Suitability of the Dadup wood (Erythrina Suberosa) for Paper Making (Laboratory and Plant Trials)

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The laboratory and plant scale trials conducted indicate that the Dadup (Erythrina Suberosa) wood, which has remained unutilised so far, could be turned into a useful raw-material either alone or mixed with bamboo for the production of bleached and unbleached papers.

Apart from the bamboo and bagasse, which are being used in our Mills for the paper manufacture, the need was felt to investigate other raw-materials, keeping in view the growth and expansion of the paper industry, which could easily be exploited for the manufacture of paper as the resources of the present conventional raw-materials are limited in the Madras States.

Raw-Material: Dadup Wood (Erythrina Suberosa) taken for investigation occurs scattered throughout the dry mixed forests and hills in India excepting the regions of heavy rainfall namely Assam, Bengal and West Coast. In Madras and Kerala States, it is generally grown in the tea and coffee estates as a shade tree. In Madras State, it is found in sufficient quantities near Pollachi (Anamalai Hills), Nilgiri district especially Cudalur Taluk, Sherverois Hills and Yercaud; in Kerala, in Murian area etc. The tree is a moderate sized deciduous prickly one with cylindrical stem having an average height of 15 metres and a girth of 1.0 metre with a specific gravity of 0.2—0.3 at a moisture content of 12.0% It is a tough and fibrous raw-material with an extremely course texture. It rapidly grows to a girth of 8″ to 10″ in six years.

The wood used in our trials was obtained from Pollachi in a debarked state in logs of 4′ length and 12″ dia. They were sliced in our saw machine, chipped in Sumner Chippers and screened. Chips were classified. A representative sample of the material was ground to (—40+60) mesh and subjected to approximate analysis using TAPPI standard methods (Table I & II).

Laboratory Trials: The chips (8 kgs. even dry) were digested by the sulphate process (Sulphidity 20%) in a rotary stainless electrically heated digester of 1.5 C. ft. capacity under varying cooking conditions. The period of cooking excludes approximately 1½ hrs. time required to bring it to the desired range. The material liquor ratio was throughout maintained at 1 : 4.

The pulps were washed in the digester itself and beaten in the Noble wood valley beater capacity 3 kgs. at a consistency of 3.5% to a freeness of 45° SR. The standard sheets were made on TAPPI sheet making outfit and tested for the physical properties at 27°C. temperature and relative humidity of 60%. A portion of the unbleached pulp was bleached in 2 stages to a brightness of 75° PV using Calcium Hypochlorite.

Results: The data for the digestion conditions, pulp yield and the strength properties along

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with the Chlorine demand figures given in Table III indicate that under suitable conditions, this short fibred wood can be pulped and bleached to produce writing and printing papers with a satisfactory strength and brightness. It was also felt that unbleached papers like kraft or wrappers, etc. would be satisfactorily produced.

Mill Trials: In continuation of our experiments on the laboratory scale, plant trials were conducted. Approximately 100 tons of the chips were digested in our Pandia continuous digester under the following conditions.

Period of cooking	—	25 mts.
Pressure	—	125-130 psi.
Alkali consumption as NaOH on B.D. Wt.	—	21%
Sulphidity	—	20%

The pulp was blown to the blow pit and washed on the 3-stage washers and screened. The unbleached pulp so obtained, was stored separately. The yield of the pulp was calculated.

The wood pulp was mixed with bamboo unbleached pulp in proportion of 50-50% and passed to the Refining system consisting of 2 Nos. Hydrafiners and 2 Nos. Jordans in series. The refined pulp was screened in the centricleaner and selectifier screen systems. 125 GSM wrapper papers and 47 gms. Kraft papers were made on the MG machine. The machine speed was maintained at 600 fpm. when running 47 GSM kraft. The paper rolls were regularly tested for their physical characteristics. Average figures for the day are given in Table IV.

The screened unbleached pulp obtained from the pulp mill was evaluated frequently in the laboratory beater at a consistency of 3.5% , the average results so obtained are tabulated in Table 5. The fibre classification was made on Clarke classifier (Table 5-A).

A composite sample drawn from the total production was bleached in the laboratory in two stages to a brightness of 75° PV with calcium hypochlorite solution. The black liquor obtained in the plant was exclusively treated in the evaporators and furnace section of the Soda Recovery and analysed in the Laboratory (Table VI).

Observations & Calculations: With a good rate of feed of 4' long wood pieces to the chipper, the size of the chips were quite uniform and dust losses considerably low. The feeding of the chips to Pandia was quite good and the pulp was easily washable with a freeness of about 17 SR. The pulp presented no difficulty in bleaching though the bleach consumption was little high on account of the fact that in the plant scale trial the permanganate number of the pulp was maintained between 21-23 for the manufacture of wrapper and kraft. We are confident with the adjustment of the cooking conditions slightly an easily bleachable pulp could be produced having less chlorine demand and satisfactory brightness. The yield of the pulp was noticed to be in the range of 51-53% on bone dry weight of wood used, which indicates possibilities of getting a fairly good yield from this species of hard wood. Further plant trials for determining the possibilities of using the wood for producing bleachable pulps are being taken up.

On paper machine, while running the paper practically no problem was encountered. In admixture with bamboo pulp to the extent of nearly 50%, the machine run at 600 rpm. and 47 GSM kraft was quite smooth, and the physical strength characteristics of the paper have been noticed to be comparable with the paper from other conventional raw materials used hitherto.

The above observations and results indicate that under suitable conditions, this wood can be safely exploited economically to produce various types of bleached and unbleached papers with satisfactory strength and brightness either alone or in admixture with bamboo. Once a start is made for the consumption of this hard wood which is of no practical utility at the present, tea and coffee plantation establishments could be requested to arrange for

the proper felling and plantation of these trees. The development and utilisation of this hard wood is sure to reduce the scarcity of the conventional raw-materials for the paper manufacture to a certain extent.

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TABLE I

CHIPS CLASSIFICATION

Retained over	2″	:	5.8 %
	1″	:	5.0 %
	½″	:	50.20%
	¼″	:	33.60%
	1/8″	:	2.80%
less than	1/8″	:	2.60%

TABLE II

APPROXIMATE CHEMICAL ANALYSIS OF THE WOOD

		% on O.D. Material.
Cellulose (Cross Bevan)	:	66.4
Lignin	:	20.0
Pentosans	:	12.57
Ash	:	1.79
Hot water solubility	:	4.35
Cold water solubility	:	3.20
1% NaOH solubility	:	11.35
Alcohol benzene solubility	:	11.09

TABLE IV

PHYSICAL STRENGTH OF THE PAPER

	Wrapper	*Kraft.*
Substance	125 gsm.	47 gsm.
Ash	10%	—
Burst Factor	13	22
Tear Factor	95	70
Breaking Length	2500	3200
Double Folds	15	8

TABLE V

PULP EVALUATION ON THE PULP MADE IN THE MILL

Freeness in °SR	Burst Factor	Tear Factor	Breaking length.	(Schopper) Folds
25	27	80	4000	18
35	34	67	5000	40
45	38	60	5300	54
55	42	52	5500	56

TABLE V(A)

FIBRE CLASSIFICATION

30 mesh.	—	20.3
30-50 mesh	—	15.5
50-100 mesh	—	19.2
100-200 mesh	—	27.8
less than 200 mesh	—	17.2

TABLE VI

TESTS ON UNBLEACHED PULP

K.No.	22-23
1% NaOH solubility	7.0
Yield of pulp	52%
Chlorine demand	13-14%
Brightness of the pulp	75 PV.

BLACK LIQUOR ANALYSIS

Residual Alkali as Na_2O	16 gpl.
Specific Gravity at 70°C	12-14 TW.
Total Solids	150 gpl.
Total Na_2O	38 gpl.
Calorific value	3400 cal/gm

TABLE VII

Maximum length of the fibre	—	2.3 mm.
Minimum length of the fibre	—	0.44 mm.
Average length of the fibre	—	1.8 mm.
Diameter of the fibre	—	.04—.044 mm.

TABLE III

COOKING CONDITIONS, YIELD AND PHYSICAL CHARACTERISTICS

Chemicals % as NaOH on O.D. Basis.	Pressure psi	Period of cooking Hrs.	K. No.	% Yield of unbleached	Chlorine demand	Breaking length	Tear Factor	Burst Factor	Double Folds (Schopper)
18	75	3	not cooked	—	—	—	—	—	—
18	100	3	29.0	52.2	16.0	6500	75.0	35	130
18	150	3	24.4	48.0	14.5	5598	76	35	95
20	75	3	28.0	48.0	15.2	7979	73.4	35	130
20	100	3	21.0	48.4	11.5	5233	65.5	34.5	55
20	150	3	15.8	46.0	9.09	3367	40.7	15.0	30
20	100	$2\frac{1}{2}$	24.5	47.0	13.90	5555	73.3	35	85
22	75	3	20.4	46.5	11.50	5210	67.0	33.8	40
22	100	3	14.5	45.0	9.0	3200	40.0	30.5	28