An Investigation into Characteristics of Wax Varnishes on Acrylic Paint Films

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Abstract:
This research project explored the properties and characteristics of wax varnishes. It also investigated the interaction of wax varnishes with acrylic paint films and how the appearance of a paint film was altered by this application. The wax varnishes tested include two proprietary brands and two formulations. Tests performed on the samples included observations of handling properties, colorimetry, glossmeter, hardness, tackiness, removability, and analysis using Fourier Transform Infrared Spectroscopy (FTIR).

Introduction:
The goal of this study is to identify an acceptable varnish for acrylic paintings. Acrylic paintings are difficult to varnish due to the porosity and solvent sensitivity of the paint film. Both the properties and characteristics of a wax varnish alone and its interaction with an acrylic paint film are of concern. Several formulas for wax varnishes have been developed using different types and concentrations of waxes.

Two proprietary brands of wax varnish and two wax varnish formulations by Rosen and Massey were selected for this study. Collectively, they contain four types of waxes: beeswax, carnauba, ceresin, and microcrystalline wax (Microsere 5906). (See Table 1.) Wax Varnish formulations containing different types of waxes were specifically chosen to diversify the characteristics of the wax varnishes observed.

Experimental:
Sample Preparation
• Sample Set #1: Samples (2 x 4 in.) made for observations of handling properties, colorimetry, glossmeter, removability, and analysis using Fourier Transform Infrared Spectroscopy (FTIR). The colors of Golden and Maimeri acrylic paint used were yellow ochre, ivory or bone black, titanium white, cadmium red medium, and ultramarine. (See Figure 2.)
• Sample Set #2: Samples (2 x 15 in.) made for tackiness testing. They were prepared in the same way as the first set of samples using only the color black.
• Sample Set #3: Samples (2 x 4 in.) made in triplicate for hardness testing were prepared on plate glass. The varnish was applied directly on glass cleaned with acetone.

Methods of Testing
1. Observations of Handling Properties
2. Colorimetry: Color measurements of all the samples were taken with a Minolta Chroma Meter CR-300 Colourimeter using the CIE L*, a*, b* colour-space before varnishing and after varnishing.
3. Glossmeter: Readings taken before and after varnishing of samples.
4. Hardness: ASTM D2134-93, “Standard Test Method for Determining the Hardness of Organic Coatings with a Sward-Type Hardness Rocker.” (See Figure 1.)
5. Tackiness: Particulate adhesion to varnished samples was observed and recorded with photography.
6. Removability: FTIR was used to confirm the amount of varnish removability by mineral spirits and turpentine. The cotton swabs were also observed. (See Figure 2.)
7. Composition of Proprietary Varnishes (FTIR tested, See Figure 5.)

Results:

<table>
<thead>
<tr>
<th>Varnish</th>
<th>Handling Properties</th>
<th>Colorimetry (L<em>a</em>b*)</th>
<th>Glossmeter (paint)</th>
<th>Hardness</th>
<th>Tackiness</th>
<th>Removability FTIR Spectra Results</th>
<th>FTIR Spectra Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golden Acrylic Paint Varnish</td>
<td>White, easy application, high viscosity, medium pressure to polish.</td>
<td>Range for all colors of paint</td>
<td>Gray-white, easy application, low viscosity, polishing not needed to achieve a glossy surface</td>
<td>23 - 52</td>
<td>3 hardness value</td>
<td>No mineral spirit= All removed.</td>
<td>No mineral spirits= All removed.</td>
</tr>
<tr>
<td>Maimeri Acrylic Paint Varnish</td>
<td>Pale yellow, easy application, high viscosity, medium pressure to polish.</td>
<td>Pale yellow, easy application, high viscosity, medium pressure to polish.</td>
<td>White, easy application, high viscosity, high pressure to polish.</td>
<td>0.7 - 1.3</td>
<td>0.6 - 1.1</td>
<td>Mineral Spirit= 1 color with small residues.</td>
<td>Mineral Spirit= 2 colors with small residues.</td>
</tr>
<tr>
<td>Modified Massey Formula Varnish</td>
<td>White, easy application, high viscosity, high pressure to polish.</td>
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Conclusions:
The results of this study are hoped to contribute both to the fine arts and conservation fields. The handling of wax varnishes depends on the type of wax used and the solvents they are combined with. Wax varnishes are good for contemporary painters that wish to maintain the matterness of acrylic paint and still protect the porous nature of the paint film.