FEBRUARY 2006

ADVANCED ADHESIVES REPORT
Your corrugating newsletter from Harper/Love Adhesives Corporation

Cold weather vs. quality and productivity

Should you be running a winter formula?

By Larry Watson

A winter adhesive formula is one that is adjusted to anticipate problems that might be caused by lower temperatures. In winter, we assume it will be more difficult to maintain proper flute tip temperature. We may also be challenged to maintain adequate starch temperature, which affects viscosity and application rate. Several things can contribute to the need for a winter formula; some may be out of your control but others can be managed:

Several things can indicate the need for a winter formula; some may be out of your control but others can be managed

- Paper comes into the plant much cooler than it did in July or August. For most plants this plays a large part in the decision to run a winter formula. It is especially important if you store rolls outside or in an unheated warehouse.
- Uninsulated starch lines, holding tanks, and dosers are more susceptible to cooler temperatures.
- It is important to maintain proper temperature of starch in storage.
- In cooler weather, it's easier to lose heat from the flute tips before they enter the hot plate section.

Decision checklist

- Is your machine hotter now than it was a few years ago? Many machines are not only hotter but much more efficient as well. Don't forget to consider your product mix. Do you run a higher percentage of high ring crush liners than you did in the past? The high ring crush paper available today requires considerably less heat compared to materials we've run in the past.
- Do you use every means of preheating the paper that you can? Are your wrap arms fully wrapped when extra heat is called for? Are all your preconditioners working properly? Are all of the siphon pipes working as they are supposed to? How about your traps? These also need to be operating as designed. Are the vessels that are designed to turn actually doing so? Are all of the vessels paralleled? (You can lose 40 degrees or more from side to side if they are not.) And is the paper wrapped in the right direction for proper heat transfer? Many plants have improved their flute tip temperature by simply rewrapping the web. Rewrapping the liners can also improve heat transfer.
- How is the insulation of your feed and return starch lines? Have you insulated your storage tanks? And don't forget your dosers if you are using them. It is staggering the amount of heat that is lost simply because starch lines and storage tanks have not been properly insulated. Lost heat is lost energy — and lost dollars!
- Some plants have no way to maintain starch temperature in storage. For those that do, it's important the system works as designed. If you're running a TVC system, have you established a procedure for cleaning and servicing the system? Cleaning and flushing the system twice a year, as you would a radiator, will extend the life of the system and help ensure it is working properly. If you are using a hot water tank system it should also be drained twice a year and flushed if necessary. Have you increased the temperature of your system to compensate for heat that is being lost through ambient temperature? Are your coils working properly? You need to make sure that excessive starch has not been allowed to build up around the coils; this acts as an insulator and does not allow the heat to do its job. While you're at it, be sure to check your heating coils for any leaks. Leaking coils will not only lower the temperature but will also decrease your solids significantly over a short period of time.
- The location of your corrugator and your kitchen also play a big part in determining whether or not you may need a winter formula. Some corrugators, as well as the kitchen, are located on an outside wall where temperature variation is usually greater. Others are centrally located and are not affected as directly as those that are not.

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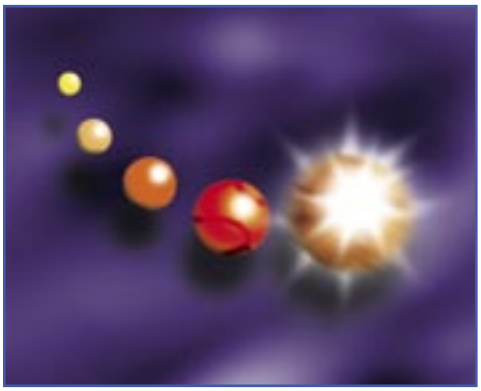
What is the real gel point of your adhesive? Why does it matter?

by Bill Nikkel

The conventional method of determining the temperature at which a starch corrugating adhesive gels does not accurately predict the actual temperature at which this adhesive gels on the corrugator. The actual gel point on the machine is, in fact, much higher than the one established with the conventional method.



The conventional method of establishing a gel point is to heat slowly a relatively large volume of adhesive over a period of several minutes. On the corrugator, a small volume (glue line) has to gel during a very short dwell time. In the case of the double facer, this dwell time, at high speeds, is just a matter of a few seconds. At the single facer this dwell time is only a fraction of a second.

The gelling of a thin film of starch (like a glue line) can be clearly observed under a microscope while this starch is being rapidly heated, closely simulating conditions on a corrugator. Tests conducted in this manner show that to gel such a small quantity of starch in just a few seconds, a temperature in the range of 190^0 F to 210^0 F is needed when using a starch adhesive which has a conventional gel point of 150^0 F.

This tells us the gelling process depends on time as well as temperature: It takes a certain amount of heat energy to gel the starch and this amount of energy can be applied at a low temperature over a long period of time — or at a high temperature for a short period of time. (An analogy would be what happens in a pressure cooker, where cooking time can be reduced by increasing the cooking temperature.)

Test results show not only that shorter heating times require higher temperatures to achieve gelation, but also that initial conventional gel point values have little effect on the actual short-term gel point on the machine. Adhesives with conventional gel points ranging from 140^0 F to 155^0 F all gel at about the same much higher temperature when subjected to the same short heating period.

There is an important message in these findings related to the length of a double facer heating section.

There has been a tendency to shorten double facers to reduce space requirements. A result of such shortening is a reduction in dwell time (heating time). This means the real gel point will be higher. The problem becomes one of having less time to reach a higher temperature to gel the starch.

To achieve high running speeds it is necessary to have a rapid rate of heat transfer, which requires elevated heating vessel temperatures and intimate contact between the paper and the heating surfaces. In addition, it becomes necessary to use stronger adhesive mixes with higher solids and performance enhancing additives.

So think twice before shortening your double facer. It will result in continuing higher adhesive and energy costs and reduce potential running speed.

Winter formula, continued:

An exhaust fan located close to the machine can drop the temperature of the paper as well as starch, making a good bond more difficult to achieve.

- And, of course, your plant location is a large factor. Weather in the Northeast may get very cold as early as September. If you are in a warmer climate you might enjoy balmy weather for 10 months out of the year.

It is not difficult to adjust for a winter formula if it is needed, but it is advisable to contact someone schooled in doing so. My suggestion would be to contact your Harper/Love representative. He can help you assess the unique conditions of your operation and make recommendations and adjustments so cold weather doesn't affect your quality and productivity.

Harper/Love Technical Representative Larry Watson serves our customers with 30 years of experience as corrugator operator and supervisor and several years experience in specialty adhesive sales. He resides in Duboise, Pennsylvania.

Calculating starch adhesive percent solids

Think pounds, not gallons

by Peter Snyder

The total percent solids of starch-based corrugating adhesive is the ratio of so-called dry material to total batch weight. There was a time when only the carrier starch and the slurry starch were included in the calculation. Today, all ingredients are used to generate percent solids; the dry material may include liquid caustic soda, performance enhancers, or resin ingredients.

For box plants with newer starch kitchens, the percent solids of the adhesive in use may be available on the computer touch screen or on a print-out of the batch histories. For those box plants making adhesives manually or in semiautomatic systems, the following calculations may be useful.

The most common error in calculating the percent solids is that water is typically measured in gallons and everything else is measured in pounds.

Second, for plants located in colder climates, steam condensate can add a significant amount of extra water to a batch, thus lowering the percent solids, especially in winter. Steam condensate is added by the action of the steam during the heating steps of the primary and/or secondary mixers. The only way to know for certain how much extra water is being added to the adhesive by the steam is by obtaining a gallons-per-inch volume chart for both mixers and measuring the inches down both before and after the heating steps. You may find the after measurement is an inch or two higher, which means there is additional water present. Use the volume charts to determine how much water is being added for each heating step.

To calculate percent solids of a typical adhesive, we first need to determine total dry weight and total batch weight:

	Solids wt.	Water wt.	Batch wt.
Carrier starch	300 lb.		300 lb.
Slurry starch	1,400 lb.		1,700 lb.
Caustic soda — dry	36 lb.		1,736 lb.
Borax (5 mol)	24 lb.		1,760 lb.
Total solids	**1,760 lb.**		
Primary mixer water*		1,834 lb.	3,594 lb.
Primary steam condensate*		125 lb.	3,719 lb.
Secondary mixer water*		3,044 lb.	6,763 lb.
		Total batch	**6,763 lb.**

** Water weight is calculated at 8.34 lb. per gallon*

Percent solids calculation:

1,760 lb. dry weight

6,763 lb. batch weight

= 26.023% solids

Two join Harper/Love laboratory services

- **James Evans** has joined the Harper/Love team as a lab technician for corrugated board testing. He has more than two years of experience in paper and corrugated board testing at Weyerhaeuser's East Coast lab in Fort Mill, South Carolina. He is a part time student at Winthrop University in Rock Hill, South Carolina.
- **Susan Miller** is a quality control technician for finished product testing. Sue has more than 10 years of experience in the corrugated field as the lab coordinator and lab supervisor at Weyerhaeuser's East Coast testing lab in Fort Mill, South Carolina. Her extensive knowledge of paper, corrugated, and test methods will help us serve our customers better. Sue lives in Fort Mill with her husband, Brian, and their two children.

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