SERS Analysis of Herbicide Diquat on Nanostructured Metal Electrodes

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The combination of electrochemical techniques with SERS spectroscopy allows us to record *in situ* Raman spectrum of an adsorbed species on the metal electrode surface. Therefore we are able to obtain both structural and conformational information associated to the interaction of the molecule on a metal-electrolyte interface.

SERS spectra are very sensitive to potential shifts in this metal-electrolyte interface leading not only to an overall enhancement of the spectra but also to an enhancement of the relative intensities of the SERS spectra bands. Consequently there is a fundamental difference between the electrodes and colloids substrates: while in the first case, we are able to easily modify the potential range, in a colloid aggregates the potential of the interface is not uniform throughout the sample, changing with the time of the system.

In this work we have studied the behaviour of different reduced species of Diquat (DQ) investigated by means of SERS spectroscopy on silver and copper electrodes. This research was aimed to complete the information obtained in a previous SERS study of this molecule on silver colloids [1]. We have interpreted the SERS spectra of DQ under different experimental conditions due to the special properties of this molecule, which is a dication species belonging to the viologens family with very interesting redox behavior.

The analysis of these SERS spectra show that the absorption mechanism of DQ on metal electrodes depends on several factors such as the potential range, the herbicide concentration, the excitation wavelength or the metal electrode used in the SERS experiment. An additional disadvantage which difficult the study of DQ is its ability to form dimmers in the proximity of the metal surface, which is also analysed in this work.

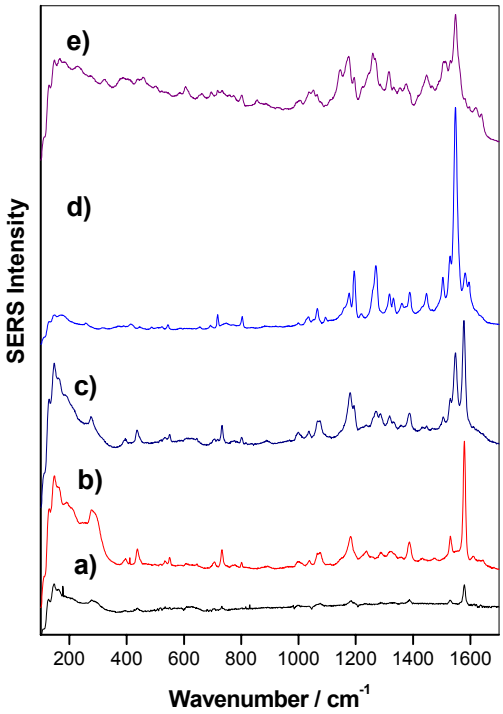

Fig. 1: SERS spectra of DQ (10^{-3} M) in Cl^- 0.1 M on Cu electrode by excitation at 785 nm at the following electrode potential: a) 0.00 V, b) -0.25 V, c) -0.50 V, d) -0.75 V, e) -1.00 V.

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