

Manufacture of corrugating medium paper utilising 100% bagasse furnish

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SUMMARY

There have been several doubts expressed regarding the possibility of making good corrugating medium paper from a furnish comprising of cent percent bagasse pulp. This paper explores the possibility of manufacture of the above variety of paper using only bagasse pulp and a process working satisfactorily in a mill in Cuba for the manufacture of this variety of paper is described. The author had the opportunity to visit this Cuban mill in 1965, 1968 and 1981.

Paper used for corrugating medium is defined as a paper (but generally classified as paper board) of 0.225 mm (0.009 inches) in thickness—often known as 9 point but sometimes thicker to form the corrugated cushioning layer(s) in corrugated board and single faced corrugated wrapping.

To perform properly fluting medium must be able to accept the stresses and strains imposed on it during its passage into the corrugating laybrinth and be capable of quickly moulding to the flute contour of the corrugator rolls. A major requirement in this respect is ready ability of the fluting to accept heat and moisture. A high moisture content in the web facilitates forming of the flutes and also helps in evenly distributing fibre net work throughout the sheet. Certain pulps have potential capability to produce a more regular, sheet formation and profile, than others.

Common fibrous raw materials used in fluting manufacture in decreasing order of purity are hardwoods, softwoods, bamboo, straw (agricultural residues), bagasse (sugar cane) box shop waste (corrugated board trim etc.) and mixed waste paper. Whether it is made from wood furnish, straw or from secondary fibre the singularly important property of fluting medium is "does it run well on the corrugated board machine?".

The corrugated medium paper is usually made on a Fourdrinier machine, but not necessarily and from a variety of fibre furnishes. The majority of fluting is made from semi-chemical wood pulp. (But straw, bagasse, reeds and waste paper grades are very common raw materials in a number of countries).

Fluting medium when made from straw pulp is termed "Schrenz" and when made from waste paper is termed "Bogus".

Typical strength properties of corrugating medium paper are given in Annexure 1,

Process suggested for making corrugating medium from 100% bagasse

Fibre preparation

50% moist bagasse is screened in rotary drums or vibrating screens in sugar mills itself to remove as much pith as possible. The separated pith can be mixed with bagasse and burnt in boilers or otherwise disposed off. The partially depithed bagasse can be baled and stored in sugar mills' yard till moisture comes down to at least 35% (to reduce transport cost). If the paper mill is located nearby it can be transported to (Paper) mills storage yard and stacked.

Depithing at paper mills

Wet depithing using a hydropulper is the best method of depithing bagasse from the point of view of minimum dust nuisance and fibre damage. Necessary quantity of pith also gets removed without much fibre loss. The bales are fed to the hydropulper and with addition of water to maintain a consistency of 3% the pith gets loosened almost instantaneously. A retention time of 4-5 minutes should suffice. It will be ideal if the depithed fibre contains 12-15% pith only and pith does not contain more than 10-15% fibre. Any further attempt to depith damages the fibre and results in more fibre loss.

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ANNEXURE—1

Properties of fluting Medium from N S S C. Waste Paper and Straw

Quality	N S S C Fluting				Waste Paper			Straw
Grammage g/m ²	108	115	135	163	125	122	170	125
Thickness mm	0.208	0.216	0.263	0.298	0.219	0.233	0.311	0.218
Bulk, Cm ³ /kg	1.926	1.878	1.948	1.828	1.752	1.910	1.829	1.744
Breaking Length, m:								
Machine Direction	7,200	7,100	6,800	6,300	2,800	4,900	3,600	3,500
Cross Direction	2,200	2,500	2,500	2,500	1,500	2,400	1,700	2,000
Elongation, %:								
Machine Direction	1.8	1.4	1.6	1.7	1.6	2.8	1.2	1.7
Cross Direction	2.4	2.6	2.6	2.5	2.5	4.6	3.1	2.2
Burst Mullen, kg/cm ²	3.4	3.7	3.9	4.5	1.8	3.4	2.8	2.7
Tear Factor, Thwing- Elemendorf: Machine Direction	56	56	60	56	66	88	82	57
Cross Direction	79	77	77	80	75	95	94	67
Ring Crush Test. lb :								
Machine Direction	42	51	71	86	30	43	54	38
Cross Direction	30	37	46	60	25	35	39	32
C M T ₃₀ . lb :	46	50	58	69	27	42	33	34

Digestion cycle

Theoretically, for agricultural residues, only rapid continuous digesters are most suitable in view of the low bulk density-3 kg/cft. However by adopting mechanisation and controlling digestion cycle, capacity of pulping can be maximised even from spherical digesters. Loading should be done by belt conveyors as fast as possible-cooking time should not exceed 90 minutes for corrugating medium in a 12' dia rotary spherical digester.

Filling	40 minutes
Liquor charging	30 "
Raising to pressure	40 "
Cooking time	60 "
Discharging or blowing	30 "

	200 "

This cycle is followed in "PAPELERA DAMU-GHEB" a paper mill in Cuba located 400 km south of Havana.

Thus from one spherical digester 7 charges should be had and under slack conditions minimum 6 charges should be done. Per charge at least 2 tonnes of pulp at 55% yield is obtained. (5 tonnes of actual weight of bagasse at 20% moisture amounting

to a charging of 4 tonnes of B.D. material). 12 tonnes of good pulp for corrugating medium can be obtained from each spherical digester.

Cooking conditions for corrugating medium

Pressure	60-80 lb/sq. inch.
Total active alkali as NaOH	10-12% on B. D. fibre.
	(to be decided after trials)
Strength of cooking Liquor	45 gpl.
	(to be adjusted to get a bath ratio of 1:4)
Cooking time	30-60 minutes
Residual alkali in black liquor	3 gpl.

Though neutral sulphite semi chemical pulping is most ideally suited for manufacture of corrugating medium paper, there is no harm in using caustic for cooking (Soda Process).

Washing of pulp

- The pulp can be washed on a washing drum in a poicher having a breaker and washing drum below the rotary digester
- the pulp can be blown to a blow tank
- after blow tank, it is important that the fibre bundles are defibrated in a conical or disc

refiner or breaker at 4-5% consistency and washed well by passing the pulp through a screw press.

No screening is needed for this type of paper.
Stock Preparation

The freeness of the unbleached pulp can be raised from 25°SR to 32°SR by passing through a brushing refiner before paper machine.

Development of freeness at different points can be as follows:—

After blow pit	22° SR
After disc refining	25° SR
After paper machine)	30° SR—32° SR
brushing refiner)	
Head Box	35° SR—40° SR

The physical test properties of corrugating medium paper made in 'PAPELERA DAMUGHEE' Cuba from 100% bagasse furnish are as follows:—

Substance	170 gsm
Thickness (caliper)	12.6 thou.
Bursting strength	65 lbs/sq. inch.
Burst factor	25
Tear factor	98
Breaking length	4280 meters in M.D. 2760 meters in C.D. 3520 meters (average)
Tear strength	20 lbs
Tensile strength	24 lbs/15mm width in C. D.

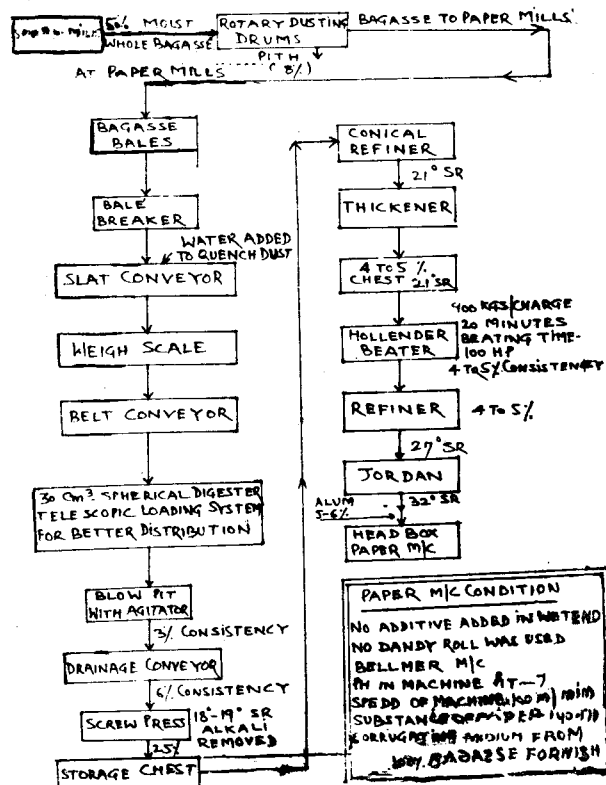
(tested in Seshasayee Paper Mills Laboratory)

Flat crush could not be tested. The Cuban paper technologists say that this quality corrugating medium paper has good export market in their country.

The above process for making corrugating medium is in vogue in "PAPELERA DAMUGHEE" a mill started in 1962 with old machines fabricated and assembled in Cuba itself. This is probably the only mill in the World specialising in corrugating medium paper from 100% bagasse furnish.

A flow chart for bagasse pulping followed in the above mill is enclosed.

FLOW CHART FOR CORRUGATING MEDIUM IN PAPELERA DAMUGHEE CUBA



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