ADVANCED ADHESIVES REPORT

April 2000

Your corrugating adhesives newsletter from Harper/Love Adhesives Corporation

High-shear mixers: The good. The bad. The merely annoying.

How to find and fix common problems.

By Lou Cuccia

One of the greatest advancements in starch adhesive mixing equipment has been the introduction of the high-shear mixer. This sophisticated piece of equipment has reduced batch time and eliminated the need to store large quantities of starch. It speeds start-up by allowing fresh adhesive to be produced quickly, and blended with low levels of existing stored starch adhesive. Fresh starch adhesive delivers more reliable viscosity, temperature and gel points, resulting in consistent pick-up and transfer from the glue roll to the flute tip.

There are some older two-tank systems still in use, but most newer high-shear systems are single-tank setups. Both produce excellent results, but the single-tank systems are faster, take up less space, and require less energy than the two-tank systems. The accuracy and repeatability of the newer systems are outstanding.

In either case, operators need to pay close attention to the equipment, the formula, procedures and raw materials to maintain consistent performance.

Look first to the equipment!

In the event of a problem, especially one that occurs frequently, the first place to look for a cause is the system's alarm data base. Here you will find an entry every time an alarm is generated. Normally, the entries

are routine, such as, "Batch finished for inspection." Entries that flag a fault, such as, "Water valve did not close," or "Starch blower on too long," will either tell you exactly what's wrong or at least direct your search in the right direction. Check your data base for the past 30 days; you may discover a pattern.

Routine maintenance and calibration of scales, temperature gauges and other control components will keep them from causing problems.

Could it be the formula?

A common problem with high-shear systems is increasing viscosity of adhesive in storage. When starch is put under high shear, it shears down quickly. But a batch that finished at 32 to 34 Stein-Hall seconds at 105°F can rise to 40 or 42 S. H. in storage. Since running viscosity is more important than batch viscosity, this is a phenomenon that must be anticipated in the formula.

As starch sits with little or no agitation, it has a characteristic called dilatancy, which causes it to behave like quicksand. Since starch granules are attracted to each other, the mixture will thicken with time. To test how a batch will behave in storage, simply turn off the mixer and let it stand for 30 minutes. Check viscosity and temperature every 10 minutes. When viscosity stops increasing, you will see your worst-case scenario in storage.

The amount of viscosity increase or set-back is directly related to the pounds of carrier

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High-shear mixers, continued

starch in the formula. More starch will increase viscosity set-back in storage. Less starch will decrease viscosity set-back in storage.

What about those raw materials?

Sometimes, a new lot of pearl, caustic, or borax can be different enough to create problems. It's a good idea to chart your supplier COAs (Certificates of Analysis) so you'll know when new materials differ significantly from the ones you've been using.

It's also wise to do your own starch moisture and caustic sensitivity tests when you receive a new lot of starch. These will help you spot variations that directly affect viscosity and gel point. Usually, you can adjust the amount of caustic soda in your batch to bring viscosity and gel point back in line without affecting corrugator performance. (Contact Harper/Love for test procedures.)

If you're using 50% liquid caustic, remember it freezes at 53°F. Your tanks must be heated, and should also employ a circulation or agitation system to keep the contents from settling out. As caustic soda approaches freezing point, crystals are formed which can change the amount of caustic soda delivered. Be sure that all supply lines are insulated, particularly those from any storage system to the starch preparation area. This line is a frequent cause of caustic delivery variation.

If you suspect a new delivery of caustic is causing viscosity and gel-point changes, you can measure the percent solids using a calibrated hydrometer. Fifty percent caustic soda has a specific gravity of 1.52 at 68°F.

Finally, be sure you are receiving the correct borax. Watch the color of the bags and be aware of this when material is received. Five mol borax comes in a purple or red bag. Ten mol comes in a green bag. Boric acid comes in an orange bag. Bag labeling will identify 5 mol borax as *pentahydrate*, and 10 mol borax as *decahydrate*.

Another borax issue is the borax hopper chute. Be sure the hopper chute is checked and cleaned every day. The starch system program may tell you that all the borax was discharged but it may be sitting unused in the supply chute.

Oh, that pesky starch build-up!

If you find that batch viscosity increases as the day proceeds you are probably experiencing build-up of starch on the side of the tank (or a steam leak). In a single-tank mix, any build-up that is left in the mixer at the end of the batch becomes additional carrier in the next batch. Since the system zeroes itself, this build-up is ignored by the system. Be sure your high-shear tanks are clean to avoid growing batch viscosity.

Batch weights tell the tale.

Another good troubleshooting guide is to chart the final batch weight. This is the total indicator that everything went into the batch as programmed. The new high-shear systems are extremely accurate, so swings in the total batch weight are a reliable indicator that something is not right.

Just take it one step at a time.

Hunting down viscosity and gel-point problems is a lot less frustrating if you keep good records and check out one thing at a time in a logical order.

Good hunting. Let us know if we can help.

Remembering Conley Ellis

Harper/Love's Conley Ellis died February 4. His loss is felt deeply by his friends and colleagues in the corrugating industry.

Conley began in the industry in the early 1950s and progressed from operator to foreman, to plant superintendent before joining Harper/Love as a technical sales and service representative in August of 1972. He was most recently technical service manager for our Northeast Region.

Says Regional Manager Bill Gerard, "Conley always put the customer first. He believed doing the right thing is always good business. Conley was also a strong team player, who took pleasure in the success of others. We'll miss him."

Bill Gerard (left), remembers Conley Ellis as a team player with a strong ethic of customer service. Conley provided technical service to Harper/Love customers in the Northeast Region from his home in Elizabethton, Tennessee.

Field staff additions

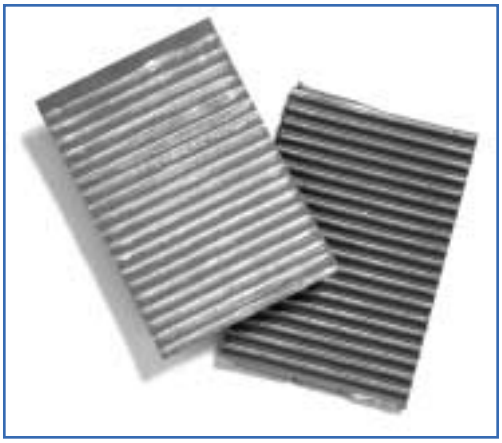
Tony Clabo and Alan Harris have recently joined Harper/Love to expand sales and technical coverage in the Southeast and Midwest.

Tony will be based in Tennessee to provide technical services to a growing customer base in the Southeast. He has over 20 years' experience in corrugator operations. He began his career with Westvaco and most recently was corrugator superintendent for another large integrated company.

Alan has over 8 years experience providing adhesive and service to the industrial packaging and corrugating market. He also has deep experience with both Anheuser Busch and Coors in sales and marketing. Alan will be based in the Kansas City, Missouri, area, with responsibility for sales and technical service.

Tony Clabo (left) and Alan Harris (right) in Harper/Love's laboratory to consider the finer points of starch adhesive formulation with Lou Cuccia, southern regional manager.

Working with high ring crush liners



HRC liners tend to resist moisture absorption, making it difficult to obtain a good bond.

HRC liners offer the benefit of greater strength with less weight, but the compressed fibers and harder finish make it more difficult to get a good bond.

Compared to standard liners, HRC materials resist moisture absorption. Starch tends to remain on the surface. They also transfer heat faster causing the starch gel point to occur too early for proper wetting out. The result is a shallow, brittle bond.

Here are a few things that will help you accomplish a better bond with HRC liners:

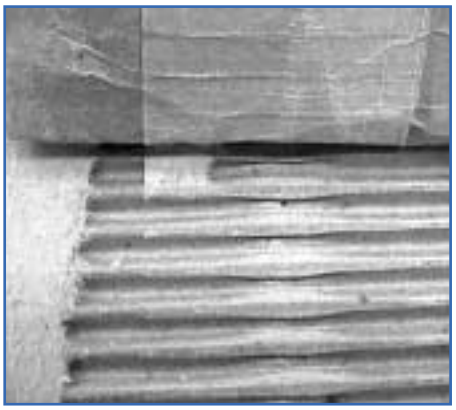
- **Higher solids.** Run a higher solids carrier. Increase overall adhesive solids to 26 to 30 percent.
- **Lower viscosity.** Try 30 to 40 Stein-Hall seconds.
- **Less heat.** Reduce the heat going into the glue mechanism to about 200°F to 210°F.
- **Increase gap setting.** Open the gap to about .002" more than regular board.
- **Higher speed.** Run as fast as you can without compromising quality.

Also, make sure your single facer is in good operating condition and that proper settings are maintained.

Harper/Love Adhesives will soon introduce a new product designed specifically to provide superior bonding at higher speeds with HRC liners.

Quick tip: Solving Sesame tape blisters

Some of our customers have encountered a blistering problem when using 2" reinforced Sesame tape applied between the lower liner and the web.



The problem appears to be caused by insufficient temperature and pressure. The tape needs to reach at least 215°F to melt the adhesive. Greater load pressure helps.

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IN THIS ISSUE

HYDRATITE 599™

Cross-linkable performance resin

Hydratite 599 is a second-generation liquid polyphenolic resin. It combines the technology of Hydratite 550™ with new crosslinking products to yield a production tool with a greater range of wet strength potential. The polyphenolic and ketone blends react more aggressively to form permanent crosslinks. This high-performance polyphenolic resin enhances wet strength properties and bond formation. Contact your Harper/Love representative for application information.

- Accelerates glue line dehydration
- Drier, firmer, flatter board
- Enhanced downstream efficiency
- Cross-linking capability improves wet strength
- Easy to use liquid
- Compatible with automatic starch kitchens
- Very safe to use
- Distinctive color for visual assurance of use