The Behaviour of Bagasse Fibres mixed with Bleached Bamboo Pulp

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At present in India the basic raw materials for making paper are Bamboo and mixed with hard woods. The cost of the bamboo and hard wood has gradually increased by approximate 40% in the period of 6 years and there is a trend that the cost of bamboo may still rise. Besides the cost, Bamboo and mixed hard wood required for pulping are short in supply and it is not possible to meet ever-increasing demands of paper in India with those two basic raw materials only. To meet increased demand for pulp and paper, the utilisation of agricultural resources for making paper have high potential. India is top ranking country in cane sugar production, hence bagasse can be a great potential paper making material in India.

It is well known to paper maker that some quantity of long fibred pulp is to be mixed with bagasse fibres to have better runability of the stuff on conventional paper machine. Hence a study was made to find out the effect of bagasse fibre mixed with normal millbleached pulp of 90% bamboo and 10% mixed hard wood in different proportion and the proportion of bagasse pulp obtained by Soda cooks at various temperature.

In India Rohtas Industries is pioneer to utilise bagasse for regular pulping since the year 1951 . The bagasse used was delivered to bales forms from the Sugar Mill situated very close to the paper mill. Rohtas adopted Celdecor Pomilio System for pulping of bagasse. Depithing of whole bagasse was done by dry method with squarrel cage disintegrator. 20-23 % of the whole bagasse is separated out as pith, containing some amount of good fibre, by this process. Disintegrated bagasse was allowed to fall through magnetic separator into the dusting drum where separated pith was removed and was blown to bag fitter. Occasionally this pith was utilised in the boiler. Further amount of pith adhering with bagasse fibres was removed by cyclonic duster. Depithed bagasse was fed to closing equipment where Caustic Soda Solution of 2 to 2.5% strength was sprayed on the bagasse. Caustic Soda soaked bagasse was cooked in the continuous digestor under atmospheric pressure. The digester was steam jacketed. The cooking time it in the digester was 3 to 5 hours.

The cooked pulp was defibrised in breaker tube. Then the pulp was on vacuum filters in to stages. The washed pulp was passed through screw press to get the pulp of 25-30 percent consistency. High consistency pulp was disintegrated to loosen the fibres by open and cone machine. The pulp was then collected on the mouth of chlorination tower. The mouth of chlorination tower was always kept full to avoid the leakage of chlorine. The Chlorine was introduced into the chlorination tower, at three places top, middle and bottom of the tower .There was also provision to introduce chlorine gas in the centre of chlorination tower. About 5% of chlorine was consumed in the chlorination stage. Alkali contracted washed pulp was first screened on flat vibrating coarse screen and finally it was screened in the rotary screen in three stages. The accepted pulp was bleached in Hollender with about 6% Calcium Hypo Chlorite as available chlorine. Then the pulp was transferred to another sheet and it was washed on vacuum filter. Bleached bagasse pulp was mixed with blached bamboo pulp as per requirement. This process of utlisation of bagasse at Rohtas has stopped mainly due to stoppage of Sugar Mill of Dalmianagar.

It was also observed that a few persons got lung disease like bagassoists due to bagasse dust.

The cost of bagasse pulp obtained by Celdecor system is found to be more than Ayota Process., Caustic Soda consumption is high in Celdecor Pomilio system and caustic recovery from Black liquor is not economical as Black Liquor obtained is of very low solid contents. The authors feel that this processes may not be suitable for India, where the cost of Caustic Soda and power is much higher than U.S.A. and other developed countries.

Experiments and Results :

The whole bagasse used in the present series of experiment is of following chemical composition as used by us in cold Soda Pulping.

TABLE I

Moisture	—	7.5%
Cellulose	—	51.0%
Lignin	—	20 %
Alpha-Cellulose	—	37.0%
Ash	—	2.6%
Pith	—	30.0%
Soluble in 1% NaOH		36.0%
Pentosan	—	30 %

The pith of bagasse was removed first. The whole bagasse passed through Waldron Sprout disc. refiner keeping clearance of m.m. The disintegrated material was washed under pressure on 10 mesh screen and 31% pith was removed from the whole bagasse. Some amount of good fibres were also lost with pith. The depithed bagasse was cooked in rotary electrically heated digester having 15 litres capacity . The

Table II. Cooking Conditions

Cook No.	B-1	B-2	B-3	B-4
Bagasse Liquor Ratio	1:7	1:4	1:4	1:4
Concentration of Cooking Liq.g/L	20.0	35.0	35.0	37.5
Temperature °C	100	130	165	165
Time, Hrs.	4	4	3¼	3½
Yield% on b.d. bagasse	62.0	58.8	55.8	54.8
Alkali Consumption%	10.8	12.6	13.26	13.7

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pulp obtained at 100° and 130°C was refined in Sprout Waldron refiner by keeping minimum possible clearance between the plates. The bleached pulp was beaten in Laboratory Valley beater to 45° SR and the hand sheets were made and tested as per TAPPI Standards.

The bleached pulp obtained from cook No. B_1 and B_2 and mill bleached pulp containing 90% Bamboo and 10% hard woods were beaten separately in laboratory Valley beater to 45° SR, then the beaten pulps were mixed in the proportion as mentioned. The 60 G.S.M. hand sheets were made and tested for physical strength properties as per TAPPI Standard, and surface oil absorption (by Patra). The cooking condition, Bleaching Data Physical strength properties and S.O.A. test results are given in Table II, III and IV.

Depithed bagasse was cooked by Soda process using 15 to 16% caustic soda on B. D. Bagasse at maximum temperature 165°C for 105 minutes, and was bleached by Calcium hypochlorite in single stage to obtain the bleached pulp having more than 70° G. E. brightness. The bleached pulp's physical strength properties were determined as per TAPPI Standards, using valley beater. The cooking conditions, bleached data, and physical strength properties are given in Table V and VI respectively.

Conclusions :— Bleached bagasse of good brightness with total chlorine consumption of 8% can be obtained by cooking depithed bagasse at max. temperature of 130°C for 4 hours and bleached in conventional three stage bleaching. The bleached pulp yield by above conditions is found to be 52.8%. Its physical strength properties were found satisfactory except low tearing strength.

It is evident from Table IV that by mixing bagasse bleached pulp to mill bleached bamboo pulp, the varnishability, surface oil absorption and Dennison Wax pick number improve with the increase in percentage of bagasse fibres in the furnish.

The bagasse cooked by Soda processes is easily bleached and can be bleached in single stage by Calcium hypochlorite to get bleached bagasse pulp of above 70° G. E. brightness with 6—8% Calcium hypochlorite as available chlorine of satisfactory physical strength properties except low tearing strength.

Table III. Bleaching Conditions

Cook No.	CHLORINATION				ALKALI EXTRACTION					1st Hypochlorite Treatment					2nd Hypochlorite Treatment					Total Chlorine Consumption	Bleached Yield %	Brightness ° GE
	Time Hrs.	Temp °C	pH	% Consumption of Cl_2	Time Hrs.	Temp °C	% Caustic	Time Hrs.	Temp °C	pH	Consumption %	Time Hrs.	Temp °C	pH	% Consumption			
B-1	15	Room	2	6.0	2	45	3.0	3½	38	8.9	3.1	2½	38	8.9	1.2	10.3	—	72
B-2	,,	,,	,,	5.0	,,	,,	2.5	,,	,,	,,	3.0	—	—	—	—	8.0	52.8	76
B-3	,,	,,	,,	4.1	,,	,,	1.5	,,	,,	,,	3.0	—	—	—	—	7.1	50.5	76
B-4	,,	,,	,,	4.0	,,	,,	1.5	,,	,,	,,	2.8	—	—	—	—	6.8	49.6	76

Table IV. Effect of Mixing Bagasse Pulp to Bleached Bamboo Mill Pulp

Furnish		Strength Properties at 45° SR Freeness						Surface oil absorption Vitrea 75.Secs. 28°C	No-Wax Pick number	Varnishability
		Breaking Length metres		Burst Factor		Tear Factor				
Bamboo Pulp %	Bagasse Pulp %	Bagasse Pulp of Cook B-1	Bagasse Pulp of Cook B-2	Bagasse Pulp of Cook B-1	Bagasse Pulp of Cook B-2	Bagasse Pulp of Cook B-1	Bagasse Pulp of Cook B-2			
100	0	3800	4150	34.5	38.6	100.7	87.0	3.5	7A	Poor
75	25	3990	4410	38.8	38.5	94.4	72.6	10.0	7A	Fair
50	50	4320	4750	38.3	38.0	78.0	63.0	27.0	Above 14A	Satisfactory
25	75	4780	5010	38.1	38.0	64.2	54.2	40.0	Above 14A	Good
0	100	5100	5300	38.0	27.8	40.0	42.1	48.0	Above 14A	Good.