An Experience with Jute Caddies Pulping For quality papers

*Darwesh H.R , *Sharma Mahendra.

ABSTRACT

In the light of dwindling forest resources, Indian Pulp and Paper Industries are in search of alternative Raw Materials. In Mukerian Papers Limited, Jute fibre, which is a renewable source of Raw material, is used as a long fibre Pulp, blended with other straw pulps In this paper, our experience in Jute caddies pulping and paper making is discussed.

Introduction :

There are 40 species of jute distributed through out the tropics, about 8 species occur in India of which two are important, viz, Corchorus capsularis and C.olitorius.

The Jute producing tract of India is located in North-East India and is more confined to the lower courses of the rivers Brahmaputra and their tributaries. It is Bangladesh and West Bengal (India) which produces nearly four-fifth of world's Jute output. The important area in West Bengal are Murshidabad, Hoogly, 24-Paragnas, Nadia and Jalpaiguri Districts. In Bihar most of the entire crop is confined to Purnea District. Other prominent Jute growing areas are Gopalpara, Nowgong, Kamrup and Darrang Districts in Assam.

The fibre content generally ranged between 4.5 to 7 5% of the green weight with an average at 6%. After retting the fibres are peeled off and the sticks are left over. For one kg of Jute fibre, we get about 2.5 kgs of Jute sticks.

Bulk density of Jute fibres is 110 kg per Cu. Mtr; as compared to Bamboo having 210 kg per Cu.Mtr. Fibre portion is mainly used for manufacturing items like, carpet backing, hessian gunny bags, decorative fabric etc.

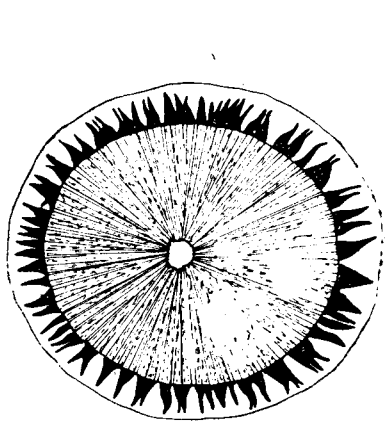
Morphology

Fibre Characters

The Jute fibre comes from outer portion or bast of the stem of C.capsularis and C olitorius. The fibres are arranged in concentric manners alternating with the thin walled tissue of phloem forming a characteristic mesh along the length of the stem. The fibre layers which are (in number) 13-17 in C. olitorius and 17-19 in C.capsularis consist of a number of fibre bundles or groups varying greatly in shape and size. Each of these bundles represents single filaments which is thus seen to be composite in character being made up of a number 4-50 cells as seen in a cross section (Fig No 1)

The individual cell which makes up the fibre strands are elongated(in the direction of the stem axis) with pointed or tapering ends and appear more or less polygonal in outline with well defined angles in a cross section. These ultimate fibre cells vary from 500 to 650 μ in length and from 10 to 30μ in diameter. The walls are thick and lignified and except for occasional transverse cracks, are relatively smooth and unmarked. The lumen or cell cavity is as wide as the cell walls, but shows characteristic constrictions at irregular intervals and sometimes may even be completely closed due to uneven thickening of the cell wall. The average measurements of a single cell are—

*Mukerian Papers Limited
Mukerian–144211
Distt. Hoshiarpur (Pb)



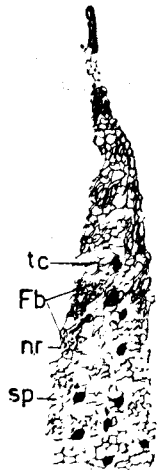


FIG NO-1

(Left) Transverse section of a jute stem showing the wood and phloem wedges (Right) A Phloem wedge-Fb fibre bundles nr new secondary rays, sp soft phloem tissue, tc tannin-containing cells

a)	Cross-sectional area (Total)	118.0 Sq μ
b)	Cross-sectional area of Cell wall	108 9 Sq μ
c)	Cross-sectional area of lumen	8 9 Sq μ
d)	Total area occupied by the lumen	7 5%
e)	Length of fibre	2 4 mm
f)	Width of the fibre (filar micrometer)	10 0μ

The cell wall has a fibrillar structure, the fibrils being arranged in slow right handed spirals

When examined by X-ray spectrographic method, Jute fibres are found to give a typical cellulose diagram The cellulose chains are more or less parallel to the axis of the fibrils and hence lie at a small angle to the fibre axis. It has been estimated that the degree of micellar orientation is about 35%.

The colour of the fibre varres from pale cream to dark slate or purplish-grey. The grey stain is due to the interaction of the tannin in the plant and iron compound in the retting water and is deeper in C.olitorius fibre than in C. capsularis, as the tannin content in former is higher.

The jute fibre shows a fairly high degree of double refraction corresponding with its quasicrystalline nature, due to the more or less parallel arrangeent of cellulose chain molecules.

Chemical Composition :

The main constituents of the fibre are cellulose, hemicelluloses and lignin. The percentage of true cellulose does not exceed to 60% in the oven-dry fibre, but the percentage of holocellulose—as determined by the treatment of solvent extracted material with Sodium chlorite solution, usually exceed 80%.

Compared to Bamboo or wood, it is predominent in hemicellulose but different in lignin content to some extent, like hard wood, Jute hemicellulose is predominent in xylan. In respect of fibre length it is more similar to long fibre pulps.

The following figures give the composition of an average sample of Jute, fairely free from adherent bark and other tissues (on oven dry basis)—

1.	Cellulose %	56—62
2.	Hemicellulose %	22—26
3.	Lignin %	11—13
4.	Nitrogenous substances %	1–1 5
5.	Fats and Waxes %	0 8–1 2
6	Ash %	1–1 5
7.	Miscellaneous %	1.5–2.5

TABLE-1
Chemical Composition of Jute Fibre Compared With Other Non–Wood Fibres

Raw Material	Cellulose %	Hemi Cellulose %	Lignin %	ASH %
Jute Fibre	60	23	11	1.4
Bagasse	58	32	20	3.2
Sarkanda	58.2	—	20.5	2 3
Wheat Straw	53	—	19	7 8
Rice Straw	49	28	13	14.2

Preparation of Raw Material :

In Jute industries about 80 tonnes of Jute processing produces 3 to 3 5 MT of waste Jute, called Jute Caddies. This Jute caddy is purchased by the Paper Industries for Pulp and Paper making. Jute caddies are received in bales of average weight 100 kg per bale, contains moisture 10 to 20%. This material is sorted manually and then processed through Rag Cutter and dedusted.

Cooking, Beating & Bleaching :

Pulp of good quality is produced from Jute caddies in spherical rotary batch digester using Soda process.

Due to less amount of knots, Jute pulp does not impose any major difficulties in screening and cleaning, requires less power consumption during Beating when compared with that of Cotton–linter. To get required bleached pulp of brightness from 70 to 73%, beaten pulp is chlorinated and then properly washed in the potcher. where washing and further bleaching of the pulp is done. Number of cooking and bleaching studies were carried out and the optimum conditions are given in Table No. 2

Jute pulp has got a very peculiar characteristic in comparison to other chemical pulps. It has got an unusually high degree of initial wetness in the unbleached and unbeaten conditions (28–30°SR). This severally restrict output from conventional drop leg washers used for agricultural residues. Flow chart of the Jute Pulping system adopted in Mukerian Papers Limited is given in Fig No.2.

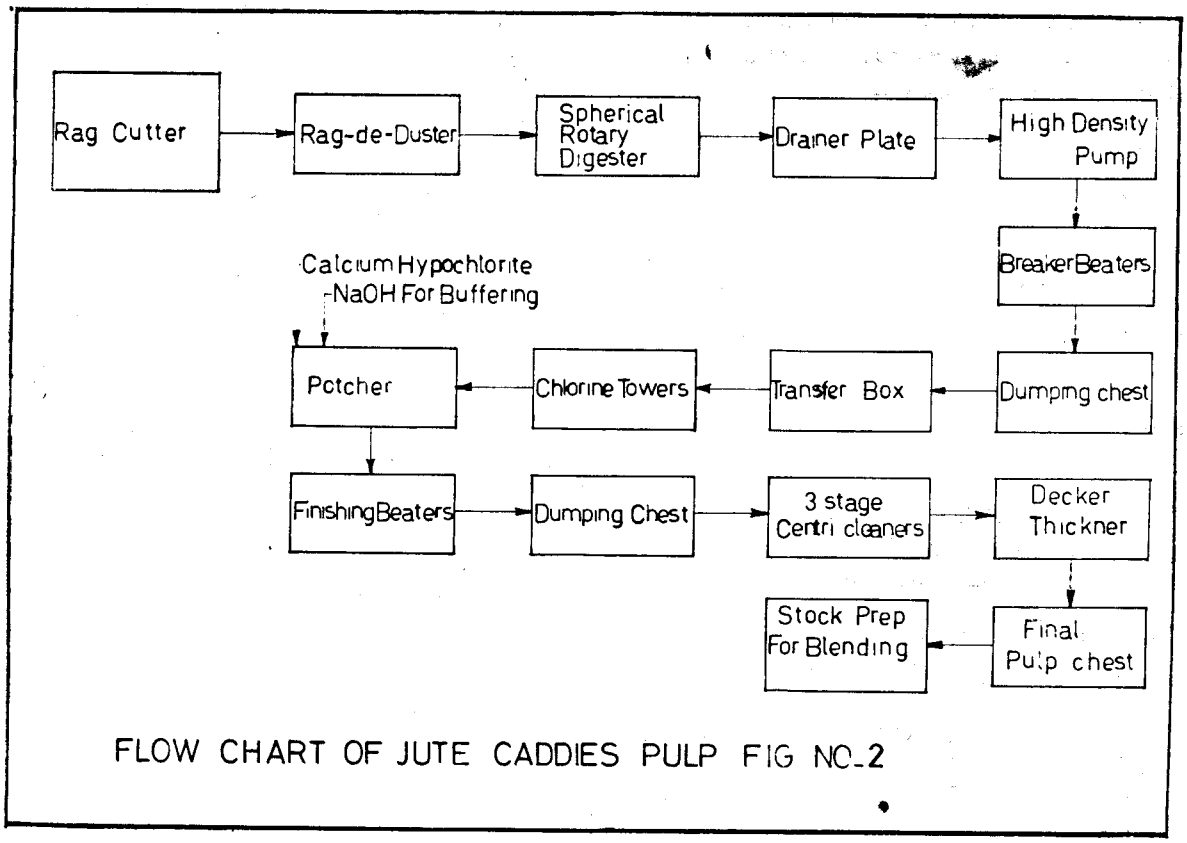
Jute Pulp As A Sweetner Stock in Straw Street

Limitations in respect of paper making from straw pulp could be largely overcome by blending Jute fibre pulp with straw pulp prior to the stock being fed to chlorine tower. The blending ratio applied could vary depending on the grade of paper, design features of the Paper machine, speed of the paper machine and the target properties desired for a particular grade of paper.

The slow drainage on the wire is largely overcome by using Jute fibre pulp which forms a drainage net for the slow draining straw pulp. For the same reasons

TABLE—2

Cooking Time	Temp. of Digestion°C	Bath Ratio	Chemicals Charged (As NaOH) %	Unbld. Yield %	Permang Nate No.	Total Cl_2 Demand %	Temp. °C
2+3	160	1:3.5	11	60.4	17.5	18.6	Ambient



FLOW CHART OF JUTE CADDIES PULP FIG NO-2

TABLE - 3

Freeness °SR	Substance GSM	Bulk Density	Burst Factor	Tear Fac.or	Breaking Length Mtrs.	Bright ness %	Ash %	Final BLD. Pulp Yield %
45	61.0	2.58	21.0	94	4000 to 5000	72 0	2.45	50.0

the drainage problem on the washers and thickners could be overcome by the use of Jute fibre as sweetner stock to the straw pulp.

Jute Evaluation

Bleached pulp obtained from the jute fibres was evaluated for its physical strength properties.

Results and Discussion

Average conditions of cooking obtained from different number of cooks are given in TABLE No.2. Jute pulp is little difficult to lift through the high density pump when compared to Cotton linter pulp.

Slightly more dilution for lifting, it is manageable to pump to Breaker Beaters After chlorination of pulp, it is thoroughly washed in potchers. After hypo chlorite bleaching final washing is done and the pulp is pumped to finishing beaters.

Due to very good strength properties of final bleached Jute Pulp, loading of fillers in paper increased to higher extent, machine runnability was improved, thus increasing the productivity. Material of construction used for potcher.'s washing drum and agitators is of SS 316L.

Due to high cost of good quality cotton linter and its unavailability, attempts for Jute fibre pulping were made, There is no doubt that Jute fibre pulp can easily replace the other long fibre with increasing productivity. Sorting of Jute caddies raw material is one of the problem faced which carries lot of foreign material.

Conclusion

It i concluded that jute fibre pulp can be used successfully alongwith straw pulp as a long fibre pulp. Following major points are concluded.

1. Addition of fillers increased.
2. Increase in strength properties of final paper.
3. Improved runnability thus better productivity.
4. Good mat formation and improved washing efficiency when used as a sweetner to straw pulp, ultimately increased 15% efficiency of vacuum washers.

References

1. World Pulp & Paper Technology–199', Page No. 49, JAY T. JEYASINGHAM.
2. World Pulp & Paper Technology–1993, Page No. 63, ATTILA RAB, ZOLTAN SZIKLA.
3. Wealth of India–1950 Raw materials, Vol–II, Page No 326 to 336.
4. IPPTA Vol XII No.2–1975, S MUKERJEE
5. IPPTA Vol. XVII No. 4, Dec' 1990, BANERJEE, B C, BHARGAWA K S.
6. IPPTA Vol.XVIII, No 2, June' 1981, BANERJEE S.K., Day.A, DEVSARKAR N.
7. IPPTA Vol. XVIII, No.4 Dec' 1981, ROY. A K. SANYAL A.K, GHOSH I.N.
8. IPPTA, Jan–Feb: 1975, Page No. 20–21, Dr. S.C. JAIN, K.P. SINHA, S.P. GOYAL, P.B. JAIN.
9. IPPTA Jan–Feb: 1975, Page No.20, DR. JAIN.