Solvent Sensitivity of Water-Mixable Oils

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Introduction

Water-Mixable Oils (WMOs) have been used for the past two decades as an alternative to traditional oil paints, which require the use of relatively toxic solvents such as turpentine. Major suppliers of WMOs include Winsor & Newton, Grumbacher, Holbein, Reeves, Royal Talens, Weber, Daniel Smith, and Daler Rowney. Their excellent working properties, ease of use, and resemblance to traditional oil paint means that conservators may expect to see more artists using WMOs in the coming decades.

Conservation treatments and preventive conservation measures are greatly informed by the conservator's understanding of artist materials. As a result, it is necessary for conservators to know how the paints are manufactured, how they may react to different solvents, and how they age and deteriorate. This paper hypothesizes that WMOs are more sensitive to water and polar organic solvents than traditional oils because they contain hydrophilic components.

Experimental

- Winsor & Newton™ Artisan Water Mixable Oil™ and Winton Oil™ paints (burnt sienna and alizarin crimson) were hand painted onto glass microscope slides.
- Samples were aged at 70°C and 75% RH for 300 hours.
- Paint samples ranging from 20-100mg were immersed in either distilled water (24 hours), ethanol (10 minutes), or acetone (10 minutes).
- Extracts were analyzed with Fourier transform infrared spectroscopy (FTIR) and gas chromatography-mass spectrometry (GC-MS).
- Paint swatches were swabbed with the aforementioned solvents for one minute.
- Color and gloss measurements were taken to evaluate visual changes.
- Weight changes and changes in film hardness were measured.

Results

FTIR

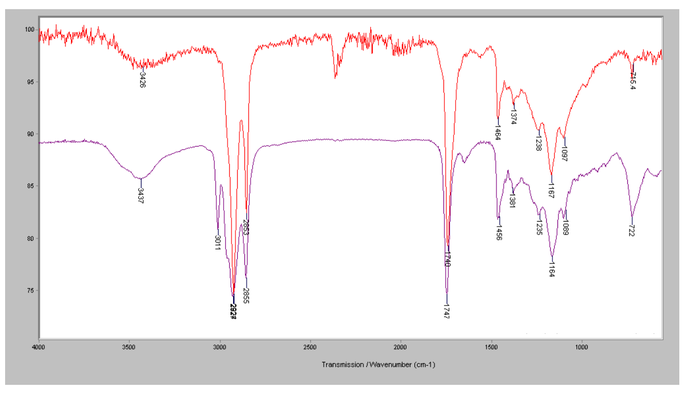

Fig. 1 FTIR spectra for ethanol extract of Winton alizarin crimson paint (red) and refined linseed oil (violet).

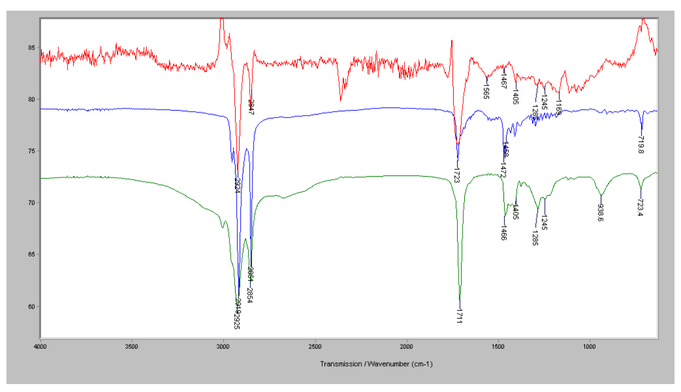

Fig. 2 FTIR spectra for subtracted ethanol extract of Winton alizarin crimson paint (red), with stearic acid (blue) and oleic acid (green).

GC-MS

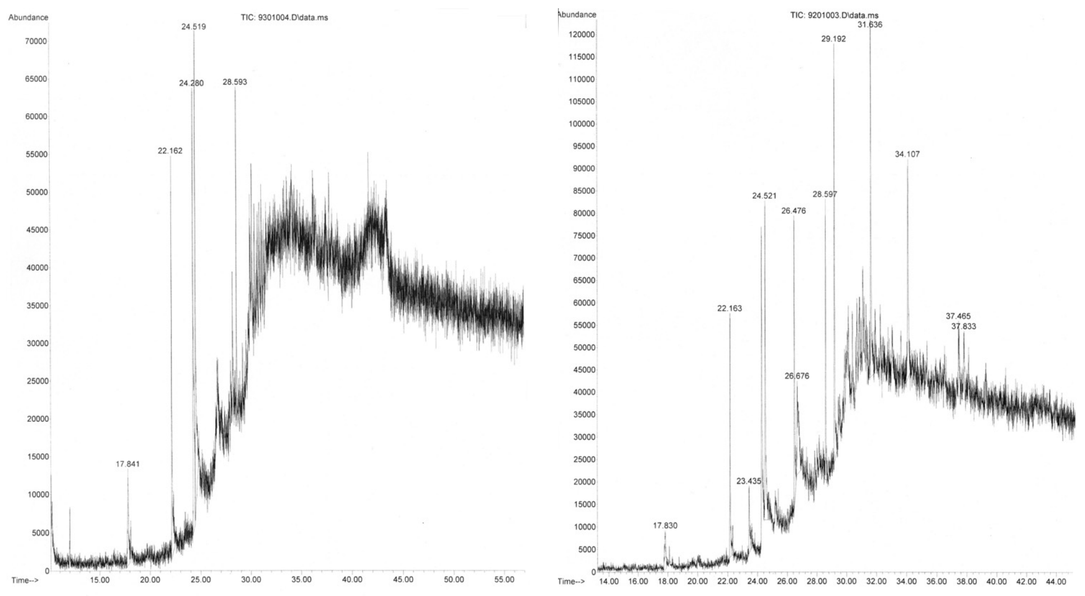

Fig. 3. Gas chromatograms for ethanol extractions of Winton burnt sienna paint (left) and Artisan burnt sienna paint (right).

Physical Changes

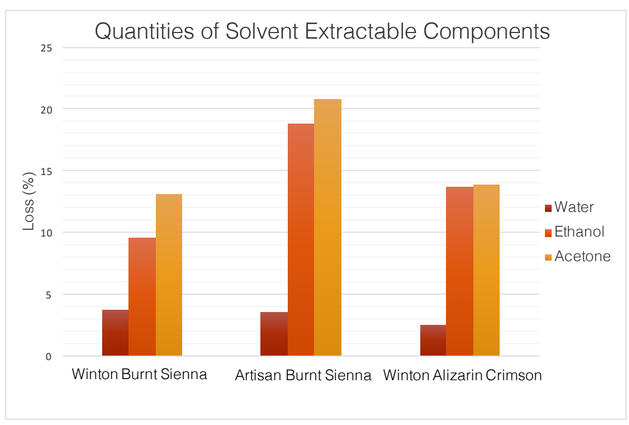

Fig. 4. Quantities of solvent-extractable components by paint type and solvent. Paint samples were weighed before and 72 hours after exposure.

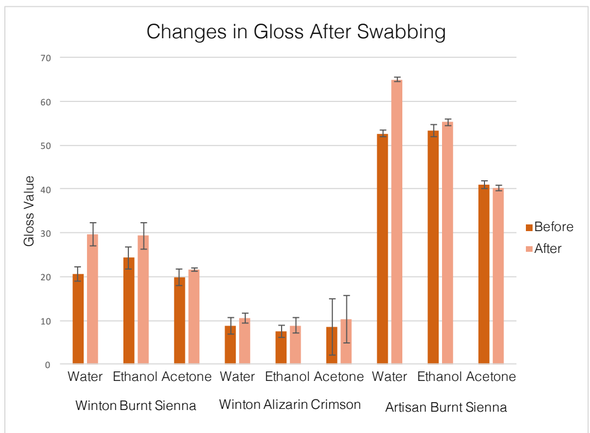

Fig. 5. Changes in gloss of paint films after swabbing, by paint type and solvent. An angle of 85° was used for all measurements.

Microscopy

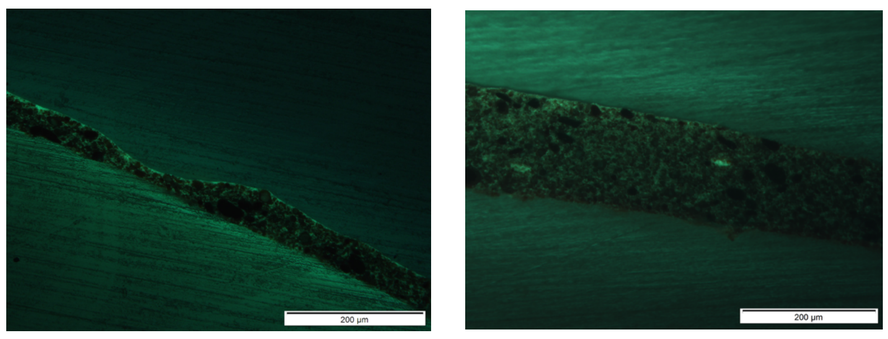

Fig. 6. Microphotographs of cross sections of dried Artisan burnt sienna paint under NV radiation at 20x magnification. Medium skins are visible on the unexposed film (left) and after exposure to water for 24 hours (right).

Discussion and Conclusions

- The identification of linseed oil as the primary extracted component may indicate the paint film has not aged enough to produce the degradation products commonly found in other studies.
- More compounds were detected in the Artisan extract, possibly including pentaethylene glycol monomethyl ether. Fatty acids were detected in both ethanol extracts.
- Quantities of solvent-extractable components were highest for acetone, followed by ethanol and water.
- Swatches of Winton burnt sienna in particular were visibly glossier after swabbing.

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