

Raman Standards and TAH User Manual for Manuscripts in the University of Glasgow Collections

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Introduction to the placement

This placement aimed to create a database of 15th to 16th century historical pigments, for analysis through Raman Microscopy. This database of pigments will then be available for future use in the technical art history department, to cross reference with new results. These results will also benefit teachers and students in understanding how Raman is used successfully. This work should indicate which pigments it is suited to analysing and provide good spectra, and which pigments it is not successful at analysing. This will provide useful data to future students in using Raman and assessing its benefits and limitations in relation to future projects.

Making up Historical Samples

In order to create this database, I made up samples of ink pigments on a 19th century parchment scrap (fig.3) and colourants on paper (fig.2). The pigments were sourced from different places within the Technical Art History department. I created a digital and paper record of these pigments (fig.4), to ensure the validity of the sources - enabling this database to be used by TAH students in the future.

The pigments were ground with a binding medium of 3p gum Arabic 10p water, and then applied thickly to the paper and parchment, with paintbrushes. In future tests it could be interesting to analyse the inks with different application methods, such as quills or fountain pens, and to see if this has any bearing on the final spectra.

Figure 1 shows the process of grinding up and mixing Verdigris with the pestle and mortar, a process I underwent with all of the pigments. The ability to work with these pigments and grind them provided valuable experience in understanding how historical pigments would have been formulated.

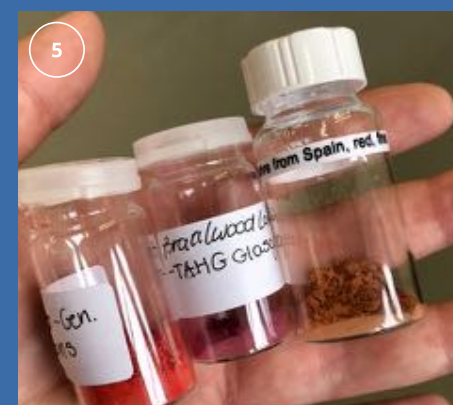
Raman Spectroscopy Tests

Raman spectroscopy is a non-destructive analytical technique, which can aid in an understanding of the chemical structure of a material. This is achieved through pointing a laser at a given material and then analysing the scattered light which comes back. This is transferred into spectra. This then becomes a fingerprint of the pigment - which can be analysed in reference to other spectra in order to identify the pigment. In our analysis we used a laser within the red visible region, with a wavelength of 6.33nm. We ran tests on all of the pigments, and re analysed some with different acquisition times and higher or lower accumulations. This provided a range of results with differing levels of success. Vermillion provided the strongest spectra, whereas other pigments provided little to no spectra whatsoever.

Results and Conclusions

Throughout this placement I was aiming to analyse inks and binders, however these did not return spectra. This could be due to a number of things, which me and Dr Garside discussed. These include the wavelength of the laser falling into the red visible spectrum, which cannot read the blue and green and black pigments as successfully. Also, Dr Garside described how the strength of the laser used could hinder the ability to collect full data. In the Raman set up we used; focus has to be achieved manually and therefore it would benefit the results to incorporate a camera to the focus, in order to achieve more recurrent results. These issues indicate the experimental quality of this work, and also the importance of these tests.

Through these results we were able to gain interesting insight into which pigments are suitable and benefit from Raman analysis and which pigments don't suit the technique. Carbon based pigments seemed to show little to no results, as did green earth pigments. However interesting results were obtained from the red and yellow group. We used Vermillion as a standard for the tests, as the spectra was very strong and easily identifiable and therefore was very well suited to Raman testing. We also found interesting results with regards to the sample of Naples Yellow, which showed a spectra different to that expected from the Naples yellow pigment. Through analysis of another sample of Naples Yellow we concluded that the initial sample must have been mixed with some other pigment or filler, and therefore did not constitute a pure sample. This highlights the benefits of Raman testing, and how it can be useful to analyse mixed pigments or indicate the purity of a given material.



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