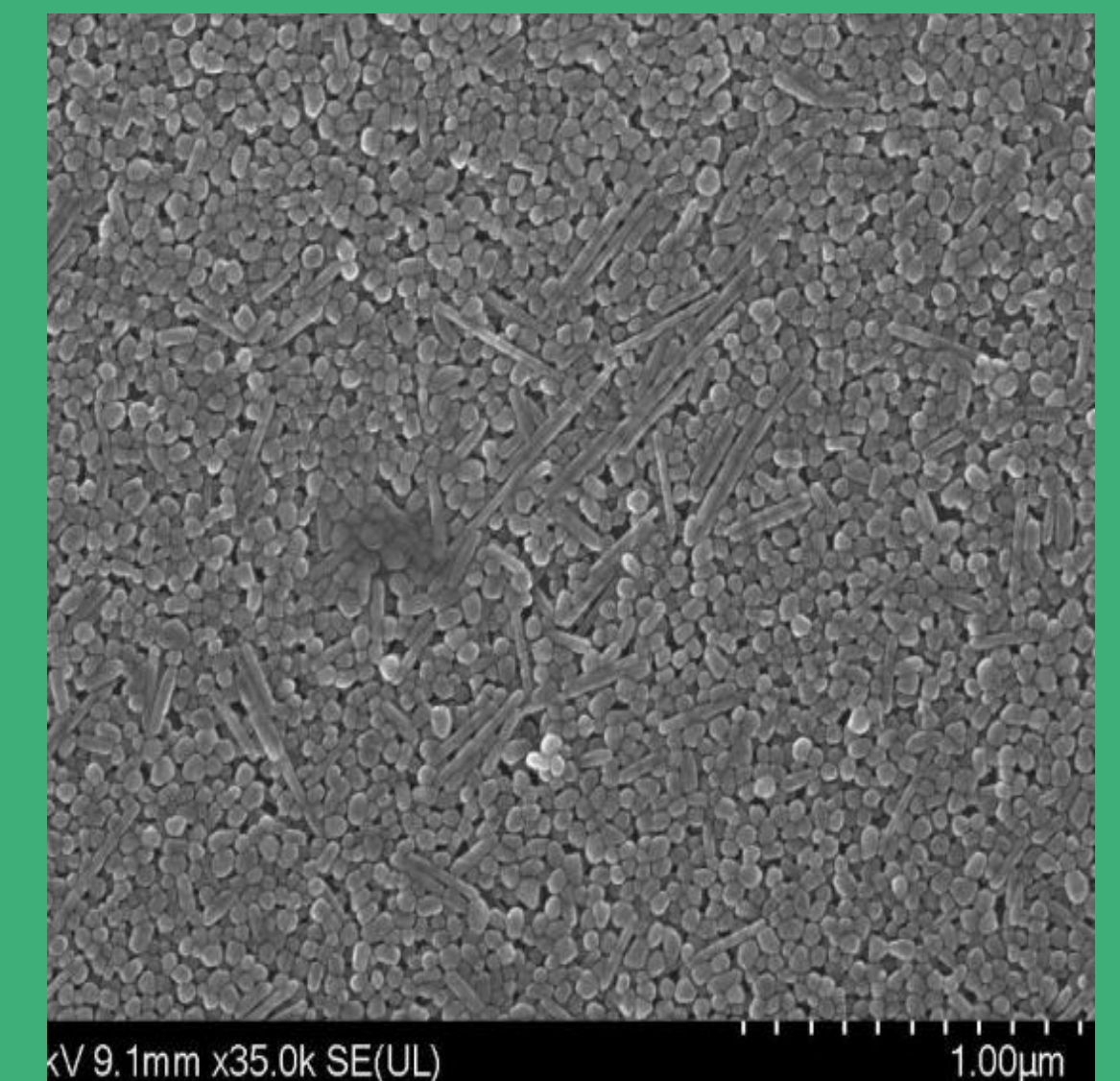
TEM image of AgNPs-LeeM.



UV-vis extinction spectra of the colloidal AgNPs.



Schematics of nanoparticle film formation by convective self-assembly (CSA).

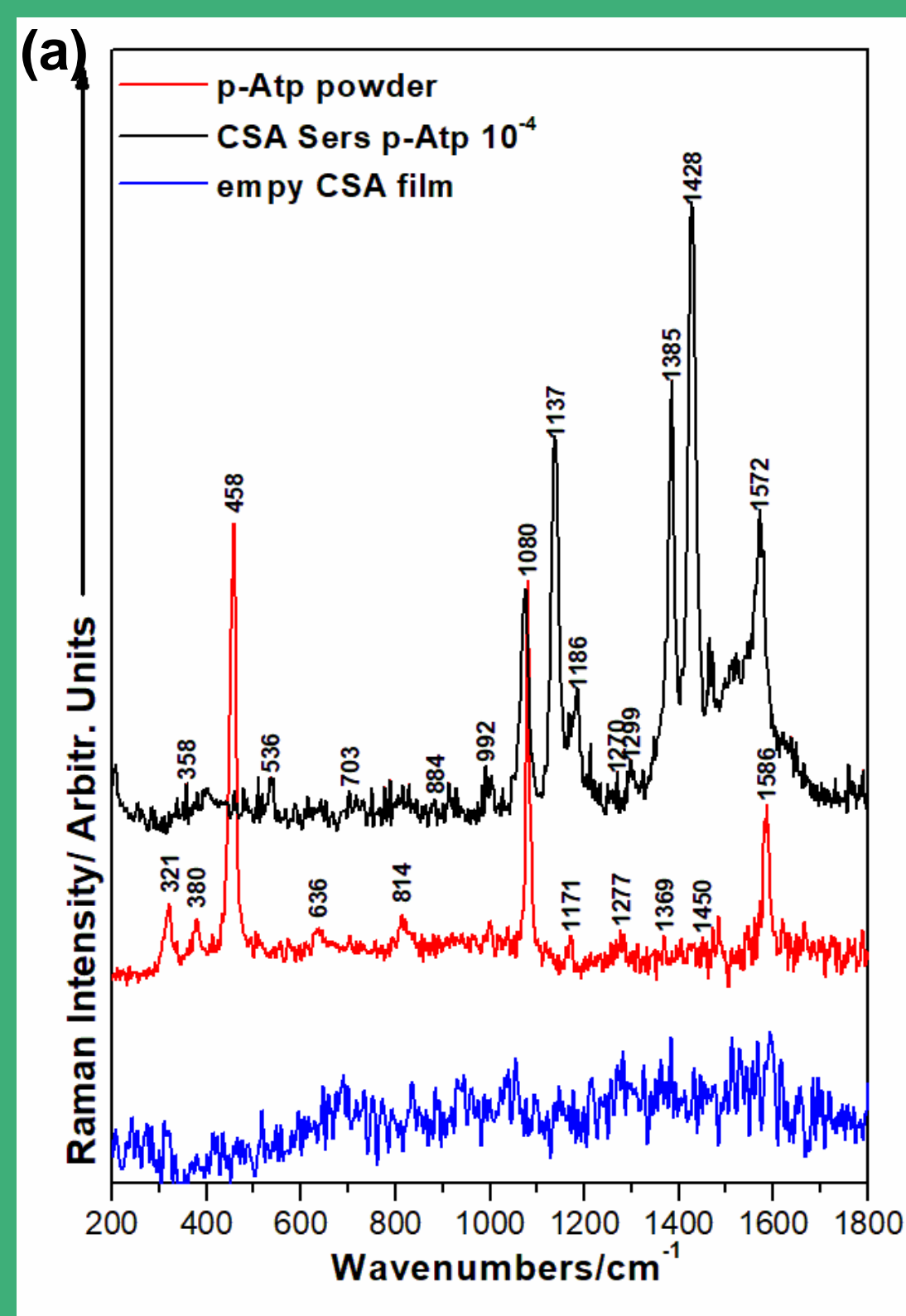


SEM image of AgNP film.

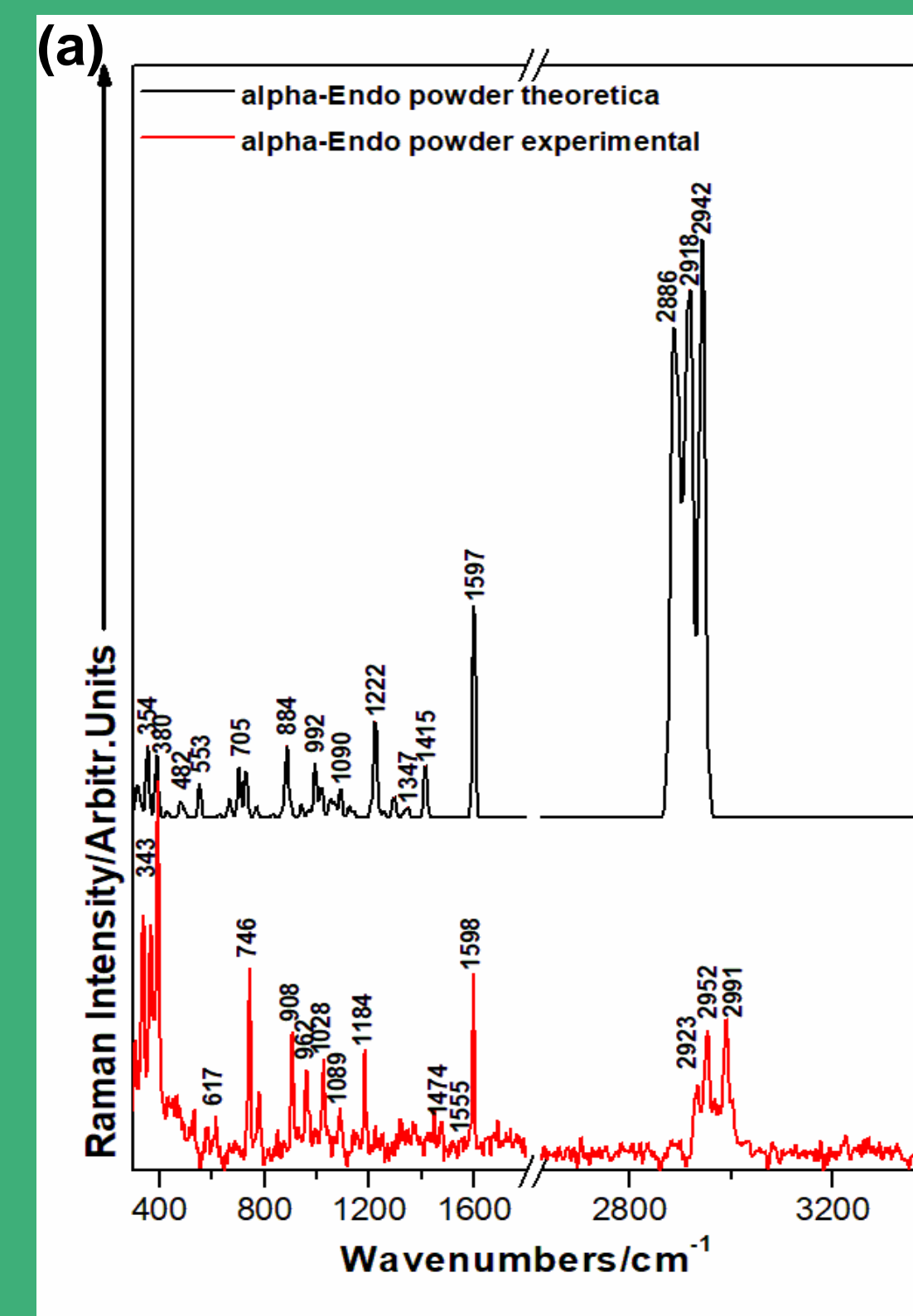
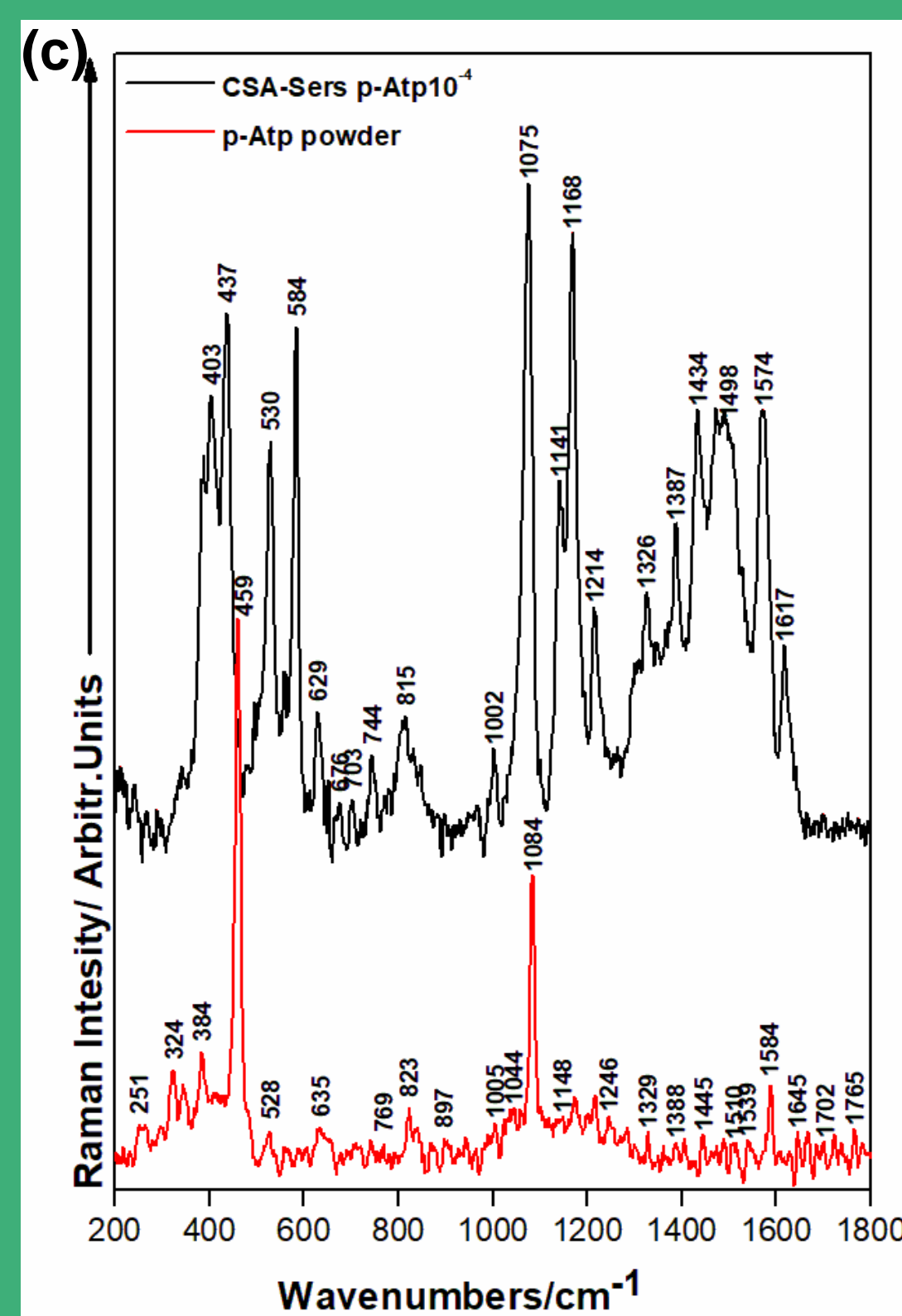
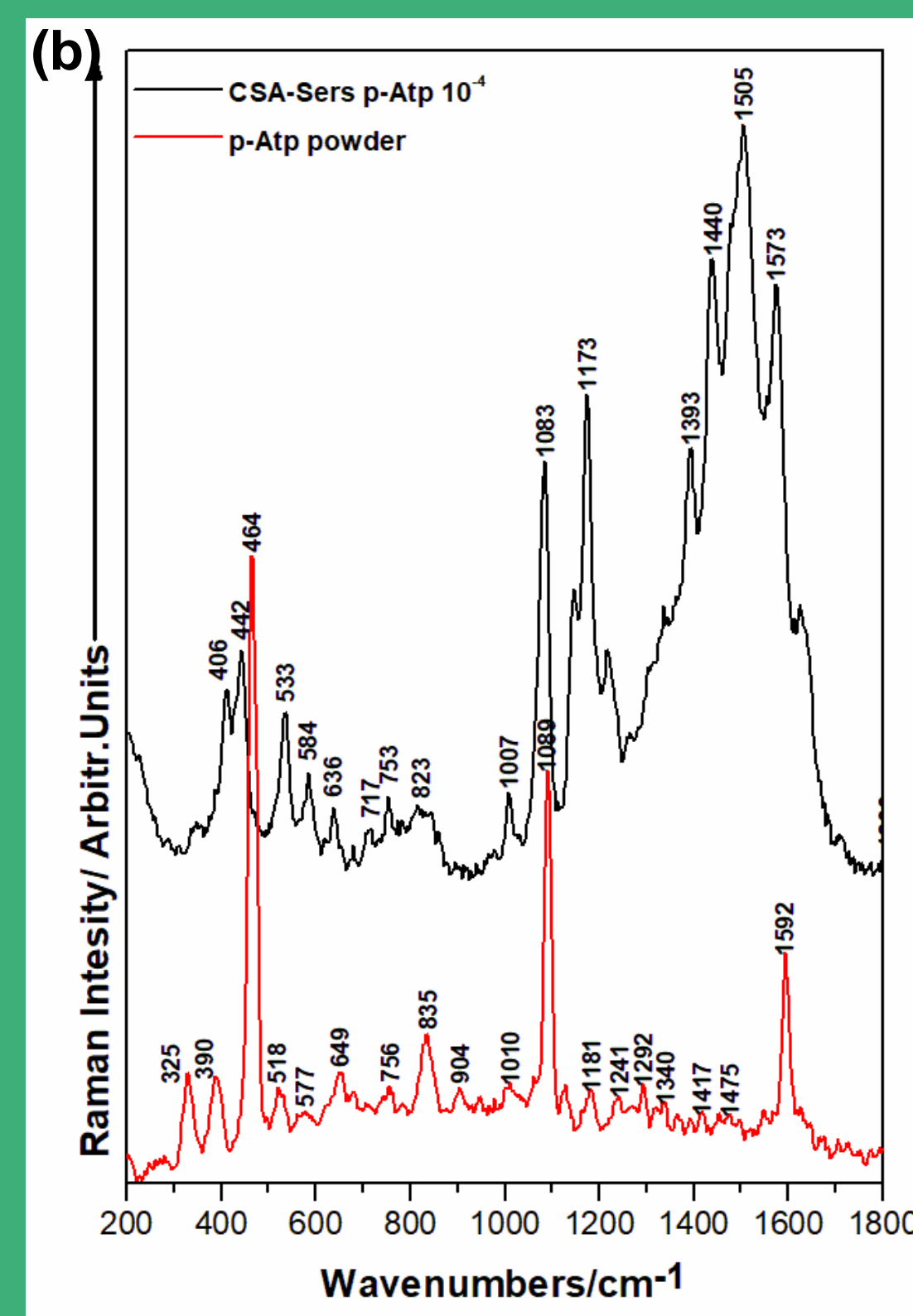
RESULTS AND DISCUSSIONS

II.1 SERS characterization of the AgNP films substrates

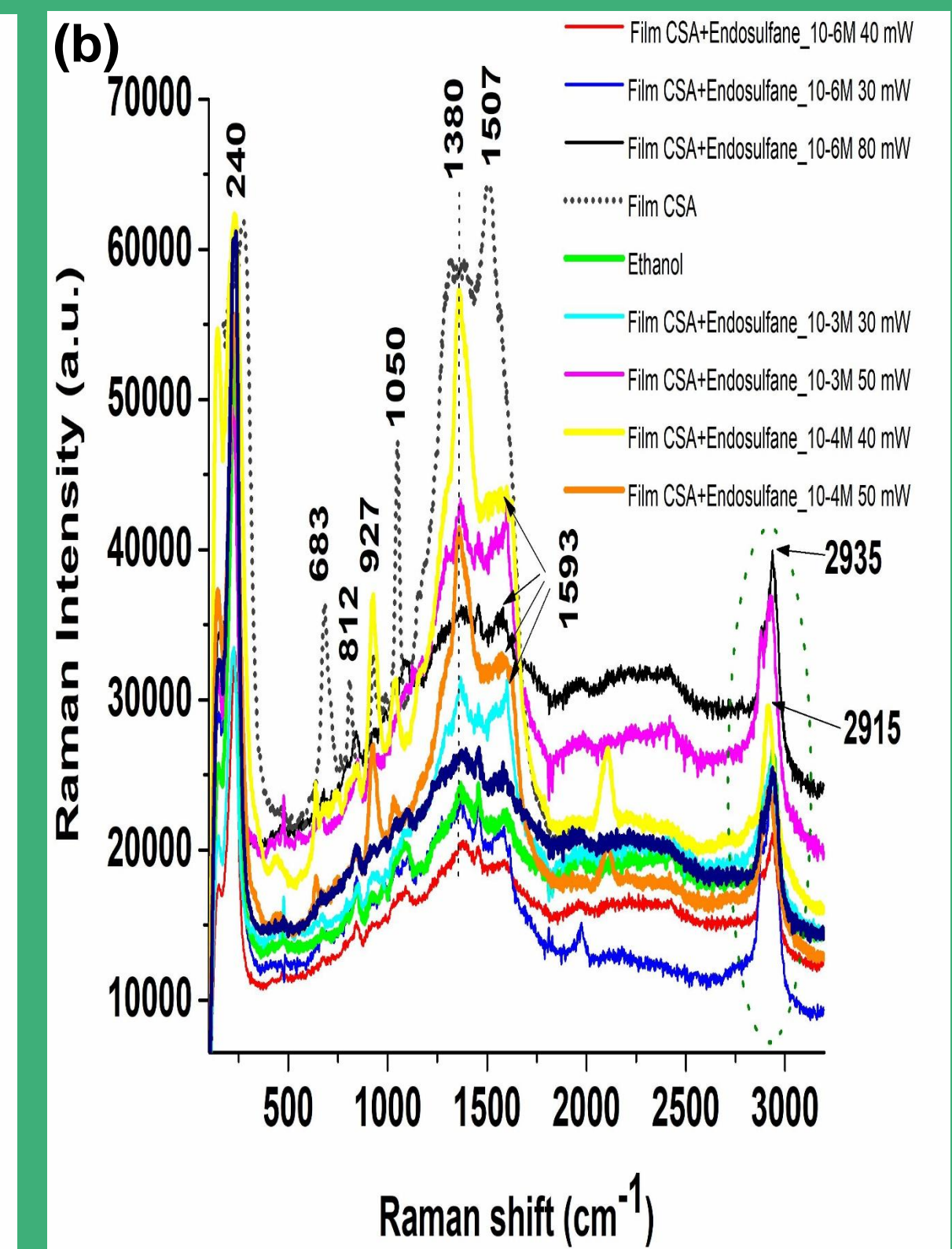
II.2 Raman and SERS of on α -endosulfan



Average SERS spectra of p-ATP adsorbed on the AgNP films, obtained at different laser excitations: (a) 532 nm, (b) 633 nm, (c) 785 nm.



(a) Theoretical and experimental Raman spectra of α -endosulfan; (b) SERS spectra of α -endosulfan 10^{-3} - 10^{-6} M, adsorbed on the AgNP film.



CONCLUSIONS

ACKNOWLEDGMENT

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