

## Troubleshooting Corrugator Adhesives

Every corrugated box plant prepares some form of starch based corrugating adhesive to bond the liners and medium together. Each box plant has a formula created for their specific needs, including corrugator type, product mix, special needs (i.e. water resistance) and converting requirements. In this edition of *Paperwise*, we discuss adhesive components and how the quality and consistency of those components can affect the corrugator and the quality of the corrugated board produced.

### Back to the Basics

In general, corrugator adhesives have the following components:

- **Water** – as a transport mechanism, absorption medium and for viscosity control
- **Carrier starch** – the cooked portion that suspends the raw starch. In conjunction with caustic, borax and water, determines the final viscosity of the adhesive and provides the initial bond to the paper on contact.
- **Caustic soda (NaOH)** – modifies the gel point, provides “bite” into the paper and, with borax, sets the rheology of the adhesive.
- **Borax** – modifies the texture of the adhesive, helps control the gel point and builds viscosity.
- **Raw pearl starch** – builds the bulk of the solids and absorbs water rapidly to form the strength of the glue line.
- **Additives** – required for greater corrugator speed, water or moisture resistance, and for the control of bacteria, yeast and mold infection.

The adhesive’s job is to join the liner and the medium in the same manner that welding joins two pieces of metal. If there is a failure, you want it to occur in the joined material (liner or medium), not in the weld (starch adhesive). For a good bond or “weld,” the adhesive must “bite” into the medium as well as the liner.

Viscosity control is paramount to making sure the adhesive has good “bite” into the medium, but it shouldn’t be made too thin to achieve a bite into the liner. Viscosity is sensitive to a number of factors. Knowing these factors will

help you troubleshoot and control viscosity more consistently. Conditions affecting adhesive viscosity include:

- Excess water
- Carrier starch
- Excess heat
- Shear
- Bacteria

**Excess water** is an obvious cause of viscosity loss or viscosity breakdown. Possible sources of excess water include:

- Wash up water – return lines left to storage return instead of to drain.
- Water jacket at single face – pinhole leak to glue pan.
- TVC coil leak – a leak in the coil dilutes adhesive in storage.
- Water meter inaccuracy – no calibration program is in place.
- Excessive condensate – reformulation is required where water temperature varies from season to season to adjust for additional steam used. Undrained condensate in the steam lines is another source.

**The carrier starch** is a major contributor in determining viscosity. The type of carrier may influence viscosity stability. Other factors include:

- Excessive shear – agitation in storage, particularly if uncontrolled by a timer
- Inadequate or excessive carrier dry weight – a variation of as little as three pounds from the formula will have a major influence on final viscosity.
- Excessive cook temperature – may weaken the cooked granules and lead to viscosity breakdown.

**Excess heat** will effect a 10% loss or gain in viscosity for every change of 2°F from storage temperature, up or down. Excessive heat could result from:

- Single facer – cooling jacket not working or water too warm.
- TVC – malfunctioning or turned off.

- Poor circulation in glue pan – adhesive remains in the pan too long and absorbs heat.
- Ambient temperature – delivery and return lines generally run near the ceiling. During warm weather, the adhesive absorbs heat from the ambient conditions.

**Shear** or intense mechanical action and friction will chop the starch molecule and rob it of its inherent viscosity. The following may cause this:

- Agitation - agitators in the storage tanks if left on continuously.
- Pumps and lines – worn gear pumps and too many right-angle turns in lines.
- Metering roll/glue roll nip – continuous circulation will break down viscosity over time without new adhesive being added.
- False viscosity – insufficient shearing of the carrier in the initial cook will give a false final viscosity of the completed batch. If this is pumped to storage, it will break down over time for the reasons mentioned in the preceding points.

**Bacteria** and strains of yeast and mold will attack the cooked carrier starch and convert it into sugars that can dissolve in the water and lower the viscosity. Possible sources of infection are:

- Dirty storage tanks
- Dirty lines
- Water
- Air
- Inadequate preservative or using one preservative for too long a period (resistant bacterial strains develop)

## Gel Point

Besides viscosity, gel point is a property that must be controlled. Poor control can result in both poor bond and poor runnability. Conditions that affect the gel point may include:

- Inaccurate weighing of dry caustic pellets or liquid caustic delivered at more or less than a 50% solution.
- Substituting 10 mol borax for 5 mol borax in the formula. Find a proven recipe and stick to it.
- Using adhesive that is old and has not been refreshed with a new batch. If it sits for over four hours, loss of viscosity and gel point increase can occur. Making starch during the day shift for use during all shifts is not normally recommended.
- Using old adhesive that has WR resin in it as a regular

domestic adhesive. Most resins are ketone-aldehyde cross-linking types. They insolubilize the starch in the glue line and require that both heat and moisture remain in the board for the reaction to continue. Take away either heat, moisture or both and the reaction ceases. This is the reason for a cure time on the floor of the box plant before further conversion. Additionally, because the reaction is water-heat sensitive, it begins to cross-link as soon as it is added to the storage or day tank, insolubilizing the cooked carrier. Dosers are the solution to this problem. For example:

- If you keep too high a volume of adhesive in storage over long weekend holidays, the on/off agitation, heating/cooling will gradually break down the carrier allowing raw starch to precipitate out. Keeping the minimum volume under 250 gallons, reduces the time required to build up low viscosity with fresh batches.

You can see there are a number of factors that are fundamental to managing your adhesive system and consistently making quality board. Many start with the design and controls of your starch kitchen and the handling system. The balance depends on your plant's operation and practices.

*If you would like more information on corrugator adhesives or other technical topics, contact your Smurfit-Stone Sales Manager or call us toll free at 1-877-785-7835 or e-mail us at [paperwise@smurfit.com](mailto:paperwise@smurfit.com)*