STUDIES ON SOME BASIC ASPECTS OF RECOVERY OF WOOL GREASE IN PAKISTAN

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Grease contents of indigenous wools together with the physico-chemical constants of the grease have been estimated. The increase in the grease content resulting from cross-breeding between indigenous and foreign sheep breeds has been investigated, keeping in view the possible influences of wool fineness and environment. Waste wool scouring liquors from woollen mills have also been tested for their grease contents. Cross-breeding in moderate to cold regions and the treatment of imported raw wool render grease recovery a practical proposition.

Introduction

Wool grease, an important commercial material, causes other impurities (dirt and sand) to adhere to the fibre and its removal constitutes the first step in processing. In most parts of the world the grease is subsequently recovered from the used scouring liquor.

The purified form of wool grease known as lanolin finds use in cosmetics and pharmaceuticals. Moreover, about half the world's production of cholestrol is extracted from wool grease. The demand for cholestrol has increased recently as it is the starting material for the synthesis of certain vitamins and hormones.

The economic recovery of wool grease largely depends on the amount present in the raw wool and this in turn is dependent on a number of factors, the most important being wool fineness.[1] Since indigenous wools fall in the carpet (coarse) wool group, their grease content is very low[2] and woollen mills in Pakistan have not been recovering grease so for. Recently, however, developments have taken place, which call for a reconsideration of the situation. Firstly, some woollen mills have now installed top-making plants for which fine wool is being imported. Secondly, cross-breeding between indigenous and foreign breeds has been introduced in certain areas, resulting in the production of finer wool rich in grease. These changes could lead to the recovery of grease as a practical proposition. The need for examining the grease contents of the various wools and the factors influencing them is thus evident.

Not only does the grease content vary from wool to wool, but also the physico-chemical properties of the grease vary from sample to sample. In fact, the composition of wool wax varies even within the individual staple.[3]

The objectives of the present study were:

1. To estimate grease contents of various indigenous wools and to examine the physico-chemical characteristics of the grease recovered.
2. To examine trends of increase in grease content arising from cross-breeding between indigenous and foreign breeds.
3. To estimate grease contents of waste scouring liquors, especially as altered by the use of imported raw wool.

The term "cross-bred wool" has been used in this study to refer to wool obtained from cross-breeding between indigenous and foreign breeds and is not employed in the sense in which it is normally used in wool commerce.

Materials and Methods

Indigenous Wools.—Full fleeces were collected from 10 leading indigenous breed types from various areas of West Pakistan. In order to overcome variations within breeds some 8–10 sub-samples weighing about 1 g were selected from mid-sides of different fleeces to form bulk samples representing particular breeds.

Wool wax was recovered by the usual soxhlet method. Thus petroleum ether was employed as solvent and soxhlet extraction was carried out for 6 hr. In addition, fineness was determined on a lanameter.[4]

Tests on the Recovered Grease.—A number of chemical characteristics of the grease namely iodine value,[5] acid value,[6] saponification value,[7] ester value,[8] hydroxyl value and acetyl value[9] were determined by the usual methods. Wool grease obtained from the indigenous Kaghani breed was converted into lanolin by first washing with alcoholic sodium hydroxide and then bleaching with hydrogen peroxide (1.2%) till no peculiar odour of wool wax could be detected. The sample was compared with original grease in respect of colour, moisture, volatile matters at 105°C, ash, saponification value, acid value, iodine value,

free fatty acids,[6] refractive index at 28°C[10] and melting point.

Cross-bred Samples.—Cross-bred samples were collected from both Kaghan valley and Mianwali where cross-breeding has been carried out. From both the areas, in addition to the samples from the various progenies, F_1, F_2, F_3 etc., samples from original parent breeds were also obtained. At Mianwali cross-breeding between imported Corriedale and local Thalli breeds has been carried out at a well-organised farm (Commonwealth-Livestock Farm, Kaloorkot). In the case of imported Rambouillet x local Kaghani breeds, however, cross-breeding is being carried out by local shepherds rather irregularly, and it is not always possible to trace the geneology or to find the original parents. In this case, therefore, samples were collected from 3 different flocks and only those animals were selected whose geneology could be traced. In addition samples of F_1 and F_2 Rambouillet x Kail were supplied by the Animal Husbandry Department of Azad Kashmir.

Wool grease was obtained from all these samples by the soxhlet method and fineness was determined by the method described earlier.

Scouring Liquors from Woollen Mills.—Waste scouring liquors in respect of both indigenous and imported wools were collected from a number of mills. Samples were taken usually at the time of discharge of the used liquor except for a few cases where samples were also taken at different intervals. The grease contents of the liquors were determined by the acid cracking method.[11]

Results and Discussion

Indigenous Breeds.—The grease contents and diameters of the samples are given in Table 1. A high-grease yielding F_3 cross-bred sample (Rambouillet x Kaghani) has been included for comparison. The chemical constants of the grease obtained have been listed in Table 2. The properties of lanolin have been compared with those of original grease in Table 3, which also includes values reported in literature.

TABLE 1.—WAX CONTENT OF INDIGENOUS WOOL.

Breed	Mean fineness (μ)	Mean wax percentage
Rambouillet x Kaghani (F_3)	22.0	8.0
Kaghani	39.6	4.5
Makrani	40.4	4.0
Kooka	44.2	3.0
Terahi	46.3	2.6
Lohi	48.4	2.5
Michni	49.5	2.2
Hashtnagri	46.2	2.6
Harnai	46.7	1.5
Thalli	39.2	1.3
Bahawalpuri	39.8	2.9

TABLE 2.—CHEMICAL CONSTANTS OF WAX FROM INDIGENOUS WOOL.

Breed	Sponification value	Ester value	Acid value	Iodine value	Hydroxyl value	Acetyl value
Terahi	80.0	36.0	44.0	32.7	155	174.7
Kooka	80.4	40.0	40.4	31.5	150	172.9
Lohi	81.7	44.5	37.2	33.0	152	170.3
Bahawalpuri	83.5	44.1	39.4	32.4	150	177.2
Hashtnagri	85.6	50.6	35.0	30.0	153	173.5
Michni	86.2	52.9	33.3	34.0	150	175.0
Makrani	104.2	63.3	40.5	35.1	159	178.8
Kaghani	125.0	78.5	46.5	18.8	159	179.5

TABLE 3.—COMPARISON OF PHYSICO-CHEMICAL CHARACTERISTICS AND LANOLIN CONTENT OF INDIGENOUS WOOL WAX WITH FOREIGN STANDARDS.

Characteristics	Result obtained		Reference to available data			
	Indigenous wool wax	Lanoline prepared	Lanolin Lower[12]	Wool fat B.P.	Wool wax x Truter[13]	Wool fat Lange[14]
Colour	.. Brownish	Whitish yellow	—	Pale yellow	Yellow to pale brown	—
Moisture content ..	.. 8%	1%	—	0.5%	—	—
Volatile matter at 105°C	.. 3.4%	2.8%	—	—	—	—
Ash %	.. 0.1%	0.8%	0.4- 0.11%	—	—	—
Saponification ..	.. 125.0	96.0	97.0	82–130	95–120	82–130
Acid value ..	.. 46.5	26.0	0.4- 2.0	59.8	—	59.8
Iodine value ..	.. 18.8	28.0	19.0–30.0	17–29	15–30	17–29
Free fatty acids ..	.. 26.0%	18.0%	—	—	4–10%	—
Refractive index at 20°C	.. 1.496	1.494	1.480/40°C	1.478–1.4822 25°C	1.48/40°C	1.4784–1.4822
Melting point ..	.. 37.7	39.9	37–38	41.8	35–40	38-40 solidifying pt

TABLE 4.—WAX CONTENT OF CROSS-BRED WOOLS (Rambouillet x Kaghani).

Sr. No.	Rambouillet		Cross F_1		Cross F_2		Cross F_3	
	Diameter	Wax %	Diameter	Wax %	Diameter	Wax %	Diameter	Wax %
1	21.8	12.0	23.2	5.5	23.86	5.6	21.52	8.8
2	20.9	8.8	21.8	7.5	23.45	8.0	22.90	7.7
3	21.8	8.2	24.0	4.9	22.05	8.3	20.75	7.4
4	21.0	11.2	28.4	3.5	22.30	7.8	21.80	8.0
Range	21–22	8–12	22–28	4–8	22.24	6.8	21–23	7–9
Average	21.0	10.0	25.0	6.0	23.00	7.0	22.00	8.0
Kail x Rambouillet	—	—	23.1	7.8	18.3	9.6	—	—

TABLE 5.—WAX CONTENT OF CROSS-BRED WOOLS (Corriedale x Thalli).

Breed	Wax %	Fineness μ
Thalli	1.3	39.2
F_1	1.5	34.1
F_3	1.7	30.6
F_4	2.3	29.0
F_5	2.7	25.8
Corriedale	5.5	24.9

The grease contents of the indigenous wools are very low and the highest is that of Kaghani at 4.5%. This low content renders recovery of grease uneconomical and seems to justify the practice adopted by our mills of discarding used scouring liquors.

The physico-chemical constants fall within the range of those reported for foreign breeds (Table 3). Thus despite vast differences in breed type and climate, the wool grease appears to be essentially of the same general nature.

Cross-bred and Imported Wools.—Table 4 gives grease contents of the various progenies F_1, F_2, F_3 resulting from cross-breeding between Rambouillet and Kaghani (or Kail) breeds. The grease contents of Rambouillet wool grown under similar conditions have also been given for comparison. The table includes mean values of diameters of the samples and Table 5 gives similar values in respect of cross-breeding between imported Corriedale and local Thalli breeds.

In the case of Rambouillet x Kaghani crosses, it is evident that both the diameter and the grease content approach those of Rambouillet when cross-breeding is carried up to F_3 stage. The F_3 samples have, on the average, a grease content of 8% comparable with that for most wools abroad for which grease recovery has become an established practice and thus this provides sufficient basis for recovery of wool wax, provided large quantities of this type of wool are processed.

In the case of cross-breeding between Corriedale and Thalli breeds (Table 5), the grease contents have not increased beyond 2.7% at F_5, although the diameter has approximated that of Corriedale wool. The factors affecting this situation have been discussed in the next section, but it is, nevertheless, obvious that these wools are identical with indigenous types in so far as the economic recovery of grease is concerned.

The random scouring liquors collected from woollen mills have been compared for their grease contents in Table 6. The grease contents of indigenous varieties do not exceed 0.35%, thus confirming the uneconomical nature of recovery in these cases. The grease content of liquors in respect of the imported wools is, in general, higher, approximating 1% in the case of the 1st tank, at the end of the shift, using Merino 60/64's wool (at Lawrancepur Mills) although scouring liquors are now discharged at a disposal rate not influenced by any consideration of grease recovery. When regularised, the scouring liquors could yield contents very suitable for grease recovery.

Relationships Among Grease Content, Fineness and Climate.—Grease content of a wool is known to be related to a number of factors, the most significant being diameter. This is generally borne out by our results within the same type, as all the three groups viz. indigenous wools (Table 1), Kaghani x Rambouillet (Table 4) and Corriedale x Thalli (Table 5) conform when taken separately. When all the data is assembled together (Fig. 1), it be-

comes evident that Corriedale x Thalli even to F_4 and F_5 produces much less grease than would be expected from the diameter. This is further explained in Table 7 where the samples have been compared with data reported in the literature. The influence of climate on the grease content is well known,[15] and the behaviour of these wools indicates that such a hot climate as that existing in the Mianwali area, where cross-breeding with Corriedale has been carried out could upset the increase in grease expected on the basis of fineness. For practical purposes, therefore, liquors from wools grown in this hot climate, even if the wool is of fine diameter, would not be suitable for grease recovery which would have to be confined to the wools coming from moderate to cold regions.

Conclusions

1. Grease content of indigenous wools is too low to allow for economical recovery, although the gross chemical constants of the grease are similar to those reported from abroad.

2. Grease content of wools resulting from cross-breeding between local and foreign breeds has risen to par with most foreign breeds and would allow for economical recovery. This, however, applies to wools grown under moderate to cold conditions.

3. Grease content increases, in general, with wool fineness but extremely hot climatic conditions can offset this relationship.

TABLE 6.—WAX CONTENT OF SCOURING LIQUORS OBTAINED FROM MILLS.

Woollen Mill	Wool type	Tank No.	Wax %
Karachi	Mixed indigenous wools	1st tank at the end of shift. (Counter flow method).	0.254
Bannu	Local Bannu wool	1st tank	0.052
Bannu	Local Bannu wool	2nd tank	0.232
Bannu	Local Bannu wool	3rd tank	traces
Bannu	Mixed indigenous wools	1st tank	0.129
Bannu	Mixed indigenous wools	2nd tank	0.349
Bannu	Mixed indigenous wools	3rd tank	traces
Watton	Mixed indigenous wools	1st tank	0.185
Watton	Mixed indigenous wools	2nd tank	0.201
Lawrancepur	Merino	1st tank after 5 hr (Counter flow method)	0.355
Lawrancepur	Merino	1st tank at the end of shift	0.9608
Lawrancepur	Merino	1st tank over flow	0.705
Lawrancepur	Merino	2nd tank at the end of shift	0.280

TABLE 7.—COMPARATIVE STUDY OF WOOL QUALITY, FIBRE FINENESS AND GREASE CONTENT OF PAK BREEDS.

Breed	Fineness μ	U.S. Govt. Quality No.	Wax % w.r.t. Quality	Wax % Pak Breed
Kaghani				
Ind. Kaghani	39.6	36's	6.8	4.5
Rambouillet	21.0	70's	16.9	10.0
F_1	25.0	58's	10.5	6.0
F_2	23.0	62's	13.6	7.0
F_3	22.0	64's	14.6	8.0
Kaloorkot				
Thalli	39.2	36's	6.8	1.3
Corriedale	24.9	60's	12.7	5.5
F_1	34.1	46's	8.3	1.5
F_2	—	—	—	—
F_3	30.6	50's	8.9	1.7
F_4	29.0	56's	9.8	2.3
F_5	25.8	58's	10.5	2.7

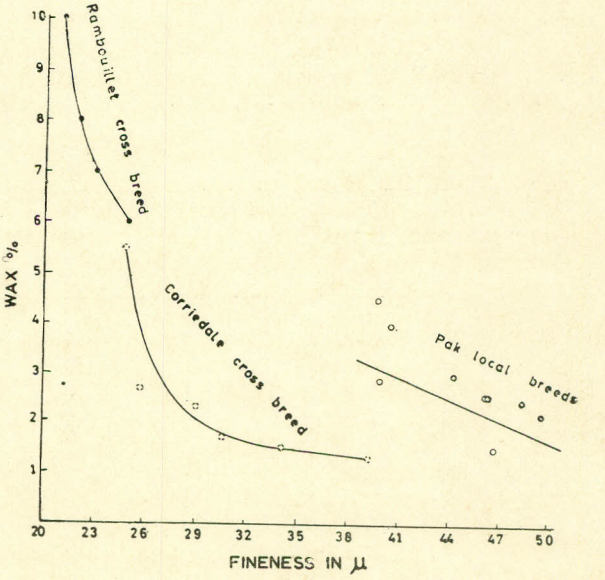

Fig. 1.

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