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Applications of Raman spectroscopy in archaeometry: An investigation of pre-Columbian Peruvian textiles

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Abstract

In this work fibers from pre-Columbian Peruvian textiles and synthetic analogs of the natural dyes previously found in Andean historical textiles (indigo, carmine, indigo carmine, purpurin, alizarin and luteolin) were analyzed using a Raman microscope which was also used as a microspectrofluorimeter. SEM-EDS and FTIR were used as complimentary techniques. The efficiency of HNO₃ etched copper surface as SERS substrates was investigated aiming at its application in archaeometry; in this particular case, the capability of such SERS active substrate to cope with luminescence presented by the dyed textile was evaluated. The archaeological fibers were identified as dyed wool by FTIR, FT-Raman and SEM; the red dye (carmine) was identified by resonance Raman and SERS, however, the blue dyed fiber presented a strong fluorescent background in the visible and, in the NIR, the FT-Raman spectrum was not conclusive, therefore the identification was performed using SERS through the dye in-situ reduction on a Cu etched disk. Specifically in the case of synthetic dyes, although all of them had already their SERS spectra reported in the literature, it is here shown that the copper etched surfaces provide SERS and SERRS information that are in full agreement with previously reported data, with the advantage of a much simpler and faster preparation.

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