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COMPARISON OF FELLMONGERED AND SHORN WOOL

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Samples of fellmongered wool, collected from a fellmongering firm in Lahore have been examined. The important fibre characteristics such as mechanical properties, felting, friction and dyeing of the wool have been evaluated and compared with shorn wool. No significant differences could be detected in these characteristics between the two types of wool.

Skin or fellmongered wool refer to the wool removed from the skin of slaughtered sheep by the process of fellmongering. This wool comprises about 10 percent of the world wool supply and is considered to be inferior to shorn wool.[1] The industry is a world wide one, with France the largest processor of skin wool. The two main products of fellmongering are the wool (called slipe wool, if unscoured and skin wool after scouring) and the de-woolled skin or pelt.

Sheep skins can be classified broadly into fine-woolled types such as that of Merino and coarse-woolled such as that of Lincoln and carpet type.[2] The pelt of the former type is thin and has little commercial value while that of the latter is thicker, denser and consequently more valuable for leather making. It is evident that as far as fellmongering practice is concerned, it is practically impossible to lay down rigid rules, because the raw material, climatic conditions and plant layout all may vary significantly. Moreover, the fellmongering techques used in a particular country depend on whether the pelt or the wool is the more valuable commodity. The effect on wool of the various fellmongering processes is also controversial.

In Pakistan no work seems to have been done on the local fellmongering practice. The present study aims at elucidating whether the methods applied here for de-woolling affect the wool characteristics. Thus in this paper important fibre characteristics such as mechanical properties, felting, friction and dyeing behaviour of skin and shorn wool have been investigated and compared.

Materials and Methods

Wool Samples.—The wool samples were collected from a fellmongering firm in Lahore. The skins of slaughtered sheep are brought over from various parts of West Pakistan to Lahore for fellmongering. Samples of shorn wool from inside of the skin were taken from each of the 10 skins before fellmongering process. The samples were again taken after fellmongering process from the same vicinity. The samples were cleaned with petroleum ether and then with alcohol followed by water and the following studies were made on these wools.

Mechanical Properties.—A Schopper dynamometric apparatus[3] (constant rate of loading) was used for finding breaking strength and percent elongation. One end of the single fibre was suspended from the upper clamp of the hydraulic type testing machine, while the pretension (200mg) was suspended freely from the other end of the fibre and then tightened. Measurements were made at about 21°C and 65% R.H.

Frictional Properties.—Lipson's method[4] was employed to determine the directional frictional effect (D.F.E. and scalines of dry fibres (21°C and 65% R.H.) and wet fibres (0.1N HCl) of skin and shorn wool. Ten fibres were withdrawn at random each from true, heterotypical and medullated fibres from each sample and the following techniques were adopted.

Each fibre was suspended on a cylinderical rod of polished horn and a hook weighing 0.2 g was attached to each end. Small weights were added on one side, so that slippage occured, when the difference in tension T_1-T_2 reached a critical value. The frictional coefficient is then given by $\mu=\frac{1}{\theta}\log\frac{T_1}{T_2}$ where θ is the angle of contact between fibre and cylinder and in this case $\theta=\pi$ radians. Difference in frictional coefficients with and against the scales ($\mu_1-\mu_2$) gives D.F.E., whilst scaliness has been defined by Speakman[5] to be

$$\text{Scaliness }(\%) = \frac{\mu_1-\mu_2}{\mu_2} \times 100$$

Felting Properties.—Exactly one gram of scoured, carded wool, conditioned at 21°C and 65% R.H. was put in a bottle which contained 0.1N HCl with one drop of non-ionic detergent. After shaking for one hour, the ball was rinsed several times with distilled water. The volume of the felted ball was determined by Faure's method,[6] which consists in evaluating the volume directly by saturating the ball with water and weighing it in this condition.

Dyeing.—The dyeing behaviour of shorn and skin wool was studied by the method described elsewhere.[7] In short 2% dye, 3% sulphuric acid, 8% sodium sulphate (on the wt of wool) were added to the dye bath. To this, 3% amyl alcohol was also added as a carrier and boiled for 30 min. About 6 dyes of different shades were used for shorn and skin wool. Spectrophotometer was used to see dye uptape of shorn and skin wool.[8,9] The washing fastness was also tested.[10]

Discussion

There are various methods for de-woolling; among them the important methods are sweating, sulphide painting, enzyme depilation and hot water soaking.[10,11]. The method adopted in Pakistan does not seem to conform wholly to any of the well known practices abroad. Some common salt (NaCl) is painted on the skin side of the wet skin. The skin is immersed in a tub of water and after 24 hours, it is taken out and the wool is pulled by hand. The fellmongering firms are not very much particular about the wool, and their primary objective is to get a good pelt.

It is a fact that strength and elongation of wool fibre is of primary importance, as the wool fibre is subjected to stresses and strains in varying degrees in processing. Statistical analysis shows that no significant differences exist in breaking force corresponding to true fibres of shorn and skin wool (Table 1) In the same manner, heterotypical and medullated fibres of shorn wools are not significantly different than those of skin wools (Table 2) Moreover, no significant differences were found in elongation (%) of shorn and skin wool. Thus it is evident that wool fibres are not damaged to any appreciable degree by the present fellmongering process.

From microscopic examination it is clear that the skin fibre has its bulbous end still attached to it, which may produce problems in dyeing. Difficulties in dyeing fellmongered wools have been experienced and skitteriness in fabrics has different dye uptake properties than the rest of the fibre.[12,13] But recently Walls and Yates[14] have shown that pulled fibres were also dyed evenly, but there was slight difference in colour between fabrics from fellmongered and shorn wools.

Very little or no work seems to have been done on frictional properties of fellmongered wool. In this paper frictional properties were also studied

TABLE 1.—FORCE AT BREAKING POINT OF TRUE, HETEROTYPICAL AND MEDULLATED SHORN AND SKIN WOOL FIBRES.

Sample No.	True force (g wt)		Het: force (gm. wt)		Med: force (g wt)	
	Shorn	Skin	Shorn	Skin	Shorn	Skin
1.	17.0	17.2	22.1	19.1	42.0	31.0
	±1.5	±3.6	±3.4	±3.1	±4.3	±3.2
2.	16.3	15.0	25.3	23.8	40.0	37.2
	±1.6	±1.4	±2.8	±2.2	±3.7	±3.3
3.	14.0	16.8	—	—	25.2	28.9
	±1.5	±1.4			±7.0	±4.3
4.	14.5	12.7	27.5	28.2	35.8	32.1
	±1.4	±1.5	±3.0	±3.2	±4.5	±4.7
5.	16.0	11.5	23.5	17.0	45.0	32.7
	±1.3	±2.0	±4.0	±2.9	±3.3	±3.4
6.	15.2	16.3	20.2	18.6	37.6	36.1
	±1.8	±1.7	±2.6	±2.9	±3.2	±3.5
7.	14.3	17.5	—	—	33.8	33.2
	±1.5	±2.0			±3.8	±5.2
8.	14.8	15.6	23.5	25.6	31.6	32.5
	±2.0	±2.2	±3.3	±3.7	±3.8	±3.2
9.	16.6	13.1	23.8	19.1	39.5	33.4
	±2.6	±3.1	±2.7	±3.1	±4.3	±5.5
10.	15.7	13.0	28.1	26.2	42.3	33.6
	±1.3	±1.5	±4.2	±3.8	±4.6	±4.2

TABLE 2.—ELONGATION (%) AT BREAKING POINT OF TRUE, HETEROTYPICAL AND MEDULLATED SHORN AND SKIN WOOL FIBRES.

Sample No.	True, Elongation (%)		Het: Elongation (%)		Med: Elongation (%)	
	Shorn	Skin	Shorn	Skin	Shorn	Skin
1.	36.0 ±2.8	35.0 ±5.4	31.2 ±2.5	32.5 ±2.9	33.0 ±5.2	23.4 ±4.1
2.	27.2 ±2.9	25.2 ±5.2	23.0 ±2.6	24.5 ±2.9	25.0 ±5.1	23.1 ±3.2
3.	30.2 ±4.4	34.9 ±2.7	—	—	22.5 ±5.2	27.2 ±2.9
4.	29.8 ±4.2	31.6 ±3.1	28.2 ±3.2	26.0 ±3.5	27.5 ±5.4	26.2 ±3.2
5.	30.0 ±4.9	20.9 ±4.1	26.5 ±5.6	26.2 ±6.1	32.5 ±3.6	24.4 ±4.3
6.	33.2 ±3.6	25.0 ±4.6	29.2 ±4.0	30.5 ±3.8	30.4 ±3.9	25.1 ±4.2
7.	26.2 ±3.8	31.5 ±7.4	—	—	24.4 ±5.5	24.6 ±6.8
8.	32.3 ±4.5	30.2 ±5.0	27.3 ±4.2	25.1 ±4.5	24.2 ±5.0	22.6 ±4.5
9.	36.2 ±4.6	33.9 ±4.5	26.0 ±6.1	31.6 ±5.8	23.9 ±5.8	27.2 ±5.0
10.	28.5 ±3.2	26.2 ±3.7	27.8 ±3.1	24.8 ±3.4	31.3 ±5.6	30.2 ±5.2

TABLE 3.—ANTI-SCALE ($\mu 1$) AND WITH-SCALE ($\mu 2$) COEFFICIENT OF FRICTION: D.F.E. AND SCALINESS OF SHORN AND SKIN WOOL.

	Skin or shorn wool	$\mu 1$	$\mu 2$	D.F.E.	Scaliness
True (Dry)	Shorn	.4426	.3243	.1182	38.2
	Skin	.3529	.2973	.0555	18.8
Heterotypical (Dry)	Shorn	.4077	.3029	.1047	34.9
		.2801	.2480	.0497	20.5
Medullated (Dry)	Shorn	.3896	.3050	.0845	27.7
	Skin	.2334	.2970	.0636	27.1
True (Wet)	Shorn	.6988	.5026	.1961	39.0
	Skin	.7062	.4868	.2211	45.8
Heterotypical (Wet)	Shorn	.7089	.5002	.2085	42.7
	Skin	.6528	.5311	.1394	27.1
Medullated (Wet)	Shorn	.6338	.4918	.1420	28.9
	Skin	.6580	.4950	.1630	32.9

alongwith felting. From Table 3, it is clear that in the case of dry fibres, $\mu 1$, $\mu 2$, D.F.E. and scaliness have higher values for shorn than for skin wool. But in wet state no differences in these values are evident. In this case dry values are referred to as an indication of surface configuration, although the wet values could be expected to be more closely related to felting. The decrease in $\mu 1$, $\mu 2$ and D.F.E. seems to be due to wear affect of the fibre. In the present experiment, no difference in loose wool felting was observed, thus confirming Walls and Yates results, although previous work had suggested that fellmongered wool fabrics tend to shrink less.[15]

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References

1. B. J. Onions, *Wool* (Earnest Benn Ltd. London, 1962), p. 202.
2. *Wool Science Review* (International Wool Secretariat, Scientific and Technical Department, London, 1966), p. 12.
3. Mumtaz Ahmad, Pakistan J. Sci. Ind. Res., **6,** 8(1963).
4. M. Lipson, Nature, **156,** 268 (1945).
5. J.B. Speakman, and E. Stott, J. Text. Inst., **22,** T339 (1931).
6. P.K. Faure, Text. Res. J., **35,** 700 (1965).
7. A.A. Wakil and Amir Mohd., Pakistan J. Sci. Ind. Res., **6,** 270 (1963).
8. F.T. Simon, Text. Res. J., **19,** 567 (1949).
9. E.R. Trotman, *Dyeing and the Chemical Technology of Textile Fibres*, 3rd edition (Griffan, London, 1964), p. 560.
10. Reference 2, p. 1924.
11. M.S. Carree, I.K. Walker and W. J. Harrison, J. App. Chem., **9,** 608 (1959).
12. G. Satlow. *Deutsche Forschungsgsgemenischaft Wolle*, 24 (1959) (Cited after Review of Textile Progress) (Butterworths, 1960), volume II, p. 85.
13. L.L. Lloyds, J. Soc. Dyers. Col., **45,** 243 (1929).
14. G.W. Walls and J.R. Yates, J. Text. Inst., **57,** T65 (1966).
15. Reference 1, p. 206.