SUPPLEMENTARY MATERIAL

Infrared Spectroscopic and Chemometric Approach for Identifying Binding Medium in Sukias mansion's Wall Paintings

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This paper addresses the application of infrared spectroscopy in combination with chemometrics to identify wall painting's binding medium while employing pattern recognition techniques to process FTIR dataset of complex samples. In this regard, based on the historical documents and previous researches, firstly 56 standard samples were prepared to represent strata of Persian wall paintings in the safavid period in addition to real historic samples from the case study; Sukias mansion. Then, each sample was analyzed by the means of FTIR and chemometrics. Finally SIMCA was applied to the whole region of studied IR spectra which predicted egg yolk as binding medium of Sukias mansion samples.

Keywords: Binding medium, Chemometrics, FTIR, Persian wall painting, safavid period

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Table S1. FTIR characteristic bands of standard samples materials (Derrick et al. 2000; Stuart 2004; Stuart 2007)

Binding medium	Vibrational wavenumber (cm ⁻¹)	Description Assignment
Gum Arabic	1300-900	C–O stretching band
	1480-1300	C–H bending band
	1650	O–H bending band
	3000-2800	CH ₂ asymmetric stretching band
	3600-3200	O–H stretching band of carbohydrates
Linseed Oil	1378, 1460	CH ₃ asymmetric bending band
	1750-1740	C=O stretching band
	2850, 2930	CH ₂ asymmetric stretching band
	3020	=C–H stretching band
Egg Yolk	1450	C–N bending band
	1550	60% N–H bending band; 40% C–N stretching band
	1650	80% C=O stretching band; 10% C–N stretching band; 10% N–H bending band
	2850, 2930	CH ₂ asymmetric stretching band
	3110, 3300	N–H stretching band in resonance with overtone (2 × amide II)
Indigo	1620-1420	Aromatic bands
	1700-1550	C=O stretching band
	3100-2800	C–H stretching band

	3400-3200	N-H stretching band
Chalk	910-850	O-C-O bending band
	1490-1370	CO ₃ ²⁻ stretching band
White Lead	693-683	Bending bands
	1047-1045	O-H bending band
	1400	C=O stretching band
	3535-3530	O-H band

Table S1. (Continued)

Binding medium	Vibrational wavenumber (cm ⁻¹)	Description Assignment
Gypsum	~620	SO ₄ ²⁻ bending band
	1140-1080	asymmetric SO ₄ ²⁻ stretching band
	3700-3200	asymmetric and symmetric O-H stretching band
Ultramarine Blue	800-400	bending bands
	1150-950	overlapping stretching bands for Si-O-Si and Si-O-Al
Red Ochre	800-400	bending bands
	1200-1050	overlapping stretching bands for Si-O-Si band

References

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