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## ACCEPTED MANUSCRIPT

### Non-invasive Characterization of Colorants by Portable Diffuse Reflectance Infrared Fourier Transform (DRIFT) Spectroscopy and Chemometrics

Marcello Manfredi<sup>1, 2</sup>, Elettra Barberis <sup>1, 2, \*</sup>, Maurizio Aceto<sup>1</sup>, Emilio Marengo<sup>1</sup>

#### **Abstract**

During the last years the need for non-invasive and non-destructive analytical methods brought to the development and application of new instrumentation and analytical methods for the *in-situ* analysis of cultural heritage objects. In this work we present the application of a portable diffuse reflectance infrared Fourier transform (DRIFT) method for the non-invasive characterization of colorants prepared according to ancient recipes and using egg white and gum Arabic as binders. Approximately 50 colorants were analyzed with the DRIFT spectroscopy: we were able to identify and discriminate the most used yellow (i.e. yellow ochres, lead-tin yellow, orpiment, etc.), red (i.e. red ochres, hematite) and blue (i.e. lapis lazuli, azurite, indigo) colorants, creating a complete DRIFT spectral library. The Principal Component Analysis – Discriminant Analysis (PCA–DA) was then employed for the colorants classification according to the chemical/mineralogical composition. The DRIFT analysis was also performed on a gouache painting of the artist Sutherland" and the colorants used by the painter were identified directly *in-situ* and in a non-invasive manner.

**Keywords:** Non-invasive analysis; colorants characterization; DRIFT spectroscopy; Surface analysis; In-situ technique; Chemometrics

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