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Working With Paste

Figure 1: Paste made on a stove top.

Figure 2: Using an aluminum pan for rapid cooling of hot paste.

Introduction:
When I began making fireworks in my youth, a time when sources of information were very limited and there was no AFN or the internet, I assumed that the "wheat paste" referred to in the traditional texts was simply made by dissolving flour into warm water. While this did make a sort of paste that resulted in harder casings, it performed nowhere near as well as paste made in the correct way as I discovered years later.

The term "wheat paste" generally refers to a type of paste that can in fact be made by simply adding the flour-like substance to water. However, it is not really flour, rather it is an extract from flour that is designed for easy mixing. The most available form of this paste goes by the name Golden Harvest, and is a type of wall-paper paste that can be found in some hardware stores. The same wheat paste packaged under the Golden Harvest name can also be purchased in much larger quantities from PyroSupplies.com. I purchased one of the 40 pound paste bags form PyroSupplies about four years ago and, many many shells later, there is still about 15 pounds left.

Making Paste from Flour:
Traditional paste can in fact be made from common baking flour found in the grocery store. The trick, however, is to boil the water during the process so that the gluten is released from the flour. This is what results in the nice, thick goop that you won't get by simply mixing flour and water together. The procedure for making a typical batch of paste using flour and water is as follows:

1) Boil 3 cups of water in a soup pot.

2) In a blender, mix 3 cups of cold water with one cup of flour.

3) Pour the flour/water mixture from the blender into the boiling water, stirring as they mix.

Figure 3: Using a whisk to mix small batches of paste.

4) Keep stirring the mixture, making sure the paste does not burn and clump up on the bottom of the pot. At a certain point the paste will begin to get noticeably thicker. The longer you cook it, the thicker it will get.

5) Once the paste has reached the desired viscosity, let it cool and use it right away.

If the paste is allowed to cool in the cooking pot, it will take quite a while. This long wait will result in some skinning on the surface and the paste will become thicker by the time it is ready to use. By transferring the paste into an aluminum pan as seen in Figure 2, the cooling will be much faster due to the rapid heat transmission characteristics of aluminum combined with the increased surface area of exposed paste.

Figure 4: Using a blender to make short work of the mixing process.

While this paste works just as well as wheat paste, the primary disadvantage is that it is more trouble to make for the hobbyist who typically needs only a small quantity for pasting in a few shells. It is more ideally suited for commercial operations where large pots of paste are cooked and used the same day.

Making Commercial Wheat Paste:
Since the commercial wheat paste can be produced without the need for boiling water, it is ideally suited to small batches. Very small batches can be made by simply using a whisk to stir in the powder and break up the lumps. It is important to add the wheat paste to your water in small quantities when mixing paste in this way, otherwise you will get lumps that are hard to remove. If you live in a humid climate and your wheat paste has a lot of lumps in it, you may need to screen it before adding it to the water, otherwise these lumps are not going to easily dissolve.

Figure 5: Using the vortex size as a gauge for when the paste is ready.

A more efficient method of mixing wheat paste is to use a kitchen blender, as seen in Figure 4. The blender makes the mixing process go very fast, and results in a very uniform paste that is completely free of lumps every time. However, a minimum of about three cups of paste must be made when using this technique, otherwise the paste tends to get splattered around the mostly empty blender and doesn't mix well.

The blender method also provides an easy way to tell when your paste has reached the proper consistency, which is the size of the vortex created while the blender is running. When the vortex just starts to disappear, that is usually when your paste will be ready. The procedure for making wheat paste in a blender is as follows:

Figure 6: Paste consistency using Golden Harvest wheat paste.

Figure 7: Using a squeegee to quickly clean up the mess from pasting operations.

1) Add 3 or 4 cups of water to your blender. Do not fill the blender more than half full of water.

2) Run the blender on low speed, pouring in the wheat paste through the hole in the lid.

3) Continue adding paste until the vortex disappears, then switch the blender to high speed. The vortex should appear again on the new speed.

4) Continue adding paste until the vortex disappears. At this point your paste will be ready to use.

The desired viscosity of your paste will depend on the thickness of the paper you will be using it on. In general, thicker paper should have a slightly soupier paste, since the paper will absorb a lot of the water. Thinner paper, such as 30 pound outer wraps and crossette wrappers, work well with a slightly thicker paste.

Paste tends to get thicker the longer it sits, so it is best to use it right away after making it. An unfortunate disadvantage of wheat paste is that it can not be stored for more than a day or two before it spoils. Various additives are said to remedy this problem, such as sodium salicylate or paris green, but I have not had any luck with these. Mixing white glue with wheat paste does seem to slow down the spoiling process, but I have seen nothing the completely eliminates it. You are better off just getting used to making only the amount you need, or pasting in all your shells in one batch operation instead of one at a time as you produce them.

Yet another problem with wheat paste is that various insects seem to find it quite tasty. These bugs will not only infest your dry paste storage, but they will even eat your shells after they have been pasted. Some Maltese shell builders have remedied this problem by adding poisons to the paste, such as paris green, which keeps the bugs away. Tight fitting lids on your paste storage will also keep the bugs out of your dry paste.

One final tip: that huge sticky mess left on your workbench after pasting in shells can be easily cleaned up by using a squeegee as seen in Figure 7. A large silk-screening squeegee is shown here, but any variety should work well. Just be sure to cleanup as soon as you are done, or even at various intervals if doing a large job, otherwise the paste will dry on the table and become a lot more work to remove. Simply adding water to dried paste does not turn it

back into its original state, so it is best to remove it before it is too late.

Wheat paste is a critical component in fireworks manufacture and is likely to be the paste of choice for quite some time. It is cheap, easy to make, non toxic and very good at producing strong, well sealed shell casings.

Happy pasting!