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SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH INSTITUTE
OF THE CSIR

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SEASON'S GREETINGS

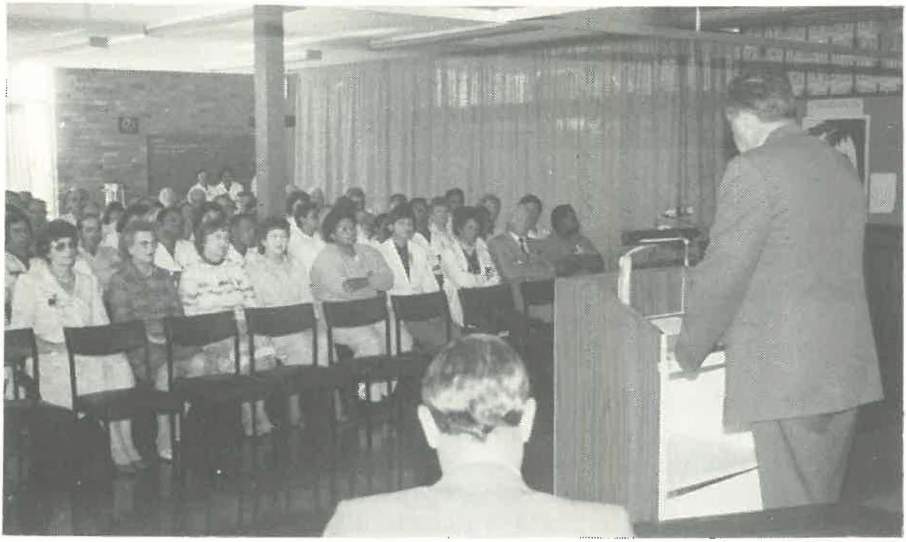
The Chief Director and Staff extend Season's Greetings and Best Wishes for 1987 to readers of the Bulletin.

INSTITUTE NEWS

Change of course for the CSIR and SAWTRI

During the past forty-one years of its existence, the environment in which the CSIR functions, has undergone major changes to the extent that a major review of its activities has become necessary. A Government White Paper on an Industrial Development Strategy for South Africa was published in May 1985 in which specific responsibilities were assigned to the CSIR regarding technology transfer and development as part of a total strategy to promote industrial development in South Africa in order to achieve the required economic growth to meet the demands of the future. This, together with cutbacks in government funding, recent international political trends and the fact that international technology development is becoming ever more competitive, acted as stimuli for review within the CSIR.

The first phase of this review has now been completed, and it has emerged that a need exists to reformulate corporate goals, strategies and tactics for the



Dr C F Garbers, President of the CSIR, addressing SAWTRI staff on the future strategy of the CSIR.

TABLE 1

THE EFFEFCT OF MOHAIR SINGLES YARN TWIST AND OIL CONTENT ON LOOP AND BRUSHED LOOP YARN PROPERTIES

OIL CONTENT OF MOHAIR (%)	MOHAIR YARN TWIST (turns/m)	FAULTS PER UNIT LENGTH		FIBRE LOSS DUE TO BRUSHING (%)
		Loop Yarn	Brushed Yarn	
0,7	200	28	4	2,7
	250	33	11	3,2
	300	52	33	3,2
	350	57	89	3,0
	400	53	141	2,6
1,7	200	21	6	2,7
	250	29	14	2,8
	300	38	27	3,2
	350	48	112	3,3
	400	50	170	2,4
3,0	200	20	7	2,6
	250	28	17	2,6
	300	46	36	3,0
	350	44	97	2,7
	400	57	165	2,1

spun to Z200 turns/m containing 0,7% and also approximately 3% oil content.

In the second experiment the results on these yarns are shown in Table 2.

Loop yarns:

The folding twist levels in the first and second operations affected the number of loops per unit length, there being a 40 — 50% increase in the number of loops inserted at S500 turns/m compared with S400 turns/m . Fig 2 shows that the loops in the yarns folded to S500/Z200 were also smaller than those folded to S400/Z100. The number of loop faults was substantially increased with higher levels of twist at the first folding operation. There was, however, a reduction in the number of loop faults, with higher levels of twist at the second folding operation. In general, the number of faults in loop yarns containing mohair having an oil content of 3,0% was lower than the equivalent yarns containing 0,7% oil.

The mohair singles yarn spun to Z200 turns/m containing 3,0% oil and

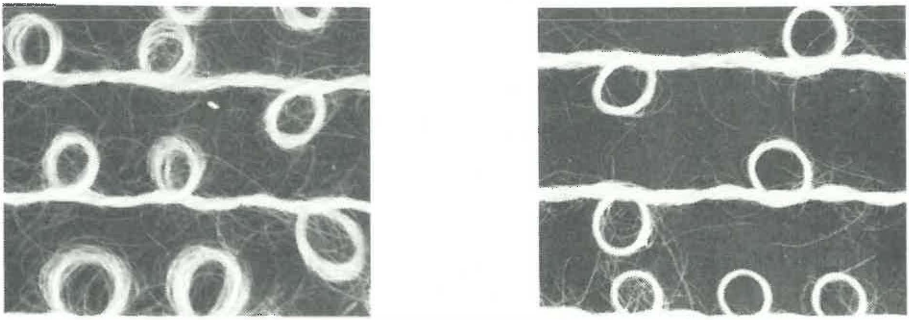
TABLE 2

THE EFFECT OF DIFFERENT FOLDING TWIST LEVELS, OIL CONTENT AND DYEING ON LOOP AND BRUSHED LOOP YARN PROPERTIES

FOLDING TWIST (turns/m)		UNTREATED					SCOURED AND DYED				
		Loop Yarn			Brushed Yarn		Loop Yarn			Brushed Yarn	
1st Operation (S)	2nd Operation (Z)	Oil Content (%)	Loops per Unit Length	Faults per Unit Length	Faults per Unit Length	Fibre Loss (%)	Oil Content (%)	Loops per Unit Length	Faults per Unit Length	Faults per Unit Length	Fibre Loss (%)
400	100	0,7	451	13	19	3,0	0,6	485	9	15	4,5
		3,0	450	7	22	3,7	0,8	461	1	9	4,6
	150	0,7	461	6	18	2,1	0,6	484	3	15	4,5
		3,0	513	2	16	2,4	0,8	518	0	16	4,2
	200	0,7	484	4	8	3,3	0,6	476	0	9	5,0
		3,0	518	1	12	3,0	0,8	483	0	24	4,2
450	100	0,7	542	35	1	3,2	0,6	556	28	8	7,3
		3,0	487	30	6	3;0	0,8	527	23	4	10,1
	150	0,7	548	26	0	2,4	0,6	566	10	3	4,6
		3,0	538	23	3	2,0	0,8	548	11	3	4,9
	200	0,7	591	18	6	1,8	0,6	599	7	4	3,7
		3,0	595	13	7	0,8	0,8	582	10	5	4,5
500	100	0,7	670	66	6	1,5	0,6	683	59	6	5,3
		3,0	688	59	8	1,0	0,8	676	44	9	5,8
	150	0,7	711	43	5	1,0	0,6	721	41	2	4,7
		3,0	717	38	7	1,3	0,8	716	34	0	4,6
	200	0,7	720	50	10	2,0	0,6	726	46	1	4,2
		3,0	727	41	8	1,2	0,8	709	32	4	4,1

Figure 1

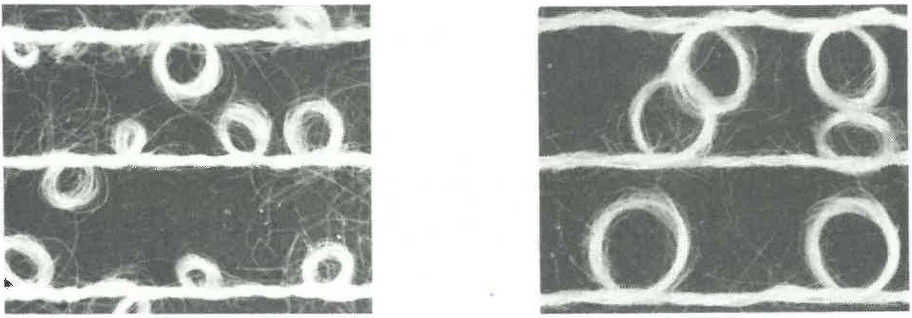
Effect of singles mohair twist levels on loop appearance



120 tex Z200 **120 tex Z400**

Figure 2

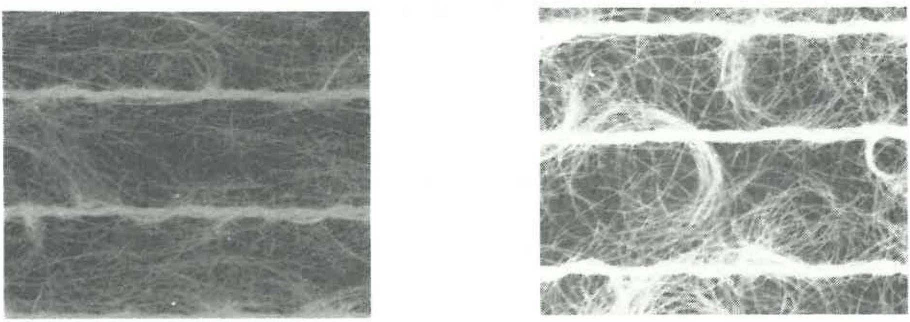
Effect of folding twist levels on loop appearance



S500/Z200 **S400/Z100**

Figure 3

Effect of hank-dyeing the loop yarn



Undyed loop yarn (brushed) **Hank-dyed loop yarn (brushed)**

folded to S400/Z200 turns/m was considered to be the most acceptable loop yarn in terms of the number of faults and also loop regularity, in both untreated and hank-dyed form.

Brushed loop yarns:

The untreated and hank-dyed loop yarns folded to S400 turns/m and subsequently brushed had the highest number of faults. The untreated yarns (S450 turns/m) had the lowest number of faults. There was no obvious advantage having a high oil content in the mohair yarn component of the untreated brushed loop yarn.

The untreated yarn containing mohair having an oil content of 0,7% and folded to S450/Z150 turns/m had the lowest number of brushed loop yarn faults. This yarn also produced the most uniform brushing of the mohair fibres — see Fig. 3.

Hank-dyeing

All 18 lots of loop yarns were hank-dyed and rewound satisfactorily. There were fewer loop faults per unit length after dyeing.

Although the hank-dyed loop yarns were brushed without problems, Fig. 3 shows that the mohair fibres tended to curl and reorientate to the contour of the unbroken loops. Fibre loss after brushing was higher than the untreated brushed loop yarns.

SUMMARY AND CONCLUSIONS

South African dry-combed mohair tops having a mean fibre diameter of 37 μm and a mean fibre length of 100 mm were selected for processing into loop and brushed loop yarns. A 120 tex mohair yarn containing 0,7% oil was spun to a range of single twist levels. Each lot was divided into three sub lots, two of which were lubricated during winding to give an oil content of 1,7% and 3%, respectively. The mohair yarns were then folded with wool/nylon yarns into a loop yarn construction, having yarn linear densities in the region of 400 tex.

The optimum singles mohair yarn twist level was determined and used to produce further yarns containing 0,7% and 3% oil content respectively. These yarns were then folded into loop yarns to a range of twist levels at the first and also the second folding operations. Half of each lot of loop yarns was hank-dyed. Dyed and untreated loop yarns were then brushed using 6 wraps on a yarn brushing machine.

The amount of twist in the single 120 tex mohair yarn influenced the properties of the resultant loop and brushed loop yarns. The optimum twist level was found to be S200 turns/m . The amount of folding twist determined the number of loops inserted per unit length and the size of the mohair loop.

The number of loop faults increased with higher levels of twist at the first folding operation and decreased with higher twist levels at the second folding operation. Loop yarns containing mohair having a high oil content had fewer loop faults.

The untreated loop yarns which were folded to S450 turns/m had the lowest number of brushed loop faults. In general brushed loop yarns containing a low oil content had fewer faults and there appeared to be no advantage in the singles mohair yarns component having a high oil content. Loop yarns which had been hank-dyed and then brushed had a relatively high fibre loss and the mohair fibres tended to curl.

The optimum loop yarn, both in untreated and hank-dyed form, was obtained by folding the 120 tex Z200 mohair yarn containing 3,0% oil to S400/Z200 turns/m . Singles mohair yarns containing 0,7% oil and folded to S450/Z150 turns/m produced the optimum brushed loop yarn. Where a dyed brushed loop yarn is required, the components should preferably be dyed prior to folding.

ACKNOWLEDGEMENTS

The authors thank Mr S.G. Marsland for spinning the yarns. The permission of the Mohair Board to publish these results is gratefully acknowledged.

THE USE OF PROPRIETARY NAMES

The names of proprietary products where they appear in this report are mentioned for information only. This does not imply that SAWTRI recommends them to the exclusion of similar products.

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WOOLLEN SPUN WRAP YARNS
PART I: THE EFFECT OF WRAPPER FILAMENT LINEAR DENSITY ON SOME WOOLLEN SPUN WRAP YARN AND FABRIC PROPERTIES

by

A G BRYDON and J P VAN DER MERWE

ABSTRACT

The effects of wrapper filament linear density on some properties of woollen spun wrap yarns and the properties of the plain fabrics knitted from these yarns were investigated. Five different filament linear densities were used and a ring spun yarn was produced for the purpose of comparison. It was found that an increase in filament linear density resulted in higher yarn strength, increased elasticity, improved fabric abrasion resistance and greater bursting strength. Fabrics produced from wrap yarns were superior to fabrics produced from the ring yarn in respect of abrasion resistance, bursting strength, air permeability, and stitch clarity.

INTRODUCTION

A method of yarn manufacture whereby woollen spun wrap yarns can be produced by means of hollow spindles fitted directly to the condenser of a woollen card, has recently been developed by SAWTRI[1-2]. This method of yarn formation has attracted considerable interest both locally and abroad[3] and work is currently being undertaken, in conjunction with industry, to assess the commercial viability of such a system, as well as to fully investigate both yarn and fabric properties. Some of this work was recently outlined by Van der Merwe[4]. In this report, the effects of filament linear density on certain yarn and plain knitted fabric properties are discussed, relating specifically to woollen spun wrap yarns produced directly on a woollen card.

EXPERIMENTAL

Raw Materials

A blend of wool fibres, 24,6 μm in diameter and 52,5 mm in mean fibre length was used to produce the various yarns.

Spinning

Woollen spun wrap yarns were produced by passing 130 tex slubbings through hollow spindles fitted between the rubbing aprons and the take-up drums of the condenser of a woollen card, in a manner previously described[1-3,5]. The following five flat polyamide filament yarns were used as wrappers: 17 dtex f5; 22 dtex f5; 33 dtex f10; 44 dtex f13 and 78 dtex f20.

All the yarns were wrapped at a wrapping density of 175 wraps per metre. A ring spun yarn of 130 dtex Z175 was spun from 173 tex slubbings on a Platt MWR4 ring spinning frame, for the purpose of comparison. The direction of twist was the same as the direction of wrapping in the wrap yarns. The spindle speed was 4 000 rev/min and the false twister speed was set at 2 000 rev/min.

Knitting

Plain single jersey fabric samples were knitted from each individual yarn lot on an 8 gauge Dubied MF5 flat bed knitting machine. The fabric pieces were knitted to a M.T.F. of 10.

Fabric finishing

Knitted fabric samples were cut to approximately 1 metre lengths. The samples were folded in half, face to face and linked at the sides.

TABLE 1

PHYSICAL PROPERTIES OF THE VARIOUS WRAP YARNS

Filament Linear Density and Type		17 dtex PA	22 dtex PA	33 dtex PA	44 dtex PA	78 dtex PA	RING YARN
Breaking Strength	cN	257	312	384	442	680	342
	CV%	13	16	8	10	13	19
Tenacity	(cN/tex)	2,0	2,4	3,0	3,4	5,2	2,6
Extension	(%)	14,7	17,6	19,8	23,0	21,9	8,5
Irregularity	(CV%)	13,2	14,4	13,3	13,3	13,5	14,7
Thin Places	(per 1 000m)	16	80	24	16	16	14
Thick Places	(per 1 000m)	16	8	0	0	96	4
Neps	(per 1 000m)	0	0	0	0	8	24
Hairs	(hairs/m)	11	13	13	18	16	38

The fabric samples were then milled in a Pegg side paddle machine for 20 minutes at 40°C in a bath containing 1 g/ℓ ®Ultravon HD (Ciba-Geigy). Upon completion of the milling cycle, the fabrics were rinsed at 40°C for 5 minutes followed by a final rinse for 5 minutes at room temperature. The fabrics were subsequently hydro-extracted and tumble dried for 20 min.

Yarn and fabric testing

Various yarn and fabric properties were measured, employing standard test methods.

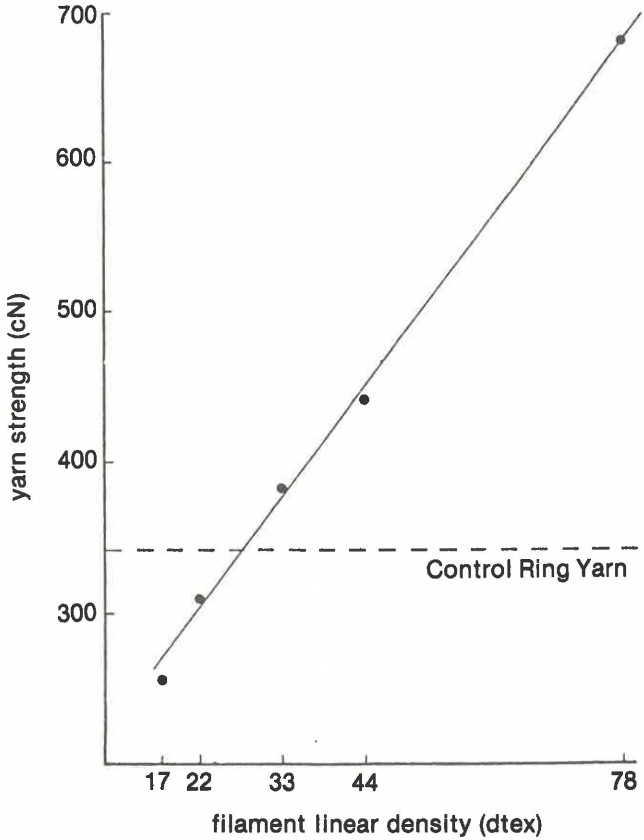

Fig. 1:

EFFECT OF WRAPPER FILAMENT LINEAR DENSITY ON YARN STRENGTH.

RESULTS AND DISCUSSION

Effect of wrapper filament linear density on yarn properties

Table 1 shows that yarn strength increased as filament linear density increased, the relationship being linear (Fig. 1).

Those yarns having a wrapper of 33 dtex or higher, were stronger than the ring spun yarn. Yarn extension increased with an increase in filament linear density and all wrap yarns were more extensible than the ring spun yarn (Fig. 2). Yarn irregularity and imperfections did not change consistently with changes in wrapper filament linear density. Yarn hairiness increased slightly as filament linear density increased, and all wrap yarns were considerably less hairy than the ring yarn.

Effect of wrapper filament linear density on plain knitted fabric properties

The results obtained for the properties of the knitted fabrics are given in Table 2. Increases in filament linear density resulted in a reduction in percentage mass loss during Martindale abrasion. This became more apparent as the number of test cycles increased (Fig. 3). Fabrics produced from wrap yarns were more resistant to abrasion than the fabric produced from the ring

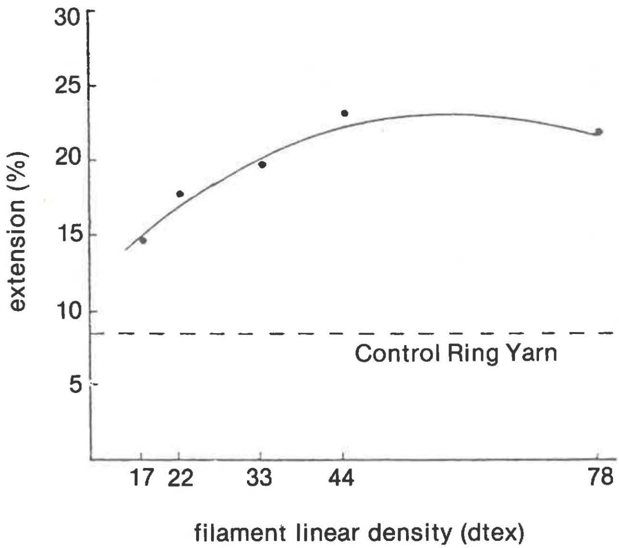

Fig. 2:
EFFECT OF WRAPPER FILAMENT LINEAR DENSITY ON YARN EXTENSION.

TABLE 2

PHYSICAL PROPERTIES OF PLAIN KNITTED FABRICS

Filament Linear Density and Type	17 dtex PA	22 dtex PA	33 dtex PA	44 dtex PA	78 dtex PA	RING YARN
Fabric Mass (g/m^2)	260	271	269	260	275	248
Fabric Thickness (mm)	2,8	2,8	2,8	2,6	2,7	2,6
Air Permeability ($m\ell/s/cm^3$ Pa) (2 layers)	85	80	84	84	82	91
Pilling 2 000 cycles	2,8	2,7	2,7	2,7	2,8	2,9
Bursting Strength (kN/m^2)	522	535	530	535	616	477
Felting Shrinkage (%)	27,5	30,2	26,9	33,7	24,2	32,6
Total Synthetic Content (%)	1,73	2,67	3,2	3,87	7,6	—

spun yarn. There was no significant difference in air permeability between fabrics containing filaments of different linear densities, although the fabrics produced from wrap yarns were less air permeable than the fabric produced from the ring spun yarn, thus suggesting that the wrap yarns obtained a higher degree of cover in knitted form than did the ring yarn. Fabric bursting strength increased as filament linear density increased (Fig. 4) and the fabrics produced from wrap yarns gave a higher bursting strength than the fabric produced from the ring yarn.

Individual values of specific volume decreased as filament linear density increased. This means that the wrap yarn fabrics became less bulky as filament linear density increased. No consistent trends were noted relating to pilling propensity or area shrinkage.

A visual assessment of the knitted fabrics showed that, in comparison to

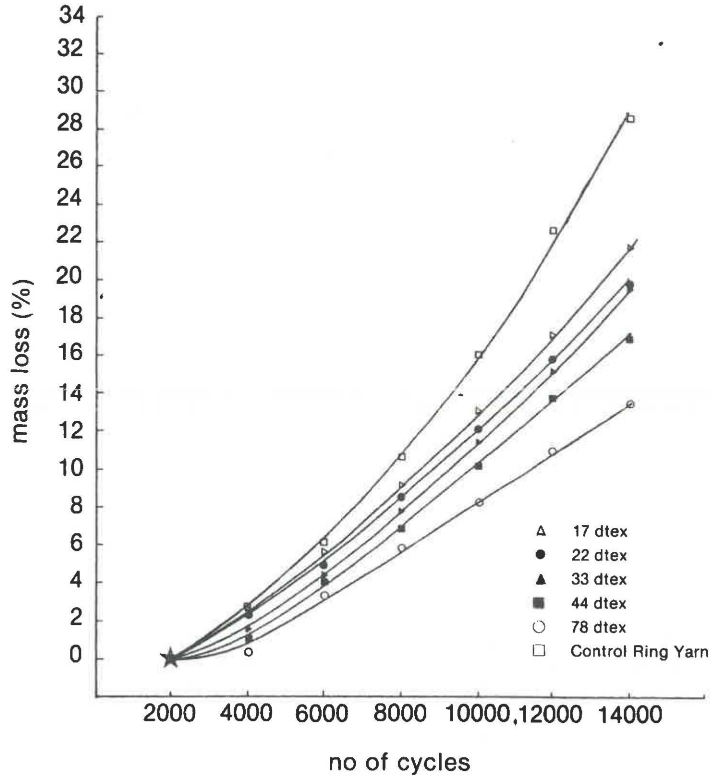

Fig. 3:
EFFECT OF FILAMENT LINEAR DENSITY ON ABRASION RESISTANCE OF PLAIN KNITTED FABRICS.

the ring yarn, the wrap yarns obtained a more uniform loop formation. In addition, it was found that only the fabric containing the 78 dtex filament had more than 5% total synthetic fibre content. Thus most of the wrap yarn fabrics would qualify for the Woolmark label.

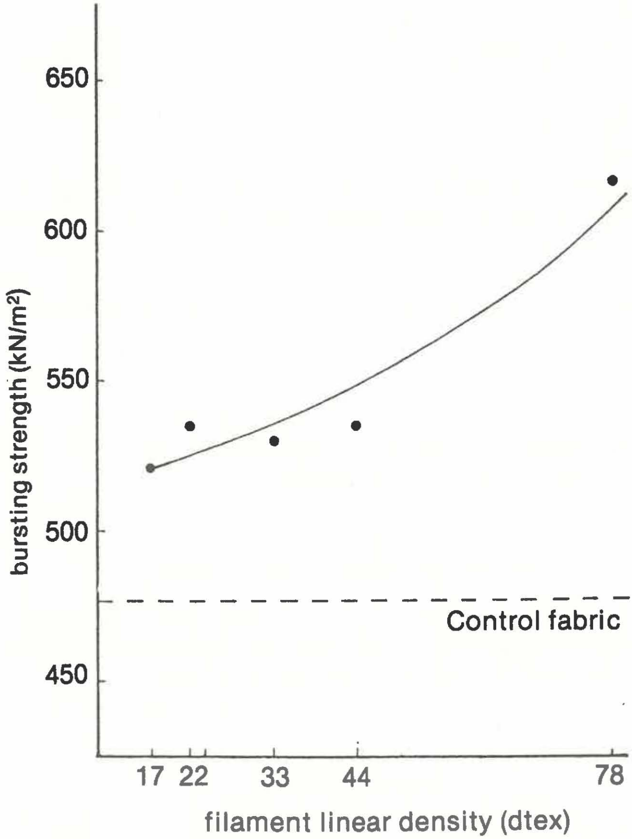

Fig. 4:
EFFECT OF FILAMENT LINEAR DENSITY ON BURSTING STRENGTH OF PLAIN KNITTED FABRICS.

SUMMARY AND CONCLUSIONS

The effect of wrapper filament linear density on some yarn and plain knitted fabric properties has been investigated. Woollen spun wrap yarns were produced directly on a woollen card by fitting hollow spindles to its delivery end. Five different flat polyamide filaments were used as wrapper yarns and a woollen spun ring yarn was produced for the purpose of comparison.

Changes in filament linear density had no apparent effect on yarn irregularity, imperfections, fabric pilling propensity, air permeability or percentage area shrinkage. Yarn strength and yarn extension increased as filament linear density increased, whilst yarn hairiness increased only slightly. An increase in filament linear density resulted in a higher fabric bursting strength and improved resistance to abrasion, although bulkiness decreased. Most fabrics produced from wrap yarns contained less than 5% total synthetic content and would thus qualify for the Woolmark. The wrap yarns were considerably stronger, less hairy and had a higher extension than the ring yarn whilst the fabrics produced from these wrap yarns gave a higher bursting strength, were more resistance to abrasion, more bulky and less air permeable than the fabric produced from the ring yarn. The wrap yarns appeared to obtain a more uniform loop formation in knitted form, than did the ring yarn.

ACKNOWLEDGEMENTS

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USE OF PROPRIETARY NAMES

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