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FIBRE FINENESS OF WHITE JUTE OF DIFFERENT DISTRICTS OF BANGLADESH: AN IMPORTANT PHYSICO-MECHANICAL PROPERTY FOR FINE YARN MANUFACTURING

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ABSTRACT

Molla MAM, Mollah AK, Khan MAM, Shahinoor S, Alam MK (2015) Fibre fineness of white jute of different districts of Bangladesh: an important physico-mechanical property for fine yarn manufacturing. *J. Innov. Dev. Strategy.* 9(1), 9-12.

The work deals with an objective measurement of fibre fineness of white jute produced in Bangladesh. Fibre fineness is an important physico-mechanical property which has a great impact on processing system for preparing quality yarn. Hence the main objective of the study was to find out the location where fibre of specific diameter could be obtained for producing right type of product. Variation of fibre fineness for different climates, soils and waters was also observed in this study. The samples were collected from Faridpur, Shariatpur, Khulna, Jessore, Rangpur, Naogaon, Kishoregong, Jamalpur and Chandpur of Bangladesh during the period 2006-2009. The samples were examined in the laboratory of textile physics division of Bangladesh Jute Research Institute under standard testing conditions. Airflow Method, an internationally excepted method, for measuring fibre fineness of jute and cotton was used to determine fibre fineness. In this method whole jute reed is used in bundle form to measure fineness. Five samples of individual characteristics were tested for each district. The fineness of the tested samples was found ranging from 31.5 to 40.22 µ. It was found that sample ID-0005 of Talma, Faridpur and sample ID-0013 of Bawshi, Jamalpur showed the same fineness value 32.15 µ and appeared to be the finest than those of others. Another two samples ID-003 of Kanaipur and ID-0012 of Aramnagar possessed fineness values 33.15 µ and 32.75 µ respectively. They were also found finer than those of others. From the individual results established under this study Faridpur and Jamalpur districts could be mentioned as the place of fine fibre. Though samples of those districts appeared to be finer but a significant variation among the obtained fineness values were established. It was found that the samples of Naogaon district from ID-0031 to 0035 possessed fineness values ranging from 34.00 µ to 34.80 µ with negligible variation. It was observed from this study that finer fibres were obtained from Faridpur and Jamalpur and coarser fibres were found in the other districts.

Key words: *fibre, fineness, mechanical property, airflow method, climate*

INTRODUCTION

Jute is the cheapest cellulosic natural fibre and has a great socio–economic importance in Bangladesh as it has a positive impact on the national economy and provides subsistence to the millions of farmers along with others attached to it in various related activities. Next to cotton jute is the most important natural fibre in view of availability, production, global consumption and usages. As jute fibre is biodegradable and environment friendly, the diverse use is increasing remarkably in the world market. Besides traditional uses, jute fibre is now used in (i) Home textiles (ii) Geo–textiles (iii) Agro-textiles (iv) Medicare textiles and (v) Industrial textiles where physical properties play a vital role. The functional properties of jute fibre, such as strength and fineness have a bigger part in manufacturing system.

In a fibre, the cross-sectional area is expressed as its fineness. Fibre fineness is one of the main criteria of jute fibre that plays an important role in the production of fine and regular yarns. Only fine fibre can produce fine yarns (Kar 1954).

Two main varieties *viz. Corchorus olitorius* and *Corchorus capsularis* grow abundantly in Bangladesh. Raw jute is categorized in six different grades at the time of marketing. Strength and luster are given more importance for the assessment of fibre quality. Another important parameter, which must be well considered in the grading of jute, is its diameter (Saha *et al*. 1997). But in conventional jute grading system fineness is not given its due importance. The subjective judgment in grading of jute fibre is in serious errors largely because the importance of fibre fineness is not receiving its due attention. The finest and strongest fibre produces good quality jute yarn required for various specific applications (Hannan *et al.* 1993).

Yarn quality mostly depends on fibre fineness and length. In the determination of the merit of a material for spinning the fibre length is often taken as the criterion whereas for many purposes the fineness of fibre is of equal or sometimes of greater importance (Booth 1968). The quality ratio of yarn is very much dependent on the fineness and indicative of better quality yarn (Mia *et al.* 2007). Yarns of certain qualities are expected from certain fibre grade, although jute is not always what it is supposed to be. The fineness of a fibre is recognized in all branches of the textile industry as one of the major physical properties determining the degree of levelness of a yarn. The yarn winding breakage rate is determined, almost entirely, by the geometry of the fibre composing it, i.e. their staple length and diameter. For yarn quality prediction, deviation in fibre fineness is two or three times more important than deviation in bursting energy (Mather 1967).

Much research works reported in journals have demonstrated the effect of fibre dimensions on processing and on ultimate fabric and garments properties. As a consequence of this, the price of fibres, particularly the natural fibres, is highly correlated with one or more of their dimensional properties (Anderson 1977). If fibre fineness is known, the yarn manufacturer can easily design proper batch composition as required and then production of yarn of definite quality will be easier and cost effective.

The weather of Bangladesh consists of six seasons. The soil, climate and weather are favorable for the cultivation of jute. Qualities based on physical properties of jute fibre depend on natural climates and on the processing condition involved in obtaining the fibre. As the physico-mechanical properties of jute fibres have a tendency to vary depending on various associated agro-processing, so jute produced in different areas of Bangladesh need to examine its physical and mechanical properties. This study was performed to determine the fibre fineness of jute grown in different major jute growing areas of Bangladesh to compare with one another and to identify whether there are significant differences. It would be helpful to the manufacturer in producing right type of regular yarn and the whole jute sector would be benefited thereby as this would facilitate production of fabrics for specific usages as well as for specific market.

MATERIALS AND METHODS

Both graded and non-graded jute fibre of *Corchorus capsularis* variety was collected from different major jute growing areas, *viz*. Faridpur, Shariatpur, Khulna, Jessore, Rangpur, Naogaon, Jamalpur, Kishoregonj and Chandpur. The samples were examined following Airflow method to determine the fibre fineness. For determining fibre fineness, Airflow method was chosen, as the method is the single most widely used commercial method and has achieved international standardization for wool, cotton and jute (Sinkle 1949). The samples were prepared suitably and the tests were performed under standard conditions.

Fineness Test: The crop end of a bundle of sample was introduced in a cylindrical cell of 6 inches long and approx.3.3 cm internal diameter as it remains 18 inches distance from the cut end. A cutter attached with the machine then cut both the end of the elongated fibre. The bundle of this section then weighed as 54.2 gm. The sample was then introduced into another cell of 3 inches long and of same diameter and the elongated area was cut by the same cutter. Thus specimen was prepared and inserted into the sample holder of the machine and the reading was taken. The bundle of fibre then weighed again. If it becomes less or more than 27.1 gm then the difference would be subtracted or added to the value noted beforehand.

RESULTS AND DISCUSSION

The samples were tested in the laboratory of Textile Physics Division at standard testing conditions i.e. 20 ± 2^0C temperature and 65±2 %RH. The obtained results were furnished in nine different tables as given below.

Table 1. An analytical view of fibre fineness in micron (µ) grown in Faridpur district

ID	Place	Range	Min.(µ)	Max.(µ)	Mean(µ)	S.E.	SD.	CV%
0001	Kanaipur	0.20	34.10	34.30	34.20	o.10	0.141	0.412
0002	Kanaipur	0.26	35.04	35.30	35.17	0.13	0.183	0.520
0003	Kanaipur	0.90	32.70	33.60	33.15	0.45	0.636	1.918
0004	Talma	0.20	34.10	34.30	34.20	0.10	0.141	0.412
0005	Talma	1.30	31.50	32.8o	32.15	0.65	0.918	2.855
Average		0.57	33.48	34.06	33.77	0.28	0.403	1.169

Table 2. An analytical view of fibre fineness in micron (µ) grown in Shariatpur district

ID	Place	Range	Min.(µ)	Max.(µ)	Mean(µ)	S.E.	SD.	CV%
0006	Dogri	0.20	36.00	36.20	36.10	0.10	0.141	0.391
0007	Dogri	1.00	39.00	40.00	39.50	0.50	0.707	1.790
0008	Bhajeswere	0.60	33.80	34.40	34.10	0.30	0.424	1.243
0009	Bhajeswere	0.50	34.00	34.50	34.25	0.25	0.354	1.033
0010	Bhajeswere	1.00	34.00	35.00	34.50	0.50	0.707	2.049
Average		0.66	35.36	36.02	35.69	0.33	0.46	1.30

Table 3. An analytical view of fibre fineness in micron (µ) grown in Jamalpur district

ID	Place	Range	Min.(µ)	Max.(µ)	Mean(µ)	S.E.	SD.	CV%
0011	Aramnagar	0.80	34.00	34.40	34.40	0.40	0.565	1.642
0012	Aramnagar	0.50	32.50	33.00	32.75	0.25	0.353	1.078
0013	Bawshi	0.30	32.00	32.30	32.15	0.15	0.212	0.659
0014	Bawshi	0.60	37.00	37.60	37.30	0.30	0.424	1.137
0015	Bawshi	0.70	35.00	35.70	35.35	0.35	0.460	1.736
Average		0.58	34.10	34.68	34.39	0.29	0.397	1.250

Table 4. An analytical view of fibre fineness in micron (µ) grown in Kishorgonj district

ID	Place	Range	Min(µ)	Max(µ)	Mean(µ)	S.E.	SD.	CV%
0016	Karimgonj	0.50	35.50	36.00	35.75	0.25	0.353	0.993
0017	Karimgonj	2.00	36.00	38.00	37.00	1.00	1.414	3.821
0018	Tarail	0.10	35.20	35.30	35.25	0.05	0.070	0.198
0019	Tarail	0.40	35.60	36.00	35.80	0.20	0.283	0.790
0020	Katiadi	2.60	33.50	36.10	34.80	1.30	1.838	5.282
Average		1.12	35.16	36.28	35.72	0.56	0.791	2.220

Table 5. An analytical view of fibre fineness in micron (µ) grown in Jessore district

ID	Place	Range	Min(µ)	Max(µ)	Mean(µ)	S.E.	SD.	CV%
0021	Noapara	2.48	36.86	39.34	38.40	1.24	1.753	4.601
0022	Noapara	2.60	35.60	38.20	36.90	1.30	1.838	4.981
0023	Noapara	1.80	32.70	34.50	33.60	0.90	1.273	3.788
0024	Kashobpur	0.70	36.80	37.50	37.15	0.35	0.494	1.329
0025	Kashobpur	0.40	34.30	34.70	34.50	0.20	0.283	0.820
Average		1.59	35.25	36.84	36.11	0.80	1.128	3.104

Table 6. An analytical view of fibre fineness in micron (µ) grown in Khulna district

ID	Place	Range	Min.(µ)	Max.(µ)	Mean(µ)	S.E.	SD.	CV%
0026	Dawlatpur	0.40	33.10	33.50	33.30	0.20	0.283	0.850
0027	Dawlatpur	1.00	33.50	34.50	34.00	0.50	0.707	2.079
0028	Dumuria	0.90	33.10	34.00	33.55	0.45	0.636	1.890
0029	Dumuria	1.00	33.50	34.50	34.00	0.50	0.707	2.079
0030	Chuknagar	2.22	38.00	40.22	39.10	1.11	1.569	4.013
Average		1.104	34.24	35.34	34.79	0.55	0.780	2.182

Table 7. An analytical view of fibre fineness in micron (µ) grown in Naogaon district

ID	Place	Range	Min.(µ)	Max.(µ)	Mean(µ)	S.E.	SD.	CV%
0031	Pajhorebhanga	0.40	33.80	34.20	34.00	0.20	0.283	0.832
0032	Pajhorebhanga	0.50	34.50	35.00	34.75	0.25	0.353	1.016
0033	Kirtipur	1.60	34.00	35.60	34.80	0.80	1.131	3.250
0034	Satihat	0.20	34.60	34.80	34.70	0.10	0.141	0.406
0035	Satihat	2.80	32.70	35.50	34.10	1.40	1.980	5.806
Average		1.10	33.92	35.02	34.47	0.55	0.778	2.262

Table 8. An analytical view of fibre fineness in micron (µ) grown in Rangpur district

ID	Place	Range	Min.(µ)	Max.(µ)	Mean(µ)	S.E.	SD.	CV%
0036	Satibari	0.80	35.00	35.80	35.40	0.40	0.566	1.599
0037	Kawnia	1.90	34.10	36.00	35.05	0.95	1.343	3.832
0038	Jagirhat	1.00	35.00	36.00	35.50	0.50	0.707	1.991
0039	Mirjapur	2.80	34.80	37.60	36.20	1.40	1.980	5.470
0040	Ranipukur	0.60	35.00	35.60	35.30	0.30	0.424	1.201
Average		1.42	34.78	36.02	35.49	0.71	1.004	2.819

Table 9. An analytical view of fibre fineness in micron (µ) grown in Chandpur district

ID	Place	Range	Min(µ)	Max(µ)	Mean(µ)	S.E.	SD.	CV%
0041	Hajigonj	0.80	33.00	33.80	33.40	0.40	0.566	1.694
0042	Kachua	0.40	34.60	35.00	34.80	0.20	0.283	0.813
0043	Kachua	0.00	35.50	35.50	35.50	0.00	0.00	0.00
0044	Kachua	0.00	34.60	34.60	34.60	0.00	0.00	0.00
Average		0.60	34.42	34.72	34.57	0.30	0.424	1.253

S.E. = Standard error of mean, SD = Standard Deviation, CV% = Percentage of Co-efficient of Variation

The obtained results presented in tables 1 - 9 in the result section showed significant differences of fineness of fibres grown in various areas. Comparing the averages of five mean values of each nine districts, it was found that the fibres of Faridpur and Jamalpur areas (33.77 µ & 34.39 µ) were better than those of other districts. It is noticeable that fineness of all the five samples of Faridpur district was found to vary in the range of 31.50 µ to 35.30 µ and possessed better fineness than those of other districts. The samples of Jamalpur district hold the second position next to Faridpur bearing average of mean values of fineness 34.39 µ. The average CV% (1.25) of those samples of Jamalpur illustrated in table 3 was found to be higher than that of the CV% (1.17) of those samples of Faridpur shown in table 1. The samples of Jessore, Khulna, Shariatpur and Rangpur were found to be nearly of same fineness as they were 36.11 µ, 34.79 µ, 35.69 µ and 35.49 µ respectively. The highest average fineness value was obtained for the sample of Jessore district. It means that the fibre collected from Jessore appeared to be coarsest among all.

Making an allowance for the results of each single sample, ID No.0005 sample of Faridpur area was found as the finest one and ID No.0007 sample of Shariatpur was found as the coarsest fibre. Pointing on this view fibre of Faridpur district appears to be the finest white jute fibre while that of Shariatpur district appears to be the most unwell fibre caused by attaining the single highest fineness value of 39.50 µ. Evaluating the results in average fineness Jessore district appeared to be the producer of white jute of highest fineness, which means the coarsest fibre.

It is difficult to make a precise comparison between the samples of Faridpur and other districts. Faridpur district is more famous for quality jute fibre than other districts. The cause of variation in fibre fineness was not determined in this study. However it may be suggested that comparatively high land and abundant water having

appropriate temperature and pH for retting may be the cause of production of fine fibre as it facilitates more splitting of fibres. The importance of seed is to be considered seriously as its quality may have a role in the formation of fibre as well as fibre fineness. Genetic characteristic plays the vital role in defining fibre qualities. The farmers of Bangladesh do not get sufficient good quality jute seed at the time of sowing. So they often use jute seed coming from across the border for jute cultivation. This aspect needs further research to find out the real cause of variation in fibre fineness.

CONCLUSION

The variation of fibre fineness of white jute fibre grown in different part of Bangladesh is an established matter. The fibre quality in relation to fibre fineness of Faridpur and Jamalpur areas is significantly higher than those of other districts. So it bears a message for to the manufacturer of fine product from jute as they can use jute grown in Faridpur and Jamalpur areas. Thus the study will be helpful to the users.

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