STUDIES ON CELLULOSE, PROTEIN, WAX AND ASH CONTENTS OF KHIP FIBRE

NISAR AHMAD JAMIL, A. H. HANIF
AND
KHALIL AHMAD KHAN*

Khip fibre has the highest cellulose content as compared to the other bast fibres with the exception of flax and ramie, which have almost the same cellulose percentage. The khip fibre is the finest among the bast fibres in protein content. The fineness increases with an increase in nitrogen. Wax content is higher than the other bast fibres with the exception of flax. The ash content of khip fibre is higher than jute fibre and is at par with flax and Haitian variety of ramie. Thus, khip fibre is better than most of the bast fibres and can be ranked along with flax and ramie in quality.

INTRODUCTION

The chemical characteristics of bast and vegetable fibres have been investigated to some extent. Such information about the Khip (*Leptadenia pyrotechnica*) fibre has not so far been reported. Khip fibre is also a bast and vegetable fibre, which is extracted from the stalks of a perennial and xerophytic wild plant growing in Cholistan area of Bahawalpur, Tharparkar and Quetta regions.

Pakistan is rich in natural fibres of vegetable origin, particularly cotton and jute. Large quantities of khip fibre are also available. An estimation of chemical characteristics including cellulose, protein, wax and ash contents is essential for an understanding of the fibre properties of this plant. The present paper reports studies on cellulose, protein, wax and ash contents of khip fibre, undertaken at Lyallpur.

REVIEW OF LITERATURE

Information on chemical characteristics of khip fibre is not available. However, literature available on other bast and vegetable fibres such as jute, flax, kenaf, and ramie is being reviewed.

Muller (1876) reported 71.50 to 82.57 per cent cellulose in flax and 80.01 per cent in ramie. Cross and Bevan (1887) observed that the jute fibre

*Department of Fibre Technology, Faculty of Agricultural Engineering and Technology, West Pakistan Agricultural University, Lyallpur.

contained 61.74 to 64.24 per cent cellulose and 0.68 per cent ash and that ash content in completely dry jute ranged from 0.60 to 1.75 per cent. Urquhart and Howitt (1953) stated that main constituent of vegetable fibre cell was cellulose. Cotton contained 82.7 per cent cellulose, whereas ramie, hemp, jute and sisal contained 68.6, 67.0, 64.4 and 65.8 per cent cellulose respectively. Matthews and Mauersberger (1954) reported that cellulose content of jute fibre ranged from 62.05 to 76.0 per cent, whereas wax content ranged from 0.32 to 0.39 per cent. The wax content ranged from 2.37 to 2.39 per cent in flax, 0.22 per cent in ramie, 0.56 per cent in hemp, and 0.55 per cent in sunn fibre. Kirby (1963) reported 64.4 per cent cellulose in jute fibre. The total nitrogen of raw cotton of American origin was 0.21 per cent of the air dry weight, while Egyptian cotton contained 0.30 per cent (Ridge, 1924). If this is considered to be all protein nitrogen, the protein content will be 1.3 and 1.9 per cent respectively. Nickerson *et al.* (1941) found that nitrogen tended to increase with an increase in the fineness of fibre. Khan (1967) recorded that the protein values for jute ranged from 1.316 to 1.438 per cent.

MATERIALS AND METHODS

Chemical characteristics of the four samples of khip fibre collected from different places of Ladamsur hut area of Bahawalpur District were studied. The fibre was extracted from the khip plant (stalks) mechanically by the simple beating process. The standard method for the estimation of cellulose content suggested by Doree (1950) was followed. The conventional micro-kjeldahl digestion and distillation was adopted for the determination of total nitrogen (A.O.A.C., 1960). The percentage of protein of the fibre was determined by multiplying total nitrogen with 6.25, assuming that all the nitrogen in the fibre was present as protein. Wax content was estimated on dry basis of the fibre according to the method suggested by A.O.A.C. (1960). The ash content was determined by placing 5 gm. of thoroughly cleaned air dried sample in a china dish, burning the material on the electric heater and transferring the dish in an electric muffle furnace at 450—500°C. Ten estimations of each character for each sample were made. The data were subjected to statistical analysis according to the standard methods (Snedecor, 1956).

RESULTS AND DISCUSSION

The results of the estimations made are presented in Table 1.

Cellulose

The overall mean value of cellulose in four samples was 78.96 per cent and the mean value ranged between 77.06 and 80.52 per cent. The cellulose content of khip fibre in the present investigation was in conformity with the findings of Muller (1876), who reported 71.50 to 82.57 per cent cellulose in

flax and 80.01 per cent in ramie. The cellulose content of khip is higher than the values of jute reported by Cross and Bevan (1887), Matthews and Mauersberger (1954) and Urquhart and Howitt (1953), who reported the values of 61.74, 62.05 to 76.00 and 64.4 per cent respectively.

Protein

The overall mean value of protein in four samples was 2.51 per cent and the mean values ranged between 2.28 and 2.74 per cent. The protein content of khip fibre is higher than the values of American and Egyptian cotton and jute reported by Ridge (1924) and Khan (1967), who reported the values 0.21, 0.30 and 1.316 to 1.438 per cent respectively.

It is concluded that the khip fibre is finer than the other bast fibres as far as the protein content of the khip fibre is concerned as higher the percentage of protein, the more the fineness. This confirms the findings of Nickerson *et al.* (1941) that nitrogen tends to increase in amount with the increasing fineness of fibre.

TABLE 1.—*Cellulose, protein, wax and ash percentage of khip fibre (means of 10 observations).*

Sample	Cellulose	Protein	Wax	Ash
1 ..	77.97	2.44	2.17	2.23
2 ..	80.52	2.74	2.10	2.38
3 ..	80.27	2.28	2.17	2.02
4 ..	77.06	2.58	2.19	2.36
Overall mean ..	78.96	2.51	2.16	2.25
Confidence .. interval at 5%.	± 0.72	±0.06	±0.004	±0.04
Confidence .. interval at 1%.	± 1.04	±0.08	±0.005	±0.05

Wax

The overall mean value of wax in four samples was 2.16 per cent and the mean values ranged between 2.10 and 2.19 per cent. The wax content of khip fibre is higher than the values of jute, ramie, hemp and sunn fibre reported by Matthews and Mauersberger (1954), who reported values of 0.32 to 0.39, 0.22, 0.56 and 0.55 per cent respectively and lower value than flax reported by Matthews and Mauersberger (1954), who reported 2.37 to 2.39 per cent.

The higher wax content of khip fibre may be attributed to the natural environmental adaptation. The waxy layer prevents the loss of water due to transpiration in xerophytic plants.

Ash

The overall mean of ash in four samples was 2.25 per cent, whereas the mean values of the four samples ranged between 2.02 and 2.38 per cent. The ash content of khip fibre is higher than that of jute, sunhemp and Haitian variety of ramie reported by Muller (1876), Cross and Bevan (1887) and Cross and Taylor (1948), who reported 0.60 to 1.75 and 0.61 per cent respectively. The ash content of khip is lower than jute and Japanese variety of ramie reported by Muller (1876) and Cross and Taylor (1948), who reported 1.32 to 2.74 and 3.15 per cent ash respectively.

LITERATURE CITED

A.O.A.C. 1960. Official and Tentative Methods of Analysis. 9th Edn. Benjamin Franklin Station, Washington, D.C.

Cross, C. F., and E. J. Bevan. 1887. Report on Indian fibres and fibrous substances. E. & E. Spon., London.

Cross H. T., and J. L. Taylor. 1948. "Ramie To-Day". Textile fibres, their physical and chemical properties. John Wiley and Sons Ltd., New York (1954).

Doree, C. 1950. The Methods of Cellulose Chemistry including Methods for the Investigation of Substances Associated with Cellulose in Plant Tissues. 2nd Edn., Chapman & Hall Ltd., 37 Essex Street, W. C. 2, London.

Kirby, R. H. 1963. Introduction and Identification of Vegetable Fibres (Botany), Cultivation and Utilization, Leonard Hill Ltd., Int. Sci. Pub. Inc. New York.

Khan M. I. A. 1967. Effect of Salinity on the Yield and Quality of Jute, M.Sc. Thesis, W.P.A.U., Lyallpur.

Matthews, J. M., and H. R. Mauersberger. 1954. Textile Fibres, their Physical, Chemical and Microscopic Properties. John Wiley and Sons Inc., New York.

Muller, H. 1876. Textile Fibres, their Physical, Chemical and Microscopic Properties. John Wiley and Sons Inc., New York.

Nickerson, R. F., T. D. Fontaine, and C. B. Leape. 1941. Chemistry of Lint Content in Chemistry and Chemical Technology of Cotton, by Ward K. Jr. Int. Sci. Pub. Inc., New York.

Ridge, B. P. 1924. Protein Analysis in Egyptian Cotton. *Jour. Text. Inst.* 15. T-94T : 103.

Snedecor, G. W. 1956. Statistical Methods. 12th Ed. Collegiate Press Inc. Ames, Iowa.

Urquhart, A. R., and F. C. Howitt. 1953. The Structure of Textile Fibres, *Bull. Text. Inst. Manchester*. 1 : 1-165.