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Fiber-optics reflectance spectroscopy for the direct identification of natural red and purple dyes on textiles

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The identification of dyes in heritage objects is always a demanding task. Common analytical techniques, like high performance liquid chromatography and gas chromatography are limited by the need of sampling, while a non-invasive technique such as Raman spectroscopy is hampered by the strong luminescent background related to dyes, binders, fibers and other related materials. In the search for a faster, more accurate and sample-free method for dye identification, fiber-optics reflectance spectroscopy (FORS) has emerged as a viable option for the study of artworks. Information related to specific light scattering and absorption can be obtained in the visible and infrared range (300–1400 nm) and support fiber signals can be observed in the near infrared region (1000–2500 nm). The main spectral features of natural dye fibers samples, such as reflection maxima, inflection points and reflection minima, can be used in the differentiation of various red natural dyes. FORS was applied for the analysis of fibers dyed with brazilwood, cochineal and a cochineal–indigo mixture., prepared following traditional Mexican recipes. The spectral features of fresh and aged fibers were determined and used for the identification of the dye present in twenty-nine indigenous textiles, where cochineal, brazilwood and the cochineal-indigo mixture were successfully identified in several pieces.

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