PIGMENTED WAX/RESIN FILLS

PIGMENTED WAX/RESIN FILLS are made and used by painting conservators to fill losses in oil paintings. It is an ideal material because textures, such as canvas weave, can be impressed into the fills to match the painted surface. In addition, coloring the wax with pigments can aid in the inpainting process. The Buffalo State College Art Conservation Program employs a successful pigmented wax/resin fill formula that uses beeswax, microcristalline wax, resin, and pigments (Table 1). One of the components, Laropal® K-80, a resin that gives more hardness and tack to the fill, is no longer manufactured. The purpose of this investigation was to research and find an alternative resin that would yield an equal or improved pigmented wax/resin fill.

Another aspect was to identify the advantages and limitations of pigmented wax fills in general. By developing a practical wax fill formulation and application process, a better understanding and appreciation of pigmented wax/resin mixes may be gained.

EFFECTS OF AGE
Frederick Wallace, who is now Chief Conservator of the Mariner’s Museum in Newport News, Virginia, researched wax fills as a student 21 years ago. 20 wax samples, included in his research project, were examined. They consisted of different wax mixtures, many of which contained pigments but none contained resin. By observation only, it was concluded that the two major consequences of aged pigmented wax included cracking and bloom. Almost all of the ten samples that contained beeswax had a white efflorescent bloom. This could be the result of low molecular weight volatiles migrating to the surface over time.

Many conservators use wax fills but their ratios and application methods were unknown. A short questionnaire was emailed to nine painting conservators to find out more. The responses varied greatly and only one conservator said that wax was their preferred fill and are generally using sorcer wax mixtures, many of which were constructed for relative comparisons. Wax samples included in his research were conducted. A need for permanent molds was not available, therefore, a simple apparatus was constructed for relative comparisons. Waxes were placed under a needle and calibration weights were placed on a platform above the needle. Measurements were made and recorded for Multowax™ W-445, Cosmolloid® 80H, Beeswax, and Be Square™ 195.

Multowax™ W-445 was the softest because the needle penetrated 35mm, with a 1000g weight. Conversely, Be Square™ 195 demonstrated to be the hardest, with a needle penetration of only 2mm with a 1000g weight. Beeswax and Cosmolloid® 80H had comparable hardness, each at 5mm with a 1000g weight. A new formula was made using Cosmolloid® 80H and Be Square™ 195 waxes with Regalrez® 1094 and pigments.

EXPERIMENT
After researching different resins, the following were chosen as possible alternatives to Laropal® K-80: Regalrez®, 1094, Laropal® A-81, and Paraloid™ B-72. Formulations were made, based on proportions in Table 1. A 1:1 ratio of raw umber and titanium white was used for pigment. Basic proportions of components remained the same as the original formula, but pigment quantities varied slightly, depending on the consistency desired. One formula was made without resin, to compare its properties. The following procedure describes how the formulas were made:

1. Beeswax was melted in a double boiler.
2. Microcristalline wax was added and melted, followed by the resin, which dissolved.
3. Pigment was added slowly with mulling until the mixture had sufficient body, but was liquid enough to pour.
4. The mixture was poured into a silicone mold and leveled with a wooden tongue depressor.
5. Once cool, extra wax was removed from the mold and returned to the pot for reuse.
6. Sticks were removed from the silicon mold. Rather than bending, sticks should be hand and stiff, even brittle at room temperature. This quality is ideal because the wax fill should have similar mechanical properties as dried oil paint, in order to support stiff varnishes.

MODIFICATION OF FORMULA
Resin B-72 did not dissolve in the formula. This could be due to its relatively high molecular weight of 105,000 g/mol. Since B-72 did not work, consideration was given to replace beeswax in the formula with other waxes, such as Multowax™ W-445 or Cosmolloid® 80H. To help make the choice, hardness tests were conducted. A need for permanent molds was not available, therefore, a simple apparatus was constructed for relative comparisons. Waxes were placed under a needle and calibration weights were placed on a platform above the needle. Measurements were made and recorded for Multowax™ W-445, Cosmolloid® 80H, Beeswax, and Be Square™ 195.

TESTING ON A PAINTING
Each wax/resin formula was tested on a donated painting. A dental tool was warmed and used to soften, compress, and level wax into the loss. Excess wax was removed using a bamboo skewer. A warm, pre-made silicone mold was pressed onto the wax using a block of wood.

RESULTS
When physical and working property comparisons were made between the waxes/resins, there were no apparent differences between the formula containing Laropal® K-80 and the one with Laropal® A-81. The other formulas did not match the same standard (Table 2). The Laropal® A-81 formula also performed best in compatibility and cross-cut tests.

CONCLUSION
Resin Laropal® A-81 is a good replacement for Laropal® K-80 in the pigmented wax/resin formula, resulting in convenient wax sticks that:
• have good consistency
• can be applied, leveled, and removed easily
• can be emboised with textures
• have good adhesion
• become hard and brittle (like paint) when cool
• are compatible with varnishes/impainting media

ACKNOWLEDGEMENTS
Faculty advisors James Hamm and Dr. Carissa Roger; Participants of email survey/questionnaire
Financial Support: Buffalo State College; The Andrew W. Mellon Foundation; The National Endowment for the Arts; Cameron & Jane Baird Foundation

<table>
<thead>
<tr>
<th>COMPONENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wax 1: Beeswax</td>
</tr>
<tr>
<td>Wax 2: Be Square™ 195</td>
</tr>
<tr>
<td>Resin: Laropal® K-80</td>
</tr>
<tr>
<td>Pigments</td>
</tr>
<tr>
<td>Total Parts</td>
</tr>
</tbody>
</table>

Table 1. Pigmented Wax/Resin fill formulation made commonly used in the Buffalo State College Art Conservation Paintings Department.