

High Yield Pulps from Mangrove Species of Andaman/Nicobar Islands

MAN MOHAN SINGH,* RITA CHOPRA* and B.G. KARIRA*

SUMMARY

Laboratory scale experiments were carried out, on the production of newsprint from a furnish containing mechanical and Chemi-mechanical pulps from Mangrove species of Andaman and Nicobar Islands. The process adopted were refiner mechanical, cold soda and hot sulphite process and bleaching of refiner mechanical and cold soda pulps was also carried out. The results have been compared with the results obtained from Andaman/Nicobar tropical hardwoods, *Eucalyptus grandis* and *Mysore gum*. From the results, it is concluded that newsprint of satisfactory strength properties and brightness could be prepared from this furnish.

INTRODUCTION

The islands of the Andamans large and small are a chain of 204 islands in the bay of Bengal lying in a Northernly and Southernly direction having approx. 6,311 sq. km. and only 1,136 sq. km. are under mangroves. Nicobars cover an area of 1,605 sq. km. forming a group of 22 islands, and about 35 sq. km. are mangrove forests. These forests are most highly developed in those areas, which are covered by salt or blackish water at high tide and the borders of lagoons and estuaries more or less protected against heavy wave action and somewhat sheltered from high wind. These forests are of gregaricus type, i.e. they are wholly or largely composed of a single species or a few closely allied ones. The mangroves swamps constitute a valuable asset to these islands and if properly managed will prove to be a permanent source of income to the people and the Government. The main use of the wood so far is as fire wood. The bark is used as tanning material. The wood is also used as poles. Sahnî¹ has described in detail about the mangrove forest in Andaman and Nicobar Islands.

In 1978-79, the production of newsprint was around 50,000 and the State Trading Corporation's target of import was 3,06,000 tonnes. Thus there is a scope for setting up newsprint mills to reduce imports.

*Cellulose and Paper Branch, Forest Research Institute & Colleges, DEHRA DUN

It is seen that enough of the area in Andaman/Nicobar Islands is under the mangrove and if properly managed at an economic level, it may be able to support a newsprint mill.

RAW MATERIAL

For this investigation five logs of three different species of wood about 61-68 cm. long and 34-37 cm. girth were obtained. The three species have been identified as under:—

- (1) *Heritiera littoralis*
- (2) *Bruguiera conjugata*
- (3) *Rhizophora mucronata*

For pulping the logs were chipped in the Factory chipper. The chips were screened and air-dried. The size of the accepted chips varied from 20-25 mm.

EXPERIMENTAL

Production of pulps.

(a) Production of refiner-mechanical pulps :

This process gives uniform pulp and is an ideal process for using crooked logs of hardwoods.

The chips (200g., o.d.) were refined in 12" single disc Sprout waldron refiner using the clearance of 15, 10 and 5 mils. successively. The pulp was washed, screened and the yield of the pulp was determined. The results are recorded in Table-I.

TABLE—I REFINER MECHANICAL PULPING OF ANDAMAN/NICOBAR ISLANDS WOODS

Sl. No.	Species	Power consumption (kwh/tonne o.d. wood)	Screened yield (%)	Bleached yield (%)	Breaking length (metres)	Burst Factor	Tear Factor	Brightness (MgO=100 Elrepho)
1.	H. littoralis	2100	83.0	76.8	820	5.2	35.0	35.9
2.	B. Conjugata	1950	86.2	77.4	950	5.8	42.5	46.8
3.	R. Mucronata	2010	82.0	75.2	794	4.5	30.7	44.2
4.	E. grandis ²	2300	—	—	850	5.1	37.0	47.0
5.	Mysore gum ²	2250	—	—	810	5.1	44.1	36.0

Bleaching of refiner-mechanical pulps :

With a view to improve their brightness, the refiner mechanical pulps were bleached with hydrogen peroxide in single stage under the following conditions :—

Chemical, % 2.0
 Consistency, % 10.0
 Temperature, °C 50.0
 Time, hours 2.0

As these pulps had high freeness, the bleached mechanical pulps were beaten in the lampen mill to bring its freeness to 250 ml. (C.S.F.). These beaten pulps were blended with 30% chemical pulp from bamboo. The standard sheets of 60 g.s.m. were prepared and tested for their strength properties. The power consumption, brightness and strength properties of the standard sheets from the blend are recorded in Table-I. For comparison, results of *E. grandis* and *Mysore gum*² are also given.

(b) Production of Chemi-mechanical Pulps

Chemi-mechanical pulps are obtained in high yields and are stronger than the mechanical pulps. Two types of chemi-mechanical pulps were prepared :—

- (i) Cold soda pulps.
- (ii) Hot sulphite pulps.

Production of Cold Soda Pulps

200g. (o.d. basis) chips of each wood separately were kept in 8% caustic soda solution (as NaOH) at 30°C for 3 hours keeping the bath ratio 1:4.5. The softened chips were refined in Sprout waldron refiner keeping the clearance of 15, 10 & 5 mils. successively. The pulp was washed, screened and the yield of the pulp was determined.

Bleaching of Cold Soda Pulps

Cold soda pulps were bleached under the following conditions :—

Chemical 15% (as available Cl₂ on o.d. pulp).

Consistency 10%
 Temperature 40°C
 Time 3 hours.

The bleached cold soda pulps were beaten to 250 ml. (C.S.F.) freeness in lampen mill. The beaten pulps were blended with 30% bamboo chemical pulp. Standard sheets of 60 g.s.m. were prepared and tested for their strength properties. The screened yield, bleached yield, power consumption, the brightness and the strength properties of the standard sheets are recorded in Table-II. For comparison, results of *E. grandis*, *Mysore gum*, *Canarium euphyllux*³ and *Terminalia bialata*³ are also given.

Production of Hot Sulphite Pulps

In hot sulphite pulping, wood is treated under pressure with hot solution of sodium sulphite.

200 g. (o.d.) chips were pulped under the following conditions in a vertical stationary digester :—

Sodium sulphite (on o.d. wood chips, %) ... 3
 Maximum temp., °C ... 140
 Total time, minutes ... 60 (including 35 min. to raise to max. temp.)
 Bath ratio ... 1 : 4

The softened chips were fiberized in Sprout waldron disc refiner keeping the clearance 15, 10, & 5 mil. successively. The pulp was washed, screened and standard sheets of 60 g.s.m. were prepared after boiling the pulp to 250 ml. (C.S.F.) freeness and blending the pulp with 30% bamboo chemical pulp. The screened yield, power consumption, the brightness and strength properties of the standard sheets are recorded in Table-III. For comparison, results of *E. grandis* and *Mysore gum* are also given,

Blending of pulps

With a view to improve the strength properties of the mechanical pulps, the refiner mechanical pulps from all the three woods were mixed with Cold soda pulps from the same woods and Chemical pulp from bamboo in the ratio 35:35:30 respectively. The strength properties of the various blends were evaluated and are recorded in Table-IV.

TABLE—II COLD SODA PULPING OF ANDAMAN/NICOBAR ISLANDS WOODS

Sl. No.	Species	Power consumption (kwh/tonne o.d. wood)	Screened yield (%)	Bleached yield (%)	Breaking length (metres)	Burst Factor	Tear Factor	Brightness (MgO=100 Elrepho)
1.	<i>H. littoralis</i>	1410	80.6	72.0	2230	7.3	41.4	45.9
2.	<i>G. conjugata</i>	1490	83.6	75.5	2420	8.8	57.0	53.7
3.	<i>R. mucronata</i>	1360	75.4	70.1	2190	6.2	46.0	51.6
4.	<i>E. grandis</i>	1660	79.2	—	2270	8.6	56.2	57.0
5.	<i>Mysore gum</i>	1380	77.3	—	1470	8.2	57.5	53.0
6.	<i>Canarium euphyllux</i> ³	—	86.0	—	2565	6.9	27.0	—
7.	<i>Terminalia bialata</i> ³	—	86.5	—	1340	4.6	46.0	—

TABLE—III HOT SULPHITE PULPING OF A/N WOODS

Sl. No.	Species	Power consumption (kwh/tonne o.d. (wood))	Screened yield (%)	Breaking length (metres)	Burst Factor	Tear Factor	Brightness (MgO=100 Elrepho)
1.	<i>H. littoralis</i>	1310	81.3	1040	5.6	37.7	16.5
2.	<i>B conjugata</i>	1480	81.7	1260	6.0	44.0	28.3
3.	<i>R. mucronata</i>	1230	78.7	990	4.8	35.0	34.0
4.	<i>E. grandis</i> ²	1270	85.4	1620	5.1	50.3	50.0
5.	<i>Mysore gum</i> ²	1200	84.0	1160	5.0	45.0	40.0

TABLE—IV PROPERTIES OF DIFFERENT BLENDS

Sl. No.	Furnish of blends	Properties of blends			Brightness (MgO=100 E.repho)
		Breaking length (metres)	Burst Factor	Tear Factor	
1.	35% <i>H. littoralis</i> refiner mech. pulp and 35% <i>H. littoralis</i> C. Soda pulp + 30% bleached bamboo pulp.	1270	7.8	40.3	40.1
2.	35% <i>B. conjugata</i> refiner mech. pulp and 35% <i>B. conjugata</i> C. Soda pulp + 30% bleached bamboo pulp	1980	5.7	45.5	50.1
3.	35% <i>R. mucronata</i> refiner mech. pulp and 35% <i>R. mucronata</i> C. Soda pulp + 30% bleached bamboo pulp.	1040	8.0	59.0	46.7
4.	35% <i>E. grandis</i> refiner mech. pulp and 35% <i>E. hybrid</i> C. Soda pulp + 30% chemical pulp	1520	6.3	43.4	47.0

DISCUSSION

The results of refiner-mechanical, Cold soda and Hot sulphite pulping are recorded in Tables-I, II and III respectively. A perusal of Table I and II indicates that power consumption for the three mangrove species is nearly the same and varies with the process adopted. Power consumption for different processes as expected are in the following order :—

R. mechanical > H. sulphite > C. soda

As expected the yield and strength properties of the pulps are in the reverse order, i.e. cold soda pulps have the high properties while refiner mechanical pulps have the poorest strength. The strength properties of hot sulphite pulps lie in between the two. Among the species, yield and strength properties lie in the following order :—

B. cojugata > H. littoralis > R. mucronata
Power consumption for the three species lies in the reverse order

The results are comparable with *Eucalyptus grandis*, *Mysore gum* and *Terminalia bialata*.

As expected, the brightness of the pulps lies in the following order :

C. soda > R. mechanical > H. sulphite

As the refiner mechanical pulps have poor strength properties even after blending with 30% bamboo sulphate pulp, the refiner mechanical pulps obtained from the three species were blended with the cold soda pulps obtained from the same species in proportion of 35% each. Table-IV

shows the properties of various blends. A perusal of Table IV indicates that the furnish consisting of 35% refiner mechanical, 35% cold soda pulp from *B. conjugata* and 30% bamboo sulphate pulp gives the best strength properties as compared to the other blends. The strength properties in general are comparable with those obtained from a furnish containing 35% refiner mechanical and 35% cold soda pulps from *Eucalyptus* species and 30% chemical pulp.

In general, it can be concluded that the newsprint with satisfactory strength properties and brightness can be prepared from a furnish containing 30% chemical pulp from bamboo and 70% refiner mechanical pulps and chemi-mechanical pulps from the above mentioned mangrove species of Andaman and Nicobar Islands.

REFERENCES

1. K. C. Sahni, Indian Forester, Sept., 1958 pages 554-562.
2. R.L. Bhargava, A. Panda, S. R. D. Guha, Man Mohan Singh, D. K. Jain, Krishan Kumar, P. P. Bhola, B. G. Karira. Kerala Newsprint Project results of laboratory trials at F. R. I. Dehra Dun. Ippta C. N. 1973, 20-23.
3. Man Mohan Singh, R. N. Madan, Rita Dhawan and B. G. Karira, Investigations on Andaman and Nicobar Islands woods for different grades of paper—(under publication).