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G.C.B.M.A. CORRUGATED BOX MANUFACTURE CHARITABLE ASSOCIATION

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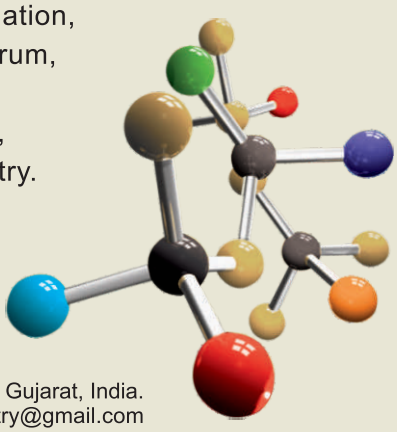

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GCBMA ના મેનેજિંગ કમિટીના સભ્યશ્રીઓ

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GCBMA ના FCBM માં મેનેજિંગ કમિટીના સભ્યશ્રીઓ વર્ષ ૨૦૧૮-૧૯ માટે

પ્રમુખ GCBMA
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પ્રમુખશ્રી નો સંદેશ

સર્વપ્રથમ અત્યારની મહામારીમાં Covid 19માં આપ સર્વે સભ્યોની કુશળતા ઇચ્છું છું.

ઘણા સમયથી આપણે આપણું પોતાનું આપણા સભ્યો માટે **GCBMA TIMES** નામનું મેગેઝિન પ્રસિદ્ધ કરવા માટે કોશિશ કરી રહ્યા છીએ, પરંતુ નિયમિત રીતે પ્રસિદ્ધ ન થતા આની જવાબદારી રાજીખુશીથી આપણા સભ્ય પુલકિત શાહને સોંપવામાં આવેલ છે, અને મને આશા છે કે હવે આપણને સર્વેને નિયમિત રીતે **GCBMA TIMES**નું પ્રકાશન કરી તેમાં આપણા જ્ઞાનની વૃદ્ધિ થાય તેવા લેખ પ્રતિભાશાળી અને જ્ઞાની લેખક પાસેથી મેળવી પ્રકાશિત કરવામાં એડિટર શ્રી ને સફળતા મળે એવી અભ્યર્થના...

મારી સર્વે સભ્યોને ખાસ વિનંતી છે કે આપણા માટે આ **GCBMA TIMES** મેગેઝીન આપણુ પોતાનુ હોઈ દરેક સભ્ય તેમાં વિશેષરૂપે રસ લઈ એડિટર ને દરેક રીતે મદદરૂપ થશો.

એડિટરશ્રી એ અથાક મહેનત કરી આપણા ઉદ્યોગ ને લગતા જુદા જુદા વિષય પર રોજબરોજ ના કામમાં ઉપયોગી થાય તેવા લેખ મેળવી પ્રસિદ્ધ કરેલ છે તેનાથી સર્વે સભ્યોને જરૂર મદદ રૂપ થશે.

એ જ આપનો

પ્રહલાદભાઈ પટેલ

પ્રમુખશ્રી

GCBMA GUJARAT CORRUGATED BOX MANUFACTURE CHARITABLE ASSOCIATION

એડિટરશ્રી નો સંદેશ

આથી હું આપણા **GCBMA - GUJARAT CORRUGATED BOX MANUFACTURE CHARITABLE ASSOCIATION** ના માનનીય પ્રમુખશ્રી ટ્રસ્ટીગણ તેમજ કારોબારી સભ્યોનો આભારી છું કે તમો શ્રી એ મારામાં વિશ્વાસ મૂકી મને **GCBMA TIMES** પ્રસિદ્ધ કરવાની સંપૂર્ણ જવાબદારી સોંપી છે. હું સંપૂર્ણ જવાબદારીથી નિયમિત રૂપે GCBMA TIMES પ્રસિદ્ધ કરી આપણા ઉદ્યોગ ને લગતા લેખ મેળવી, આપણા જ્ઞાનમાં વૃદ્ધિ થાય તથા આપણને ઉદ્યોગમાં પડતી મુશ્કેલીઓનો સફળતા પુર્વક સામનો કરવા જ્ઞાન મેળવી મદદરૂપ થાય તેવો પ્રયત્નો કરતો રહીશ.

આપણી સરકારશ્રી તરફથી હાલમાં તેમજ ભવિષ્યમાં સરકારી નિયમો ધારાધોરણોમાં જે કાંઈ પણ સુધારા વધારા થાય તે આપણે આપણા **GCBMA TIMES**માં સામેલ કરીશું જેથી આપણા સભ્યોને તમામ માહિતી મળી રહે.

સદર પ્રથમ અંકમાં આપણા મિત્રો જેઓ એ આપણને જાહેરાત આપી આપણા એસોસિએશનને સહકાર આપ્યો છે તેઓનો ખુબ આભાર માનું છું. આપણને સુંદર જ્ઞાન મળે એવા લેખ આપવા બદલ શ્રી રામ કુમાર સુંકારાજી નો આભાર વ્યક્ત કરું છું. આપણા પ્રમુખશ્રી ટ્રસ્ટીગણ કારોબારી સભ્યો તેમજ તમામ સભ્યોનો સહકાર મળતો રહે તેવી આશા રાખું છું.

હાલની વૈશ્વિક મહામારીમાં આપણા તમામ સભ્યો તથા સભ્યોના પરિવાર નું સ્વાસ્થ્ય સારું રહે એવી પ્રભુને પ્રાર્થના...

એ જ આપનો

પુલકિત શાહ

તંત્રી

GCBMA TIMES

GCBMA GUJARAT CORRUGATED BOX MANUFACTURE CHARITABLE ASSOCIATION

Adhesive Viscosity

Adhesive viscosity can have a significant impact on starch consumption, bond strength, combined board warp, and corrugator performance, so maintaining optimal and stable adhesive viscosity is essential to efficiently producing quality board.

What is Viscosity

The dictionary defines viscosity as "the property of a fluid that resists a force causing the fluid to flow." More simply, it is the measure of fluid's resistance to flow—motor oil has a higher viscosity than water.

Starch-based corrugating adhesive is typically composed of 20% - 30% solids and 70% - 80% water. To make corn starch-based adhesive with a stable viscosity (i.e., resistant to loss of viscosity over time), a portion of the starch is completely cooked, which sets the viscosity of the adhesive. The cooked portion is referred to as carrier starch because it keeps the raw starch in suspension and carries the uncooked starch through the pipes and to the glue line for gelatinization by heat on the corrugator. Making adhesive this way is called the Stein Hall method and has been the basis for most corrugating adhesives since the 1940s. The carrier portion of the adhesive is generally only 3% - 6% of the total adhesive, but it is key to the process. This fact is very evident on automatic high-shear starch mixers, where the amount of carrier is easily changed, and the resultant change in the finished batch viscosity is easily observed.

Measuring Viscosity

There are two main methods to measure starch adhesive viscosity in a box plant: Love cup and Stein Hall cup. Both methods measure the time for a defined amount of adhesive to flow through a specific-sized orifice. To get an accurate result with a Stein Hall cup, the cup must be pre-heated with adhesive before the actual measurement is performed. The cup has a wall of 3/16" solid brass that, if colder than the adhesive being measured, will cool the sample and alter the viscosity before the measurement is completed. When filling the Stein Hall cup, the adhesive must first be strained to remove any debris that could plug the 0.10" hole which the adhesive passes through. Failing to strain the adhesive can yield a viscosity measurement that is higher than the true viscosity. The viscosity is measured by the time it takes for the adhesive level in the cup to drop from the top pin to the bottom pin. This time is recorded as "xx seconds Stein Hall." The Love cup method is similar but does not require preheating the cup or straining the adhesive because the cup construction, wall thickness, and orifice size are designed to simplify the measurement process. For calibration and reference, the viscosity of water is 15 seconds Stein Hall (+/- 0.5 seconds), or 7 seconds Love cup.

How Does Viscosity Affect Corrugator Performance.

Changes in adhesive viscosity can influence the application rate, penetration into the paper, bond strength, and ultimately, corrugator speed and board quality. An increase in viscosity will increase the amount of adhesive carried on the glue roll and consequently applied to the flute tips—even if the gap between the glue roll and metering roll remains constant. This potential variability increases the importance of maintaining consistent and stable viscosity.

The viscosity of the adhesive can also affect the penetration of the adhesive into the paper, which has a significant impact on the strength and quality of the bond. Viscosity can be used to compensate for the absorbency of the papers, particularly when the liners and medium exhibit similar tendencies. When running unbalanced papers (e.g., a very absorbent medium and a highly sized liner), it is difficult to achieve the appropriate absorption simply by adjusting the viscosity. In these situations, it is far more effective to adjust the adhesive chemistry through the use of appropriate additives.

Because adhesive viscosity can have a direct impact on the application rate and the absorption into the papers, it ultimately can have an impact on corrugator speed and board quality. Too little adhesive can lead to a poor-quality bond. Too much adhesive can lead to a green bond, warp, and having to slow down the corrugator.

Optimal Viscosity

The optimal adhesive viscosity depends on the specific design and condition of the corrugator, the starch system, and the papers being run. For example, glue machines (double backer and single facer) with restrictive piping may require lower viscosity to ensure sufficient adhesive supply during high-demand operating conditions. An anilox glue roll with cells may need an adhesive with a different viscosity than one with a sandblasted surface. Single facers can tolerate (and sometimes benefit from) lower viscosities than double backer glue machines. This is partly due to the difference in how the bond is made, with higher pressure and temperature. Older, fingered

corrugators run better with lower viscosity adhesives that can flow and bridge the gaps left by the fingers (i.e., the finger lines).

There are indicators and diagnostic tools that can aid in determining whether the adhesive viscosity is optimal. Glue line iodine stains are particularly useful in identifying viscosity related problems because glue line integrity is compromised by improper viscosity. Other indicators are slinging, foaming, and glue pans that run out of adhesive when the corrugator is running at high speeds.

Viscosity Changes

Viscosity can easily be manipulated through formulation, but achieving consistent viscosity requires good process control and a starch kitchen that is clean and in good mechanical condition.

The starch kitchen must deliver precise and repeatable amounts of each ingredient in every batch. Variability in the ingredient addition amounts will lead to inconsistent viscosities. Steam leaks, water leaks, dirty or clogged hoppers, and scales that are not calibrated can all lead to imprecise or varying formulations. Furthermore, bacteria in the starch system will affect the stability of the viscosity as the bacteria attack the starch over time.
Viscosity will change significantly with even small changes in temperature. For every 2°F drop in adhesive temperature, there is ~10% increase in viscosity. Additionally, an adhesive with a lower temperature will require more time to gel because of the larger temperature differential between the starting temperature and the gel temperature. The higher viscosity will also cause excess glue application which further exacerbates the time to gel.

The mechanical design and setup of the starch system can also affect the viscosity of the adhesive. Older mixing equipment with marine-type propellers will make adhesive that will lose viscosity due to mechanical stresses. Adhesive loops with constant circulation, numerous elbows, or gear-type pumps will shear adhesive over time and lead to decreased viscosity.

Correcting Viscosity Issues

If you are seeing changes in viscosity, it is important to identify and remedy the source of the problem. Don't simply compensate for the problem by altering the formula. The most likely causes are temperature changes, dilution from a water leak, and bacteria attacks.

Every plant should have procedures in place that prescribe what actions to take when a batch of adhesive has the incorrect viscosity. A batch with a small deviation from the standard may still be runnable with special attention from the operators and adjustments to the application rate. A larger deviation may require making a new batch and mixing the bad batch with it to yield a more acceptable viscosity. Although high viscosity can be corrected with the addition of water, care should be taken to avoid major additions because the water dilutes the chemical properties and may lead to bonding problems. There is no acceptable way to correct low viscosity adhesive other than to mix it with a higher viscosity adhesive. Adhesive that is out of spec because it is several days old (e.g., it was made on a Friday and sat unused over the weekend) is often segregated in a separate tank and slowly mixed in with fresh adhesive as the machine runs. If you adopt this practice, take care to avoid blending it when running challenging board combinations, such as heavyweights

or double wall. To assist the operators and ensure consistent practices, the procedures for correcting out-of-spec adhesive should be formally documented along with the viscosity ranges at which each corrective action should be taken.

Summary

Adhesive viscosity is one of the many factors that can significantly impact the performance of a corrugator and the quality of the board produced. Changes in viscosity will affect application, penetration, and bonding, and will adversely impact overall corrugator performance. Maximizing corrugator performance and board quality requires determining the optimal viscosity, accurately measuring the actual viscosity, and addressing the plant conditions that can adversely affect consistency and stability.

Temperature / Viscosity Control Systems

Maintaining the viscosity of starch adhesive at a constant level is critical for consistent application and performance. Because the viscosity of starch adhesive changes dramatically with temperature, it is important to control its temperature with a TVC (Temperature/ Viscosity Control) system. To ensure optimal corrugator speed and to maintain steady viscosity, most corrugating plants try to maintain starch between 100°F and 105°F in storage. The starch temperature is usually maintained by running heated water through a series of coils located inside the storage tanks. These coils are typically made from 2" inside-diameter carbon-steel or stainless-steel tubing connected to a steam-heated open water tank or an industrial water heater. TVC systems are controlled by a temperature sensor in the storage tank, and a setpoint is entered for the desired temperature. If the temperature drops below the setpoint, a centrifugal pump pushes heated water through the coils while the storage tank agitator circulates the adhesive. When the setpoint is reached, the pump is stopped. The heated water is maintained at a temperature ~15°F below the gel point of the starch to prevent gelling near the coils. Most TVC systems also have controls and timers to run the agitators intermittently. It is important to keep the heating coils clean and free of encrusted starch because the hardened starch acts as an insulator and sharply reduces heat transfer from the coils to the adhesive. It is also important to ensure there are no leaks in the TVC system because leaking water will dilute the adhesive and adversely affect the viscosity. If you suspect a leak in the TVC system, you can add a dye to the water to help troubleshoot the issue.

Courtesy Harper Love

PREVENTIVE MAINTENANCE CHECKLIST

Machine Name: Machine No: F.Y. :

Sr.	Check-points	Frequency	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar.
1		***Monthly***												
2		**Bi-Monthly**												
3		**Quaterly**												
4		**Half-Yearly**												
5		**Yearly**												
		Checked by												
		Verified by												

Sr.	Date	Observation /Remarks	Sign

Note: To put these signs >	PLAN		ACTUAL		

FEFCO TESTING METHOD N 1

July 1984

Sampling procedure

1 Scope

To define a procedure for sampling from a batch of corrugated fibreboard in sheets, or from corrugated containers, for the purpose of obtaining a representative sample for testing. The test is applicable to all kinds of corrugated fibreboard.

2 References

From each batch a number of bundles or pallets will be selected at random. Random means that any item shall have an equal chance of being selected as part of the **sample**. From each of the bundles or pallets a specified number of **individual samples** will be picked. From individual samples the **test specimens** for the various tests will be cut with adequate dimensions.

A **batch** is a quantity of corrugated fibreboard of one sort or type which may be considered homogeneous, and may consist of one or several bundles or pallets.

A **sample** is the total number of individual samples from one batch.

An **individual sample** is a sheet of corrugated fibreboard, or a case, taken from a bundle or pallet.

A **test specimen** is a piece of corrugated board cut from an individual sample.

3 Principle

3.1. *Determination of the total number of individual samples*

The number of individual samples to be taken, as a minimum, from a batch will be determined by the formula :

$$n = \sqrt[3]{N}$$

Where:
n = total number of individual samples, and
N = total number of sheets or cases in the batch.

For convenience, the following table may be used:

N	n
1,000 or less	10
1,001 to 5,000	15
5,001 to 10,000	20
10,001 to 20,000	25
20,001 to 30,000	30
30,001 or more	40

(the minimum in any case will thus be 10, and the maximum 40).

3.2. *Selection of individual samples*

Each of the bundles or pallets selected according to Clause 3 will be handled as follows :

After removal of the wrapping or strapping materials at least five topmost sheets or cases will be eliminated. Thereupon, so many individual samples will be picked at random from the bundles or pallets that the total number of individual samples thus obtained from the batch will equal n as defined in Clause 3.1. An approximately equal number of individual samples shall be taken from each bundle or pallet selected.

3.3. *Handling of individual samples*

Keep the samples flat, without compression, and protect them from direct sunlight, liquids, or anything liable to alter their condition.

3.4. *Marking of samples*

Individual samples will be marked in a corner in such a manner as to ensure perfect identification.

3.5. *Repeated sampling*

If repeated sampling is necessary, it will be done in accordance with the method. Unless it is otherwise specified, and if it is possible, samples shall not be taken from bundles or pallets which have been used for the first sampling.

4 Report

The report will contain the following information :

a *Date and place of sampling*
b *Inspectors name*
c *Manufacturers name*
d *Size of batch*
e *Number and type of bundles or pallets*
f *Number of individual samples pursuant to clause 3.1.*
g *Identification marks on the samples*
h *Details of any deviation from this sampling method*
i *Any other information which may assist in the evaluation of the sample.*


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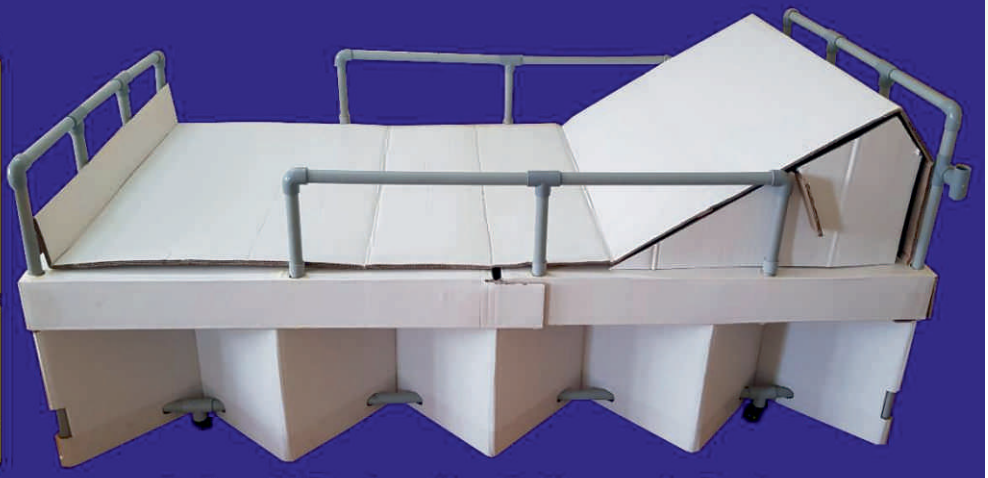

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Why Fluting paper should be a different grade ?

Presented by

Ram Kumar Sunkara,

R & D Chairman, FCBM

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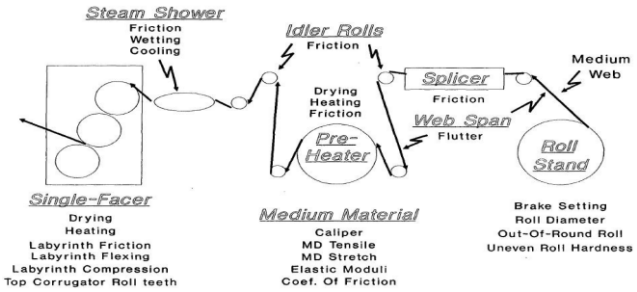
- Web site: www.ramkumarsunkara.com

The human mind is like a parachute, it only works when it is open.

1

Schematic diagram of single facer forces and material factors



2

Medium

- Fluting medium is not considered as important part of corrugated board.
- Important or not, the fluting medium is what makes the board perform.
- The corrugated board is a sandwich structure in which the medium is the “meat of that structure”
- The medium must maintain the separation of the liners to form the sandwich.

3

Medium

- It must do this after:-
  - Being burned on the pre-heater drums.
  - Punished with steam shower.
  - Pulled, bent, and squashed in the corrugating rolls.
  - Doused with a watery starch mixture.
  - Flat crushed compressed in the hot plate section.
  - And, finally in the finishing section.

4

Stresses and Strains

- Corrugating process imposes sufficiently large stresses and strains on the medium while forming and moulding medium to the shape of flute under conditions of
  - Elevated temperature
  - Elevated pressure
  - Elevated moisture.

5

Stresses and Strains

- The stress and strain in medium during formation of flute consists of two parts:
  - The tensile stress and strain acquired during transportation of the medium from parent roll to the point where the flute is formed.
  - The stress and strain of forming resulting from severe local deformation of the medium as it attains the fluted shape.

6

Tension in the medium

- The tension in the medium is largely dependent on the:
  - Force required to unwind the paper roll
  - Overcome friction between the medium and the pre-heater drum.
  - Overcome the friction at the reel brake.

7

Bending and shear strains

- Analysis of bending and shear strains show that:
  - Failure due to bending strains manifest itself as rupture of the surface fibres. (type 1)
  - Shear failure would result in delamination at or near the centre of the medium. (type 2)

8

Type 1 failure

9

Type 1 failure

10

Type 2 failure

11

Medium properties

- A medium which is being punished and abused like this, what properties are your specifying?
- GSM
- BF
- Cobb
- Now a days RCT

12

Medium Properties

- The medium properties that have been related to medium runnability are:-
  - MD Tensile.
  - MD Stretch.
  - Caliper.
  - Co-efficient of friction.
  - MD Modulus of elasticity.
  - ZD modulus of elasticity.
  - Compressibility and Abrasiveness.
  - Porosity

13

Medium Runability

- Medium should have a "**Good Runability**".
- Runability is defined as the ability to run corrugator at maximum permissible speed with out affecting flute quality.

14

Medium performance

- The term runability encompasses two major performance criteria:
  - Flute formation.
  - Bonding.
- The flute formation criteria includes:
  - Fractured flutes
  - High / Low flutes.

15

Medium performance

- Both defect categories are influenced by the:-
  - **Medium Physical properties.**
  - Corrugating process settings.
  - Mechanical condition of the corrugating equipment.
- Up to 10% loss in compression strength due increase percentage of high /low flutes and 30% drop in flat crush due to fractured flutes.

16

High / Low Flutes

- The term high / low flutes refers to the variation in the height of the fluted medium component of the single face web.
- The high / low flute defect is important because of its adverse effect on the combined board strength properties and package performance.
- For example, there will be loss of compression strength up to 10% due to decrease in ECT as the percentage of high / low flutes increases.

17

Material factors affecting High/low flute defects

Variable	Change needed to reduce high / low flutes
Basis weight	Decrease
Calliper	Decrease
Co-eff of friction against heated steel	Decrease
Formation	Uniform
MD Stretch	Increase

18

Fractured Flutes

- The term “Fractured flutes” refers to the physical separation of the corrugating medium fiber network during the flute forming process in the single facer.
- There will be a drop in ECT as well as flat crush due to fractured flutes.

19

Material factors affecting the flute fracture defect

Variable	Change needed to reduce flute fracture
Moisture content	Increase
MD tensile	Increase
MD stretch	Increase
Calliper	Decrease
Co-eff of friction	Decrease
Formation	Uniform
Porosity	Decrease

20

Medium properties affecting medium strength retention after fluting

Variable	Change needed to improve the strength retention after fluting
Tensile strength	Increase
MD tensile stretch	Increase
Density	Increase
Calliper	Decrease

21

Flexural stiffness of board

- Flexural stiffness of board is adversely affected by flat crush strength of board.
- A 10% reduction in board calliper will cause
  - 20% loss in CD flexural stiffness
  - 50% loss in MD flexural stiffness.

22

Flat Crush Test – F C T

- Describes the strength of the corrugating medium and the success of the corrugating.
- The flat crush test is a measure of the resistance of the flutes in corrugated board to a crushing force applied perpendicular to the surface of the board.

23

Flat Crush Test – F C T

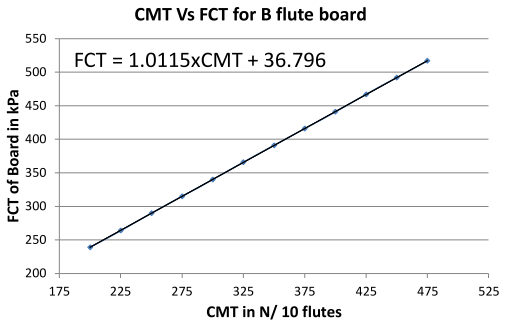
- Flat crush is a measure of the flute rigidity of corrugated board.
- A high flat crush value indicates a combination of good flute formation and at least adequate strength medium.
- Low flat crush indicate a number of conditions,
  - Low strength medium,
  - Leaning flutes,
  - Crushed flutes, or poorly formed flutes.

24

F C T

- Assuming that, we do everything right during flute formation, the FCT depends to a large extend on the property called CMT of paper.
- CMT stands for “Concora Medium test”
- There a direct relation between CMT of paper and FCT of the board.

25



26

Conclusion for medium

- Following properties must be considered:
  - GSM
  - BF
  - Cobb
  - RCT
  - CMT
- Besides the above you must also consider

27

Conclusion for medium

- Following Properties must be considered:-
  - MD Tensile
  - MD stretch
  - Formation
  - Caliper (Low bulk)
  - Porosity
  - Cobb
  - Co-efficient of friction.

28

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