STUDIES ON THE CHARACTERISTICS OF HARNAI WOOL AND ITS STANDARDISATION FOR CARPET MANUFACTURE

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(Received April 15, 1963; revised March 2, 1964)

Sixty five samples of Harnai wool, collected from the sheep home tract i.e. Quetta and Kalat Division of West Pakistan, have been tested. About 53,000 fibres were tested for percentage proportion of the four types of wool, viz. true, heterotypical, medullated and kemp, and 12,000 fibres for average fibre diameter of body wool, 5,500 for diameter and lengths of true wool, 3,500 and 2,800 fibres for diameter and lengths of heterotypical and medullated wool fibres, respectively. Comparing the data with that of carpet standard, it was found that Harnai wool is best suited for carpet manufacture.

Introduction

In the previous communication,[1] the tensile characteristics of Harnai wool fibres have been reported. In the present work a number of important characteristics, such as general fibre diameter (body wool), percentage proportion of the four types of wool i.e. true, heterotypical, medullated and kemp, and the stretched length as well as diameter of three out of the four types have been studied for evaluating the suitability of these fibres for carpet manufacture. Since the percentage of kempy fibres is very low and their dimensions are not so important, they have not been studied.

Materials and Method

Harnai wool is of a mixed type and contains different types of fibres, namely, true wool, heterotypical, medullated and kemp and coloured fibres. Except for the coloured fibres, the distinction between the fibre types is made according to the degree of medullation—non-medullation (true wool); partial medullation (heterotypical); or complete medullation (hair). The different types of fibres were separated with the help of benzene test.[2] In benzene, true wool is invisible, heterotypical semi-visible while the medullated wool is visible. Fibres in each class were counted and their proportions worked out mathematically.

Stretched fibre length measurements were made on the fibre types which were separated out in the count analysis. The stretched length was measured by stretching the fibre on a black velvet board against a scale (in inches), placed along the sides. Since the percentage of true wool is greater than that of the heterotypical and medullated fibres, about 100 fibres of true wool per sample were taken for length measurements. Similarly 50 fibres each of heterotypical and medullated were drawn and their length measured.

Thickness measurements of each sample as a unit and of the fibre types after separation were made separately. In the former case the sample was cleaned and treated with benzene. Thereafter it was cut to small pieces and slides were made. The slides were studied at a magnification of $\times 500$ by using lanameter, and about 200 readings were recorded. In the case of true wool about 100 fibres were tested, and for the heterotypical and medullated varieties, 50 fibres each were tested.

About 53,000 fibres were tested for the percentage proportion of the four types of wool; 12,000 fibres for average fibre diameter of body wool, 5,500 for fibre diameter and fibre length of true wool, 3,500 for diameter and lengths of heterotypical, and 2,800 for the diameter and length of medullated fibres.

Results

The results of medullation test by type analysis show that the average fibre type content in the 65 samples is 65 percent true wool, 22.1 percent heterotypical, 12.8 percent medullated and 0.1 percent kemp fibres. The largest variation is found in the medullated fibre and is from 0.5 percent to 43.9 percent; in heterotypical fibres, from 4.7 percent to 44.7 percent; in true fibres, from 54.9 percent to 81.8 percent; and in kemp fibres from 0 to 3.6 percent. Out of the 65 samples tested only 15 samples show the absence of medullated fibres.

Table 1 shows the distribution of general fibre diameter along with the other three types of wool fibres. In the former case the distribution is very wide. The fibre ranges from 10 to 105μ with an average of 34.5μ. A majority of the fibres, i.e. 90 percent, lies in the range of 15μ to 60μ. The range of true wool is from 10μ to 50μ, heterotypical from 15 to 70μ and medullated fibres from 35 to 120μ.

TABLE 1.—PERCENTAGE DISTRIBUTION IN DIAMETER OF TRUE, HETEROTYPICAL, MEDULLATED AND GENERAL FIBRE (BODY WOOL).

Interval (micron)	True	Hetero-typical-	Medu-llatde-	Gene-ral
10-15	7.6	—	—	4.4
15-20	30.1	5.2	—	22.3
20-25	19.6	4.7	—	13.8
25-30	24.4	13.5	—	21.3
30-35	8.4	11.6	—	7.2
35-40	6.8	20.8	3.7	10.5
40-45	1.3	10.1	2.9	3.6
45-50	1.7	14.8	9.4	5.3
50-55	—	5.8	6.7	2.3
55-60	—	8.4	14.4	3.5
60-65	—	2.5	6.6	1.1
65-70	—	2.5	11.8	1.6
70-75	—	—	4.2	0.3
75-80	—	—	14.1	1.0
80-85	—	—	4.1	0.4
85-90	—	—	7.1	0.5
90-95	—	—	2.5	0.2
95-100	—	—	6.0	0.4
100-105	—	—	1.9	0.1
105-110	—	—	2.2	—
110-and above	—	—	1.3	—

Fibre diameters of the three types are: true, 24.7μ; heterotypical, 40.5μ; and medullated, 70.9μ; with the coefficients of variation at 23.8 percent, 17.5 percent and 15.6 percent, respectively.

The fibre lengths (stretched) of the three types are: true, 4.1 inches; heterotypical, 6.2 inches and medullated, 5.2 inches with the coefficients of variation at 21.2 percent 27.4 percent and 28.8 percent, respectively. The length distribution of the said three types are also given in Table 2.

Discussion

Comparing the results of Harnai wool with the standard for ideal carpet wool fixed by Burns, Johnston and Chen,[3] the percentage proportion of the different types of wool conforms to the standard closely. The average diameter and length also falls within the range. However, the coefficient of variation in the length of heterotypical and medullated fibres are higher, the difference being 7.4 percent and 8.8 percent, respectively. It may however be pointed out that diameter alone does not control medullation in wool because in some cases true wool fibres with a thickness of 50μ and medullated fibres with a thickness of 35μ are also encountered. The fibre length of Harnai wool is much greater than required by the standard.

TABLE 2.—PERCENTAGE DISTRIBUTION IN LENGTH (STRETCHED) OF TRUE, HETEROTYPICAL AND MEDULLATED HARNAI WOOL FIBRES.

Interval (Inches)	True	Hetero-typical	Medul-lated
1.5–2.0	4.0	—	—
2.0–2.5	7.2	2.4	4.9
2.5–3.0	11.6	4.3	6.4
3.0–3.5	14.4	5.4	10.5
3.5–4.0	13.1	8.6	12.8
4.0–4.5	15.6	9.9	10.6
4.5–5.0	10.3	9.9	7.1
5.0–5.5	9.1	8.8	7.6
5.5–6.0	5.5	6.5	5.5
6.0–6.5	3.9	7.8	7.4
6.5–7.0	3.3	5.7	7.5
7.0–7.5	1.4	4.3	6.1
7.5–8.0	0.5	4.7	3.7
8.0–8.5	—	3.5	2.4
8.5–9.0	—	3.2	2.4
9.0–9.5	—	3.2	1.6
9.5–10.0	—	3.5	1.2
10.0–10.5	—	3.1	0.9
10.5–11.0	—	3.1	0.9
11.0–11.5	—	1.0	—
11.5–12.0	—	0.9	—

Table 3 shows the characteristics of various leading carpet wools. According to Burns, Johnston and Chen, Vicanere and Aleppo types of wool are the best for carpet manufacture. The other types of wool such as the Bikaner wool analysed by Mahal *et al.*[4] and the Hashtnagri wool studied by Syed[5] are also well suited for carpet manufacture. Comparing the results with the Vicanere Wool, the percentage of true wool stands higher by 5.7 percent and lower by 9.6 percent in the case of Aleppo wool. Bikaner and Hashtnagri wool also show less percentage of true wool than the Harnai. The best carpet wool generally has a lower percentage by count of true wool fibres. The diameter of true wool fibres is approximately the same except that of Vicanere wool which has the lowest diameter (17.4). The same is the case with heterotypical fibre diameter. The length of Harnai wool also stands higher than the three breeds namely Vicanere, Bikaner and Hashtnagri. Thus in respect of length the Harnai wool is suitable for carpet manufacture.

TABLE 3.—MEDULLATION AND DIMENSION OF THE LEADING CARPET WOOLS.

Wool type	Medullation (%)			Diameter (μ)		Length (inches)	
	True	Hetero-typical	Kemp	True	Hetero-ropitical	True	Hetero-typical
Vicanere ..	59.22	40.67	0.11	17.4	25.7	2.8	4.6
Aleppo ..	74.69	22.45	2.86	23.9	41.0	5.4	8.6
Bickner ..	58.60	41.3	0.10	24.1	37.7H 63.5M	4.0	5.6H 5.2M
Hashtnagri ..	60.00	38.8	1.20	24.9	54.7	4.0	4.8
Harnai ..	65.00	34.9	0.10	24.7	49.6	4.1	5.8

The results of the count analysis of fibre types and their dimensional characteristics in sixty-five samples as a whole show that the variation in length and fibre thickness is larger. Harnai wool as a commercial type can, therefore, be considered as being very good for the manufacture of carpet rug and blanket, although some improvement in attaining the uniformity of fibre length and thickness is necessary in order to fix it as an ideal carpet wool. This can be improved by regularizing the shearing practice in the breed area. The scientific breeding should be introduced so that only tested rams may be used for breeding and should show a desirable amount of medullation in the fleece and possess the maximum uniformity in fibre thickness and length. Lastly, at the time of shearing, wool should be sorted into body wool, skirting, and coloured wool.

Acknowledgement.—The authors express their thanks to Dr. S.A. Warsi, Director, North Regional Laboratories, P.C.S.I.R., Peshawar, for his keen interest in this work. Thanks are also due to Mr. Ghulam Nabi and Mr. Abdul Khaliq, Senior Laboratory Assistants, Wool Research Division, for their help.

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