

PULPING CHARACTERISTICS OF MELIA AZEDARACH (RED BAKAIN) GROWN IN N.W.F.P. AREAS

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Abstract

Pulping characteristics of *Melia azedarach* (Red Bakain) grown in NWFP were determined. The results of the study reveal that *Melia azedarach* wood may be pulped by Kraft process. At 15 percent active alkali and 25 percent sulphidity, yield of the pulp was about 50.3 percent. As far as strength properties were concerned, at 66 SR⁰ (Schopper Regiler), Breaking Length of the paper was recorded 6181 km. These results clearly indicate that pulp industry can use *Melia azedarach* wood for Kraft pulping in the country.

Introduction

Pakistan is deficient in forest and forest products. As a result of meager forest resources in the country, local pulp and paper industry uses non-woody raw materials for paper manufacturing. Quality of the paper manufactured from non-woody raw material like wheat straw, bagasse and grasses is not comparable with the imported paper in the country. Pakistan annually spends about 13 billion rupees on the import of paper products. Demand for pulp and paper is expected to surge further because of increasing GDP and literacy rate in the country. Hiking demand of pulp and paper in the country emphasizes the need for the efforts to extend the base of raw materials to the local pulp and paper industry. Such efforts can only succeed if local pulp and paper industry is ready for backward integration to ensure the supply of raw materials. Second approach may be finding those tree species, which could be used as pulpwood. This is only possible if physio-chemical and anatomical properties of the tree species which have yet not been considered as raw material for pulp and paper industry are determined. Realizing this fact, a study was planned at Forest Products Research Division to estimate the pulping characteristics of *Melia azedarach* wood.

The tree of *Melia azedarach* is native to lower Himalayas including Nepal and Pakistan. In Pakistan, it is extensively planted in plains of Punjab and NWFP provinces. *Melia azedarach* is described as a small to medium-sized shrub or tree in the mahogany family (Meliaceae) It has been successively planted in many other parts of the world (Sheikh, 1993).

Niskanen (1993) evaluated the profitability of *Melia azedarach* as pulpwood and timber and compared it with other fast growing species grown in Thailand. *Melia azedarach* is small sized deciduous tree with diameter 0.57m to 0.70m (Pearson and Brown, 1932). The crown is spreading and rounded. Flowers are fragrant. Fruit is stalked,

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one-seeded drupe that is greenish yellow to yellowish tan, globose, and 1-1.5 cm in diameter. The seed contains up to 40% of a drying oil. It is used for lightening and varnish etc.

Material and method for pulping

Logs from *Melia azedarach* were taken and debarked. After debarking, chips were prepared by using staffi chipper. Chip size distribution is very important factor in chipping operation. For this purpose N-3 fraction (1 inch in length and 3.2mm in thickness) was used for pulping through laboratory chips screener. Moisture contents were then determined. 15% Active Alkali and 25% sulphidity were charged to digester. Chips were cooked at 170°C for 3 hours in the digester. After cooking, pulp was washed thoroughly. The washed pulp was then disintegrated in order to get a uniform pulp. Cooking yield was then determined. This disintegrated pulp was beaten in a beater to find out consistency through SR⁰ (Schopper Regiler). After this, pulp was refined in refinery machine. Sheets were then made from refined pulp at different SR⁰ (Schopper Regiler), these sheets were then pressed in Semi-Automatic-Press and dried to get fine sheets. In order to find quality of paper, various tests were carried out to estimate paper properties like grammage, density, bulk, breaking Length, tensile Index etc.

Result and Discussion

In order to determine the suitability of *Melia azedarach* for pulp and paper manufacturing, its basic density and other anatomical characteristics were studied and compared with other hardwood species used for pulping world wide as shown in Table-1. Basic density is an important parameter to estimate the suitability of any species for pulp and paper manufacturing. Density of wood determines, to a considerable degree, the amount of fibers contained in a given volume (Britt, 1970)

Table 1. Comparison of physical and anatomical properties of *Melia azedarach* with Poplar and Eucalyptus

Species	Red Bakain	Poplar	Eucalyptus
Basic density (kg/m ³)	541	383	546
Fiber length (mm)	1.0249	1.05	0.81
Fiber diameter (microns)	17.085	25.23	14.74
Fiber wall thickness (microns)	3.23	3.75	3.24
Fiber lumen width (microns)	10.62	19.02	8.26
Runkel ratio	0.60	0.394	0.784

On the basis of physical and anatomical characteristics, *Melia azedarach* may be considered as a raw material for pulp and paper manufacturing. Basic density of *Melia azedarach* wood (541 kg/m³) is comparable with other hardwood species like Eucalyptus and higher than Poplar wood, but within the range of basic density limits considered suitable for wood pulping. Fiber length is comparable with Poplar and higher than Eucalyptus. High fiber length results into high tear strength. Runkel ratio indicates suitability of *Melia azedarach* wood for pulping. It is comparable with the runkel ratio of Eucalyptus and higher than Poplar (Table 1).

Table 2. Kraft pulping results and physico-mechanical properties of *Melia azedarach*

Active Alkali (%)	Sulphidity (%)	Cooking Time (Hrs)	Cooking Temp. (°C)	Basic Density (kg/cm ³)	Cooking Yield (%)	Kappa Number	SR°	Grammage (g)	Density (g/cm ³)	Bulk (cm ³ /g)	Breaking Length (km)	Tensile Index (Nm/g)
15	25	3	170	541	50.3	24.6	21	50.0	1.20	0.83	4746.4	4.34
							43	56.4	1.66	0.61	6148.9	5.60
							66	51.5	2.10	0.46	6180.9	4.9

Table 2 shows the value of grammage, density, bulk, breaking length and tensile index. With increasing SR-values, Breaking length and Tensile index values also increased, showing improved quality of paper. High yield (50.3%) shows that *Melia azedarach* is suitable for paper manufacturing. Breaking length is based on tensile force of the paper. Higher breaking length value (6180.9km) shows that *Melia azedarach* wood is good for paper having improved strength properties. Higher value of bulk (0.83) shows that paper of *Melia azedarach* wood is good for printing purposes, as more ink absorption in such paper is possible. High grammage value (56.4g) shows great suitability of *Melia azedarach* for paper industry. Higher Density value (4.66 g/cm³) also adds to the strength property of paper.

Table 3. Comparison of Kraft pulping characteristics of *Melia azedarach* with Eucalyptus

Species	<i>Melia azedarach</i>	Eucalyptus
Active Alkali %	15	15
Sulphidity %	25	25
Cooking Time (hrs)	3	3
Cooking Temperature (°C)	170	170
Cooking Yield %	50.3	46.9
Freeness (SR°)	66	65
Tensile Index (KNm/Kg)	74.4	84.2
Bulk (cm ³ /g)	0.46	1.13

From the above discussion it is inferred that *Melia azedarach* wood may be used for chemical pulping in addition to its other conventional uses. Furthermore, growers of the *Melia azedarach* wood may supplement their income by extracting oil from *Melia azedarach* seeds. Local paint industry must come forward for innovative uses of *Melia azedarach* oil. Managing and commercial utilization of *Melia azedarach* tree plantations may help in poverty alleviation in the rural communities. Research carried out at Pakistan Forest Institute confirms the suitability of *Melia azedarach* wood for furniture making. All these findings urge the need for raising *Melia azedarach* plantation in Punjab and N.W.F.P. areas to meet the growing challenges of scarcity of wood and wood resources in the country.

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