Laboratory Evaluation of Maharashtra Bagasse for Development of high Brightness Pulps Under C/E/H/H, C/E/H/D and C/E/D Bleaching Sequences

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SUMMARY

Raw bagasse from Pandarpur in Maharashtra was wet depithed in the laboratory and analysed for proximate chemical analysis Sulphate pulping was carried out to optimize the cooking conditions to get unbleached pulp Kappa No of 10–12. The unbleached bagasse pulp was bleached under C/E/H/H, C/E/H/D and C/E/D sequence to get 90% P V. brightness. Fibre classification, fibre dimensions and physical strength properties of bleached pulp were determined. Imported soft wood pulp was blended in different proportions with C/E/H/H, C/E/H/D and C/E/D sulphate bagasse bleached pulp for making speciality paper of high pulp brightness. The bleached consumption was higher in C/E/H/H sequence followed by C/E/H/D and C/E/D sequence but buffer consumption was lower in C/E/D bleaching sequence followed by C/E/H/D and C/E/H/H sequence. Bagasse bleached pulp under C/E/H/H sequence has inferior strength properties than C/E/H/D and C/E/D bleached pulp. Imported soft wood sulphate bleached pulp (20–25%) bleached with C/E/H/D and C/E/D bleached bagasse pulp give desired physical strength properties for development of speciality paper but wet web strength property is little on lower side

Introduction

The current installed capacity of Indian Paper Industry is 3 55 million tonnes. Wood based units account for 1 45 million tonnes, agro based 1.19 tonnes and waste based 1.19 million tonnes. The effective capacity is therefore 2.7 million tonnes while actual production is about 2.1 million tonnes, giving an operational rate of 78 %. Based on projections, per capita consumption of paper will almost double by the year 2000, requiring a productive capacity of 4.2 million tonnes of paper and board[1]. With depleted forest resources the supply of forest based raw material has reached a precarious stage, forcing paper mills to use more unconventional type of the furnish.

It is estimated that about 40 million metric tonnes of wet bagasse is produced every year [2-4]. Even if 10% bagasse is made available to paper industry it would be possible to have additional paper production as much as 0 7 million tonnes. About 220 million tonnes of bagasse at about 50% moisture is being produced annually from Sugar mills in India. Assuming 100% availabily and Six tonnes wet bagasse would yield one tonne pulp, the country has already raw material adequate to produce more than 36.6 lakh tonnes pulp which may be used for pulp and paper production. The availability of bagasse at the end of Century is estimated to be 40 million tonnes (wet basis) which could produce 60 lakh tonnes of pulp[5].

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Raw Material

Raw bagasse was received from Pandarpur Maharashtra in Eight bales packed in aerated plastic sheet and covered with hessian cloth in order to have minimum effect from outside environment and retain its natural form as received from Sugar mills. The raw bagasse has moisture content of 53.12%.

LABORATORY STUDIES

Depithing of bagasse

Wet depithing of bagasse was done as per Shrivastava K. B. etal method[6] by disintegrating raw bagasse at 3000 r. p. m. at 1% consistency for 30 minutes Disintegrated bagasse was transferred over 10 mesh sieve and washed thoroughly with water. Material retained on 10 mesh was again disintegrated for 15 minutes and washed over 10 mesh thoroughly with water. The matter retained on 10 mesh and 300 mesh gives fibre and pith respectively. The material passing through 300 mesh gives soluble portion.

Proximate chemical analysis :

Proximate chemical analysis of raw and depithed bagasse was carried out as per TAPPI Standards and the findings were compared with rice straw, wheat straw, kenaf and Bamboo.

Autoclave Digestion :

Sulphate digestions were performed in a 30 litre capacity electrically heated digester having indirect forced liquor circulation arrangement. 2kg. O.D. depithed fibre was taken for each digestion.

Beating characteristics and physical strength properties

Beating of unbleached bagasse sulphate pulps was carried out in a P.F.I. mill at 10% consistency. Beating revolution to arrive at 25°, 35°, 45° and 55° SR freeness were recorded. Standards sheets of 60 gsm were made, pressed, dried and evaluated for physical strength properties as per Tappi standards.

Bleaching Experiments :

Sulphate pulp was bleached under C/E/H/H, C/E/H/D and C/E/D bleaching sequences to arrive at 90% P.V. brightness. The bleached pulps were analysed for various physico-chemical properties.

Fibre morphology :

Fibre length and width measurements of bleached pulp were carried out under a Projectina Projection Microscope. 200 measurements were taken to arrive at an average value.

Fibre classification :

Fibre classification of bleached kraft pulps was carried out in a Bauer Mcnett Classifier. 10 gram O D. pulp was taken for fibre classification and the equipment was run for 20 minutes. Fibres retained on different mesh was taken on O D. basis for calculating percentage retention of fibres.

Physical strength properties evaluation of bleached pulp.

Bagasse bleached pulps under C/E/H/H, C/E/H/D and C/E/D sequence were beaten at 45°SR freeness and evaluated for physical strength properties as per Tappi Standards.

Wet web strength determination

Wet web strength of bleached pulps determined by SCAN method (using Lorentzen & Wattre wet web strength tester, SCANC 31 : 77) at Central Pulp & Paper Research Institute, Saharanpur. Bleached pulps were beaten at 45°SR freeness in a P. F. I. mill and wet web strength was determined at $20 \pm 10\%$ dryness. Wet web strength of imported softwood bleached pulp and blends with bagasse pulp bleached pulp was also determined under the similar conditions.

Light scattering coefficient measurement

Light scattering coefficient of Bagasse sulphate bleached pulps and imported soft wood bleached pulps were determined with the help of Elrepho Brightness Tester at C.P.P.R.I., Saharanpur.

Blending of imported softwood sulphate bleached pulp

Imported softwood bleached beaten pulp was blended in 10%, 25%, 20% and 25% with Bagasse bleached beaten pulps of various bleaching sequence. The blends were evaluated for physical strength properties.

RESULTS & DISCUSSIONS

Depithing of Bagasse

Wet depithing of bagasse on laboratory scale shows that average fibre, pith and solubles fractions were 61 63%, 31.74% and 6.63 respectively (Table 1.0).

Bulk density of Raw depithed bagasse

Raw bagasse has higher bulk density (88 10 Kg/m³) than depithed bagasse 71.3 Kg/m³ on O D basis as compared to conventional raw materials Bamboo (180-220 kg/m³) and mixed hardwoods (200-270 kg/m³) chips.

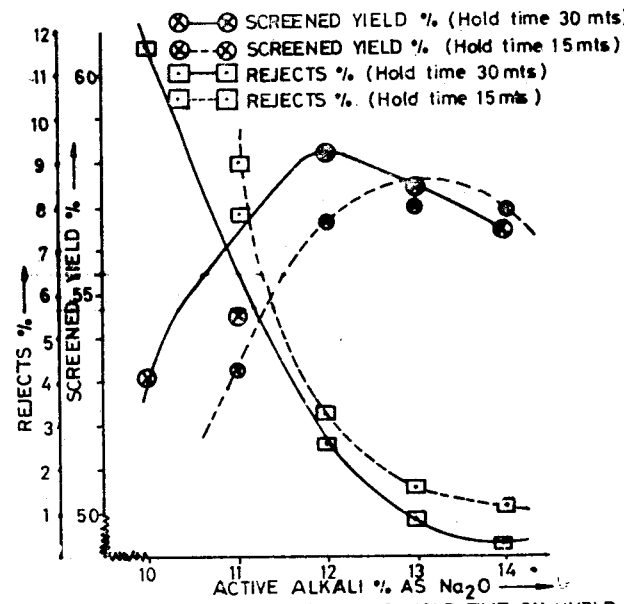
Proximate chemical analysis

Proximate chemical analysis of raw and depithed bagasse is given in Table 1.1. It is observed that raw bagasse has higher percentage solubilities of cold water, hot water, 1% NaOH and Alcohol/Benzene than depithed bagasse Raw Bagasse has higher ash content (2-3%) than depithed bagasse (1-5%). Further Lignin, Pentosan and holocellulose content in depithed bagasse was higher than raw bagasse. Higher percentage of pentosan in bagasse indicates higher percentage of alkali labile carbohydrate fraction is present which will be wiped out in black liquor even with mild alkali treatment making the black liquor more viscous.

Rice straw and Wheat straw has higher ash content as compared to raw materials like kenaf/Bamboo or raw bagasse which has nearly same precentage of ash content. Pentosan & Holocellulose content in depithed bagasse is higher than other nonconventional raw materials.

Kraft Pulping :

Depithed bagasse was digested with varying alkali percentage (10–14% as Na_2O, 20% sulphidity) and bath ratio was kept 1:5 in all the digestions Hold time at 170°C (maximum cooking temperature) was kept 30 min and 15 minutes in all the digestions (Table 1.2). Alkali percentage variation versus pulp yield and rejects percentage (30 mts hold time 15 mts hold time at 170°C) is depicted in Fig 1. It was found 14% alkali as Na_2O and 30 min hold time at 170°C is ideal condition to get desired lower Kappa No (11.5). In our laboratory experiments alkali percentage in sulphate pulping is towards higher side as all the digestions were performed in a stationary digester with higher raw material to liquor ratio, It is also observed that the unbleached pulp yield on laboratory scale is higher than at plant level due to better depithing of bagasse.



EFFECT OF ALKALI ADDITION AS Na_2O, HOLD TIME ON UNBLD PULP YIELD % AND REJECTS %

Fig–1

It is observed °TW and residual active alkali of black liquor is towards lower side and will need higher steam consumption to concentrate the black liquor. The swelling volume ratio (SVR) of black liquor under optimum pulping condition is low which will retard internal evaporation and result in a deuser mass on hearth bed making air and char contact difficult[7].

Strength properties of unbleached sulphate bagasse pulp :

Sulphate bagasse pulp under optimum cooking condition was beaten at 25,35,45 and 65° SR freeness. Breaking length & burst factor were increased with increase in freeness of pulp but tear factor showed a reverse trend. Physical strength properties were optimum at 45° SR freeness but with slow drainage time (Table 1.3),

Bleaching of sulphate bagasse pulp :

Sulphate bagasse pulp (Kappa No. 11 5) was blea ched under C/E/H/H, C/E/H/D and C/E/D bleaching sequences to get 90% P V. brightness (Table 1.4). Bleaching sulphate bagasse pulp under C/E/H/H sequence could not enhance the brightness to 90+as per literature and reduces pulp viscosity considerably[8] but such studies were undertaken for comparison only C/E/H sequence can be adopted for producing bleached bagasse pulp within the brightness range 82-85 G E. but pulp brightness over 90% could be achieved under C/E/H/D sequence with minimum pulp degradation[9].

Chlorine consumption was lowest under C/E/H/D sequence (5.5%), followed C/E/D sequence (7.0%) and C/E/H/H sequence (8 5%), to achieve 90% P. V. brightness Pulp viscosity was maximum under C/E/D sequence (13.2 Cps) followed by C/E/H/D (12 8 Cps) and C/E/H/H sequences (6.0 Cps). Ash content was lowest in C/E/D sequence bleached pulp. The bleached pulp yield was highest in C/E/D sequence (52 26%) followed by C/E/H/D sequence (51.98% and C/E/H/H sequence (50.57%) The total buffer addition was minimum in C/E/D bleaching sequence.

Fibre characteristics :

Fibre dimension of sulphate bagasse C/E/D sequence bleached pulp and its comparison with Rice straw, Wheat straw. Kenaf Bamboo and imported soft wood bleached pulp is given in Table 1.5. Bagasse has higher fiber length to width ratio and therefore has higher flexibility[10] Due to this property bagasse has low tear factor but higher breaking length. Imported softwood sulphate bleached pulp (I.S S.B. pulp) has much higher fibre length and diameter than other nonconventional pulps Rice straw and wheat straw has lower fibre length than bagasse pulp, The average fibre diameter of bagasse pulp is equivalent to kenaf but higher than rice straw, wheat straw and bamboo.

Fibre classification :

Fibre classification of sulphate bleached pulps under C/E/H/H, C/E/H/D and C/E/D sequence is reported in table 1.6 Bagasse bleached pulp under C/E/H/H sequence has highest fines percentage but lower percentage of long fibre retained on + 40 mesh as compared to C/E/H/D and C/E/D sequence bleached pulp.

Physical strength properties of sulphate Bagasse bleached pulps.

Physical strength properties of bagasse bleached pulps beaten at 45°SR freeness in a P F.I. mill is given in Table 1.7. Beating revolutions and physical strength properties of C/E/D sequence bleached pulp is highest followed by C/E/H/D and C/E/H/H sequence bleached pulps Strength properties specially tear and burst factor has suffered the most in C/E/H/H sequence. Sp. Scatt coefficient is highest in C/E/H/H sequence confirming about higher percentage of fines present in the bleached beaten pulp.

Blending of imported sulphate softwood bleached pulp :

Imported softwood sulphate bleached pulps was blended in 10%, 15%. 20% and 25% with bagasse pulps bleached under C/E/H/H, C/E/H/D and C/E/D sequences and results of various blends of each bleaching sequence are reported in Table 1.8, 1.9 and 1.10 respectively.

A perusal of table 1.8 shows even after blending 25% imported soft wood pulp with C/E/H/H bleached pulp desired wet web strength of sheet could not be attained although tear factor has improved significantly.

In table 1 9 wet web strength has nearly re ched the desired level by blending 20-25% imported softwood bleached pulp with C/E/H/D bleached pulp The wet web strength should be 0 9-1 0 for writing and printing paper. The physical strength properties of these blends were excellent.

A perusal of table 1 10 shows 20-25% imported softwood bleached pulp in the blends with C/E/D bleached pulp gives desired wet web strength. The physical strength properties of these blends were excellent.

Graphically comparision of breaking length, burst factor and tear factor of C/E/H/H, C/E/H/D and C/E/D blends in figure 2, 3 & 4 shows Breaking length & burst is on higher side in C/E/D bleaching sequence (fig 2 & 3 respectively) and tear factor of C/E/H/D and C/E/D bleaching sequence is nearly same.

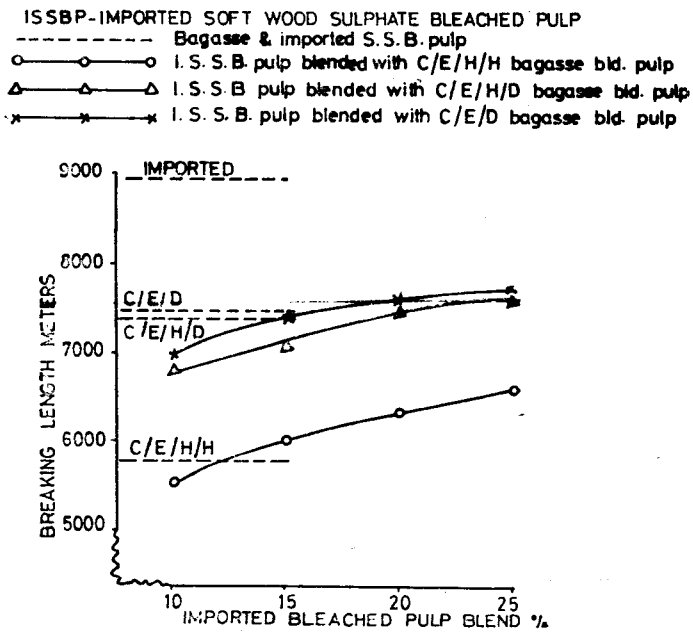


Fig 2–Effect of I S S B. pulp bleaching on .B E of bagasse C/E/H/H, C/E/H/D bld. pulp.

Conclusion

It is observed that 90% P. V. brightness of Bagasse sulphate pulp can be achieved with C/E/H/H, C/E/H/D and C/E/D bleaching sequence but the pulp is degraded under C/E/H/H sequence with higher chlorine consumption. The physical strength properties of C/E/H/D and C/E/D bagasse bleached pulps were suitable for making speciality paper after blending 20-25% imported softwood sulphate bleached pulp.

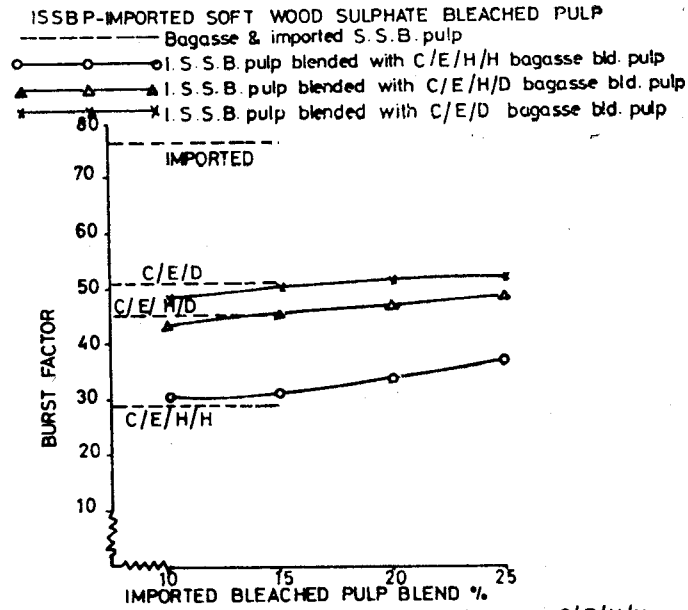
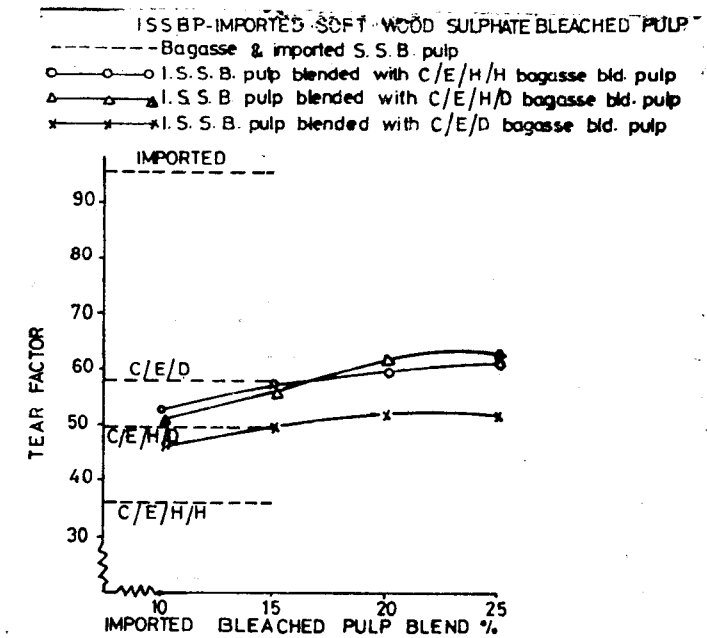


FIG-3-Effect of I.S.S.B. pulp blending on B.F. of bagasse C/E/H/H, C/E/H/D, C/E/D bld. pulp



4-Effect of I.S.S.B. pulp blending on T.F. of bagasse C/E/H/H, C/E/H/D, C/E/D bld. pulp.

Acknowledgement

The authors are deeply indebted to Shri D. P. Saboo, Executive Vice Psesident and Shri N. R. Agarwal, Vice President (Technical), Orient Paper

Mills, Amlai for their valuable guidance and keen interest in running the project. The authors gratefully acknowledge with thanks the kind permission from Shri D. P. Saboo, Executive Vice President, Orient Paper Mills, Amlai to present the paper at the Seminar. The authors acknowledge with thanks the technical assistance rendered by Shri S. K. Kar, Research Chemist, Orient Paper Mills, Brajrajnagar.

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TABLE—1.0

Determination of Fibres, Pith in Raw Bagasse and Bulk density

S No.	Particulars	Fibres (%)	Pith (%)	Soluble (%)
(A) 1.	Raw Bagasse	62.34	30 00	7.66
1.	—do—	61.42	32.28	6 30
3.	—do=	59.48	34 02	6 50
4.	—do—	63.26	30 67	6 07
5	Average	61.63	31 74	6 63
(B 1.	Moisture % in Raw bagasse	53.12		
2.	Bulk density of raw bagasse Kg/m³	88.10		
(C)	Bulk density of Depithed Bagasse Kg/m³	71.3		

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TABLE—1.1

Proximate chemical analysis of Raw bagasse, depithed bagasse and their comparison with wheat straw, rice straw, kenaf & bamboo

S.No.	Particulars	Raw Bagasse	Depithed Bagasse	Rice straw	Wheat straw *	Kenaf **	Bamboo
1.	Ash %	2.30	1.50	16.10	6 0	2 4	2 35
2.	Cold water solubilty, %	3.80	3.50	9 50	—	—	3 29
3.	' ot water solubility, %	7.76	5 75	12.60	9 30	7 9	6.12
4.	1% NaOH solubility, %	36.46	31.77	45 20	40 20	26.80	21 35
5.	Alcohol Benzene solubility, %	3.25	2 23	3 47	4 60	1 86	2 7
6.	Lignin, %	20.85	21 43	12.80	21 00	21.50	25 85
7.	Pentosan, %	26 70	27.85	22 70	23 00	10 50	I5 06
8.	Halocellulose,	73 60	75 80	63 00	64 00	72 00	65.30

* Nipun M, Bhatia V K & Roy T.K., IPPTA, Vol 4. No. 4, Page 10, 1992

** Agarwal A, Garg S.C. & Raghunath V. IPPTA, Vol. 24, No. 1, Page 44, 1987.

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TABLE—1.2

Sulphate Pulping of Bagasse

S.No.	Particulars	Digestion No.								
		1	2	3	4	5	6	7	8	9
1	Active alkali as Na_2O % on OD chips.	10.0	11.0	12.0	13.0	14.0	11.0	12.0	13.0	14 0
2	Sulphidity %	20.0	20.0	20.0	20 0	20.0	20 0	20.0	20.0	20 0
3	Bath ratio	1 5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
4	Cooking schedule									
	(i) Upto 170°C (mts)	90	90	90	90	90	90	90	90	90
	(ii) At 170°C (mts)	30	30	30	30	30	15	15	15	15
5	Screened yield, % O.D.	53.1	54 5	58 3	57 5	56 5	53.3	56.7	57.0	56.9
6	Rejects, % O.D.	11.7	7.88	2 63	0 90	0.30	9.0	3.30	1.6	1 2
7	Kappa no.	25 8	19.8	16 6	14.5	11.5	20.5	17 5	15 2	13 8
	Black liquor analysis									
8	°TW at 60°C	8.5	9.5	11.0	12 5	13 0	9.0	10.0	11.0	12 5
9	Residual active alkali as Na_2O g/l	4.7	5.1	5.8	7 0	7.8	6.3	6.3	7 3	8 2
10	Inorganics % O.D. as sulphated ash.	18.81	19.65	20.88	23.40	24.5	20.65	23.23	24 36	26.22
11	Organics %	81.19	80.35	79.12	76 6	75.5	79 35	76 77	75 64	73 78
12	Calorific value Cal/g	—	—	—	3478	3600	—	—	3138	3348
13	Swelling volume ratio	—	—	—	—	15.9	—	—	—	16.8

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TABLE—1.3

Physical strength properties of Bagasse sulphate unbleached pulp beaten at different °SR freeness.

S.No.	Particulars	Pulp beaten at °SR freeness			
		25	35	45	55
1	Initial °SR freeness 14	—	—	—	—
2	Drainage time, Secs.	6.1	7.2	8 0	9 4
3	Beating revolution, PFI Mill	2,000	4,000	6,500	8,000
4	Bulk c c./gram	1.33	1.31	1 30	1 28
5	Breaking length, meters	6801	7394	7666	7541
6	Burst factor	38.4	44.8	51.1	46 5
7	Tear factor	80.0	75.0	65 0	60.0
8	Double fold	213	329	503	512
9	Tensile Index N.m/g	66.68	72.49	75.16	73 93
10	Burst Index K Pa.m^2/g	3.76	4 39	5.01	4 56
11	Tear Index mN.m^2/g	7.74	7 35	6 37	5 88

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TABLE—1.4

Bleaching of sulphate Bagasse pulp with different bleaching sequences.

S No.	Particulars	C/E/H/H sequence	C/E/H/D sequence	C/E/D sequence
1.	Kappa No. of unbleached pulp.	11.5	11.5	11.5
	Bleaching Condition			
	Ist stage (Chlorination)			
1.	Chemicals as available chlorine %	3 75	3 75	3.75
2.	Consistency, %	3.0	3 0	3.0
3.	Temperature, °C	Room	Room	Room
4.	Time, min.	60	60	60
5.	End pH	1.8	1 8	1.8
6.	Chlorine consumed, %	3.31	3 31	3 31
	Second stage—Alkali Extraction			
1.	Chemicals as NaOH, %	1.5	1.5	1 5
2.	Consistency, %	10.0	10 0	10.0
3.	Temperature, °C	55	55	55
4.	Time, Mins.	60	60	60
5.	End pH	10.2	10 0	10 1
	Third Stage– Calcium Hypochlorite			
1.	Chemicals as available chlorine, %	4.0	1 5	—
2.	Consistency, %	10.0	10.0	—
3.	Temperature, °C	40	40	—
4.	Time, min	120	120	120
5.	End pH	9 5	9.0	—
6.	Buffer, %	0.75	0.70	—
7.	Chlorine consumed, %	3 75	1.45	—
	Chlorinedioxide stage			
1	Chemicals, as available chlorine, %	—	1 0	4 0
2	Consistency, %	—	10 0	10.0
3	Temperature, °C	—	70	70
4	Time, Mins.	—	120	120
5	End pH	—	4 8	5 2
6	Buffer, %	—	0 12	0 35
7	Chlorine consumed, %	—	0.93	3 93
	Fourth stage—Calcium hypochlorite			
1	Chemicals available chlorine, %	1.5	—	—
2	Consistency, %	10 0	—	—
3	Temperature, °C	120	—	—
4	End pH	9 0	—	—
5	Buffer, %	0 7	—	—
6	Chlorine consumed, %	1.46	—	—
	Final Results			
1	Pulp yield, %	50.57	51 98	52.26
2	Total chlorine added, %	8.5	5 5	7.0
3	Total chlorine consumed, %	7.91	5.08	6 62
4	Total buffer, %	2.9	2.32	1.85
5	Brightness of pulp % PV	90	90	90
6	Viscosity (0.5%, CED) CPS	6.0	12.8	13.2
7	P.C.No. (18 hrs at 105°C)	0.98	0.66	0 78
8	Ash, %	0 53	0 27	0 09

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TABLE—1.5

Fibre dimensions of sulphate bagasse C/E/D sequence bleached pulp and its comparison with wheat straw, Rice straw, Bamboo, Kenaf and imported softwood bleached pulp.

S.No.	Particulars	Sulphate bagasse C/E/D bleached pulp	Rice straw pulp*	Wheat straw pulp*	Kenaf pulp	Bamboo pulp	Imported softwood sulphate bleached pulp (I.S,S.B. Pulp)
1	Fibre length, mm						
	Minimum	1.2	—	—	1.3	1.2	3.5
	Maximum	3.2	—	—	2.8	3.0	7.0
	Average	1.7	0 5–1.0	1.5	1.8	2.1	4.3
2	Fibre diameter, mm						
	Minimum	0.020	—	—	0 010	0.007	0 030
	Maximum	0.055	—	—	0.042	0.015	0.080
	Average	0.030	0.008–0.010	0 015	0 027	0.011	0 050
3	Slenderness ratio	56.67:1	62.5–100.00:1	100:1	66 67:1	190.90:1	86 00:1

* Kumar A, Jindal A K., Rao N.J., IPPTA, Vol.23, No.4, Page 40, 1986

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TABLE—1.6

Fibre classification of Bagasse sulphate bleached pulps with different bleaching sequences.

S No.	Mesh	C/E/H/H bleached pulp	C/E/H/D bleached pulp	C/E/D bleached pulp
1	+ 40	46 02	50 10	56 10
2	— 40, + 70	13 01	12 60	12.85
3	— 70, + 100	11 23	12.34	8.60
4	— 100, + 140	11 60	10 90	7.65
5	— 140	18.24	14 10	14.80
6	Total	100.00	100 00	100 00

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TABLE—1.7

Physical strength properties of Bagasse sulphate bleached pulp with different bleaching sequences

S No.	Particulars	C/E/H/H bleached pulp	C/E/H/D Bleached pulp	C/E/D Bleached pulp
1	Beating revolution P.F.I.Mill	2250	4750	4800
2	Final freeness of beaten pulp °SR	45	45	45
3	Bulk cm^3/g	1.18	1.20	1.24
4	Breaking length, m	5775	7338	7411
5	Burst factor	29.5	44 6	50 8
6	Tear factor	36	49.5	58 0
7	Double fold	36	367	506
8	Tensile index Nm/g	56 62	71.94	72 66
9	Burst index K Pa m^2/g	2.89	4 37	4 98
10	Tear Index mN.m^2/g	3.53	4.85	5.68
11	Wet tensile index (1W WT) Nm/g at 20 ±% dryness	0.60	0.72	0.68
12	Scatt. Coeff m^2/kg	18.3	17.5	16.1

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TABLE—1.8

Blending of imported softwood sulphate bleached pulp with Bagasse C/E/H/H Sequence sulphate bleached pulp.

S. No.	Particulars	Bagasse C/E/H/H sulphate bleached pulp beaten at 45° SR freeness.	Softwood bleached pulp + bagasse bleached pulp (10:90)	Softwood pulp + bagasse bleached pulp. (15:85)	Softwood bleached pulp + bagasse bleached pulp. (20:80)	Softwood bleached pulp + bagasse bleached pulp. (25:75)	Imported softwood bleached pulp beaten at 45 °SR freeness.
1	Bulk c.c./gram	1 18	1.18	1 19	1.20	1.21	1.30
2	Breaking length, meters	5775	5536	6074	6355	6588	8987
3	Burst factor	29.5	30.5	31 6	33 8	36.1	76 3
4	Tear factor	36	52.7	57.1	59 1	60 5	95.5
5	Double fold	36	274	321	363	403	913
6	Tensile Index N. m/g	56.62	54.27	59.55	62.30	64 59	88.11
7	Burst Index K.Pa m^2/g	2·89	2 99	3.10	3.31	3.54	7.48
8	Tear index mN.m^2/g	3.53	5.15	5.60	5.79	5 93	9 36
9	Wet tensile Index (IWWT) Nm/g at 20±% dryness	0 60	0 66	0.69	0.73	0 76	1.25
10	Sp. Scatt. Coeff. m^2/kg	18 3	19.4	19.7	20.2	20.4	19.2

ORIENT PAPER MILLS : AMLAI

TABLE—1.9

Bleaching of imported softwood sulphate bleached pulp w.th bagasse C/E/H/D sequence sulphate bleached pulp

S. No.	Particulars	Bagasse C/E/H/D sulphate bleached pulp beaten at 45° SR freeness	Softwood bleached pulp + bagasse bleached pulp. (10:90)	Softwood bleached pulp + bagasse bleached pulp. (15.85)	Softwood bleached pulp + bagasse bleached pulp. (20:80)	Softwood bleached pulp + bagasse bleached pulp (25:75)	Imported softwood sulphate bleached pulp beaten at 45° SR freeness
1	Bulk c c /gram	1.2	1.2	1.2	1.21	1 22	1 30
2	Breaking length, meters	7338	6815	7236	7446	7513	8987
3	Burst factor	44 6	43 6	45 2	46 3	48 3	76 3
4	Tear factor	49 5	51.5	56.5	62 2	63 2	95 5
5	Double fold	367	354	430	470	554	913
6	Tensile index N. m/g	71 94	66 81	70 94	73 00	73 85	88 11
7	Burst Index K.Pa.m^2/g	4.37	4.27	4.43	4.54	4 73	7 48
8	Tear index mN m^2/g	4.85	5.05	5.54	6.10	6 20	9 36
9	Wet tensile Index (IWWT) Nm/g at 20±% dryness	0.72	0.73	0.74	0.82	0 85	1.25
10	Sp. Scatt Coeff m^2/Kg	17.5	18.4	19.4	19.4	21 2	19 2

ORIENT PAPER MILLS : AMLAI

TABLE—1.10

Blending of imported softwood sulphate bleached pulp with bagasse C/E/D sequence sulphate bleached pulp.

S. No.	Particulars	Bagasse C/E/D sulphate bleached pulp beaten at 45° SR freeness	Softwood bleached pulp + bagasse bleached pulp (10.90)	Softwood bleached pulp + bagasse bleached pulp (15:85)	Softwood bleached pulp + bagasse bleached pulp (20:80)	Softwood bleached pulp + bagasse bleached pulp (25:75)	Imported softwood sulphate bleached pulp beaten at 45°SR freeness
1	Bulk c.c./gram	1.24	1.23	1.24	1.26	1.26	1.30
2	Breaking length, meters	7411	6913	7394	7588	7688	8987
3	Burst factor	50.8	48.2	49 9	51.2	52.1	76 3
4	Tear factor	58	62.2	63.8	65.0	67.1	95.5
5	Double fold	506	495	479	535	560	913
6	Tensile Index N.m/g	72.66	67.74	72.49	74.39	75.37	88.11
7	Burst index K.Pa.m²/g	4.98	4.72	4.89	5.02	5.11	7.48
8	Tear Index N.m2/g	5.68	6.10	6.25	6.37	6.58	9.36
9	Wet tensile Index (IWWT) Nm/g at 20±% dryness	0.68	0.73	0.75	0.76	0.80	1.25
10	Sp. Scatt. Coeff. m²/Kg	16.1	17.4	18.2	19.5	19.9	19 2

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