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UTILIZATION OF MAZRI LEAVES FOR FIBRE PRODUCTION*

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Mazri leaves, abundantly available in the country as indigenous palm, have been evaluated as a sour=ce of fibre. A chemical-cum-mechanical method developed for the extraction of the fibre and a phytotonic liquor has been described. Physical and chemical characteristics including X-ray diffraction pattern have been compared with the commonly used vegetable fibres and it has been found that mazri fibre compares favourably with jute and sisal. The possibility of its application as long fibre substitute and by-products has been explored.

INTRODUCTION

Fibres are extracted from bast, leaves or fruits. The most common fibres like jute, flax, ramie, abaca and hemp are bast fibres but leaves have also been used, for example, sisal which is a major leaf fibre [1]. They are also extracted from palm leaves growing in tropical countries and mazri is one of the over thousand palm species so far known. Mazri is *Ritchieana wendle.* Palmae and is known as Mazri in Urdu and Hindi. It is a stemless gregarious shrub common on rocky grounds in Baluchistan, NWFP and in the trans-Indus tracts of the Punjab, growing upto about 3,000 ft. above sea level. Under favourable conditions it develops a trunk which grows about 14 ft. in height.

Mazri leaves have been used for mattings, fans, baskets, hats, sandals and other articles for a long time. Ropes are also made from its leaves and leaf stalk which contain other organic materials like lignins, in addition to the cellulosic fibre. The latter, when separated, can withstand the tensile and flexural strain better than the raw leaves.

Fibres for making good and reliable quality ropes are not available locally. Well-known fibres like sisal,jute and flax are imported. There is a demand for approximately 4000-6000 tons of sisal; 100,000-150,000 tons of jute; and 6000 tons of coir for rope and twine, packing jute cloth, brushes, sofa cushion packing etc. A number of palm leaves have been subjected to the extraction of the fibre [2]. Corosal, detil, currator, karatas, ling, palmetto and pisaba are some of the known species of palm used for the extraction of the fibre. The palma [3] is a hard fibre which is off white or light brown in colour. It is obtained from the leaf of the palm tree Yucca which grows on high mountains in northern Mexico.

A large quantity of dry leaves of Mazri is used by sub-urban dwellers and small towns to make mats, baskets and brooms. Realising the nature of the grave shortage of line fibres in Pakistan, PCSIR Laboratories, Karachi, carried out exploratory studies on the extraction of fibre from raw leaves. Its elementarization has been effected by various methods both chemically and mechanically. Its compatibility with other fibres has been studied and ropes and fabrics have been made out of this material.

EXPERIMENTAL

A number of experiments were carried out to develop pot-and-pan technology for the extraction of the fibre. For the experiments described here, mazri leaves were procured from the market. The leaves selected were of maximum length available so that adequately long fibres could be obtained. 100 kg. of Mazri leaves were soaked in water for 24 hr. and then digested in a stainless-steel digester with 3% soda ash having a leave: liqour ratio of 1:6 for 48 hr. The digested leaves were then washed and subsequently sun-dried upto 2% moisture level. The yield of the fibre whose analysis along with that of the leaves is listed in Table 5 was 45 to 50%.

Digestion of 100 kg Mazri leaves gave 200 litres of an effluent which has a phytotonic effect [4]. The sun-dried digested leaves were then subjected to a mechanical operation in a crushing/hackling machine designed by the PCSIR Laboratories, Karachi. The leaves were passed four to five times through this machine to obtain sufficient element-

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rization but still some fibres remained in bundles. These bundles were removed manually by repeatedly passing the crushed material over a board having small pins or nails. 50 kg. of Mazri fibres were obtained from 100 kg of Mazri leaves. The process for the extraction of fibre from Mazri leaves has been developed and patented by PCSIR [5].

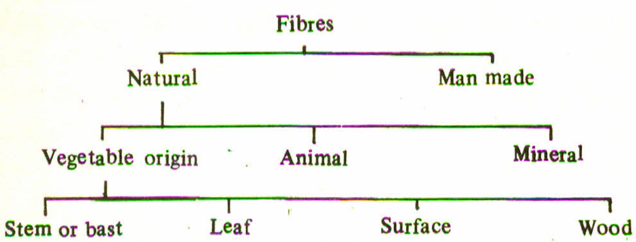
The length of Mazri fibres was determined by stretching them along a meter rod and by recording the distance between the two ends [6]. The ultimate fibres were separated and their dimension measured by the method of Maiti and Basu [7]. The ratio of length to diameter (linear density) was determined by the standard method [8]. Diameter of 100 fibres was determined by the common method of inserting fibre slides in the projection microscope (lanameter) of x 500 magnification [9]. The tensile strength of the fibres was determined by a pendulum-type tensile testing machine running on a constant rate of traverse principle. The strength and elongation of wet mazri fibres were determined by the same procedure except that each fibre was kept in distilled water for 24 hrs. at room temperature before mounting on the strength tester. The readings were taken at "standard atmospheric" condition.

Cellulose in Mazri leaf and fibre was determined by the known chlorination method of Cross and Bevan [10] and lignin by the method of Ellis and co-workers [11]. Extractives, moisture and ash content of Mazri leaf and fibre were determined by the usual standard procedures [12]. Study of the X-ray diffraction pattern of Mazri and other fibres was carried out by the powder method.

RESULTS AND DISCUSSION

On the basis of morphology, vegetable fibres can be classified into four groups, viz. leaf, stem, wood and surface fibres as given below:

FIBRE CLASSIFICATION



Mazri fibres are obtained from the leaves of monocotyledonous palm plants. The fibres occur in bundles with overlapping so as to produce continuous filaments throughout the length of the leaf. The fibres are held in place by the cellular tissue of the leaf and by lignin and pentosans and are coated on the outside by a sheath of waxy inorganic material. The waxy and inorganic substances also serve to hold the fibres to each other within the bundles. The function of leaf fibre is to impart strength and rigidity to the leaf and to give support to the water conducting cells [13]. The outer coating acts as an impermeable wall and does not allow the loss or penetration of moisture easily.

It is essential that the leaf be wetted to a degree that when squeezed under pressure, the fibres would open up. 45 to 50 kg. of Mazri fibre were obtained from the processing of 100 kg. of Mazri leaves. The fibre produced was sent to the local jute mills for the evaluation in batches of 100 kg. It was found that the fibre alone could not be spun on the existing jute machinery since it gave a rough product. It was found by several experiments that a blend of 27% Mazri fibre with jute could be obtained in the manufacture of sacks but the best results were achieved with an 18% blend of Mazri fibre and jute.

Mazri fibre was also used for making rope. For this purpose the fibre was spun in a rope-making machine in which single-or double-fibre rope could be spun and was pedal driven. The rope obtained from Mazri fibre was of good quality and was comparable to other such materials available in the market. The rope of the Mazri fibre was also subjected to weaving with cotton yarn for the manufacture of carpet having cotton in the warp and Mazri in the waft of handloom.

The waste material or shavings obtained after the combing of Mazri fibre have good packing/cushioning quality and was used in mattresses etc. in place of coir and has been proved to possess sufficient resilience.

The supernatant liquid obtained after the alkaline digestion of Mazri leaves when applied to the roots of the banana tree at a doze of 5 gal/acre brought about a 30% increase in yield. Experiments were conducted at the PCSIR Campus farm and at the farm of a private grower in Malir. Both experiments provided ample evidence that the Mazri effluent has phytotonic property useful in banana cultivation.

Table 1 shows the mean values of certain physical characteristics of Mazri fibres. An average value of 100 specimens has been taken for each set of experiments because Mazri fibres vary in fineness due to their extraction method.

Table 2 shows a comparison of strength characteristics of Mazri fibre with common vegetable fibres already in use.

It is evident from Table 3 that, on wetting, the fibre loses strength, but elasticity in the fibres improves percentage elongation has substantially improved in all of the fibres. The results of chemical analysis of the Mazri leaf and fibre are presented in Table 4.

It may be seen from Table 4 and 5 that the cellulose percentage of Mazri fibre compares favourably with that of other vegetable fibres in common use. Generally the vegetable fibres of the bast group contain higher cellulose than that of leaf group [16] but this study shows that sisal and Mazri are the two leaf fibres which have a reasonably high content of cellulose; 65.8% and 68.8% respectively. This value is of significance as it determines the value of a fibre for textile use. The lignin content of leaf fibres is generally higher than that of bast fibres. It is evident from Table 4 that the relatively high lignin content (24.8%) of the Mazri leaf on chemical digestion goes in the liquor and the residual lignin content remaining in the Mazri fibre is only 1.7%. It has been assumed that the high lignin content of the Mazri effluent plays a vital role in its exploitation as a soil conditioner or fertilizer. Table 6 presents a comparative study on the average percentage of loss in weight of fabric after abrasion by the Accelerator Method.

It may be seen from Table 6 that abrasion resistance of the Mazri fibre is less than cotton and jute fibres but comparatively far better than that of sisal. The abrasion resistance of the Mazri fibre can be greatly improved by substituting 50% of it with cotton or jute fibres.

A study of the X-ray diffraction pattern of Mazri fibre and other fibres like imported and indigenous sisal coir and jute was carried out and it was observed that the Mazri fibre campares with indigenous sisal much more than the imported sisal, coir and jute. This study shows no preferred orientation of the Mazri fibre along the fibre axis, whereas

Table 1. Mean values of strength characteristics of Mazri fibre

S.No.	Test Performed	Results
1.	Length	55.86 c.m.
2.	Diameter	330.2 μ.m.
3.	Linear density	668.4 g./c.m.
4.	Density	1.13 g./c.m.^{3}
5.	Tenacity	2.87 g./denier
6.	Tensile strength	4.8-10.5 kg/m.m.^{2}

Table 2. Strength Characteristic of various vegetable [14] Fibres

S.No.	Fibre	Fineness (Denier)	Tenacity (g./denier)	Tensile Strength (Kg/m.m^2)
1.	Jute	12-21.4	3.1-3.8	40.6-43.9
2.	Flax	1.7-17.8	5.6-6.6	77.0-83.4
3.	Hemp	3.1-20.0	5.2-6.8	84.0-90.3
4.	Abaca	38.3	4.0	10.8-46.8
5.	Sisal	41.8	4.2	44.1

Table 3. Comparative study of breaking strength and percentage elongation of Mazri and other common vegetable fibres (dry and wet)

S.No.	Fibre Type	Dry		Wet	
		Breaking Strength (Kg.)	Elongation (%)	Breaking strength (Kg)	Elongation (%)
1.	Mazri	10	2.2	8	2.4
2.	Jute	24	1.7	20	1.5
3.	Flax	70	1.8	62	2.2
4.	Kenaf	20	1.7	18	2.1
5.	Abaca	41	2.1	34	2.4
6.	Sisal	31	2.6	28	2.9

Table 4. Chemical analysis of Mazri leaf and Mazri fibre

S.No.	Constituent analysed	Mazri leaf (%)	Mazri fibre (%)
1.	Cellulose content	49.2	68.8
2.	Lignin content	24.8	1.7
3.	Extractives	9.1	11.3
4.	Moisture content	8.1	14.8
5.	Ash content	8.2	2.9

Table 5. Chemical composition of various vegetable fibres [15]

S.No.	Fibre	Cellulose (%)	Hemicellulose (%)	Lignin (%)	Extractives (%)	Moisture (%)	Ash (%)
1.	Jute	64.4	16.0	11.8	2.0	9.9	0.68
2.	Flax	64.0	17.0	2.0	9.0	9.0	1.00
3.	Hemp	67.0	16.0	3.3	4.0	8.8	0.82
4.	Abaca	63.2	19.6	5.1	2.11	6.1	1.00
5.	Sisal	65.8	18.0	14.5	2.5	6.2	1.00

Table 6. Comparative study on average percentage of loss in weight after abrasion

	Temperature	:	32^{o}
	Humidity	:	58%
	Speed	:	3,000 rpm
	Time period	:	12 min.
S.No.	Fibre tested (In fabric form)		% loss in weight (after abrasion).
1.	Mazri fibre		2.24
2.	Cotton fibre		0.145
3.	Mazri (50%) + Cotton (50%)		0.39
4.	Jute fibre		1.13
5.	Mazri (50%) + jute (50%)		1.80
6.	Sisal fibre		3.50
7.	Mazri (50%) + Sisal (50%)		2.85

jute shows this preferred orientation. This suggested that the mazri fibre would be of lower strength compared with the jute fibre. Study on physical characteristics also supports this point. The pattern also shows strong indications of preferred orientation perpendicular to the fibre axis in the equatorial direction which suggests that fibres may not be cylindrical in shape.

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