HARRICK SCIENTIFIC PRODUCTS

No. 10125

PAINTER'S PALLET: UV-VIS SPECTROSCOPY OF OIL PAINTS ON CANVAS

Figure 1. The Omni-Diff diffuse reflection fiber optic probe with its digital camera.

Figure 2. The FiberMate2 fiber optic coupler.

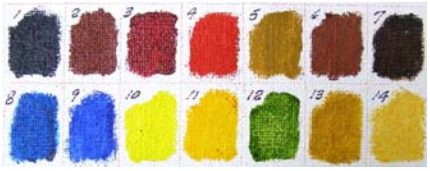

Figure 3. Oil Paints on Canvas: Paynes Gray (1), Indian Red (2), Alizarin Crimson (3), Cadmium Red (4), Mars Yellow (5), Mars Red (6), Burnt Umber (7), Ultramarine (8), Cobalt Blue (9), Cadmium Lemon (10), Cadmium Yellow (11), Sap Green (12), Yellow Ochre (13), Naples Yellow (14).

INTRODUCTION

Diffuse reflectance spectroscopy is invaluable for examining powders and rough surfaced samples. Many of the latter are too large to be examined with in-compartment diffuse reflection accessories. Such samples are more suited for investigation with a diffuse reflection fiber optic probe, particularly in the visible where high throughput fiber optics are readily available.

This applications note demonstrates the use of a diffuse reflection fiber optic probe to examine color differences in paint on canvas.

EXPERIMENTAL

The diffuse reflectance measurements were carried out using a UV-Vis spectrometer in its double-beam mode with a reduced slit, a 2-nm SBW and a 1.1-nm data interval. The UV-Vis spectrometer was coupled to the Omni-Diff diffuse reflectance fiber optic probe (see Figure 1) using the FiberMate2 fiber optic coupler (see Figure 2) and two fused silica fibers with a 1000 µm diameter core. The Omni-Diff was equipped with its digital camera, for real-time imaging of the sampled area.

Fourteen different oil paints, from two manufacturers, were applied to a canvas (Figure 3) and allowed to dry prior to analysis. The Grumbacher oil paints used were Paynes Gray, Indian Red, Alizarin Crimson, Cadmium Red, Mars Yellow, Mars Red, Burnt Umber, Sap Green, Yellow Ochre and Naples Yellow. The Winsor and Newton oil paints investigated were Ultramarine, Cobalt Blue, Cadmium Lemon and Cadmium Yellow.

All spectra were recorded from roughly the center of the painted area and a photograph of the sample was taken at each point.

RESULTS AND DISCUSSION

The recorded spectra are shown in Figures 4 through 7. The spectra are roughly grouped according to color.

Figure 4 shows two grayish samples in addition to the unpainted canvas. As expected, very few distinct spectral bands are present in either the spectra of the Burnt Umber or Paynes Gray. The Burnt Umber has a slightly higher reflectance above 550nm, indicating its slightly browner color. Both of these paints sufficiently cover the canvas to mask the change in reflectivity of the canvas that occurs at 425nm.

Figure 5 shows the spectra of the colors that can be loosely categorized as reds. All four of these paints show stronger reflectance above 600nm than the gray samples, as expected

applications note

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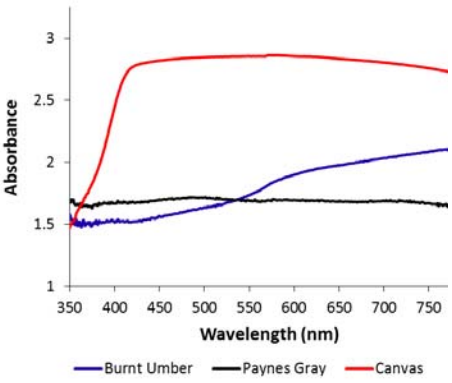

Figure 4. Diffuse Reflectance of the Grayish Samples. Canvas spectrum shown for reference.

from their reddish color. The Indian Red and Mars Red are not quite as strongly reflecting in this spectra range as the other two, as is consistent with their more muted colors. The Cadmium Red has its strongest reflectance at 625nm, in the orange region of the spectrum.

Figure 6 features the spectra of the yellowish paints. Spectroscopically, the Yellow Ochre and Mars Yellow are the most similar. The Naples Yellow has some blue-green components, as seen by the band at 500nm and also some violet by the peak at around 400nm.

Figure 7 features the spectra of the three remaining samples. The Cobalt Blue and Ultramarine have strong bands in the blue, around 470nm as expected. The Cobalt Blue also shows a band around 700nm indicating that it has a reddish hue. The third spectrum grouped with these is clearly not a blue – its distinct band around 550nm is indicative of a yellowish green colored paint instead.

These results demonstrate that the Omni-Diff fiber optic probe can be used to detect difference in the colors of paint on canvas in the visible.

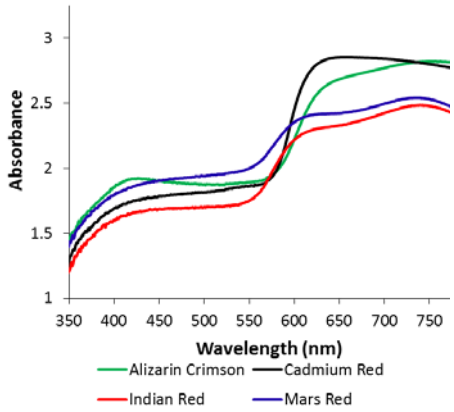

Figure 5. Diffuse Reflectance Spectra of the Reddish Samples.

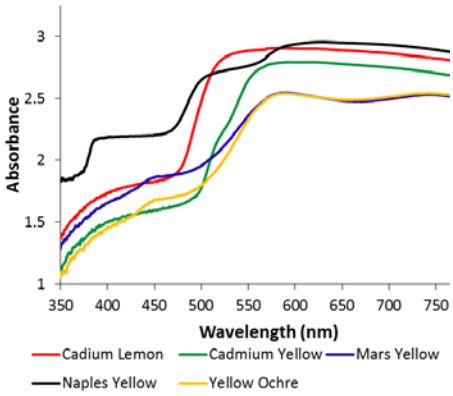

Figure 6. Diffuse Reflectance Spectra of the Yellowish Samples.

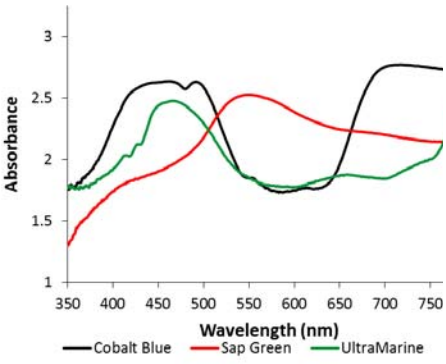

Figure 7. Diffuse Reflectance Spectra of the Blueish Samples.

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