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 result 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 CONTACT GODFREY MAMBA