SCIENTIFIC GRADING OF JUTE

Part I.—Lustre Determination of Different Grades of Jute Fibre

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Decreasing value in the lustre has been observed in both Tossa and White jute from the higher grades to the lower grades. It may be possible to accept this as one of the indices in grading.

Introduction

Grading of Jute has been traditionally done through "hand and eye" method without taking recourse to any scientific determination or standardization of any specific characteristic of jute fibre itself. The present series of studies in these laboratories aims at evaluating existing under execution or new basis which can be conviniently and scientifically assessed for defining different grades of jute. This is a problem of very wide importance and needs extensive studies before any definite recommendations can be made. Jute is not a homogeneous fibre and hence cannot readily accept the existing standards and procedures meant for cotton and other homogeneous fibres. Heterogenity of the fibre is even inherent in the same strand of jute which may be due to one or more of factors indicated below:

(i) Quality and efficiency of retting.
(ii) Insect or other parasites attack.
(iii) Agricultural Practices including effects of fertilizers.
(iv) Quality of seed.
(v) Location of farm.
(vi) Soil and climatic factors.

It can hence be easily understood that to get coherent results, capable of scientific interpretation, a significant statistical mean of various determinations has to be made. This paper presents some of the findings on the lustre determination of jute.

Lustre of jute fibre helps to ascertain the grading of different kinds of jute (without the cuttings). Among the commercial classifications of jute, Jat jute of *Chorchorous capsularies* (White jute) and *Chorchorous olitorious* (Tossa jute) varieties are the best. These are the products of high lands of the area watered by the old Brahmaputra river. The retting and washing operations carried out in such water contributes to the good colour and lustre of Jat jute. The colour is from white to cream and the lustre is silk-like.

Lustre and colour are among the characters which constitute the jute quality. This quality of jute must be maintained from harvest to consumption. And both lustre and colour of jute fibre attract the eyes of the buyers to purchase the fibre on reasonable price.

The photoelectric Leukimeter with Multiflex Galvanometer is used for the rapid and objective determination of the percentage of colour and lustre of the textiles and powdery substances. The photoelectric current produced is a direct measure of the brightness of the test object.

Instrument

The Multiflex Galvanometer is a mirror galvanometer in which the light source, light beam, scale and resistance are lodged with the galvanometer system in a case of light quality insulating material. Its galvanometer system is fitted with a taut suspension which adjust itself readily and requires no levelling. The light spot scale ensures readings free from parallax.

Length of scale 200 mm (about 8″) special scale can be substituted for the standard scale.

A two-pin shunt box with two central rheostats serves for continuous adjustment of sensibility.

Procedure

Measurements can be made by comparing a white standard using no filter. After placing the standard on the measuring unit, the deflection of the measuring instrument is adjusted to the nominal value of the standard. The intensity of lustre of the jute fibre under the treatment or test is then read off the scale, the white standard being taken as 100%.

The flow sheet presented in Table 1, illustrates the sampling technique employed for getting a representative value for the jute sample under

test. The data sheets for determinations of lustre carried out on Tossa and White jutes are presented in Table 2 and 3 respectively. The calculation for standard deviation value derived from the data has been illustrated by the calculation shown for Pak White Special Jute.

TABLE I.

Jute Fibre

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Jute Fibre
   |
   ├────────────────────┼────────────────────┐
Top portion        Middle portion       Bottom portion
   |                    |                    |
 ┌─┼─┐              ┌───┼───┐            ┌───┼───┐
Sec. I Sec. II Sec. III  Sec. I Sec. II Sec. III  Sec. I Sec. II Sec. III
 |      |      |       |      |      |       |      |      |
ABCD  ABCD   ABCD   ABCD   ABCD   ABCD   ABCD   ABCD   ABCD
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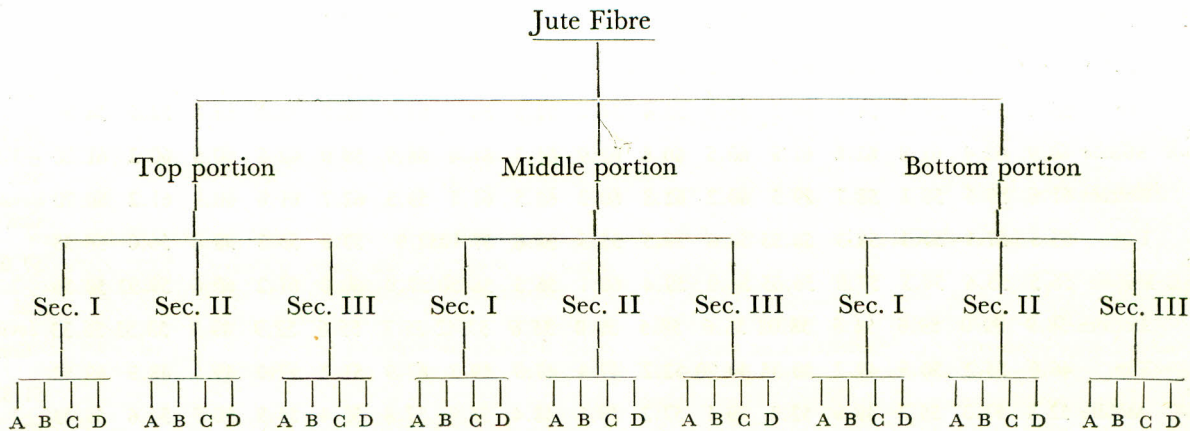
Note: A=Original upper surface
      B=Original lower surface
      C=Reshuffled upper surface   } Each of A,B,C, and D denotes the mean of five readings of the fibre under test.
      D=Reshuffled lower surface

TABLE 2.—DATA FOR BRIGHTNESS DETERMINATION OF TOSSA JUTE.

Grade of jute	Portion	Section-I				Mean	Section-II				Mean	Section-III				Mean	Total mean	Mean of sample.
		A	B	C	D		A	B	C	D		A	B	C	D			
Pak Tossa special	Top	45.0	48.0	47.5	47.4	46.97	45.0	46.8	46.1	45.2	45.8	45.3	47.5	47.1	46.0	46.4	46.25	
	Middle	44.5	48.0	48.0	48.8	46.8	45.5	47.8	46.5	46.5	46.5	44.6	46.5	47.0	46.3	46.1	46.45	46.37 ±1.70 Std. deviation.
	Bottom	43.6	45.4	46.2	45.5	44.6	48.4	46.5	47.5	46.2	47.1	48.5	52.3	50.2	47.1	49.5	46.40	
Pak Tossa Grade-A	Top	49.5	50.3	48.4	46.3	48.6	48.4	47.8	45.8	49.3	47.8	47.4	46.1	47.0	42.8	45.8	47.4	
	Middle	50.3	52.6	49.5	50.5	50.7	48.4	48.5	48.5	49.6	48.7	50.1	49.3	49.9	48.9	49.5	49.6	49.43 ±2.19 Std. deviation
	Bottom	51.6	51.5	49.9	52.9	51.5	49.3	49.2	53.5	51.4	50.8	51.3	49.0	53.6	52.3	51.5	51.3	
Pak Tossa Grade-B	Top	37.6	35.9	38.8	34.8	36.78	34.8	35.7	35.1	36.7	35.57	35.40	34.50	34.8	34.9	34.90	35.75	
	Middle	37.1	39.8	41.3	37.5	38.92	37.3	38.1	37.9	37.8	37.77	37.2	38.3	37.2	38.2	37.72	38.13	37.22 ±1.74 Std. deviation
	Bottom	36.8	38.4	36.5	37.4	37.27	41.2	39.0	39.1	37.4	39.2	34.0	38.5	37.3	37.9	36.9	37.79	
Pak Tossa Grade-C	Top	32.6	34.8	32.1	33.1	33.15	33.00	35.4	35.5	34.00	34.47	35.1	33.8	32.6	34.4	33.98	33.85	
	Middle	33.2	32.8	33.2	33.0	33.05	35.3	35.9	34.1	34.8	35.02	33.4	33.3	35.5	33.3	33.87	33.98	34.02 ±1.22 Std. deviation
	Bottom	33.7	32.0	34.8	33.7	33.55	34.5	32.4	34.7	33.8	33.85	37.0	36.6	35.0	33.4	35.5	34.22	
Pak Tossa Grade-D	Top	35.5	36.0	34.8	34.9	35.3	34.3	34.5	35.5	35.6	34.97	35.3	30.8	31.3	33.0	32.6	34.29	
	Middle	32.8	32.7	32.7	32.3	32.62	34.1	35.0	33.5	31.9	33.62	31.0	32.1	33.8	32.5	32.35	32.86	33.55 ±1.37 Std. deviation
	Bottom	31.9	33.1	34.7	34.7	33.8	32.3	34.3	33.0	34.0	33.40	34.3	33.1	32.2	33.7	33.32	33.51	
Pak Tossa Grade-E	Top	28.0	32.37	20.75	29.37	27.62	27.75	25.87	20.87	30.5	26.25	28.75	26.75	23.50	32.75	27.94	27.27	
	Middle	25.37	25.75	34.25	26.62	28.0	28.87	28.25	29.37	27.5	28.50	32.0	26.1	26.0	29.0	28.28	28.26	27.25 ±2.88 Std. deviation
	Bottom	27.25	27.1	26.37	25.20	26.48	25.62	28.62	27.50	24.25	26.50	27.23	26.50	25.50	23.50	25.68	26.22	

TABLE 3.—DATA FOR BRIGHTNESS DETERMINATION (WHITE JUTE).

Grade of jute	Portion	Section-I				Mean	Section-II				Mean	Section-III				Mean	Total mean	Mean of the sample
		A	B	C	D		A	B	C	D		A	B	C	D			
Pak White Special	Top	59.6	62.5	62.4	63.5	61.5	54.5	59.0	54.7	58.5	55.5	54.25	60.83	58.87	61.25	58.7	58.6	62.00 ±3.01 Std. deviation
	Middle	63.6	65.9	64.1	65.3	64.73	63.6	64.8	64.9	65.0	64.6	64.7	63.1	63.9	63.6	63.8	64.38	
	Bottom	64.8	64.5	64.5	64.0	64.45	63.5	64.6	60.9	62.3	62.82	62.0	63.4	61.4	60.2	61.75	63.02	
Pak White Grade-A	Top	55.8	58.7	56.5	54.1	56.2	54.3	55.4	54.4	52.5	54.1	53.3	50.0	52.6	54.2	52.5	54.3	58.73 ±3.54 Std. deviation
	Middle	60.9	62.4	61.8	62.8	61.9	60.5	60.8	62.9	61.3	61.4	58.9	59.0	62.5	60.5	60.2	61.20	
	Bottom	61.6	59.5	58.1	58.7	59.5	60.2	62.8	60.2	62.5	61.4	59.5	62.7	61.6	60.9	61.2	60.70	
Pak White Grade-B	Top	55.5	57.1	55.3	58.3	56.55	54.8	59.5	55.5	58.6	57.10	52.9	57.8	55.3	58.0	56.0	56.55	57.08 ±2.37 Std. deviation
	Middle	56.5	55.6	57.5	57.0	56.65	58.0	59.4	60.1	56.5	58.50	57.9	60.0	61.2	60.6	59.92	58.36	
	Bottom	58.9	59.0	59.6	54.6	58.02	56.6	58.5	59.0	55.6	57.42	55.8	55.6	52.9	49.9	53.55	56.33	
Pak White Grade-C	Top	46.0	55.2	50.5	49.7	50.35	49.70	52.2	47.4	47.9	49.3	47.9	51.2	47.0	49.5	48.9	49.52	51.83 ±3.30 Std. deviation
	Middle	52.8	53.3	55.3	49.8	52.8	59.1	57.2	59.1	48.4	55.9	57.8	55.4	54.8	50.5	54.6	54.43	
	Bottom	46.6	50.4	54.1	51.9	50.7	49.5	61.30	48.0	49.90	52.2	49.9	62.1	46.3	47.8	51.5	51.46	
Pak White Grade-D	Top	39.6	37.2	36.4	40.9	38.52	36.1	39.5	39.1	37.6	38.07	38.4	42.3	41.0	36.30	39.5	38.69	41.13 ±3.73 Std. deviation
	Middle	48.0	45.6	46.5	47.2	46.82	47.0	47.2	45.1	46.4	46.4	44.7	44.1	44.9	43.0	44.2	45.81	
	Bottom	42.3	40.3	36.7	41.10	40.1	39.1	39.5	39.9	37.6	39.02	38.5	37.3	36.0	38.5	37.57	38.89	
Pak White Grade-E	Top	33.8	34.3	32.95	33.87	33.73	28.8	34.75	35.1	36.17	33.70	30.85	32.6	34.50	34.04	33.0	33.48	36.11 ±2.67 Std. deviation
	Middle	36.35	39.0	33.8	35.55	36.18	38.75	35.65	39.17	39.55	38.28	36.75	36.85	36.40	34.75	36.19	36.88	
	Bottom	39.25	39.25	37.3	40.25	39.01	39.0	37.30	36.12	34.47	36.72	38.4	41.2	38.25	34.75	38.15	37.96	

TABLE 4.—CALCULATION EMPLOYED FOR DETERMINATION OF STANDARD DEVIATION.

Mean $= \mu = 62$

Reading of the sample	Reading of the sample mean of the sample i.e.	$(x-\mu)^2$	Reading of the sample	Reading of the sample mean of the sample i.e.	$(x-\mu)^2$	Reading of the sample	Reading of the sample mean of the sample i.e.	$(x-\mu)^2$	Reading of the sample	Reading of the sample mean of the sample i.e.	$(x-\mu)^2$
59.6	2.4	5.76	60.83	1.17	1.37	64.9	2.9	8.41	64.0	2.0	4.00
62.5	.5	.25	58.87	3.13	9.80	65.0	3.0	9.00	63.5	1.5	2.25
62.4	.4	.16	61.25	.75	.56	64.7	2.7	7.29	64.6	2.6	6.79
63.5	1.5	1.25	63.60	1.6	2.56	63.1	1.1	1.21	60.9	1.1	1.21
54.5	7.5	56.25	65.90	3.9	15.21	63.9	1.9	3.61	62.3	.3	.09
59.0	3.0	9.00	64.10	2.1	4.41	63.6	1.6	2.56	62.0	.00	.00
54.7	7.3	53.29	65.30	3.3	10.89	64.8	2.8	7.84	63.4	1.4	1.96
58.5	3.5	12.25	63.60	1.6	2.56	64.5	2.5	6.25	61.4	.6	.36
54.25	7.75	60.06	64.80	2.8	7.84	64.5	2.5	6.25	60.2	1.8	3.24
											326.761

Std. deviation is the root-mean squared deviation. Its mathematical formula is

$$S = \sqrt{\frac{\Sigma(x-\mu)^2}{N}} \quad \text{where } S = \text{Std. deviation}$$

$$= \sqrt{\frac{326.761}{36}} \qquad x = \text{reading of the sample}$$

$\mu = $ Mean of the sample

$$= \sqrt{9.08} \qquad N = \text{No of readings taken into consideration.}$$

$= \pm 3.01 \qquad \Sigma(x-\mu) = $ Sum of the squares of all deviations from the mean $= \sqrt{9.08}$

Mean of Pak White special Jute $= 62.00 = U$

Number of reading $= 36$

Discussion

The arrangement of shunt and constant voltage transformer has been found to be insufficient for completely eliminating the voltage fluctuations of the mains, thus somewhat affecting the standard deviation. The principle of reflecting light spot affords an increased sensitiveness for the instrument by magnifying deflections 100–1000 times. The overall accuracy of the determination is however limited to 1% by the pointer instrument.

The data presented for the different grades of jute (as authenticated by their purchase through the Pakistan Jute Association) is self explanatory. A decreasing value in the lustre, can be observed in both the cases of Tossa and White jute, even though a slight anomaly can be seen between the values for the Pak Tossa Special and Pak Tossa Grade A, which is possibly due to the very close similarity in the quality performance between the two top grades. Thus an average of the two values i.e. 47.90 ± 1.95 may serve as a representative figure for degree of lustre of these two grades.