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STUDIES ON PULPING OF KOROI (*ALBIZZIA PROCERA*) BENTH BY SODA PROCESS

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Studies on pulping of Koroi (*Albizzia procera*) Benth were made by soda process. Optimum pulping conditions were established. The physical properties of unbleached handsheets and bleached ones were determined. The results are within international specification for making writing and printing papers from 3- and 5-stage bleached soda pulp of koroi.

Key words: Soda, Pulping, Koroi.

INTRODUCTION

Koroi is included in the leguminosae family. It is a large deciduous tree [1] 60-80 feet high, growing over 6 feet in circumference, wide branches full of leaves. It is commonly distributed from Himalayas to Bangladesh and Burma. It grows on alluvial ground along stream and other moist soil. It is planted along road side throughout the country.

Koroi is mainly used for making furniture and also as fuel by the villagers.

The chemical compositions of koroi determined by Tappi standard methods [2-5] were as follows :

(a)	Alpha cellulose	(%)	40.00
(b)	Lignin	(%)	27.16
(c)	Pentosan	(%)	14.02
(d)	Ash	(%)	1.01

As no report was available for making pulp and paper from koroi, so the present studies were carried out in the laboratory by soda process.

EXPERIMENTAL

(a) *Preparation of the raw material.* Koroi was cut into pieces of 1" in length and ½" in width and sun-dried. The moisture content of the above material was determined in an electric oven by keeping samples for 18 hours.

(b) *Preparation and analysis of cooking liquor.* The cooking liquor consisted of solution of sodium hydroxide which were analysed before use for sodium hydroxide, sodium carbonate, etc. by conventional standard method [6].

(c) *Establishment of optimum conditions for pulping.* A number of digestions for soda process was done under variation of chemical (NaOH) against the cellulosic raw material (koroi), temperature, time and mass-liquor ratio. In each digestion, 1 kg oven dry. basis of the material was used in a rotary stainless steel digestor. For establishment of optimum conditions for pulping, careful studies were also made regarding yield, permanganate number [7] of the unbleached pulpsand breaking length [8], tear factor [9] burst factor [10] and brightness [11] of the unbleached pulp-sheets [12,13].

Table 1. Effect of caustic soda on pulp-yield and permanganate number of unbleached pulp and physical properties of the unbleached pulp-sheets from soda pulp of koroi.

(a) Material taken on oven dry basis 1000; (b) Temperature C^{O}-155(c) Time in hours including 50 minutes to to reach the temperature 4.0; (d) Material: liquor 1:4; (e) Pressure kg/cm^2 5.5.

Expt. No.	NaOH (%)	Unbleached yield (%)	Permanganate number	Breaking length in metre	Tear factor	Burst factor	Brightness (%)
1	24	38.47	18.05	1269	24.0	25.64	22.7
2	26	37.13	16.98	1408	25.03	27.40	24.3
3	28	35.72	15.73	1543	23.22	28.81	26.0

Table 2. Effect of temperature on pulp-yield and permanganate number of the unbleached pulp and physical properties of the unbleached pulp-sheets from soda pulp of koroi.

(a) Material taken in g. oven dry basis 1000; (b) % NaOH 26.0; (c) Time in hours including 50 minutes to reach the temperature 4.0; (d) Material: liquor 1:4; (e) Pressure kg/cm^2 5.5 at 155^o.

Expt. No.	Temperature ^oC	Unbleached yield (%)	Permanganate number	Breaking length in metre	Tear factor	Burst factor	Brightness (%)
4	145	Not well digested					
5	155	37.13	16.98	1408	25.03	27.40	24.3
6	165	34.80	15.50	1590	22.75	29.25	26.5

Table 3. Effect of time on pulp-yield and permanganate number of the unbleached pulp and physical properties of the unbleached pulp-sheets from soda pulp of koroi.

(a) Material taken in g. oven dry basis 1000; (b) % NaOH 26.0; (c) Temperature ^oC 155; (d) Material: liquor 1:4; (e) Pressure kg/cm^2 5.5.

Expt. No.	Time in hours	Unbleached yield (%)	Permanganate number	Breaking length in metre	Tear factor	Burst factor	Brightness (%)
7	3.0	Not cooked well					
8	4.0	37.13	16.98	1408	25.03	27.40	24.3
9	5.0	31.67	11.76	2143	19.55	36.69	30.5

Table 4. Effect of material-liquor ratio on pulp-yield and permanganate number of the unbleached pulp and physical properties of the unbleached pulpsheets from soda pulp of koroi.

(a) Material taken in g. oven dry basis 1000; (b) % NaOH 26.0; (c) Temperature ^oC 155; (d) Time in hours including 50 minutes to reach the temperature 4.0; (e) Pressure kg/cm^2 5.5.

Expt. No.	Material liquor ratio	Unbleached yield (%)	Permanganate number	Breaking length in metre	Tear factor	Burst factor	Brightness (%)
10	1:3	Not well digested					
11	1:4	37.13	16.98	1408	25.03	27.40	24.3
12	1:5	37.49	16.86	1423	24.82	27.62	24.5

Table 5. Optimum conditions for soda cooking of koroi.

NaOH (%)	Temperature ^oC	Time in hours	Material-liquor ratio	Pressure kg/cm^2
26.0	155	4:0	1:4	5.5

Laboratory evaluation of unbleached pulp. One kilogram (oven dry basis) of unbleached pulp was disintegrated and beaten in pilot plant Hollander beater [14] for 60 minutes. Samples of pulp-slurry at the beginning of experiment and after every 10 minutes interval were collected for making pulp-sheets for the test of physical properties. The freeness of the unbleached pulp was determined by Tappi standard method [15].

Preparation and analysis of chlorine water and sodium hypochlorite solution. Chlorine required for first stage of multistage bleaching was prepared by oxidising hydrochloric acid with potassium permanganate in water and analysed according to Tappi standard method [16]. The sodium hypochlorite was prepared by passing chlorine gas

into a cold solution of 2.0 % sodium hydroxide and analysed by Tappi standard procedures [16].

Table 6. Laboratory evaluation of the unbleached soda pulp of koroi.

Beating time in minute	Breaking length in metre	Tear factor	Burst factor	Freeness in ml
00	1408	25.03	27.40	902
10	1476	26.22	28.72	895
20	1547	28.41	30.10	888
30	1651	32.17	32.13	881
40	1690	49.00	32.89	873
50	1726	41.94	33.59	867
60	1755	38.59	34.15	860

Table 7. Laboratory evaluation of 3 stage CEH bleached soda koroi pulp.

Beating time in minutes	Breaking length in metre	Tear factor	Burst factor	Freeness in ml
00	2002	31.24	36.14	900
10	2065	33.43	37.49	896
20	2162	37.70	39.83	891
30	2281	49.18	41.81	886
40	2353	62.84	42.42	879
50	2476	55.03	44.93	871
60	2485	50.19	45.06	866

Table 8. Laboratory evaluation of 5 stage CEHEH bleached soda koroi pulp.

Beating time in minutes	Breaking length in metre	Tear factor	Burst factor	Freeness in ml
00	1816	29.00	34.14	899
10	1888	34.45	35.49	894
20	1959	39.62	36.83	888
30	2011	50.14	37.81	882
40	2097	63.75	39.42	875
50	2193	58.09	41.23	868
60	2200	48.10	41.36	860

Table 9. Yield and brightness of the bleached soda pulp of koroi.

Type of bleached pulp	Bleached yield (%)	Brightness (%)
+ CEH	34.00	82.4
++ CEHEH	32.61	84.1

+ In CEH, Where C means chlorination, where 60 % of the total chlorine required was supplied. Chlorination was done for 60 minutes at temperature 25-30°, pH 1-2, consistency 3.5 %. The remaining 30 % chlorine was supplied during H (sodium hypochlorite treatment) for 60 minutes at pH 9-11, temperature 25-30°, consistency 3.5 %. The intermediate step was E means caustic extraction (2 %) against pulp (oven dry basis) for 60 minutes at consistency 13.5 %, temperature 75-80°.

++ In CEHEH, where C means chlorination, where 60 % chlorine was supplied and the remaining was divided into two equal portions. One portion of 15 % chlorine was supplied as NaOCl during first H (first sodium hypochlorite treatment) and the rest of 15 % chlorine was supplied during 2nd H (second hypochlorite treatment). Here other conditions of chlorination, caustic extractions and hypochlorite treatments remained unaffected as those in CEH.

Table 10. Fibre-dimension of soda pulp of koroi.

Type of bleached pulp	Length in mm			Diameter in mm		
	Maximum	Minimum	Average	Maximum	Minimum	Average
CEH	1.43	0.66	0.98	0.027	0.014	0.021
CEHEH	1.41	0.60	0.96	0.026	0.013	0..021

Table 11. Fibre-fraction of soda pulp of koroi.

Type of bleached pulp	Fibre-fraction (%)				
	0.50-0.99 mm	1.00-1.49 mm	1.50-1.99 mm	2.00-2.49 mm	2.50-2.99 mm
CEH	60.81	39.19	0	0	0
CEHEH	33.63	66.37	0	0	0

RESULTS AND DISCUSSION

The yields for unbleached, CEH and CEHEH bleached pulps are 37.13 %, 34.00 % and 32.61 % respectively. It has been found from analysis that koroi contained 40 % alpha cellulose. It indicates that though there was some loss in cellulose during pulping, but within normal limits. The permanganate number (16.98) showed that the pulp yields obtained under optimum pulping conditions retained pulp purity indicating that the optimum pulping conditions for the soda process was rightly selected and were adequate for good delignification. The CEH and CEHEH pulps had brightness values of 82.4 and 84.1 respectively, the later being the best of the brightness values so far obtained for paper-grade pulps [17-36].

The freeness for soda pulp in the present studies decreased during beating.

The results of bleached pulps are within the international specification for paper-making.

CONCLUSION

1. Koroi is a short fibre pulp.
2. The soda pulp of koroi may be used for producing writing and printing paper.
3. The soda pulp may aslo be blended with long fibre pulp for production of good quality writing and printing paper.

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