Studies on Bleaching of Bamboo Sulfate Pulp With CHH and CEHH Sequences

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ABSTRACT

This paper deals with the comparative investigation of bleaching of bamboo sulfate pulp of varying kappa number with CHH and CEHH sequences. It has been observed that bleaching of pulp can be done to desired level of brightness with CHH sequence. However total chlorine requirement and post colour number are higher while the strength properties are lower of CHH bleached pulp compared to CEHH bleached pulp. For CHH bleached pulp of low kappa number these adverse effects are not much. As the alkali extraction stage is eliminated the alkali consumption will be lower and colour of combined effluent of CHH sequence will be very light compared to CEHH sequence. It has been finally concluded that CHH sequence can be followed if we maintain the pulp kappa number on lower side i.e. below 25.

Most of the Indian Pulp Mills are following CEH (H) sequence for bleaching the pulp irrespective of the pulp kappa number. However, a few mills also follow CHH sequence. No systematic work has been reported on the comparison of these two sequences for bamboo pulps particularly at varying kappa number.

During the bleaching of sulfate pulps, the removal/ modification of residual lignin to a maximum possible extent is essential to attain the high brightness. Multistage bleaching sequences are followed to ensure the lesser degradation during the process of bleaching. The role of alkali extraction stage is purification of pulp i.e. removal of chlorinated lignin which is formed in the first stage of bleaching. But along with the chlorinated lignin considerable portion of lower molecular carbohydrates are also dissolved since extraction is carried out at higher temperature. This ultimately causes the loss in pulp yield at the same time adversely reflects on the physical strength properties.

In the present study the comparative investigations are carried for bleaching bamboo sulfate pulps with CEHH and CHH sequences. Apart from this the effect of variation of cooking i.e. varying unbleached pulp kappa number, on bleaching the pulps with these two sequences are also investigated.

EXPERIMENTAL :

Sound bamboo (Dendracalamus strictus) chips were collected from the mills. The chips size classification was done and—32+3 fractions were taken for the study (Table—1).

TABLE—1

CHIPS SIZE CLASSIFICATION

SCREEN SIZE, mm	CHIPS RETAINED, %
—32+25	17.2
—25+22	13 2
—22+19	13.5
—19+16	22.2
—16+13	19.7
—13+ 6	13.7
— 6+ 3	0.5

Pulping

The pulping of bamboo chips was carried out in 15 lit. capacity electrically heated rotary digester. The active alkali was varied to obtain the pulps of different kappa number. The pulping conditions and results are recorded in Table—2.

Bleaching :

The bleaching of the pulps of different kappa number was carried out using CEHH and CHH sequences. The addition of hypochlorite was varied in

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small scale bleaching to get the desired level of brightness around 19%. Subsequently large scale (500 g. OD) bleaching was carried out for individual pulps. The conditions of bleaching and results are recorded in Table—3A & B.

Physical Strength Properties :

The bleached pulps were beaten separately in laboratory valley beater to four freeness levels. The standard handsheets, 60g/m². were prepared on British handsheet making machine. After cooditioning the sheets were tested for physical strength properties. By interpolation of graphs the properties at 40°SR were taken out and recorded in Table—4.

TALE—2
PULPING DATA

PARTICULARS	C—1	C—2	C—3	C—4
Active alkali on OD chips as Na_2O, %	15.0	16.0	17.0	19.0
Bath Ratio	1 : 2 7	1 : 2.7	1 : 2.7	1 : 2.7
Diluent	Water	Water	Water	Water
White Liquor sulfidity ±1, %	18	18	18	18
Cooking Schedule.		50 to 170°C =2 hrs at 170°C =1.25 hrs.		
'H' factor		1353		
Pulp yield, %	46.8	45.7	44.5	41.1
Kappa number	35.0	30.0	25.0	20.0
Black liquor, pH	9.5	10.3	11.0	11.6
R A. at 200 gpl T S. as Na_2O, gpl	4.5	5.7	7.0	8.7

TABLE — 3 A

BLEACHING WITH CEHH AND CHH SEQUENCES

Particulars	C — 1		C — 2	
	CEHH	CHH	CEHH	CHH
Unbleached pulp kappa no.	35.0		30.0	
CHLORINATION				
Cl_2 added, %	9.50		7.50	
Cl_2 consumed, %	8.74		6 65	
Final pH	2.5		1.8	
NaOH added, %	2.2	—	2.0	—
Final pH	10.0	—	9.5	—
HYPO I STAGE				
Cl_2 added, %	3.00	5.00	3.00	5.00
NaOH (Buffer) added, %	0.8	1 3	0.8	1.0
Cl_2 consumed, %	2.50	5 00	2 60	4.65
Final pH	8.9	7.9	8.6	7.3
HYPO II STAGE				
Cl_2 added, %	1.00	1.00	1.00	2.00
Cl_2 consumed, %	0 25	0.80	0.76	1.33
Final pH	8.1	7.3	7.0	6.4
Total Cl_2 added, %	13.50	15.50	11.00	14.50
Total Cl_2 consumed, %	12.49	13.54	10.01	13.63
Brightness (Elrepho), %	79.5	76.6	80.8	80.1
P.C. Number	12.8	15.9	11.4	15.2
Shrinkage, %	20.8	17.6	19.0	16.8

TABLE — 3 B

Particulars	C — 3		C — 4	
	CEHH	CHH	CEHH	CHH
Uubleached pulp kappa no.	25.0		20.0	
CHLORINATION				
Cl_2 added, %	6.50		5.50	
Cl_2 consumed, %	5.90		5.00	
Final pH	1.6		1.5	
ALKALI EXTRACTION				
NaOH added, %	1 6	—	1.4	—
Final PH	9.5	—	9.8	—
HYPO I STAGE				
Cl_2 added, %	2.50	4.50	2.00	2.00
NaOH (Buffer) added, %	0.6	0.8	0.6	0.8
Cl_2 consumed, %	2.20	4.41	1.93	2.00
Fjnal pH	8.3	7.7	8 4	7.6
HYPO II STAGE				
Cl_2 added, %	1.00	1.00	1.50	1.50
Cl_2 consumed,	0 67	0.71	1.11	1.27
Final pH	7.4	7.1	7.7	6 8
Total Cl_2 added, %	10 00	12.00	9.00	9.00
Total Cl_2 consumed, %	8.77	11.02	8.04	8.27
Brightness (Elrepho), %	81.6	80.5	81.3	80.0
B.C. No.	10.5	12.3	10.2	11.5
Shrinkage, %	16.4	14.0	14.8	9.8

NB—1) Chemicals were added on OD unbleached pulp basis.

2) Constant Bleaching Conditions :

	Cy, %	Temp. °C+1	Ret. Time, hr.
C —	3.0	28	0.75
E —	10.0	55	1.0
H_I —	10.0	40	2.0
H_{II}	10.0	40	2.0

TABLE—4

PHYSICAL STRENGTH PROPERTIES AT 40°SR

PARTICULARS	C — 1		C — 2		C — 3		C — 4	
Bleaching sequence	CEHH	CHH	CEHH	CHH	CEHH	CHH	CEHH	CHH
Bulk, cm^3/g	1.40	1.45	1.44	1.58	1.42	1.52	1.37	1 37
Burst Factor	43.5	41.0	25.4	17.6	36.8	24 4	36 5	37.0
Tear Factor	57	49	56	54	54	48	83	77
Breaking Length/m	7200	6700	5000	3600	6250	5200	5600	5700
Double folds, no.	72	41	28	7	76	19	105	90

Observations a Discussion :

1. The chips of uniform size distribution were taken so as to get the well cooked pulp even at the higher kappa number.
2. The pulps of varying kappa number could be obtained by varying the active alkali charge. It was observed that with kappa number pulp yield also decreases.
3. In the chlorination stage for all the pulps the chlorine was added percent 1/4 of kappa number. Further pulp was divided for CEHH and CHH sequences.

   i) For pulp of 35 kappa number in hypo I stage in CHH sequence higher dose of hypochlorite was required compared to CEHH bleaching sequence, and inspite of that, desired level of brightness could not be obtained. The post colour number of CHH pulp was very high compared to CEHH pulp but the shrinkage was on lower side. The total chlorine requirement was higher in CHH sequence.

   ii) The pulp of kappa nnmber 30 and 25 followed the similar trend as of pulp of 35 kappa number but in these cases the brightness of CHH pulp could be obtained by addition of extra charge of hypochlorite.

   iii) The pulps of 20 kappa number could be bleached to desired level of brightness with both the sequences without addition of extra hypochlorite. The shrinkage was lower for CHH sequence compared to CEHH sequence.

4. The physical strength properties of CEHH pulps were on higher side for the pulps of 35, 30 and 25 kappa number. The lowering of strength properties might be due to degradation during hypostage where extra hypochlorite was added to attain the desired brightness in CHH sequences. The properties of bleached pulp of 20 kappa number were more or less same for both the sequence.

CONCLUSION :

The bamboo sulfate pulps can be bleached to desired level of brightness with CHH sequence similar to CEHH sequence except the pulps of very high kappa number. The total chlorine requirement is higher for CHH sequence compared to other sequence, however, it is nearly the same for lower kappa number pulps. It has been also observed that post colour number is higher in the pulps bleached with CHH sequence compared to other sequence. Since, extraction stage is eliminated the alkali consumption will be lower and the colour of effluent of CHH sequence will be very light compared to CEHH sequence. It can be concluded that CHH sequence can be used with certain above-mentioned advantages if we can maintain kappa number of the pulp on lower side.

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