Identification of coexisting indigo species in an ancient green thread using direct plasmon-enhanced Raman spectroscopy

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Abstract
A green ancient thread sample from a Chilean mummy turban was analyzed by plasmon-enhanced Raman scattering spectroscopy using a direct drop-colloidal method. The enhanced-Raman signals in the sample are associated with biomolecules from the thread and two coexisting dyes, indigo and leuco-indigo. The presence of indigo (blue colour) was identified from its most characteristic vibrational bands. Leuco-indigo (yellow colour) was identified for the first time in an ancient textile; its SERS signals are coincident with the SERS bands of a synthesized leuco-indigo. The interconversion leuco-indigo to indigo was followed by UV-visible spectroscopy. Based on theoretical calculations it is proposed that the interconversion involves a π electron delocalization mainly around the NC-CN bridge. The mixture of both dyes (indigo and leuco-indigo) is the responsible for the green colour observed.

Author keywords
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