

**PULPING OF *SESBANIA ACULEATA* GROWN IN FARMLANDS IN SINDH**

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**Abstract**

*Sesbania aculeata* grown on farmlands may be pulped by using Kraft process. Chips were cooked for 3 hours at 170°C and using 15 percent Active Alkali and 25 percent Sulphidity. Yield of the unbleached pulp was 42.5 percent. Pulp was easily bleachable by DEP bleaching sequence and brightness of the pulp was 80 percent. Planting of *Sesbania* may improve the salt affected lands and increase the income of farmers through the sales of wood and raising the livestock.

**Introduction**

Pakistan is among those nations, where forest resources are not sufficient to meet the demand of raw materials for forest products industries. As a result of this, number of agricultural residues are used to manufacture the different products. Like other industries, pulp and paper industry in Pakistan uses non-wood raw material like wheat straw, bagasse, and grasses. The product, which is manufactured from non-wood raw material is not of good quality and does not have wide range of acceptance in the market. Unfortunately, wood pulping in Pakistan could not be started because of the poor response of the government as well as pulp and paper industry. In the past, same efforts were made to raise the fast growing plantations of Eucalyptus and Poplar but farmers disappointed because of the marketing constraints and lack of the wood pulping facilities in the country.

PFI, Peshawar conducted a number of studies to determine the suitability of different tree species for pulp and paper manufacture. But these efforts could only succeed until the pulp and paper industry is assured of sustainable supply of raw material, managed by the tree farmers or government. Unfortunately, pulp and paper industry is reluctant to move towards backward integration to ensure the raw material supply itself. Availability of suitable raw material for pulp and paper industry may be managed on sustainable basis under private – public or private – private mechanism. Like in the past, PFI, Peshawar continued its research efforts in finding suitability of some woody and non woody raw materials for pulp and paper manufacture. Under this research programme, *Sesbania aculeata* which is grown on farmlands in Sindh province and managed for 18 months to use as raw material in the MDF industry was tested for pulp and paper manufacturing.

*Sesbania aculeata* plantations may be raised on saline and marginal lands. Presently, such types of industrial plantations are being raised in Sindh and Punjab. *Sesbania aculeata* fixes the Nitrogen and its leaves increases the organic matters in the soil.

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*Sesbania* may also help in the poverty alleviation in the salt affected areas though additional income from livestock raised on *Sesbania* leaves, land reclamation and income from wood for industrial utilization. In addition to its uses in the MDF industry, *Sesbania* may extend the base of raw materials for chipboard and pulp and paper industry in Pakistan.

Neutral sulphite pulping was carried out by Updhyaya and Sunder (1998). Similarly Jahan *et al.* (2007) evaluated the paper characteristics of *Sesbania aculeata* and obtained the cooked yield of 43% by using Soda anthraquinone method. Nao (1983) studied the role of *Sesbania* species in two agro-forestry systems in Vietnam, where *Sesbania aculeata* was planted with rice, it increased the yield.

## Materials and Methods

Eighteen months old *Sesbania* trees were taken from Al-Noor MDF Moro. Wood from *Sesbania aculeata* was chipped in the laboratory chipper and chips were classified. N3 fraction of the chips which was about 3.2 mm thickness and 1 inch length was used for pulping. Kraft pulping was carried out by using 15 percent Active Alkali and 25 percent Sulphadity. The chips were cooked at 170°C temperature for 3 hours. After cooking, pulp was washed and yield of the pulp was determined. Later, the pulp was beaten up to 64 SR values and test sheets were manufactured. Physico-mechanical properties of the paper were determined. Furthermore, the anatomical and physical properties of *Sesbania* wood were also evaluated.

## Results and Discussion

Physical and anatomical properties of the *Sesbania* wood are given in the Table 1. It appears that *Sesbania aculeata* has wood density of about 435 kg/m<sup>3</sup>, which was nearly equivalent to poplar wood grown in NWFP. Fiber length of the *Sesbania* wood was about 0.99 mm equivalent to Eucalyptus wood and slightly lower than the Poplar wood. Rankle ratio was estimated about 0.58, which indicates the suitability of *Sesbania* for pulp paper manufacturing.

Table 1. Physical and anatomical properties of *Sesbania* wood

S.No.	Item	Properties
1.	Basic density	435 kg/m <sup>3</sup>
2.	Fiber length	0.99 mm
3.	Fiber diameter	19.98 mm
4.	Rankle	0.58

Results shown in Table 2 reveal that good quality writing and printing type of paper may be manufactured from 18 months *Sesbania aculeata* crop and pulp may be easily bleached by using DEP bleaching sequence. In order to increase the tear strength of the paper, *Sesbania aculeata* pulp must be mixed with long fiber pulp. This study clearly indicates that *Sesbania* crop grown on farmlands may be used to manufacture the paper in the country which can help in the import substitutions.

Table 2. Pulping characteristics of *Sesbania aculeata*

S.No.	Item	Properties
1.	Tree age	18 months
2.	Locality	Moro
3.	Chip size	N3
4.	Pulping process	Kraft
5.	Active Alkali %	15
6.	Sulphadity %	25
7.	Wood water ratio	1:5
8.	Cooking Temperature	170°C
9.	Cooking time at temperature	3 hours
10.	Cooked yield %	42.5
11.	Bleached yield	40.5
12.	Bleaching sequence	DEP
13.	Brightness	80
14.	SR	64
15.	Grammage	56.7
16.	Density g/m <sup>3</sup>	0.89
17.	Bulk cm <sup>3</sup> /g	1.12
18.	Breaking length	7970
19.	Tear (g)	8.00
20.	Roughness ml/cm	428

## References

Updhyaya J. S. and Sunder Pal Singh, 1998. Studies on Neutral sulphite pulping of *Sesbania aculeata*. Appita Vol. 41, pp 47-50.

Jahan M. Sarwar, Nasima D. A. and M. Khalid Islam, 2007. Characterization and Evaluation of Dhaincha (*Sesbania aculeata*) as paper making fiber, 2007. Engineering Pulping and Environmental Conference TAPPI. [www.tappi.org/s\\_tappi/doc\\_books/org.asp?CID=11235&DID=557760-25](http://www.tappi.org/s_tappi/doc_books/org.asp?CID=11235&DID=557760-25) K.

Nao, Tran. Van, 1983. *Sesbania* spp. in two Agro-forestry systems in Vietnam. Mountain Research and Development Vol.3 No.4, pp 418-421.