SURFACE ENHANCED RAMAN SCATTERING OF HUMIC ACIDS ON NANOSTRUCTURED AG-ELECTRODE

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Soil humic substances (HS) are organic heterogeneous compounds produced as by-products of microbial degradation [1]. The diversity of precursor materials and degradation process occurring in soils provide HS a wide variety of chemical and physical properties, which makes its structure elucidation extremely difficult. For this reason, the nature and distribution of the functional groups are of especial interest because they determine the solubility and aggregation behavior and also the ability to complex metals and organic molecules such as xenobiotics present in the soil [2].

Spectroscopic methods, like all other techniques generally employed to investigate HS, are severely limited when applied to humic substances. This is because HS are complex, ill-defined mixtures of macromolecules and their spectra are originated by the responses of many different species [3]. Surface-enhanced Raman scattering (SERS) spectroscopy has demonstrated to be a powerful technique to give structural information. In comparison to the normal Raman spectroscopy, it has the advantage of a huge enhancement of the spectroscopic signal which results in a higher sensibility, and can be successfully applied to the study of highly fluorescent molecules in aqueous solution such as HS.

![SERS spectra of peat (1mg/ml) in KCl 0.1M absorbed on Ag-electrode at 633 nm excitation wavelength after (a) 2 hours, (b) 4 hours and (c) 16 hours.](image)

In this work, SERS spectroscopy was applied to the study of different samples of peat (Fig. 1) and leonardite humic acids (HA) onto nanostructured Ag-electrode surface. The results of this study provide valuable information on the structure and the conformation in aqueous solution of the HAs in order to achieve a better understanding of its chemical nature.


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