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IMPROVEMENT IN DYEING OF FELLMONGERED WOOL WITH CHROME AND REACTIVE DYES

ABDUR RAZZAQ, AMIR MOHAMMAD KHAN and MUMTAZ A. KHAN

PCSIR Laboratories, Peshawar

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Abstract. Samples of shorn and fellmongered wool (obtained by sulphide painting process) were collected from a tannery in Karachi. The alkali damage of all the wool samples was determined. The samples were dyed with chrome and reactive dyes, and optimum conditions for level dyeing of fellmongered as well as the blend of fellmongered and shorn wool were established. Moreover, difficulties in scouring of fellmongered wool were also discussed and remedies suggested.

The wool removed from the skin of slaughtered sheep is called skin or fellmongered wool. In most foreign countries usually all skins are classified according to four factors; wool quality, staple length, amount of burr or dirt and soundness of the pelt.[1] Fellmongered wool is classed separately. But in Pakistan no system has yet been adopted to classify such wool. In fact the tanneries give more importance to pelt as it is of great commercial importance as compared to the wool so obtained.

There are a number of fellomongering proceesses[2] but in Pakistan two processes are in practice, viz. (a) salting process and (b) sulphide painting process. In the former process the quality of the pelt is inferior as compared to that obtained by the sulphide painting process. It may be mentioned that the main product of the fellomongering process is the pelt and the wool is of secondary importance.

Fellmongered wool is generally considered inferior to shorn wool in view of two factors.[3] Firstly difficulties in dyeing of fellmongered wool have been experienced and skitteriness in fabrics has been attributed to the fact that the root of the fibres has different dye-uptake properties from the whole fibre. Kerley[4] suggests that sweated wools have a lower rate of dye absorption than shorn wools and that painted wools have a still lower rate. The second problem is that in the sulphide painting process, the wool gets contaminated with lime as often happens even with the most careful handling and this scouring becomes difficult.

Work on the improvement of dyeing by acid dyes was published earlier from these Laboratories. As most of the mills use reactive and chrome dyes, it was necessary to use these dye also. The present studies were, therefore, conducted in order to find out optimum conditions for level dyeing of fellmongered wool as well as a blend of fellmongered and shorn wool with chrome and reactive dyes.

Materials and Methods

Wool Samples

Ten samples of shorn wool were obtained from a tannery in Karachi, from the midside of the different fleeces of sheep. After sulphide painintg process, samples were again taken from the same side (midside) of the same fleece. The untreated samples were numbered from S1 to S10 and the corresponding fellmongered samples were denoted by F1 to F10. The samples were cleaned with petroleum ether followed by ethanol and then washed with distilled water. The vegetable matter was removed and the samples were hand carded. The following tests were made on these wools.

(1) *Alkali Solubility*. The damage of all the samples was determined by the alkali solubility method.[6]

(2) *Dyeing*. Two dyes were used in the present work Chrome Fast Orange ML and Cibalan Brilliant Yellow 3 GL.

Chrome Dyeing Method.[7] The dye bath was prepared by adding 2% well-dissolved dye (Chrome dye). 10% Glauber's salt and 4% acetic acid (56%) based on the weight of fibre. The temperature was raised to boiling in 30 min and boiling continued for further 45 min. To ensure complete exhausting of the dye, another 1% acetic acid was added, and the boiling was continued for 30 min. The bath was cooled to 90° and the dissolved 1% potasium dichromate was added slowly. Again the temperature was raised to the boil and boiling was continued for another 30 min to develop the shade.

Reactive Dyeing Method.[8] The sample was placed in a bath previously heated to 50° to which 3% ammonium acetate solution was added for adjusting the pH of the bath to 6. The sample was kept for 10 min. to maintain the pH of the bath. To this bath 2% well dissolved dye (reactive dye) was added and the temperature was gradually raised to boiling in 30 min and the boiling was contiued for 30 min more.

(3) *Determination of Dye Uptake*. The dye uptake of fellmongered and shorn wool was determined with leukometer (Burno Lange, Berlin) by using red,green and blue filter. The dye uptake was calculated from the percentage reflectance of the dyed fibre using one of the corresponding filters. Normally, measurements were made by comparing a known percentage of 'standard white' for which the reflection of the measuring instrument was adjusted to the nominal value of the standard. The colour intensity of the specimen under test was then read off as percentage of the whiteness of the standard.

Results and Discussion

Comparing with the international standard,[9] it is evident (Table 1) that the fellmongered wool has undergone more damage which is obviously caused by the action of NaOH liberated on hydrolysis of Na_2S in painting processes.

It is clear that the percentage reflectance of fellmongered wool is higher than that of shorn wool (Table 2). However, there are no significant differences between reflectance of fellmongered and shorn wool. As the higher percentage of reflectance is indirectly proportioanl to the intensity of the colour on the fibre, it is evident that the dye uptake of fellmongered wool is less than that of shorn wool. The less dye uptake of fellmongered wool is also due to the presence of alkali which neutralizes some of the acid in the dye bath. Reactive dye (Table 3) follows the same pattern as the chrome dye.

The difference in shade of fellmongered and shorn wool is a big problem.[10] Moreover, the fellmongered wool gets mixed up with shorn wool as no wool classing system is adhered to in the country. In order to minimize the difference in shade of fellmongered and shorn wool, optimum conditions for fellmongered wool as well as that of a blend of shorn and fellmongered wool need to be established.

Subsequently, in case of chrome dyes, the fellmongered wool was dyed using the following conditions:(1) 3% acetatec acid for dyeing and 1% formic acid for exhaustion. (2) 7% acetic acid and 1% formic acid. (3) 7% acetic acid, 1% formic acid and 20% Glauber's salt. (4) 0.3 % acetic acid, 1% formic acid and subsequently 1% sulphuric acid for complete exhaustion. (5) 8% acetic acid. (6) 10% acetic acid. (7) Pretreatment with 1% H_2SO_4, followed by drying with the above usual method.

The above experiments revealed that with a low amount of acid less dye uptake of fellmongered wool was observed, while with an amount of acid in excess of 8% acetic acid, nonuniformity in dyeing was noted.

In the case of dyeing of fellmongered wool with reactive dyes the following conditions were investigated. (1) The pH of the dye bath was adjusted to pH 3, 4, 5, 6 and 7, and the rest of the dyeing procedure was carried out in the usual way. (2) The fellmongered wool was treated with 1% H_2SO_4 (concd) and then dyed with normal method.

It was found that with pH 3–4, dyeing led to nonuniformity, while with pH 6–7 less dye uptake was observed. Subsequently, in order to compensate for the acid neutralized by fellmongered wool, and to minimize the difference in shade of fellmongered

TABLE 1. COMPARISON OF THE ALKALI SOLUBILITY OF FELLMONGERED AND SHORN WOOL.

Shorn wool		Fellmongered wool	
Sample	Alkali solubility(%)	Sample	Alkali solubility(%)
S1	11·2	F1	8·1
S2	10·7	F2	7·3
S3	13·6	F3	5·8
S4	11·8	F4	7·2
S5	10·3	F5	7·7
S6	10·9	F6	8·0
S7	10·5	F7	7·6
S8	11·1	F8	6·3
S9	12·2	F9	5·8
S10	12·0	F10	7·7

TABLE 2. CHROME DYE UPTAKE OF FELLMONGERED AND SHORN WOOL USING LEUKOMETER.

Shorn wool		Fellmongered wool	
Sample	Reflectance(%)	Sample	Reflectance(%)
S1	74·0	F1	76·5
S2	70·0	F2	74·0
S3	75·0	F3	77·5
S4	80·0	F4	81·5
S5	80·5	F5	82·5
S6	80·0	F6	82·5
S7	81·0	F7	82·5
S8	83·0	F8	84·0
S9	81·5	F9	83·0
S10	82·0	F10	83·5

Dye, Chrome Fast Orange ML, shade 2%, Filter, Green, sensitiveity 1:10.

TABLE 3. REACTIVE DYE UPTAKE OF FELLMONGERED AND SHORN WOOL USING LEUKOMETER.

Shorn wool		Fellmongered wool	
Sample	Reflectance (%)	Sample	Reflectance (%)
S1	83·0	F1	87·0
S2	87·3	F2	88·3
S3	88·0	F3	89·3
S4	86·6	F4	89·3
S5	86·1	F5	89·6
S6	89·3	F6	92·0
S7	91·0	F7	93·3
S8	92·0	F8	93·0
S9	91·8	F9	93·5
S10	93·2	F10	95·0

Dye, Cibalan Brilliant Yellow 3 GL, shade 2%. Filter Green, sensitivity 1:10.

TABLE 4. IMPROVED DYE UPTAKE OF FELLMONGERED WOOL WITH CHROME AND REACTIVE DYES USING LEUKOMETER.

Sample	Reflectance (%)	
	Chrome dye	Reactive dye
F1	73·7	82·8
F2	70·2	87·8
F3	74·9	87·9
F4	80·2	86·4
F5	80·6	86·4
F6	80·3	89·0
F7	81·3	91·2
F8	82·9	92·0
F9	81·4	91·6
F10	82·2	92·0

Chrome dye, Chrome Fast Orange ML
Reactive dye, Cibalan Brillant Yellow 3 GL
Shade, 2% Filter: green
Sensitivity, 1:10

TABLE 5. IMPROVED DYE UPTAKE OF PRE-TREATED FELLMONGERED WOOL WITH CHROME AND REACTIVE DYE USING LEUKOMETER.

Sample	Reflectance (%)	
	Chrome dye	Reactive dye
F1	74·2	83·2
F2	70·1	87·0
F3	74·9	88·2
F4	80·3	86·4
F5	80·4	85·9
F6	80·1	89·0
F7	81·2	91·2
F8	83·0	92·3
F9	81·3	91·5
F10	82·3	93·0

Chrome dye: Chrome Fast Orange ML
Reactive dye: Cibalan Brillant Yellow 3 GL
Shade: 2%: Filter: green.
Sensitivity : 1:10

and shorn wool in blend, the method was improved by adding 8%acetic acid instead of 4% acetic acid in the case of Chrome Fast Organge ML, while in the case of Cibalan Brilliant Yellow 3 GL, the pH was maintined at pH 4–5 istead of pH 6 (Table 4).

The shade can also be improved by pretreatment of fellmongered wool with 1% H_2SO_4 applied at room temperature followed by rinsing with distilled water, drying and subsequently dyeing with chrome and reactive dye in the normal way (Table 5).

It was further noted in confirmation with earlier findings[5] that the scouring difficulties of sulphide-painted fellmongered wool can also be overcome, when it is scoured with nonionic detergent,[11] hard-water-resistant anionic detergent[12] or simply soap-soda process[13] in the presence of complex compounds.[14]

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References

1. Wool Sci. Rev., **29**, 12 (1966).
2. B.J. Onions, *Wool* (Earnest Benn, London, 1962), p. 302.
3. Wool Sci. Rev., **30**, 34 (1966).
4. L.R. Kerley, S.A. Wool Textile Res. Inst. Tech. Rep., No. 37 (1965).
5. T. Khan, A.M. Khan and M.A. Khan, Pakistan J. Sci. Ind. Res., **15**, 426 (1972).
6. A. Agster, *Farberei und. Textilechemische untersuchungen* (Springer Verlag, Berlin, 1967), tenth edition, p. 389.
7. W.V. Bergen and H.R. Mauersberger, *American Wool Handbook* (Textile Book, New York, 1947), second edition, p. 762.
8. H. Rath, *Lehrbuch der Textilchemie* (Springer Verlag, Berlin, 1963), second edition, p. 525.
9. Ref. 6, p. 390.
10. G.W. Walls and J.R. Yates, J. Textile Inst., **57**, T 73 (1966).
11. Ref. 8, p. 670.
12. Ref. 8, p. 665.
13. Ref. 7, p. 406.
14. Ref. 8, p. 702.