High yield pulps from eta reed

MANTRI, T. C., RAGHUNATH, V. AND GUHA, S. R. D.

SUMMARY

High yield pulps have been prepared from eta reed *(Oclendra travancorica)* by employing different chemical impregnation method using pressurized and non pressurized refining of chips. Results indicate that eta reed could not be pulped with satisfactory strength properties by TMP. CTMP pulp at low NaOH concentration gave improved burst, tensile, tear and wet web strength than cold soda pulps. Alkaline sulphite treated chips result in lower strength properties than alkaline CTMP pulp. Higher energy inputs were needed in pressurized refining than open discharge refining.

When refiner pulp is made from wood, the extent of fibre damage can be diminished by softening the lignin which holds the fibres together prior to defibration. In any pressurized system, wood chips or other raw material are heated with steam at elevated temperature so that chips become thoroughly softened. The softening mainly affects the binding substance or middle lamella between the individual fibres. As the fibre separation takes place while the chips are still at elevated temperature and under steam pressure, only low power consumption is needed and very little damage occurs to the fibre length which is the basis of thermo-mechanical pulping. Another method involves chemical treatment to yield lignin derivatives which swell considerably in water without dissolving. This implies simultaneous softening of lignin[1].

The object of the present investigation was to evaluate the suitability of eta reed **(Oclendra travancorica)** for the production of TMP, CTMP and cold soda pulping and to assess the suitability of these pulps for the manufacture of newsprint and other varieties of papers.

EXPERIMENTAL PROCEDURE

Raw material

Eta reed **(Ocalendra travancorica)** was received from forest Department of Kerala Newsprint Mill Ltd. Chipping was carried out on pilot chipper and chips were screened and accepted chips were collected and used throughout this work. The moisture content was 9.8%.

Treatment of chips

Chips were impregnated in sodium hydroxide solution keeping chips to liquor ratio of 1:3.5 at room temperature for overnight with varying concentration from 10 to 30 gpl. The treated chips were refined either by CTMP under pressure or atmospheric refining out cold soda pulping in two stages. Untreated chips were also refined under pressure to produce TMP pulp. After the treatment, the chips were removed and spent liquor collected was analysed for pH, residual alkali. Results are given in Table 2.

Refining

The first stage pressurized equipment consists of metering bin, rotary valve, preheater and ROP-20 Defibrator having 200 KW motor at 1000 rpm. Second stage refining is open discharge of RO-20 raffinator connected to 200 KW motor, 1000 rpm.

Unbleached pulp test

Pulps were fractionated in the Bauer McNett fibre classifier using 28, 48, 100 and 150 mesh screens. The results are presented in Table 3.

Pulp evaluation was carried out using PFI Mill

*C. P. P. R. I., Dehradun

TABLE—1 CONDITIONS USED IN THE REFINING OF ETA REED BY TMP, CTMP AND COLD SODA

Particulars	First stage refining						Second stage refining					
	Pressure in Preheater kg/cm²	Temp. in pre-heater °C	Plate clearance mm	Net Power KW	Production rate kg/H	Sp. en. consumption KWH/t	Temp. °C	Plate clearance mm	Net Power KW	Production rate Kg/H	Sp. energy consumption KWH/t	Total energy consumption KWH/t
Eta reed												
a) TMP (Control)	1.2	123	0.25	50	58	862	95	0.15	40	43	930	1792
b) **CTMP**												
NaOH 30 gpl	1.2	123	0.25	60	69	869	95	0.15	60	66	909	1778
NaOH 20 gpl	1.2	123	0.25	50	65	769	95	0.20	50	56	892	1661
NaOH 10 gpl	1.2	123	0.25	60	63	952	95	0.15	50	57	877	1829
$NaOH+Na_2SO_3$ of 30 gpl in 50 : 50	1.2	123	0.25	50	57.5	869	95	0.15	30	49	612	1481
c) **Cold soda**												
NaOH 30 gpl	—	95	0.40	50	72	694	95	0·20	30	54	555	1249
NaOH 20 gpl	—	95	0.40	40	69	579	95	0.15	30	45	667	1248
NaOH 10 gpl	—	95	0.35	40	63	635	95	0.15	20	32	625	1260

TABLE—2 TREATMENT RESULTS OF ETA REED TMP, CTMP AND COLD SODA PULPS

Particulars	Chemical applied %	Chemical consumed %	Spent liquor pH	Rejects after screening %	Unbleached Pulp brightness %	Pulp freeness CSF ml
Eta reed						
a) TMP (Control)	—	—	—	10.6	35.5	85
b) **CTMP**						
NaOH 30 gpl	10.5	7.85	11.26	1.65	28.1	75
NaOH 20 gpl	7.0	5.97	11.30	2.30	28.0	65
NaOH 10 gpl	3.5	3.00	10.16	1.85	27.6	80
$NaOH+Na_2SO_3$ of 30 gpl in 50 : 50	10.5	6.69	10.56	3.20	32.6	65
c) **Cold soda**						
NaOH 30 gpl	10.5	7.85	11.26	—	35.1	475
NaOH 20 gpl	7.0	5.97	11.30	—	36.4	340
NaOH 10 gpl	3.5	3.00	10.16	1.85	40.4	155

where the freeness of pulp after second stage refining was higher than (ml) CSF level. Hand sheets of 100 g/m^2 were prepared using back water recirculation system. Wet web strength was determined. The hand sheets were dried, conditioned and tested for their strength characteristics. The methods followed for testing of the hand sheets is given in an earlier report[2]. The results are recorded in Tables 4 and 5.

RESULTS AND DISCUSSIONS

The operating conditions alongwith the power consumption for eta reed chips are given in Table 1. It could be seen that power requirement in TMP process was much higher compared to cold soda pulping process. Pulp produced by CTMP process also required more power consumption. This clearly shows that pressurized refining required higher power than open discharge refining.

The results obtained from CTMP and cold soda process using 10 to 30 gpl NaOH keeping all other conditions constant are given in Table 2. TMP pulp results are also presented. Brightness of eta reed TMP pulp was 35.5%. The brightness of CTMP pulp was found lower and further reduced when alkali charge was increased. Brightness of cold soda pulps was not changed compared with CTMP pulps.

TABLE—3 BAUER McNETT FIBRE CLASSIFICATION OF ETA REED PULPS

Particulars Y	Chemical applied %	Bauer McNett Classification +28 %	+48 %	+100 %	+150 %	—150 %	Pulp freeness CSF ml
Eta read							
a) **TMP** (Control)	—	10.8	19.0	4.1	10.3	55.8	85
b) **CTMP**							
NaOH 30 gpl	10.5	22.2	33.6	3.2	2.7	38.3	45
NaOH 20 gpl	7.0	—	—	—	—	—	65
NaOH 10 gpl	3.5	7 0	22.2	9.9	3.9	57.0	80
NaOH + Na_2SO_3 of 30 gpl in 50 : 50	10 5	6.6	18.8	9.7	3.8	61.1	65
c) **Cold soda**							
NaOH 30 gpl	10.5	—	—	—	—	—	—
NaOH 20 gpl	7.0	—	—	—	—	—	—
NaOH 10 gpl	3.5	11.8	38.6	14.9	6 1	28.6	155

TABLE—4 STRENGTH PROPERTIES OF ETA REED TMP, CTMP AND COLD SODA PULPS

Particulars	Apparent density g/cm^3	Tensile index Nm/g	Tear index mNm^2/g	Burst index kPam^2/g	Double folds log KM	Sp. scatt. coeff. m^2/kg	Sp. energy consumption KWH/t	Pulp freeness ml
Eta reed								
a) **TMP** (control)	0.37	8.50	2.10	(1)	(1)	—		85
b) **CTMP**								
NaOH 30 gpl	0.58	34.50	10.3	1.90	1.81	—		75
NaOH 20 gpl	0.54	25.50	8.7	1.10	1.24	32.5		65
NaOH 10 gpl	0.52	18.50	4.25	0.60	0.60	—		80
NaOH + Na_2SO_3 of 30 gpl in 50 : 50	0.45	9.00	3.10	0.30	0.30	—		65
c) **Cold soda**								
NaOH 30 gpl	0.54	41.5	8.5	2.70	1.97	25.2		100
NaOH 20 gpl	0.43	23.5	5.4	0.90	0.85	34 2		1C00
NaOH 10 gpl	0.39	12.5	3.0	0.30	(1)	47.8		100

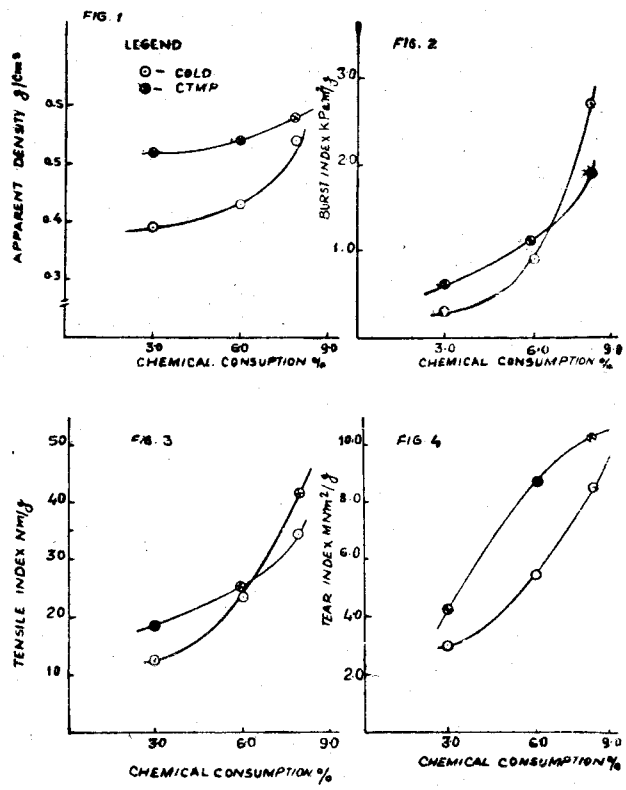
Note (1) too low to be measured.

TABLE–5 WET WEB PROPERTIES OF ETA REED TMP, CTMP & COLD SODA PULPS

Particulars	Drainage time Sec.	Initial wet web tensile index Nm/g	TEA index mNm/g	Dynamic retention value –200 %	Sp. energy consumption KWH/t	Freeness CSF ml
Eta reed						
a) **TMP** (Control)	7.31	0.22	12.8	31.0	1792	85
b) **CTMP**						
NaOH 30 gpl	63.8	0.92	182.8	36.9	1778	75
NaOH 20 gpl	49.7	0.50	54.8	37.6	1661	65
NaOH 10 gpl	31.9	0.33	30.4	41.6	1829	80
$NaOH + Na_2SO_3$ of 30 gpl in 50 : 50	7.87	0.15	7.60	40.7	1481	65
c) **Cold soda**						
NaOH 30 gpl	16.27	0.76	53.2	28 1	1249	100
NaOH 20 gpl	10.78	0.44	40,5	27.4	1248	100
NaOH 10 gpi	9.92	0.28	26.2	33.5	1260	100

In fact brightness was increased when alkali charge was reduced.

The Bauer McNett fibre classification given in Table 3 shows that more than 28.6% of pulp was obtained in the 150 mesh fraction. It is often observed in TMP pulping that a high percentage of fines produced during refining operation. Chemical treatments could facilitate less fine production during refining operation. Strength properties of sheets are recorded in Table 4. The eta reed TMP pulp gave lowest properties. It seems some chemical treatment may be essential if eta reed is to be pulped by TMP process. The influence of the different treatment conditions on strength properties of pulps are given in Fig. 1 to 5 for CTMP and cold soda pulp. Fig. 1 indicates the chemical consumed against density of sheet. It is evident that when more chemical was consumed during treatment, the density values of both CTMP and cold soda pulps were increased but low chemical treatment chips gave high density value in CTMP pulp than cold soda pulp. Fig. 2 shows the relative effects of chemical consumption on burst index. Burst index improved with chemical charge. Higher burst index values were observed at low NaOH concentration in CTMP pulp than cold soda pulp. Fig. 3 illustrates the effect of consumed NaOH on tensile index. It is evident that CTMP pulp gave better tensile value at low NaOH concentration. Tear values are given in Fig. 4. It indicates that CTMP pulps have higher tear values than cold soda pulp at different chemical consumption.



ETA REED COLD SODA & CTMP CHEMICAL CONSUMPTION Vs STRENGTH PROS.

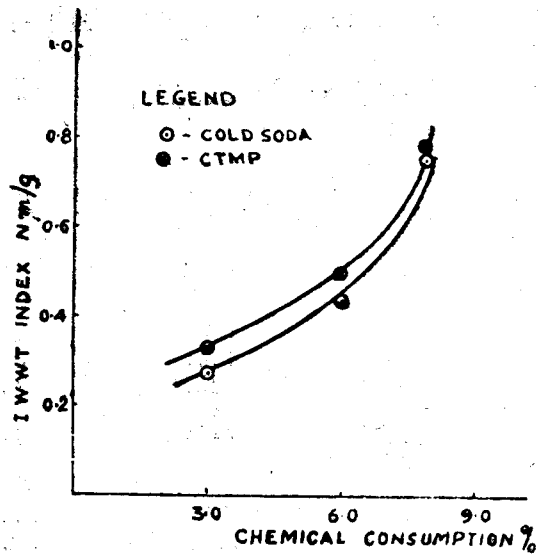


FIG.5. ETAREED/COLD SODA AND CTMP

Wet web tensile index, tensile energy absorption (TEA) and dynamic retention value of these pulps are given in Table-5. Wet web strength values at given freeness level are given in Fig. 5. Wet web tensile index values of CTMP & CMP pulps have between 0.33 to 0.92 N.m/g and 0.28 to 0.76 N.m/g respectively. Cold soda pulps have lower values of wet web tensile index when compared with the CTMP pulps.

CONCLUSIONS

From these investigations it is apparent that CTMP pulps from eta reed have better strength characteristics compared to cold soda pulps. The chemical charge during chip impregnation influences on pulp brightness during refining. Brightness of pulps were reduced during pressurized refining. But pulp with high wet web strength can be obtained. Combined NaOH and sulphite treated chips gave poor strength characteristics.

Eta reed could not be pulped to satisfactory strength properties by TMP process. On the other hand CTMP pulp at low NaOH concentration improved burst, tensile, tear and wet web strength than could soda pulps. In the event of these pulps being used in newsprint furnishes, addition of chemical pulp is necessary so as to achieve better strength characteristics.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the cooperation of Shri K.S. Moorthy, Shri Y.V. Sood, Shri T.K. Roy and Shri A.K. Kohali.

REFERENCES

1. Janson. J. and Mannstrom. B. *Pulp and Paper Canada* No. 4/April 1981.
2. Field working document no. 27 IND/73/012, Manual of laboratory research methods in paper making raw material research (November 1980).