SERS study of different species of p-aminothiophenol adsorbed on silver nanoparticles

María Rosa López-Ramírez*, Francisco José Ávila Ferrer, Juan Soto and Juan Carlos Otero

Department of Physical Chemistry, Faculty of Science - University of Málaga, E-29071 Málaga, Spain

*mrlopez@uma.es

Different *Surface-enhanced Raman Scattering (SERS)* mechanisms can operate simultaneously or separately depending on both the molecule-metal system and the experimental conditions. Therefore systematic interpretations of SERS spectra can be a challenge, given that complex selection rules are derived from these enhancement mechanisms related to electromagnetic properties of the nanoparticles or resonance Raman effects involving the molecule-metal complex. [1]

In the present work we have focused the discussion on the experimental and theoretical SERS spectra of the organic compound pATP recorded on silver colloids. The huge SERS of pATP on metal substrates is significantly different from its ordinary Raman spectra due to the formation of a new specie namely p,p' –dimercaptoazobenzene (DMAB). The features of the SERS spectra of pATP are strongly dependent on many factors as i.e. the laser power density or the laser wavelength [2] but there are still important aspects to understand as, for example, the effect of the concentration that has already been studied before by our group. [3] In this case we have analyzed the effect of the concentration at different wavelengths on the SERS spectra of pATP on silver nanoparticles.

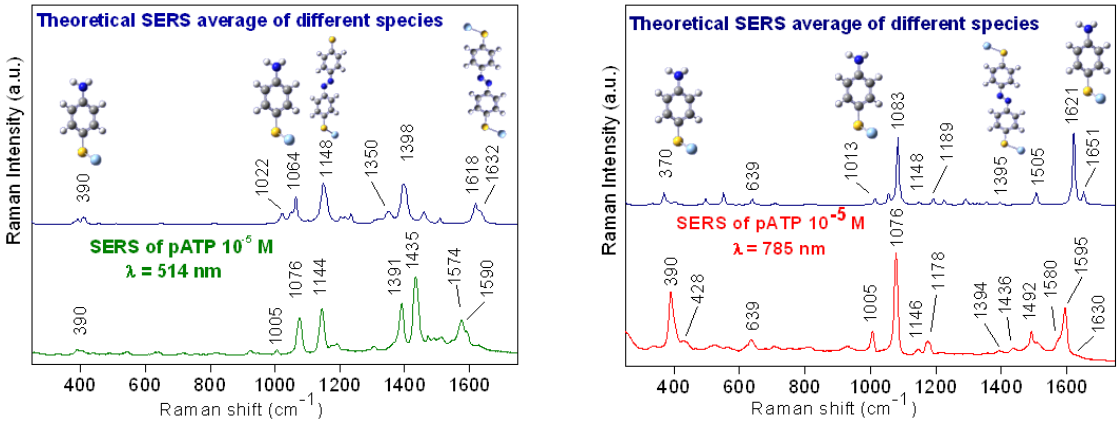

Figure 1. Theoretical and experimental SERS spectra of 10^{-5} M pATP at different wavelengths.

We have found that the Raman signals of the SERS of pATP arise from at least three different molecular species. At any concentration or wavelength we are able to detect SERS bands of pATP bonded to silver nanoparticles through sulfur atom (Ag_n-S^--Ph-NH_2). However we can only observe significant SERS bands from pATP bonded through both sulfur and nitrogen atoms (Ag_n-S^--Ph-NH_2-Ag_m) and the azo derivative in specific conditions.

Acknowledgements

This research has been supported by the Spanish Ministerio de Economía y Competitividad (Project Number CTQ2015-65816-R).

References

[1] R. Panneerselvam, G.K. Liu, Y.H. Wang, J.Y. Liu, S.Y. Ding, J.F. Li, D.Y. Wua, Z.Q. Tian, Chem. Commun. 54 (2018) 10-25.

[2] Y.F. Huang, H.P. Zhu, G.K. Liu, D.Y. Wu, B. Ren, Z.Q. Tian, J. Am. Chem. Soc. 132 (2010) 9244-9246.

[3] M.R. Lopez-Ramirez, D. Aranda Ruiz, F.J. Avila Ferrer, J.F. Arenas, J.C. Otero, J. Soto, J. Phys. Chem. C 120 (2016) 19322−19328.