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Making It Stick: Paste on Paper

ABSTRACT

Wheat-starch paste is something that most book and paper conservators use with regularity, and there seem to be almost as many recipes for making it as there are conservators who use it. This paper provides a wide glimpse of the often-personal process of making and using paste and examines the practice of pre-soaking starch before cooking.

The absence of a published reference guide for making, storing, and applying wheat-starch paste is conspicuous. Wheat-starch paste is something that most book and paper conservators use with regularity, and there seem to be almost as many recipes for making it as there are conservators who use it. This paper provides a wide glimpse of the often-personal process of making and using paste and examines the practice of pre-soaking starch before cooking.

This report compiles various approaches to making and using wheat-starch paste based on interviews with book and paper conservators in the Boston area. Interviewees represent a range of backgrounds and working environments, including art museums, libraries and special collections, private practices, and regional labs. Questions addressed include: How did each conservator learn to make paste and who taught them? How and why have their recipes changed over time? What are their reasons for choosing certain ingredients and materials? How often do they use wheat-starch paste and how do they store it?

While the paper conveys the variety of recipes and applications of paste, an experimental section closely examines one element of the paste-making process, the practice of soaking starch before cooking. Wheat starch was soaked for various amounts of time and several batches of paste were prepared and evaluated.

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I. PASTE PREFERENCES

This project was conceived as a means of compiling information about how paper conservators make and use wheat-starch paste. Interviews with conservators revealed that the process of making paste is methodical for some. For others, it is a decidedly inexact science of "feeling" their way through the cooking process, producing a similar paste with a unique cooking experience each time. For all, though, making paste is ultimately a means to an end. Though end products may vary according to the preference of the paste maker, all can agree that the smooth, tacky properties of well-made paste signify an effective paste. Results of the interviews contrast the diverse approaches to making paste with the overriding simplicity of the ingredients—water and wheat starch.

Methodology

A questionnaire was developed and seventeen book and paper conservators were asked about how they learned to make paste, how and why their paste recipes have changed over time, and why they use the ingredients and materials they do. Interviewees represent nine different labs in the Boston area. Private practices, regional labs, art museums, and libraries are represented in the survey.

Where do Recipes Come From?

Interviews revealed that some conservators have spent their careers refining a paste recipe, while others are content to make paste the way they were taught by a mentor or colleague. In both scenarios, the continued passing of knowledge from one conservator to another has contributed to a rich oral history of paste making. There are many components that contribute to a paste recipe: type and quantity of ingredients, equipment, cooking procedure, and storage method. Given these variables, it is not

surprising that that there are so many recipes currently in use by conservation professionals.

Do Recipes Matter?

Almost all of the conservators interviewed prefer to follow a recipe when making paste. Although the recipes reported in this survey vary widely, each produces an effective paste. If each of these paste-making methods works as well as the next, do recipes matter at all?

Ratio of water to starch, heat levels, cooking time, and quantity of starch play significant roles in determining the characteristics of a batch of paste. In order to compare the recipes used by the nine labs in the survey, they were divided into three categories according to the ratio of water to starch (fig. 1).

Group A: Uses a water:starch ratio of about 4–5:1, producing a paste with moderate moisture content most preferable to conservators who do not require exceptionally dry, strong paste. The paste is strained and/or diluted to suit the needs of treatment.

Group B: Uses a water:starch ratio of 10:1. Compared with the rest of the interviewees, members of this group make their paste in very small quantities, usually producing less than 50 mL of paste at a time. The resulting paste is similar in moisture content and consistency to paste made by Group A respondents, who all make much larger quantities. Like Group A, the paste is strained and/or diluted to suit the needs of treatment.

Group C: Uses a water:starch ratio of about 2–3:1 to produce a very thick, dry, and strong paste.

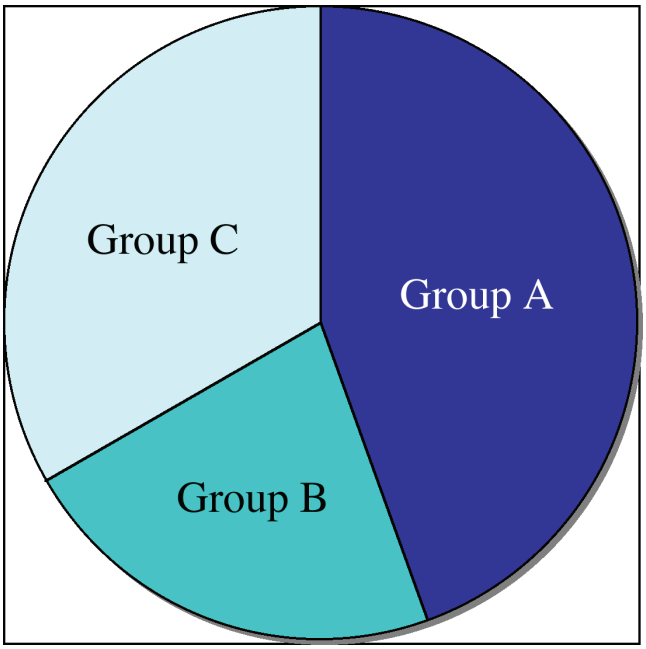

Fig. 1. Graph showing respondents divided proportionally according to paste-making technique.

Both books and works on paper are treated in all of the labs in this group. In this case, the recipe is determined by the final use of the paste, as a strong, thick paste is necessary for book treatments. Conservators performing other treatments then strain and/or dilute the paste to suit the needs of treatment (table 1).

Group B respondents make an average quantity of paste roughly one-twentieth the average amount that Group A does, while cooking their paste for about one-fourth of the time. Proportionally, Group A's paste is on the heat for a much longer amount of time, allowing more evaporation during cooking. In this case, it appears that quantity of starch and cooking time outweigh ratio in determining the final characteristics of the paste.

II. KNOW YOUR PASTE

Recipes are an effective way to produce a known and predicable product each time, yet it is valuable to remember that usable paste can be produced following more than one method. Recognizing the phases that paste goes through during cooking is the surest way to produce the desired paste every time (figs. 2–6).

III. SOAKING

What Does Pre-Soaking Accomplish?

During the course of conducting interviews it became clear that there are two very common beliefs regarding the soaking of starch before cooking:

1. It produces "stronger," "tackier" paste.
2. It produces "smoother," "nicer" paste.

Only about 11% of interviewees said that they soak their starch before cooking while 78% said that they never do. The final 11% of interviewees reported that they always intend to soak but often don't have time, so will make paste without soaking at all. Why do some conservators somewhat sheepishly admit that they don't soak their starch while others proudly announce it? Ultimately, soaking is a preference, just like any other part of the paste-making process. Those who intend to soak but rarely do may simply believe that soaking produces more favorable paste properties, while understanding that a functional paste can be achieved with or without the extra step. The goal of this experimental section is to identify differences in texture and strength among batches of paste that have been presoaked for various amounts of time.

Methodology

Four batches of paste were made using the same recipe. Ratio of water to starch, cooking time, temperature, equipment, quantity, and storage were all standardized, leaving pre-soaking time the only variable. Soaking times were determined based on participating labs' practices. In par-

Table 1. Table of responses to paste-making survey

	Starch: H_2O	Quantity of Starch	Cook Time	Heat Source	Starch Type*	Water Type	Soak	Storage
Group A								
Lab 1	5:1	60 grams	30–45 min.	Hot plate	No preference	Deionized	None	Sterile syringes
Lab 2	4:1	Varies	30 min.	Removed 2 inches from direct heat	Zen Shofu	Deionized	Sometimes overnight, usually none	Plastic or ceramic jar covered with damp towel; room temp.
Lab 3	3.5-4:1	Varies, very large quantities	45 min.	Cook & Stir	Zen Shofu	Deionized	None	Glass jar covered with water in refrigerator
Lab 4	4:1	65 grams	20 min.	Cook & Stir or double boiler	Zen Shofu	Deionized with $Ca(OH)_2$ to pH 7	About 20 min.	Glass jar with lid in refrigerator
Group B								
Lab 5	10:1	3 grams	10 min.	Hot plate	Zen Shofu	Deionized	None	Glass beaker uncovered; room temp.
Lab 6	10:1	3 grams	5–10 min.	Double boiler	Zen Shofu or Aytex-P	Tap water	None	Glass beaker uncovered; room temp.
Group C								
Lab 7	2:1	35 grams	20 min.	Cook & Stir	Zen Shofu	Deionized with $Ca(OH)_2$ to pH 7	30 min. to 1 hour	Glass jar with lid in refrigerator
Lab 8	2:1	30 grams	15 min.	Hot plate	Aytex-P	Deionized	None	"Brain" or ball of paste on a piece of Mylar; room temp.
Lab 9	3.5:1	300 grams	30–45 min.	Hot plate	No preference	Filtered tap water, pre-boiled	None	Plastic jar with lid; room temp. during day, refrigerator at night

*Zen shofu and Aytex-P refer specifically to types of wheat starch sold by Talas.

ticular, batch 4 was meant to simulate the traditional Japanese practice of storing uncooked wheat-starch in water:

- Batch 1: 5 minutes
- Batch 2: 1 hour
- Batch 3: 24 hours
- Batch 4: 5 days

Texture was assessed visually and mechanically by straining the paste, working it with a bristle brush, and applying it to test hinges. V-hinges made from lightweight Japanese paper were used. Tack was measured by feel, sheer strength of the test hinges, and by the distortions resulting from a thin layer of paste applied to a sheet of lightweight Japanese paper.

Materials

Four to five 30 cc sterile syringes
Two small white enamel pots
Two beakers for measuring
Rubber spatula
Zen shofu wheat starch
Deionized water
Reagent alcohol
Electric heating device

Procedure

Combine 50 mL wheat-starch (about 30 g) with 100 mL of water. Cover and soak the starch at room temperature for the desired amount of time. Transfer the starch/water mixture to a pot and begin to cook, stirring constantly, over moderate heat. Heat 150 mL of water in another small pot over high heat. Just before the remaining heated water boils, add it slowly to the starch/water mixture, stirring the paste vigorously (adding pre-heated water hastens the cooking process). Cook for 35 minutes, stirring constantly. Remove paste from heat. Fill the syringes with the hot paste, trying to avoid the inclusion of air bubbles. Rinse the tip and cap of the syringe with reagent alcohol before and after each syringe is filled. Cap each syringe immediately after filling.

Fig. 2. Starch-water mixture is opaque white with a thin, milky consistency.

Fig. 3. Mixture becomes translucent and thickens slightly.

Results

When all four test batches were worked up with a bristle brush on mat board, the most notable difference among them was the gradation of moisture content. A short soaking time yielded higher moisture content while a prolonged soaking time dramatically reduced moisture content. Batches 1, 2, and 3 shared a similarly smooth consistency. Batch 4 produced paste that was very dry, lumpy and grainy. Straining improved the overall texture, but the paste retained a slightly granular texture.

Tack was tested by putting a small amount of paste on an index finger and repeatedly pressing the finger and thumb together. Little difference in strength was perceived between batches 2 and 3, though both seemed tackier than batch 1. Batch 4 was by far the weakest of the group, a surprising outcome given the common belief that soaking increases the strength of paste.[1]

When brushed in a thin, even layer onto lightweight Japanese paper and left to dry, each of the four pastes caused planar distortions. The degree of distortion linked directly to soaking time. Batch 1 created the most significant distortions and batch 4 the least. The result of this test may indicate as much about the moisture content of the pastes as it does the strength, as water also produced some distortion.

Sheer strength of the test hinges was evaluated by lightly tugging at the bottom of the hinged sheet. Batches 1, 2, and 3 all produced strong hinges that held with no visible distortions in the hinged sheet. The consistency of batch 4 made even application of the adhesive difficult, and the hinges released more readily than the others.

Conclusion

Of the four batches, the author's preferred paste turned out to be batch 2. Soaking the starch for one hour produced paste with a particularly smooth consistency and pleasing moisture content. It is critical to note, however, that batches 1, 2, and 3 each produced effective paste. As with other aspects of making wheat-starch paste, soaking starch before cooking is a matter of individual preference.

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NOTE

1. This result warrants further study into other variables that may have contributed to the weaker paste.

Fig. 4. Paste continues to thicken and becomes "syrupy."

Fig. 5. Air bubbles develop as paste thickens further.

Fig. 6. Bubbles develop and elongate. Paste takes on a slightly gelatinous or rubbery quality and becomes more opaque.

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