

SEMI-QUANTITATIVE ANALYSIS OF QUININE SULFATE IN TONIC WATER BY SERS

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Abstract: Quinine sulfate has been examined by dispersive Raman spectroscopy in powdered and aqueous solution state as well as by SERS. The analytical parameters for the analysis of quinine sulfate by SERS are compared with those attained by fluorescence spectroscopy. Likewise for the analysis of quinine sulfate in tonic water.

Quinine, formerly used as an anti-malarial drug, is still widely used for interdisciplinary scientific investigations with potential applied applications e.g. for the synthesis of polyfunctional chiral solvating agents [1]. Tonic water, which contains quinine, is often used in undergraduate chemistry experiments to demonstrate the analytical sensitivity of fluorescence for the detection of quinine.

Raman spectroscopy has been used to investigate the vibrational spectra of quinine sulfate in the powdered and solution state. In addition SERS spectra of quinine sulfate have also been obtained and are compared with the SERS spectra obtained for both neat and diluted samples of tonic water as a means of undertaking, semi-quantitatively, trace analysis of quinine in tonic water. The sensitivity of the SERS technique is compared with that of fluorescence spectroscopy. A citrate reduced silver sol was employed and prepared using the modified Lee-Meisel procedure [2, 3].

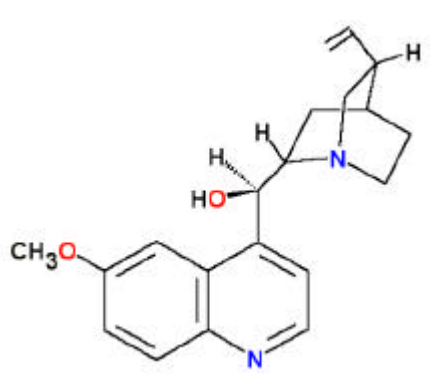


Figure 1. Schematic of the chemical structure of quinine.

All Raman and SERS spectra were collected using exciting radiation equal to 632.8 nm. Fig. 2 shows a comparison of the SERS spectra of quinine sulfate and that of neat tonic water. Surprisingly there is no significant evidence of a fluorescent background in either of the SERS spectra. Furthermore the SERS spectra of quinine sulfate and tonic water are almost identical. Although several vibrational bands can be used for the semi-quantitative analysis of quinine content in tonic water the band at $\sim 1382\text{ cm}^{-1}$ is the most intense and hence appropriate for such purposes.

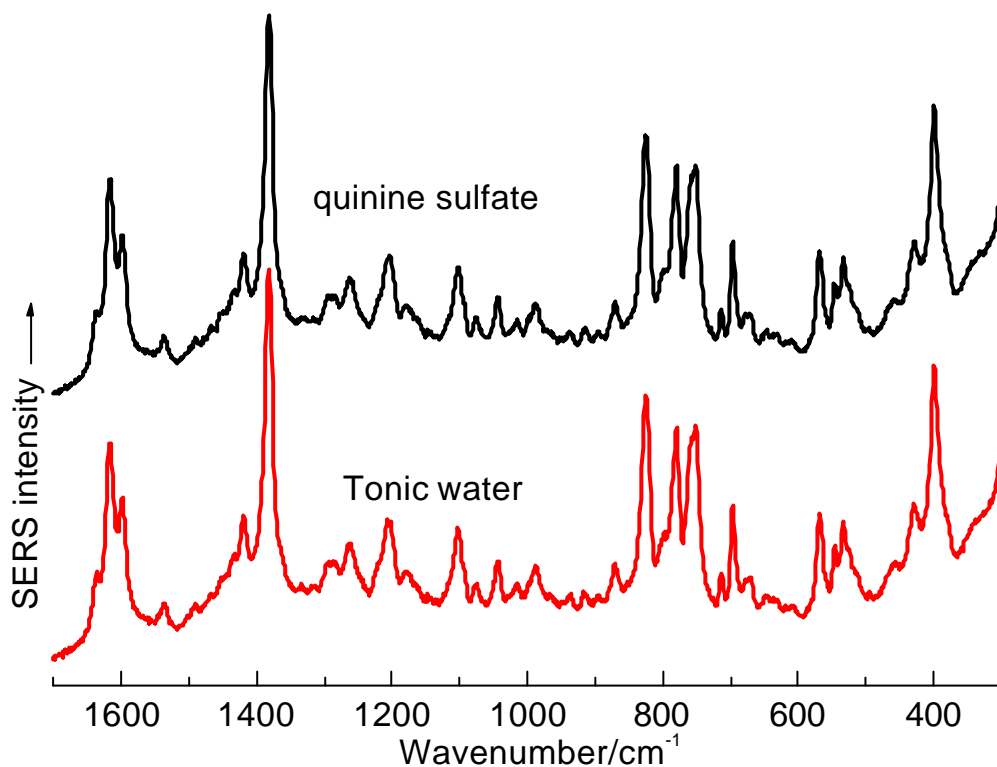


Fig. 2. SERS spectra of quinine sulfate and tonic water.

The presentation will show that SERS is as sensitive as fluorescence, in terms of analytical parameters, for estimating the quinine content of tonic water and can obviously be used for such purposes in a “round robin” series of undergraduate chemistry experiments to show several chemical principles.

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References:

1. G. Uccello-Barretta et al., *Tetrahedron: Asymmetry* **14**, 1511 (2003).
2. P.C. Lee and D. Meisel, *J. Phys. Chem.* **86**, 3391(1982).
3. C. Rodger, W.E. Smith, G.Dent and M. Edmondson, *J. Chem. Soc. Dalton Trans.* **5**, 791 (1996).