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SCIENTIFIC GRADING OF JUTE

Part III.—Determination of Lignin of Different Grades of Jute

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The lignin content of different new grades of white (*Corchorous capsularis*) and Tossa (*Corchorous olitorious*) jute has been found to increase from higher to lower grades of jute. The average lignin content of Tossa is less than the white variety. The findings of the present investigation indicates that lignin content may be correlated with grading of raw jute.

In our previous communications we have presented some results on (a) Lustre[1] determination and (b) Cross and Bevan Cellulose[2] of different new grades of Pakistani jute for grading them on scientific basis. In this paper we are presenting the lignin content of both White and Tossa varities of jute, which may be used as another favourable and acceptable index for grading of jute.

Lignin is an integral constituent of jute fibre. Chemically speaking lignin is made up of large, basic repeating units involving a not too well understood combination of C_6 to C_3 units. It is fairly established that the C_6 units are basically benzene neucleus as compared to the anhydroglucose units of cellulosic chains, which is the main component of jute fibre. Lignin is virtually noncrystalline, and is not a single compound, but is probably mixture of related compounds bonded to the cellulose chain of jute. The sulphuric acid lignin, resulting from the analytical removal of cellulose from jute with 72% sulphuric acid, is only partially soluble in organic solvents, such as, methyl and ethyl alcohols, acetone, formic and acetic acids, methyl and ethyl acetates, pyridine, chloroform and dioxane. Pulping process on the other hand dissolves the lignin and other components of jute in the alkaline reaction mixture, leaving primarily cellulose as the pulp. The lignin obtained by acid precipitation of such alkali lignin is different in properties to that of the acid lignin. For the present investigations it was considered proper to investigate analytically the sulphuric acid lignin of jute for establishing a favourable index for grading of jute. Normally, it will be expected that the inferior quality of jute will contain more lignin and in practice the lowest grade of jute as well as the stem portion of jute known as jute cuttings when separated contain the largest amount of lignin and have woody hard feel in patches. Some of these excess of lignin is present due to incomplete or partial retting thus relegating the jute fibre sample to a lower grade. Lignin is responsible for stiffness in fibre and "yellowing" of jute fibre and jute goods.

The lignin content of white (*Corchorous capsularis*) and Tossa (*Corchorous olitorious*) has been determined by sulphuric acid method from Pucca new grades of jute (defatted). Tossa variety has been found to contain comparatively low lignin value than white variety. This lower lignin content in Tossa and higher in white jute enables us to obtain marked and sharp inter-variety distinctions between them and also distinguish of the former from the latter. In both the varities, the lignin is least in the top grade, while highest in the lowest ones. And in individual grade there is increasing trends of lignin distribution from top to the bottom. The higher lignin value at the bottom is mainly due to its over maturity, improper retting, harsh and stiffness in fibre in comparison with the middle and top portion respectively.

Experimental

The pucca graded bales were purchased through the Pakistan Jute Association.

Each jute sample was cut into bottom, middle and top portions and ground to fine powder of 60 mesh in grinding machine and finally defatted by extracting with methanol—benzene mixture (2:3). The residue was dried in oven at 110° to constant weight.

Dry jute powder (1.0 g.) was treated with 10 ml 72% sulphuric acid[3,4,5] (V/V) in an ice bath for about two hours with frequent stirring by a polished glass rod. The whole mixture was diluted by adding 200 ml of distilled water and refluxed in a steam bath for six hours. After cooling the mixture was filtered through a sintered glass crucible (Porosity No. 2) and washed exhaustively

TABLE 1.—PERCENT LIGNIN DISTRIBUTION IN WHITE JUTE.

Sl. No.	Name of sample	Bottom %	Mean %	Middle %	Mean %	Top %	Mean %	Mean of bottom+ middle+ top
1.	Pak White Special	13.71 13.40 13.54	13.55	13.41 13.33 13.55	13.36	13.11 13.04 13.15	13.10	13.34
2.	Pak White A	14.72 14.55 14.77	14.68	14.53 14.44 14.50	14.49	13.63 13.75 13.32	13.57	14.25
3.	Pak White B	14.93 14.77 15.11	14.44	14.53 14.72 14.77	14.67	14.29 14.08 13.96	14.11	14.34
4.	Pak White C	15.38 15.55 15.43	15.45	14.94 14.81 15.44	15.06	14.49 14.46 14.28	14.41	14.97
5.	Pak White D	16.08 16.17 16.11	16.12	15.76 15.90 15.81	15.82	15.49 15.86 15.54	15.63	15.86
6.	Pak White E	16.84 16.39 16.62	16.61	16.21 15.91 15.99	16.06	15.74 15.86 15.81	15.80	16.16

TABLE 2.—PERCENT LIGNIN DISTRIBUTION IN TOSSA JUTE.

Sl. No.	Name of sample	Bottom %	Mean %	Middle %	Mean %	Top %	Mean %	Mean of bottom + middle + top
1.	Pak Tossa Special	13.38 13.40 13.21	13.33	13.32 13.45 13.39	13.38	13.20 13.18 13.19	13.19	13.30
2.	Pak Tossa A	13.61 13.90 13.90	13.80	13.63 13.51 13.13	13.42	13.43 13.09 13.21	13.22	13.48
3.	Pak Tossa B	14.20 13.56 13.87	13.88	13.65 13.42 13.54	13.53	13.44 13.42 13.59	13.53	13.65
4.	Pak Tossa C	15.65 15.79 15.73	15.74	14.48 14.54 14.60	14.54	14.10 14.22 14.28	14.20	14.83
5.	Pak Tossa D	15.71 15.76 15.82	15.76	15.40 15.36 15.31	15.35	15.01 14.96 14.90	14.95	15.35
6.	Pak Tossa E	15.81 15.68 15.80	15.77	15.30 15.40 15.49	15.39	15.02 15.10 15.12	15.08	15.41

with hot water until free from acid, The results have been tabulated in Table 1.

The solubility of sulphuric acid lignin of jute as isolated above in different organic solvents were very small. The solubility decreased from about 0.085% in pyridine to 0.015% in chloroform.

The above results have been graphically represented to ascertain the inter-variety and inter-grade distribution in Fig. 1. The continuous curve represents white variety and the dotted curve tossa variety of jute.

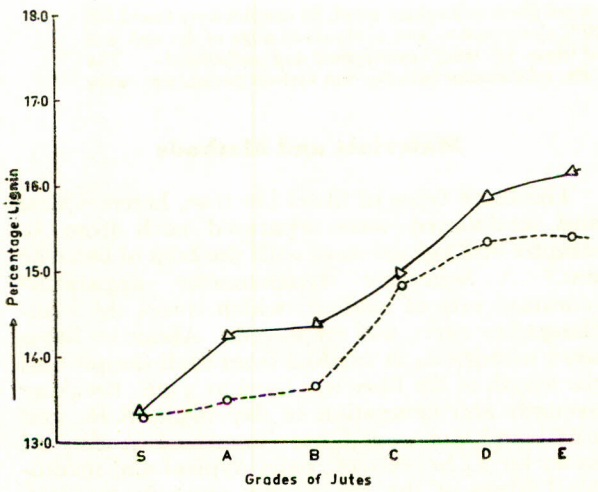

Fig. 1.

The figures clearly show that the average lignin content of the different grades of both White (continuous curve) and Tossa (dotted curve) variety of jute sharply increases from the grade B to grade D particularly. The difference in lignin content are not however so very marked in the two higher (Special and A grades) and the two lower grades (D and E grades).

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