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159

A STUDY OF THE LUBRICATION OF MOHAIR

PART 1: THE FRICTIONAL PROPERTIES OF MOHAIR/WOOL BLEND YARNS

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ABSTRACT

The frictional properties of yarns containing different percentages of mohair were investigated. It was found that the friction of the waxed mohair/wool blend yarns studied increased with increasing mohair content. By scouring or extracting the yarns with a solvent prior to waxing, the yarn friction, subsequent to waxing, could be reduced considerably. It was therefore suggested that it was not inherent differences between the mohair and wool fibres, as such, which influenced the yarn friction but that it was the ether extractible matter present on the mohair which adversely affected lubricating efficiency of the paraffin wax. The minimum friction of the waxed yarns was found to be correlated with the ether extractible matter content of the yarns.

KEY WORDS

Yarn friction, paraffin wax, mohair yarns, extractible matter.

INTRODUCTION

During an investigation[1] into the knitting performance of mohair/wool blend yarns an interesting phenomenon was encountered. It was observed that the friction of those yarns containing a high percentage of mohair could not be reduced to a satisfactory level by waxing them with paraffin wax under conditions similar to those which gave optimum frictional levels for pure wool worsted yarns. In the light of the extreme importance of yarn friction in knitting[2–13] it was decided to investigate the frictional properties of yarns comprising different proportions of mohair and wool. It was necessary to determine the reasons for the relatively high friction of these yarns and to establish optimum processing and waxing conditions to obtain the lowest yarn friction.

This study was divided into two parts. In part I the frictional properties of conventional mohair/wool blend yarns were studied. In Part II the influence of residual grease level and processing additives on yarn friction and other yarn properties were studied. In addition, the additives and processing conditions necessary to give good all round performance (i.e. good processing performance, low yarn friction coupled with good yarn evenness, strength etc.) were investigated.

TABLE I

DETAILS OF YARNS USED

Yarn No.	Blend	Additive applied to the Mohair during processing	Linear Density	Mean Fibre Diameter (micron)	
				Mohair	Wool
1	100% Mohair	Leomin KP (Hoechst)	R60 tex/2	32,9	–
2	90% Mohair/ 10% Wool	Leomin KP (Hoechst)	R60 tex/2	32,9	20,4
3	80% Mohair/ 20% Wool	Leomin KP (Hoechst)	R60 tex/2	32,9	20,4
4	70% Mohair/ 30% Wool	Leomin KP (Hoechst)	R60 tex/2	32,9	20,4
5	100% Wool		R60 tex/2	–	20,4
6	100% Mohair	Lissapol NX (I.C.I.)	56 tex	37,7	–
7	100% Mohair	Durosil (Hansawerke)	56 tex	37,7	–
8	100% Mohair	Topsol (Price)	R89 tex/2	33,7	–

EXPERIMENTAL

Details of the various yarns used are given in Table I. All the yarns listed in Table I were undyed and had been processed in the conventional manner, the wool and mohair having being blended at the top stage.

The yarns were waxed to various levels with pure paraffin wax on a power driven gravity type waxing unit. Three paraffin waxes with melting points of approximately 53°C, 60°C and 63°C, respectively, were used in the case of yarns 1 to 5 (Table I), while only the paraffin wax with a melting point of 63°C was used for the other yarns. The amount of wax applied to the yarns was calculated, in each case, from the mass of the wax disc before and after waxing and from the mass and linear density of the yarn waxed.

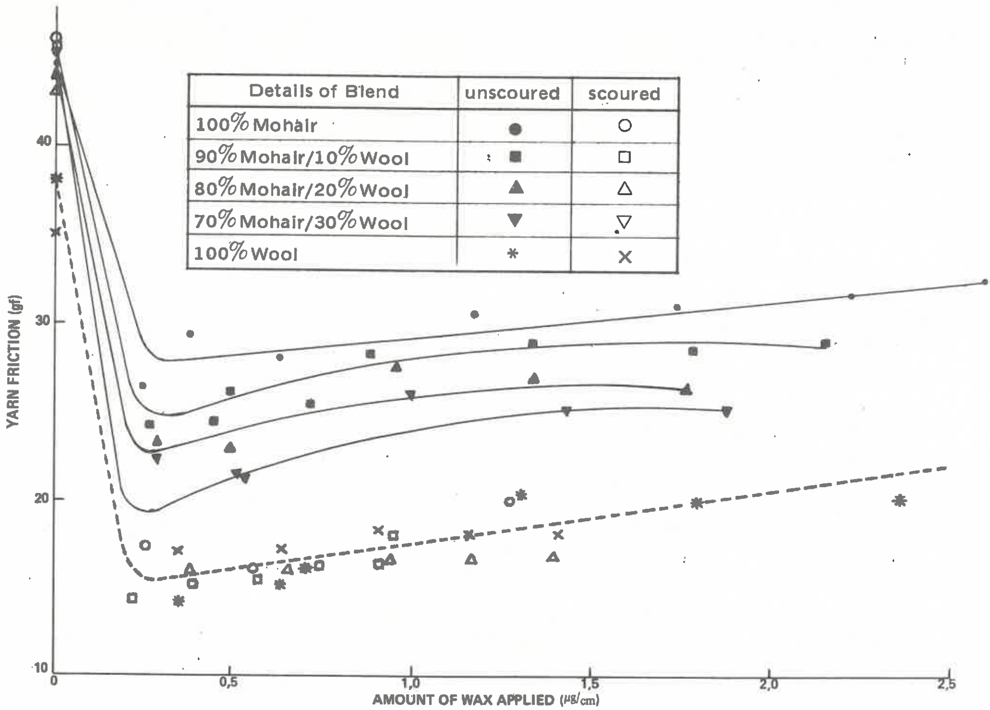

FIGURE 1

Relationship between yarn friction and the amount of wax applied (for yarns 1 to 5, see Table I, melting point of wax 53°C)

The yarn friction was measured on a Commercial SAWTRI Yarn Friction Tester[14].

The percentage extractible matter of the yarns prior to waxing was determined with three different solvents respectively, namely benzene-methanol (2:3 by volume), alcohol and ether. The A.S.T.M. "Standard Method of Test for extractible matter in oven-dried wool (D1574 - 66)" was used with the alcohol extraction being done on the same sample which had been used for the ether extraction.

Some of the yarns were scoured prior to waxing in 0,5 g/*l* Tergitol Speedwet (Union Carbide) and formic acid at pH 3,5 and 45°C for 30 minutes after which they were rinsed for 15 minutes at 45°C and again rinsed for 15 minutes at room temperature. Finally the yarns were hydroextracted and dried (this scour was considered a suitable one for removing Leomin KP (Hoechst). A few of the yarns were extracted with ether prior to waxing. The Topsol (Price) treated yarn was also scoured in 0,5 *g/l* Eriopon HD (Ciba-Geigy) and 1 *g/l* sodium carbonate for 20 minutes at 45°C after which it was rinsed for 10 minutes at 45°C and again rinsed for 10 minutes at room temperature in a bath to which 1,5% formic acid (85%) had been added in order to bring the yarn to an acid pH.

All tests were carried out in a standard atmosphere of 20°C and 65% R.H., the yarns being allowed to condition for about 3 days before any tests were carried out.

RESULTS AND DISCUSSION

In Figs. 1 to 3 yarn friction has been plotted against the amount of wax applied for the three paraffin waxes used. From these figures it is apparent that the yarn friction decreases initially with an addition of wax and then increases gradually with further addition of wax. It is, however, also apparent that the yarn friction increases steadily with increasing mohair content. However, the results obtained on the yarns which had been scoured prior to waxing (see Figs. 1 and 3) indicate that

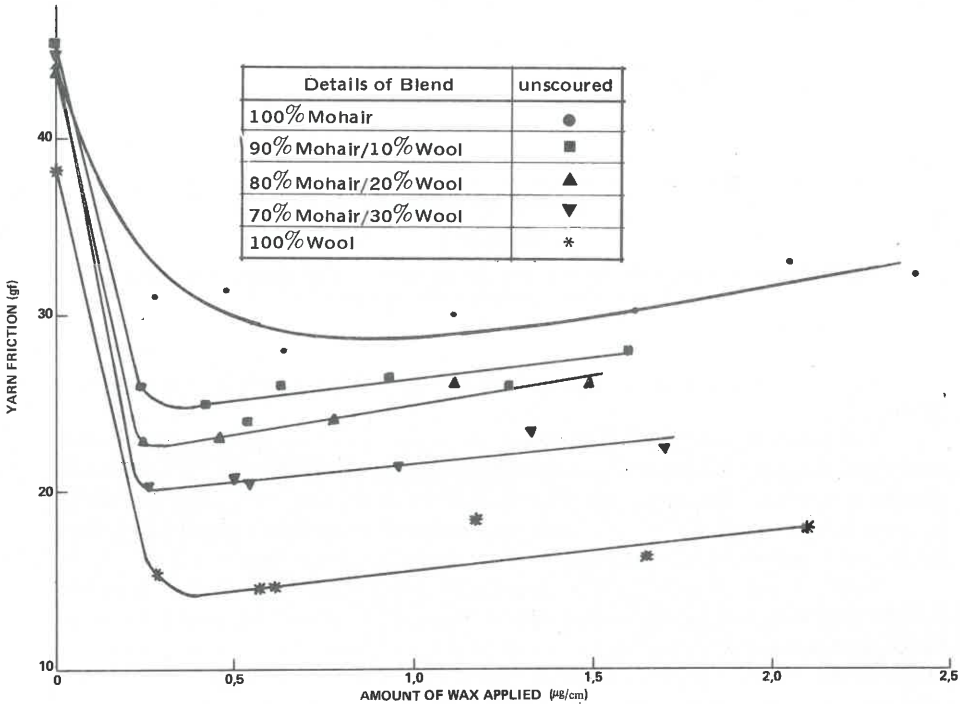

FIGURE 2

Relationship between yarn friction and the amount of wax applied (for yarns 1 to 5, see Table I, melting point of wax 60°C)

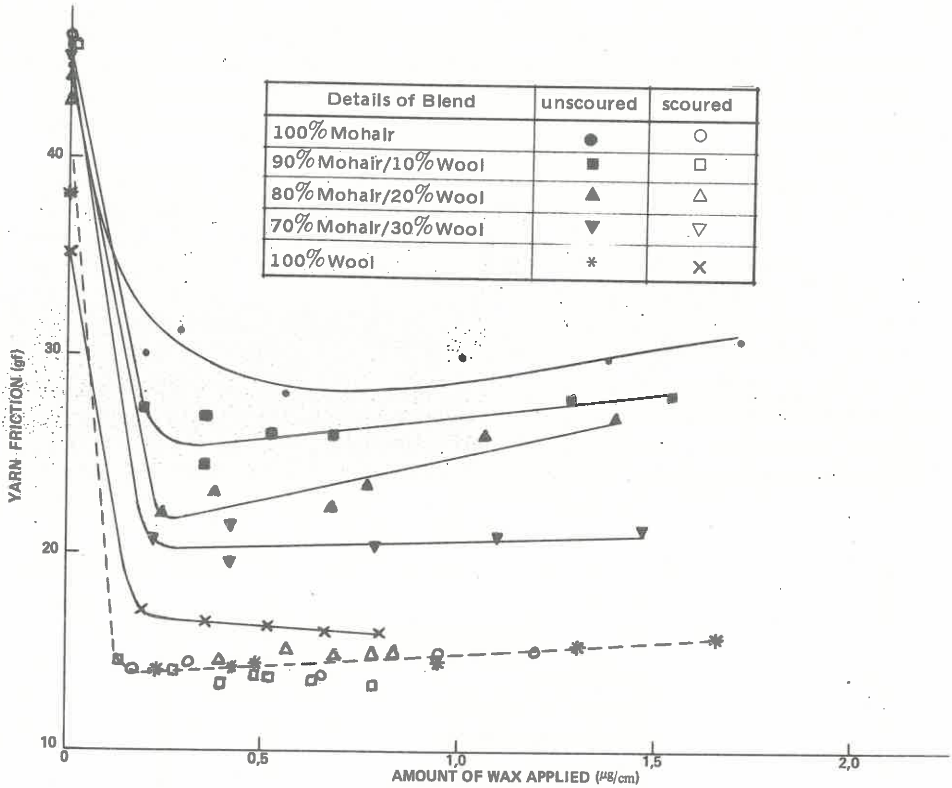

FIGURE 3

Relationship between yarn friction and the amount of wax applied (for yarns 1 to 5, see Table I, melting point of wax 63°C)

the increase in friction with increasing mohair content mentioned above, is not due to inherent differences between the mohair and wool fibre but is probably due to the presence of matter which adversely affects the performance of the paraffin wax and which is removed during scouring. This conclusion is further supported by Fig. 4 in which the results obtained on three of the yarns which had been waxed after they had been extracted with ether, have been plotted. Once again it is evident that the friction of the extracted yarns decreased considerably after waxing and do not differ much from that of the pure wool yarn which had not been extracted.

From Figs. 1 to 3 it is also apparent that the friction of the waxed yarns was approximately independent of that of the unwaxed yarns, except in the case of the pure wool yarn which had the lowest unwaxed and waxed friction. Furthermore, the friction of the unwaxed yarns was roughly independent of the mohair content of the yarn.

If Figs. 1 to 3 are compared it would also appear as though the paraffin wax with the high melting point (63°C) generally gave more consistently low frictional values than the other two waxes used. This confirms a trend observed previously during work on pure wool yarns [15]. It was therefore decided to use only the wax with a melting point of 63°C in all subsequent experiments.

To establish whether the results obtained on yarns 1 to 5 (see Table I) applied generally, the effect of three other additives on yarn friction was investigated. In Figs. 5 and 6 the results obtained on pure mohair yarns (Nos. 6 to 8, see Table I) which had been processed with the aid of Durosil (Hansawerke), Lissapol NX (I.C.I.) and Topsol (Price) respectively, have been plotted. Although the friction of the waxed, unscoured yarns was generally lower than that obtained previously (the reasons for this will become apparent in the discussion of Fig. 7) the general trend is the same, namely the friction of the waxed yarn which had been scoured or extracted prior to waxing decreased more with addition of wax. From Fig. 6 it appears as though the yarn which had been extracted with ether and alcohol had the lowest friction after waxing. This suggests that these solvents were the most effective

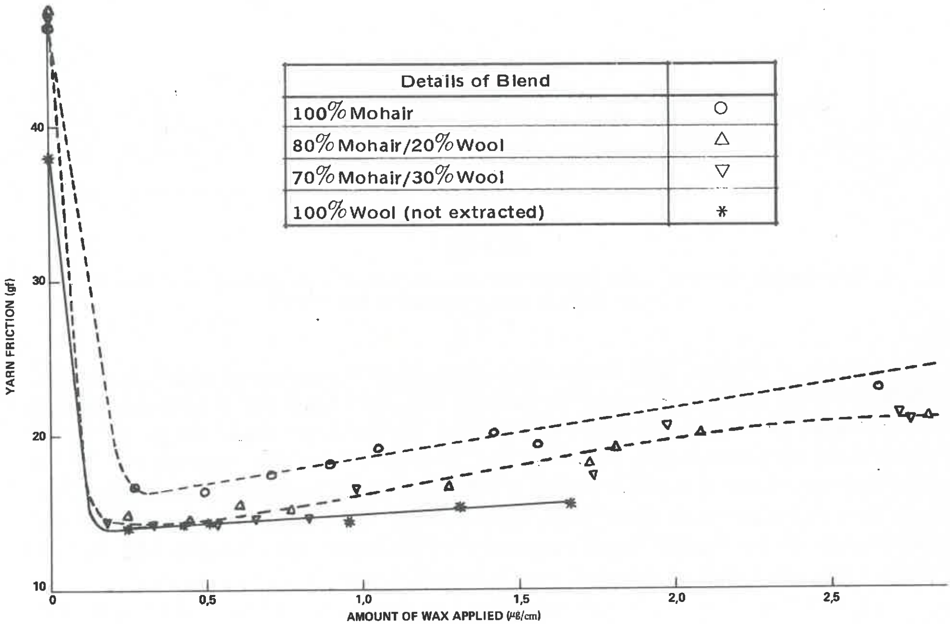

FIGURE 4

Friction of yarns extracted with ether prior to waxing vs. the amount of wax applied (yarns 1, 3 and 4, see Table I, melting point of wax 63°C)

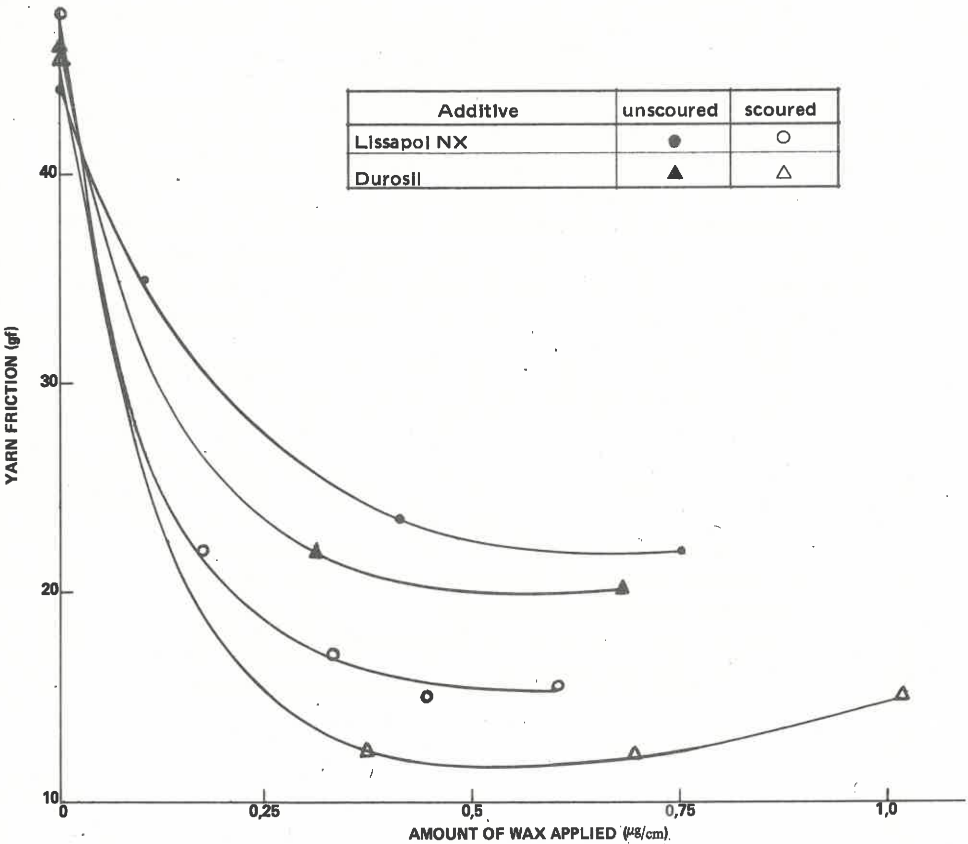

FIGURE 5

Yarn friction vs. amount of wax applied (for pure mohair yarns 6 and 7, see Table I, melting point of wax 63°C)

in removing the matter (oil, grease etc.) which adversely affected the yarn friction. Results obtained on yarn dyed with reactive dyes indicated that dyeing improved the friction of the yarns (after waxing) probably by removing some of the surface matter originally present on the yarns. The change in friction, however, varied according to the colour of the dye.

Finally, in Fig. 7 the minimum yarn friction obtained for some of the waxed yarns has been plotted against the ether extractible matter. From this figure it would appear as though the minimum yarn friction may depend upon the ether extractible matter of the yarn and may be approximately independent of the type of additive used or the fibre blend except insofar as these affected the ether extractible matter of the yarns. This matter will be treated in more detail in Part II of this investigation.

CONCLUSIONS

It was found that the friction of waxed mohair/wool blend yarns increased with increasing mohair content. By scouring or extracting the yarns with a solvent prior to waxing, the yarn friction, subsequent to waxing, could be reduced considerably and became approximately independent of the mohair content of the yarn. It was therefore suggested that it was not inherent differences between the mohair and wool fibres, as such, which influenced the yarn friction but that it was extractible matter (grease, additive applied during processing, etc.) present on the mohair which adversely affected the performance of the paraffin wax. This matter will be dealt with in more detail in Part II of this study.

The paraffin wax with the highest melting point (63°C) generally gave slightly better all round performance than the other two waxes used.

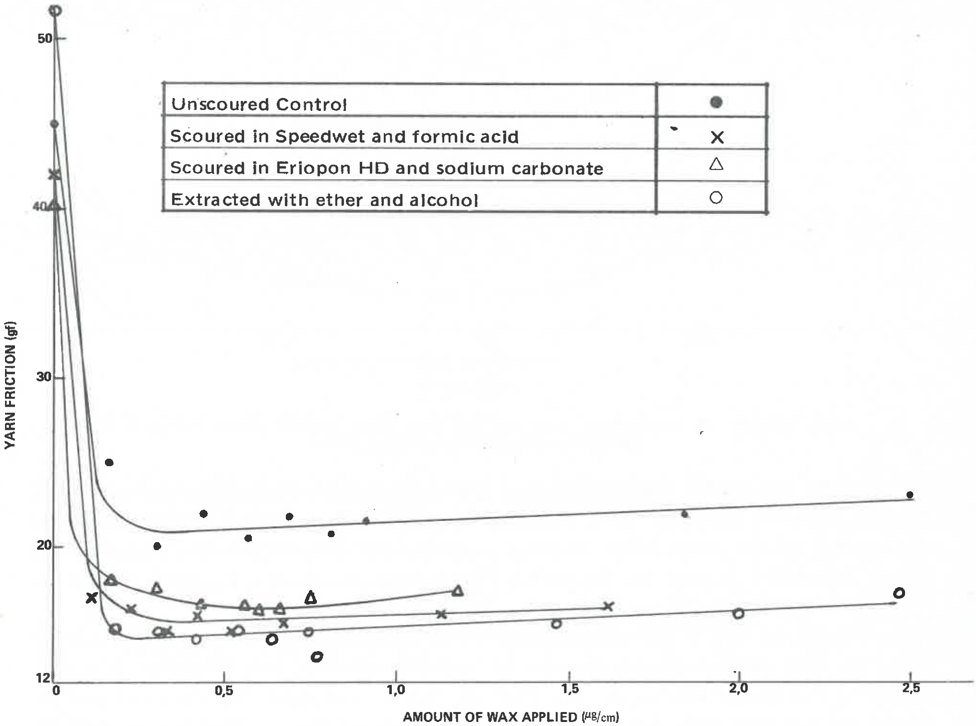

FIGURE 6

Yarn friction vs. amount of wax applied (100% mohair yarn No. 8, see Table I, melting point of wax 63°C)

Details of Blend	Leomin KP	Topsol	Durosil	Lissapol NX	Eutectal
100% Mohair	●	×	○	□	
80% Mohair/20% Wool	▲				
70% Mohair/30% Wool	▼				
100% Wool					*

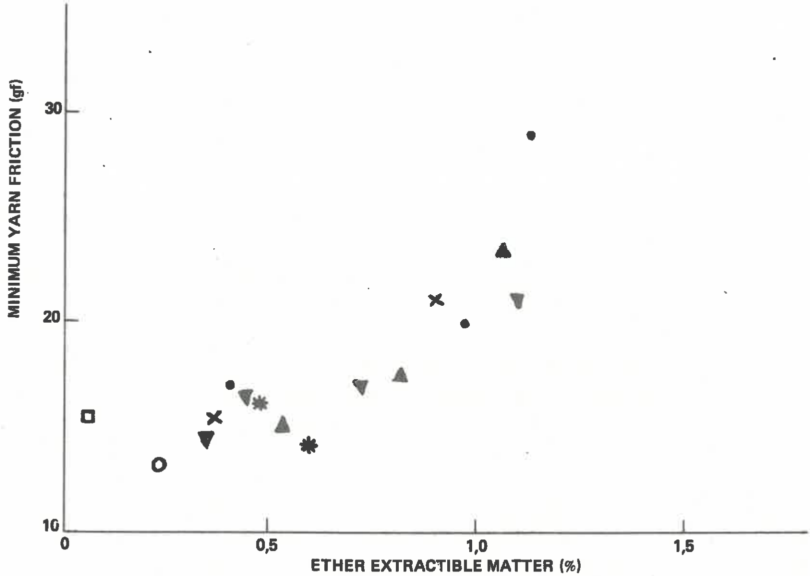

FIGURE 7

Minimum friction of waxed yarns vs. ether extractible matter prior to waxing for certain unscoured, scoured and extracted yarns (melting point of wax 63°C)

The minimum friction of the waxed yarns was found to be correlated with the ether extractible matter of the yarns (prior to waxing) but appeared to a large extent to be independent of the mohair content of the yarn or the type of processing additive except insofar as these affected the ether extractible matter of the yarns. This lent further support to the suggestion that it was actually matter present on the mohair, and not inherent differences between the mohair and wool fibres, which was responsible for the increase in yarn friction observed with increasing mohair content.

Certain processing additives gave lower frictional values, usually accompanied by lower ether extractible matter values, than others.

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THE USE OF PROPRIETARY NAMES

The use of chemicals with proprietary names in this investigation in no way implies that SAWTRI recommends their use or that there are not others as good or better.

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