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ADVANCED ADHESIVES REPORT

Your corrugating newsletter from Harper/Love Adhesives Corporation

Calculating starch adhesive solids

However you do it, understand what is in your calculation and be consistent

By John Kohl

The percent solids of starch corrugating adhesive is the ratio of the weight of the dry ingredients to the weight of the entire batch. This is an important metric used to determine if the starch content of the finished adhesive is adequate for the box plant's production mix and corrugator equipment and not too high to cause excessive consumption and cost.

Knowing the solids content of an adhesive is an excellent tool for quality control. A box plant can periodically check the solids content of a sample of adhesive by drying it in a lab oven, moisture meter, or a simple microwave oven to verify that all the ingredients are being added to the formula or to check for the presence of excess water.

Some of the newer automatic starch mixers calculate the percent solids and display it with the formula information. They also include the condensate (water from the steam) so the additional water weight is accounted for. If adhesive solids will be checked by drying in an oven, it is important to understand how the mixer software is doing the calculation. Older two-tank and semiautomatic systems do not account for steam condensate that will lower final batch solids. With some systems, and in colder climates, condensate can add as much as 30 gallons of water to a 700-gallon batch of adhesive.

TYPICAL 320-GALLON BATCH IN AN AUTOMATIC MIXER

Primary water	834 lbs	(100 gal)	
Primary starch	95 lbs		95
Caustic (dry wt)	16 lbs		16
Borax (5 mol)	10 lbs		10
Secondary water	1230 lbs	(148 gal)	
Secondary starch	620 lbs		620
Total	**2805 lbs**		**741**

Percent solids = 741÷ 2805 = .2641 x 100 = **26.41%**

If calculated with starch only:

Percent Solids = 715 ÷ 2805 = .2549 x 100 = **25.49%**

Oven dried calculation subtracting 10% water from starch:

Percent solids = 667 ÷ 2805 = .2378 x 100 = **23.78%**

All the dry ingredients, or starch only?

There are two ways to calculate the solids content. One is to include all of the dry ingredients in the numerator of the equation and divide by the total batch weight. The other is to include only the starch portion of the adhesive (both carrier and secondary starch) and divide by the total batch weight. The difference between using all the dry ingredients (starch, caustic, and borax) and just the starch in the calculation is approximately 1 percent. In all cases the units of measure need to be in pounds not gallons. (To convert gallons to pounds multiply by 8.34.)

Drying methods

There are three accepted methods used to dry down an adhesive sample to check the solids content.

1. One is to use a laboratory oven, set at 105°C. A liquid sample of approximately 5 grams is weighed and placed in the oven for 3 hours and then reweighed. The dry weight is divided by the original wet weight of the sample and multiplied by 100 to give the percent solids. Remember to subtract the weight of the weigh dish before and after the sample is dried.
2. An infrared (IR) moisture meter, common in box plants to check paper and combined board moisture, can also be used. Just set a weigh dish in the meter and zero the scale, add 3 to 5 grams of adhesive, close the lid and run the test. This type of meter takes only 8 to 12 minutes to run.
3. Microwave ovens are also used to dry down an adhesive sample. This is the same sample weigh method as with the lab oven but the weigh dish must be plastic and the sample size need be only 2 or 3 grams. The microwave must be set to a low power, about 50 percent depending upon the wattage. The more powerful the microwave the lower the power setting needs to be, otherwise the sample will boil and spray some of the starch out of the pan and give an inaccurate result. The oven needs to dry the sample for only 2 or 3 minutes to completely remove all the moisture.

Oven-dried solids results will always be lower than the percent solids calculated manually or by the mixer software, if the condensate was accounted for. This is because all cornstarch arrives from the supplier containing some residual moisture. The average is about 10 percent. This

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will make the oven-dried solids test result lower by 2 or 3 percent, depending on the total pounds of starch used. Test results can easily be verified by subtracting 10 percent of the starch weight in the numerator of the equation before dividing it by the total batch weight.

Whatever method you use to calculate percent solids, and whatever drying method you prefer for verification, it is important to be consistent and keep good records to get full value from this valuable quality control tool.

Switch to starch adhesive for running dual arch board

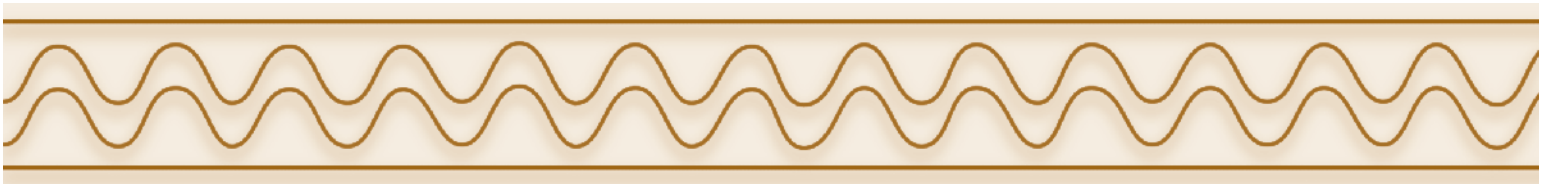
It's cheaper, more convenient, and runs faster than PVA

By Rex Woodville-Price

What is dual arch board?

Dual arch is the name given to single-wall board made using two mediums. One medium has adhesive applied to it just before it enters the single facer. The two mediums are bonded together as they are formed into flutes.

imagine the forces at work and why a thicker medium has higher stress. Two thinner mediums, of the same combined caliper as one thicker one, will form better because they can move relative to each other and thus have less chance of fracturing the flutes or tearing the fibers. The paper fiber in the two thinner mediums would be aligned in a more orderly pattern and would lie more parallel to the surface of the sheet in the machine direction. They would thus be better able to withstand these tensile forces since most would act along their length, where they are strongest.



Why dual arch?

Dual arch board uses only two liners compared to three for double-wall board. This reduces cost. Although it cannot actually replace double wall, dual arch can be a suitable substitute for certain applications.

Since a significant proportion of the ECT strength of corrugated board is provided by the medium, it can be advantageous to add fiber to the medium. Why not just use thicker medium? Well, there are some practical limitations to that. First of all, paper machines can make medium only up to a certain thickness or caliper. So if you need thickness beyond that limit, you must resort to dual arch.

There are other considerations: when the medium is formed in the corrugating labyrinth, the medium paper fibers are put under significant stress. If we consider that the medium is being forced to bend almost 180 degrees in a very small distance as it forms the flute profile, we can

Advantages of dual arch

Dual arch has some characteristics that can be exploited for special cases.

- Being a single-wall board, it takes up less space than double wall, so more of the space allotted for transportation can be filled with product and less with packaging.
- Dual arch also has superior flat crush value. In any board, flat crush strength comes from the fluted medium. It is well known that double wall has very low resistance to flat crush since the flutes that make it up (typically B & C) do not line up and will actually deflect each other. Dual arch construction doesn't have this problem.
- Dual arch allows plants with only one single facer to supply heavier duty boxes without the investment required for producing double-wall board. Considering that dual arch production is not widespread, it could allow some plants the ability to supply a market niche that differentiates them from their competition.

Limitations of dual arch

Dual arch generally runs slower than single wall, but since it can replace double wall, its production speed is offset by this since it can run at speeds comparable to double wall. Running three papers continuously on one single facer will require three splicers. It is often possible to use one of the other splicers on the machine, by adding a few strategically placed idler rolls.

You will need to have a dual arch adhesive applicator.

Why starch adhesive instead of PVA?

Until recently, polyvinyl acetate glue (PVA) has been the default adhesive for dual arch construction. Presumably, it was perceived to offer wet-strength benefits. Our tests have demonstrated that modern wet-strength starch formulations perform quite well in this application, and eliminate the disadvantages of PVA.

The most common reason to use starch adhesive for dual arch is to save money. Typically, PVA costs about $1.20 per pound. Starch adhesive prepared to run dual arch using our additives is significantly less expensive at about $0.30 per pound. Also, with starch adhesive, you use about half the pounds per MSF than you do with PVA, which reduces cost further.

There are other compelling reasons to prefer a starch-based adhesive over PVA:

- Faster run speeds. When using the proper additive combination, it is possible to run faster with starch than with PVA.
- Simpler adhesive inventory. Since dual arch tends to be a niche market, it is often difficult to predict production volumes. This makes it difficult to always have PVA in stock, keeping in mind that it has a specific shelf life. We must also clarify that this PVA is not the same as is used for glue lap adhesive. Using the same starch adhesive you are already using on the corrugator (you would change only the additives) is convenient, plus any leftover can be used up in the corrugator.
- Easier to cleanup. Compared to PVA, starch adhesive is much easier to clean up because it is less sticky and is more soluble in water. When PVA dries it is very difficult to remove; it is possible to ruin a dual arch applicator through inadequate cleaning.
- Insurance. If the bottom medium were ever to break out, the corrugating roll could be exposed to the dual arch adhesive. It will be much easier to clean up the mess if the adhesive being used is starch rather than PVA.

Dual arch board may be a way for you to offer heavier-duty boxes at lower cost for certain customer applications. If you're already running dual arch with PVA, let us show you how the proper starch formulation can help you run faster at lower cost. Your Harper/Love representative can help you explore your options and sort out the technical issues.

OBM™ One Bag Mix

Your ace in the hole when gremlins attack your automated starch system

By Bill Kahn

Almost all of us can remember a time when a breakdown to the starch adhesive mixer has virtually shut the corrugator operation down. Whether this was the case of an old Pratt two-tank system when the motor went out on the secondary mixer or a new modern high-shear mixer when the computer or an electrical problem shut the entire system down. It may have been the time that the silo bridged over or the transfer pump or weigh hopper malfunctioned.

There are just so many isolated events that could bring our ability to make starch adhesive to a screeching halt. We don't have to think too hard to remember or imagine the panic that accompanies these events.

Even if you are well prepared to address silo issues, with a truckload of pearl starch for a backup, it is still a monstrous chore to find the manual formula and begin to prepare adhesive to work around whatever malfunctioned in the system. There also are the safety concerns for handling and properly adding the caustic soda to the batch.

OBM to the rescue

These are the contingencies for which OBM was created. An emergency supply gives you peace of mind that you can cope with unforeseen emergencies and keep your corrugator in production. The product is used on Asitrade-type machines and requires only warm water added to the bag of powdered One Bag Mix to create ready-to-use corrugator adhesive.

Shelf life

At the request of several of our field technical personnel we have evaluated the effects of aging on our One Bag Mix product. These studies revealed that for machines or applications where viscosity and gel point are extremely critical it is best to use the product within six months of purchase. But when this material is used as a normal corrugator adhesive during an emergency the shelf life can be as long as two years.

We have a number of customers who are stocking enough OBM in-house to run for an entire day or an entire shift depending on their space available for storage.

All that needs to be done for this program to work is to make sure the calendar is marked with the date to consume the material by two years from purchase and then order more to stay prepared for the next emergency.

If you are interested in this program your Harper/Love representative can work with you to predict the amount of product you will need per shift and a simple formula for water, heat, One Bag Mix, and mix time.

Leaders in the science of making good adhesives better™

Harper/Love Adhesives Corporation
11101 Westlake Drive
P.O. Box 410408
Charlotte, NC 28241-0408
800-438-3066 • www.harperlove.com
e-mail: salestech@harperlove.com

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LOW-SOLIDS POLYMER PERFORMANCE ENHANCER

LSP™

Put your corrugator on a low-starch diet without sacrificing adhesive performance

LSP boosts productivity and quality with a lower-solids adhesive. You use less starch and reduce adhesive cost.

- Higher corrugator speeds
- Improves bond quality
- Improves water holdout
- Helps reduce score-cracking in dry weather
- Batch cost neutral: more than pays for itself through reduced starch cost
- Lower BTUs to gelatinize

For detailed technical information, contact your Harper/Love representative or call us toll free at 800-438-3066