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Research Paper

Extraction and processing of *Sesbania aculeata* fibre

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■ **ABSTRACT :** Fibre was extracted from stem of *Dhaincha (Sesbania aculelata)* by 15 days tank retting. It is harsh, coarse and shiny fibre but lacks the elasticity, which was further processed for scouring with 1 per cent KOH and bleached with 1 per cent H_2O_2. Treated fibres which were obtained after treatment with 1 per cent KOH and 1 per cent H_2O_2 had good in strength, fineness, moisture regain, elongation and whiteness index.

■ **KEY WORDS :** Retting, Strength, Fineness, Moisture regain, Elongation, Whiteness index

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Clothing is one among basic needs of human being irrespective of development in various fields' having impact on their life. At the start, man used to fulfill their clothing needs only from natural resources *i.e.*, fibres derived from plant and animal resources, for example, cotton and wool. Since the yield of fibres from plant and animal sources could be increased only to a specific limit, dependency of the man on fibres from chemical resources has increased manifold to fulfill the ever-growing demand. The bast and leaf resources offer an opportunity to be exploited for producing textile fibres after their processing. The fibre characteristics of bast and leaf fibres are different from that of conventional fibres in terms of strength, colour and texture. One such potential sources of fibre is *Sesbania aculeata*, locally known as *Dhaincha*. The *Dhaincha* plant belongs to Fabaceae family, so it has nodules in its roots and these provide nitrogen content to the soil. The fibre obtained from *Dhaincha* is a hard fibre as it is derived from the stem of the plants. The fibres are harsh, coarse and shiny in appearance but lack elasticity. In some states, the fibre is extracted and utilized for making fish net and rope, sackcloth, sailcloth and cordages. Thus, this fibre, owing to its characteristics, is not be utilized for regular apparel fabrics but is used only for coarse structures.

Sesbania aculeata belongs to Fabaceae family and is considered as a valuable plant source in tropical agriculture (Sileshi *et al*., 2003). The legume *Sesbania aculeata*, also known as *Sesbania bispinosa* is a small tree. It is known by many common names, including *Dhaincha, Danchi*, *Dunchi*, *Canicha*, *Prickly sesban* or *spiny sesbania.* It is an annual shrub which can grow to seven meters in height but usually only reaches one to two meters. It has fibrous, pithy stems with long leaves and bears purple-spotted yellow flowers. It produces pods which contain light brown beans. *Dhaincha* fibre is coarse, silken in appearance resembling as hemp and is resistant to sea water. It was reported that it is much superior to jute in strength and durability. Its fibre is extracted by immersing the stem in water for about 25 days. When the stem have fully retted they are dried and the fibre is removed. About 9 per cent yield of fibre is obtained from the stalks after retting and drying. The ultimate fibre cells have an average length of about 2.4 mm and breadth of 21µ. They are almost cylindrical with pointed ends, striated surface and lumen extending up to the ends of the cells (Wealth of India, 1954). *Dhaincha* stems provide a strong durable fibre, substituted for hemp in rope, twine, cordage for fish net, gunny sacks, and made into a cloth used for sails.

■ RESEARCH METHODS

The study deals with the extraction and processing of fibres from *S. aculeata (Dhaincha).*

Preparation of stem for retting :

For the extraction of fibres from stem of *S. aculeata* (*Dhaincha*), the plants, were dried and stored. The dried stems of *S. aculeata* (*Dhaincha*) were cut into short length of 12 inches and were tied into small bundles for tank retting. Further it was retted for different time intervals *viz.*, 15 days, 22 days and 30 days.

On completion of retting period, the bundles of the stem were taken out from their respective tubs. Then the fibres obtained from *S. aculeata* (*Dhaincha*) stems were opened by hand and dried on flat surface in the open air. Selection of retting periods is depend upon the samples of fibres obtained from different retting periods which were assessed for four parameters namely, colour, softness, loft and overall appearance and were also assessed for their physical properties namely, moisture regain, fibre elongation, strength, fibre fineness and whiteness index. The retting period of this best fibre sample was thus, considered optimum time for retting and was used in further study.

Processing of *S. aculeata* fibre :

After retting, *S. aculeata* (*Dhaincha*) fibres were processed by three methods namely, combing, scouring and bleaching. Combing of fibres was done manually by combing brush followed by scouring with five different agents. The samples of fibres obtained on treatment with different scouring agents were also got assessed visually and tested for their physical properties to select a scouring agent for further research work. Further, one concentration of the selected scouring agent was selected from five different concentrations in a manner similar to that followed in selection of scouring agent. The scouring was followed by bleaching with two bleaches namely, hydrogen peroxide and calcium hypochlorite from which one bleach was selected on the basis of visual evaluation and fibre properties for fibre processing in the present study.

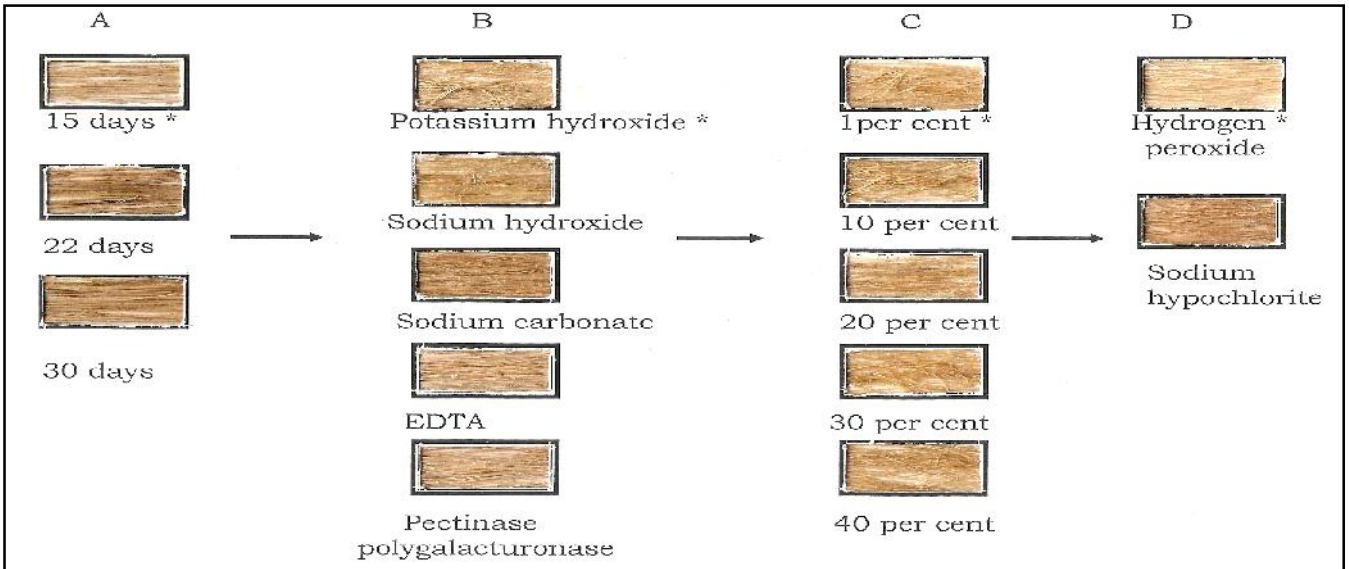
The fibres obtained from retting were called as untreated fibres while those obtained after scouring and bleaching were called as treated fibres and their physical properties were assessed.

■ RESEARCH FINDINGS AND DISCUSSION

The *S. aculeata* (*Dhaincha*) fibres extracted from retting period of 15 days, the values of moisture regain and fibre elongation of *S. aculeata* fibres were less as compared to fibre samples obtained on retting for 22 and 30 days (Table 1 and Fig. 1). This may be due to the presence of lignin in higher quantities in the fibres obtained on retting for 15 days. The moisture regain, fibre bundle strength, fibre elongation, single fibre strength, fibre fineness and whiteness index were 7.13 per cent, 19.13 g/tex, 2.13 per cent, 4.85 g/denier, 39.47 denier,

Table 1 : Physical properties of *S. aculeata* fibres obtained on retting for different periods

Physical properties	Period of retting		
	15 days*	22 days	30 days
Moisture regain(per cent)	7.13	7.41	7.93
Fibre bundle strength (g/tex)	19.13	18.30	15.28
Fibre elongation (per cent)	2.13	2.59	2.96
Fibre strength (g/denier)	4.85	3.88	2.78
Fibre fineness (denier)	39.47	38.22	37.36
Whiteness index	-17.68	-19.58	-18.78



A- Fibres obtained from different retting periods, B-Fibres obtained on treatment with different scouring agents, C-Fibres treated with different concentrations of KOH, D- Fibres treated with different bleaching agents, * Selected parameter

Fig. 1: Samples of Sesbania aculeata fibres obtained from different processes

Table 2 : Physical properties of *S. aculeata* fibres treated with different scouring agents

Physical properties	Scouring agents				
	KOH*	NaOH	EDTA	Na_2CO_3	Pectinase enzyme
Moisture regain (per cent)	8.35	7.30	5.67	6.56	4.12
Fibre bundle strength (g/tex)	17.92	15.67	16.21	13.14	14.39
Fibre elongation (per cent)	2.39	2.56	2.45	5.13	5.11
Fibre strength (g/denier)	3.98	3.62	1.42	2.72	2.77
Fibre fineness (denier)	33.36	31.22	27.32	33.32	27.96
Whiteness index	-12.60	-14.70	-10.64	-12.50	-8.30

Table 3 : Physical properties of *S. aculeata* fibres treated with different concentrations of potassium hydroxide

Physical properties	Potassium hydroxide				
	1%*	10%	20%	30%	40%
Moisture regain (%)	8.11	8.20	8.35	8.50	8.78
Fibre bundle strength (g/tex)	21.74	19.68	17.92	16.88	15.50
Elongation (%)	2.13	2.25	2.39	4.18	5.25
Fibre strength (g/denier)	5.45	4.71	3.98	3.10	2.95
Fibre fineness (denier)	36.24	35.4	33.36	32.25	29.34
Whiteness index	- 13.60	-13.26	-12.68	-16.58	-16.60

-17.68, respectively for fibres obtained on retting for 15 days.

All the physical properties of fibres obtained on retting for 15 days decreased with increase in the duration of retting except for moisture regain, fibre elongation and whiteness index

It is evident from Table 2 that *S. aculeata* fibres treated with KOH had maximum moisture regain of 8.35 per cent as compared to fibres treated with other scouring agents *i.e.*, NaOH (7.3%), EDTA (5.67%), Na_2CO_3 (6.56%) and pectinase enzyme (4.12%).

It is further revealed that the fibre elongation of *S. aculeata* fibres treated with Na_2CO_3 was maximum at 5.13 per cent as compared to fibres treated with other scouring agents *i.e.*, KOH (2.39 per cent), NaOH (2.56%), EDTA (2.45%) and pectinase enzyme (5.11%). This difference in fibre elongation property of fibres treated with different scouring agents may be due to variation in severity of agents' action on fibre bonds. Chattopadhyay *et al.* (2006) also reported in their finding that alkali treatment of bast fibres removed lignin carbohydrate complex content which in turn improved the fibre quality in terms of strength and elongation. Significant difference was found between the elongation of fibres treated with KOH and those treated with NaOH, Na_2CO_3, EDTA and pectinase enzyme at one per cent level of significance.

Scoured with one per cent concentration of potassium hydroxide and bleached with hydrogen peroxide were best in terms of visual evaluation and values of physical properties in comparison to other agents and their concentrations (Table 3 and 4). Hence, retting period of 15 days, one per cent concentration of potassium hydroxide as scouring agent and hydrogen peroxide as bleaching agent were selected for the present research work. The *S. aculeata* fibres processed by using selected parameters were assessed for the physical properties to study the effect of processing on the fibres (Table 5).

Table 4 : Physical properties of *S. aculeate* fibres treated with different bleaching agents

Physical properties	Bleaching agent	
	H_2O_2 *	Ca $(OCl)_2$
Moisture regain (%)	9.10	8.36
Fibre bundle strength (g/tex)	14.25	12.75
Elongation (%)	5.48	5.07
Fibre strength (g/denier)	4.85	4.05
Fibre Fineness (denier)	35.72	35.64
Whiteness Index	-12.7	-15.4

Table 5 : Physical properties of untreated and treated *S. aculeata* fibres

Physical properties	Untreated fibre	Treated fibre
Moisture regain (%)	7.13	9.1
Fibre bundle strength (g/tex)	19.13	14.25
Fibre elongation (%)	2.13	5.48
Fibre strength (g/ denier)	4.85	3.90
Fibre fineness (denier)	39.47	35.72
Whiteness index	-17.68	-12.7

The longitudinal microscopic structure of untreated and treated *S. aculeata* (*Dhaincha*) fibres was cylindrical in appearance with rough outlines and a canal (lumen) running through the centre while the cross sectional microscopic view showed rectangular or square shape with the serrated edges.

The moisture regain, fibre elongation, fibre fineness and whiteness index was more in case of treated *S. aculeata* (*Dhaincha*) while the untreated fibres had better tenacity and fibre bundle strength. The higher strength of untreated fibres may be due to the presence of lignin, fat, wax, etc., in more quantities which acted as cementing material and imparted strength. The scouring and bleaching process caused break in the continuity of wax layer present on the cellulosic fibres, induced swelling in the fibres and caused change in the proportion of fibre crystallinity and removed impurities from fibre surface resulting in weight loss. All these factors were responsible for improved moisture regain, reduced strength and increased elongation and better whiteness index in the case of processed fibres.

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■ REFERENCES

Chattopadhyay, S.N., Day, A., Sanyal, S.K., Kundu, A.B. and Pan, N.C. (2006). Jute for apparel uses. *Indian Textile J.*, **109**(11): 14-18.

Saxena, M. (1986). Processing, colouring and product development out of 'Rambans' fibre *(Agave Americana).* Thesis, M.Sc. G. B. Pant University of Agriculture and Technology, Pantnagar, UTTARAKHAND (INDIA) .

Sileshi, G., Sithanatham, S., Mafongoya, P.L., Ogol, C.K. and Rao, M.R. (2003). Biology of *Mesoplatys achropetra* Stal (*Coleopetra: Chhrysomelidae*), a pest of *Sesbania* species, in southern central Africa. *African Entomol.*, **11**: 49-58.

Trotman, E.R. (1990). Dyeing and Chemical Technology of Textile Fibres. London, Charles Griffin and Co. Ltd. 577p.

Varshney, R. K., Singh, R.K. Sengupta, A.K. and Kothari, A.K. (2006). Varietal response of jute fibres with varying meshiness to alkali treatment: Part I effect of alkali concentration and treatment temperature on crimp development in jute fibres. *Indian J. Fibre & Textile Res.*, **31**(6): 267-273.

Wealth of India (1954). CSIR, New Delhi, **9**: 293–295.

■ WEBLIOGRAPHY

http://www.wikipedia.org[3]/wiki/Sesbania_bispinosa. Retrieved on 10 May 2010.