

Starch for Corrugating



Topics

- Starch adhesive components
- Adhesive characteristics
- Adhesive process control (QC)
- Iodine Staining
- Issues that can be diagnosed with the iodine staining method

Starch Adhesive Components

- Water
- Raw OR Secondary starch (unmodified)
- Caustic
 - liquid OR Dry
- Borax OR Boric acid
- Other
 - Preservatives
 - WRA
 - Bond Enhancers
 - Defoamer

Water

- Necessary component in gelatinizing of starch i.e. :
 - cooking raw starch
 - swelling starch granules
- Reduces carrier temperature
- Dilutes carrier to permit pearl starch addition
- Controls viscosity
- Inexpensive

“VEHICLE FOR ADHESIVE PENETRATION”

Raw OR Native Starch

- Has natural adhesion properties
- Can be dissolved in water using heat or chemical energy
- Once dissolved in water and then dehydrated, it “Set Back” to form a sticky paste and eventually a rigid film of adhesion
- Possesses a significant AFFINITY for paper
- Gelatinizes to form the bond between the two sheets of paper i.e. “Green Bond” Formation

Caustic

- Controls the gel temperature
- Provides the chemical energy to dissolve the primary starch [Helps to cook the Starch]
- Provides some “bite” into the paper
- Imparts a stringy, sticky texture to adhesive
- Due to its high alkalinity, it also provides waterproofing by promoting the cross linking between the keto-aldehyde WRA and starch.
- Available as flakes, coarse or fine pearls and liquid (40 – 50%)
- NB: VERY CORROSIVE

Borax Or Boric Acid

- Comes in two forms (5 or 10 moles). Both are the same but contain a different amount of water.
- Acts as HUMECTANT (good water holding capability)
- Provides tack to adhesive
- Affects gel point
- Imparts viscosity
- Improve flow properties

Other Components

- Preservatives (Biocides)
- Penetrating agents [Tee-pol]
- De-foamer's
- WRA - common ones are: Corwet K6, BL10, BL5, BL1, Aqua mat B, CP88 and WP 795.
- Additives OR Performance enhancers e.g. CAS 901, Starch Booster

Adhesive Characteristics

Four principal characteristics governing the bonding process:

- Solids
- Viscosity
- Gel Temperature
- Adhesive Temperature

Solids

Study showed that high solids formulations i.e. 24% and above have some advantages:

- Better viscosity stability
- Provides better bonding
- Less water, therefore better control of warp and less washboard
- High machine speeds
- Accurate glue gap settings will results in reduced starch consumption.

Viscosity

NB: Viscosity measurement must ALWAYS be recorded together with the temperature of the Glue.

Factors contributing to viscosity loss are:

- Shear i.e. pumps, agitators, t-piece, etc.
- Microbiological degradation
- Temperature
- Primary starch
- Long storage time
- Too much water in the recipe

Gel Point

- The gel point is the temperature at which the first signs of adhesive thickening occurs
- At the gelatinization temperature, the viscosity of the adhesive changes rapidly and influences the penetration into the board and hence the bonding.

Adhesive Temperature

- The temperature of the adhesive is often neglected.
- Since it has a major effect on the viscosity it is of **CRITICAL IMPORTANCE**
- A more consistent quality of bonding can be achieved if the temperature and the viscosity are constantly monitored together and kept under control

Adhesive Process Control (Quality Control)

There are 4 tests which can be done in the plant to ensure the uniformity of the adhesive from batch to batch over prolonged periods of usage.

- Viscosity
- Temperature
- Gel Temperature
- % Solids

Starch Adhesive Parameters

WHAT and WHEN to MEASURE !!

- Viscosity
 - In the storage tanks at least every 4 hours
- Adhesive Temperature
 - Every time the viscosity is measured
- Gel Point
 - At least every 8 hours
- % Solids
 - Accurate calculation from formulation
 - Laboratory analysis when available.

In Process Testing

WHAT and HOW OFTEN ???

Machine Crew:

- Viscosity / Temperature
 - Twice per 8 hour shift
- Iodine Staining of Glue lines
 - Twice per 8 hour shift. However, there is an added advantage for testing every job
- Paper temperatures
 - Four times per 8 hour shift

Maintenance Personnel

- Misalignment
- Machine settings

Iodine staining

- It is a useful diagnostic tool at the disposal of the corrugator crew
- It is easy to do, does not require a lot of training to interpret the results.
- Can help to pinpoint many common machine or operational problems quickly.
- The quality of the glue line reflects the quality of the bond.
- Helps to keep track on adhesive application

Examining the liner

- Glue lines are examined for acceptable quality
- Should have consistent width all the way across the web
- NB: It is useful to mark the direction the board ran on the machine.

Some issues that can be diagnosed with this method

- Application Rate
- Glue roll speed
- Glue rolls out of parallel
- Worn or dirty glue rolls
- Hold – down pressure
- Slinging or Dribbling.

FOR MORE INFORMATION PLEASE
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