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EFFECT OF VARIOUS SHRINK-RESIST TREATMENTS ON FABRICS KNITTED FROM REPCO WRAPPED CORE-SPUN WOOL YARNS

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ABSTRACT

Repco wrapped core-spun (RWCS) and Repco wrapped spun (RWS) wool yarns, having textured nylon or polyester as the filament component were spun to a range of yarn linear densities from three lots of tops (1) polymer treated tops pretreated by the conventional sodium hypochlorite/sulphuric acid process, (2) the new SAWTRI gaseous chlorine process and (3) untreated. The yarns knitted satisfactorily, direct from the spinner's package into medium and fine gauge double jersey fabrics. After dyeing, the untreated *fabrics were shrink-resist treated in fabric form.*

It was concluded that RWCS yarns as fine as 16 tex and also RWS yarns could be spun from shrink-resist treated tops at a speed of 220 m/min and knitted on medium and fine gauge double jersey machines at commercial speeds, producing fabrics with good handle and physical properties.

INTRODUCTION

The production of Repco wrapped core-spun (RWCS) and Repco wrapped spun (RWS) yarns and their use in knitwear, has been reported previously[1—8]. This report deals with the knitting performance and yarn and fabric physical properties of RWCS and RWS yarns spun from untreated and also shrink-resist treated wool tops and knitted on fine (28 gg) and medium (18 gg) double jersey machines. After dyeing, the untreated fabrics were shrink-resist treated.

EXPERIMENTAL

Raw materials

Untreated tops, polymer treated tops pretreated by the conventional sodium hypochlorite/sulphuric acid process and the SAWTRI gaseous chlorine process, having a mean fibre diameter of 20,8 μm and a mean fibre length of 62 mm were selected.

Spinning

Each of the three wool lots was spun on a modified Repco Mk1 spinning machine to nominal yarn linear densities of 16, 18, 24 and 28 tex using either

TABLE I
SPINNING AND YARN DETAILS

Yarn Lot No.	Shrink-resist treatment of top	Yarn type (ST)	Nominal yarn linear density (tex)	Actual yarn linear density (tex)	Composition (%)				Roving linear density (tex)	Spinning draft
					Wool	Nylon (20dtex f7)	Polyester (33dtex f15)	Polyester (55dtex x f24)		
1	Untreated	RWCS	16	15,6	74	26	—	—	250	20,8
2		RWCS	18	17,6	62	—	38	—	250	22,0
3		RWCS	24	23,3	53	—	—	47	250	20,3
4		RWS	28	27,3	80	—	—	20	400	17,6
5	Sodium hypo-	RWCS	16	15,1	74	26	—	—	250	20,8
6	chlorite/sulphuric	RWCS	18	17,0	61	—	39	—	250	22,0
7	acid +	RWCS	24	22,8	52	—	—	48	250	20,3
8	® Hercosett	RWS	28	27,4	80	—	—	20	400	17,6
9	SAWTRI	RWCS	16	15,1	74	26	—	—	250	20,8
10	gaseous chlorine	RWCS	18	16,2	59	—	41	—	250	22,0
11	® Hercosett	RWCS	24	24,0	54	—	—	46	250	20,3
12		RWS	28	26,9	80	—	—	20	400	17,6

the RWCS or RWS technique. Three types of continuous filament (textured) yarns namely 20 dtex f7 (nylon), 33 dtex f15 and also 55 dtex f24 (polyester) respectively were used as the filament yarn components. Each yarn was spun at normal roller loading and a front roller delivery speed of 220 m/min, then wound directly on the Repco spinner onto cheese type packages. Approximately 15 kg of each yarn lot was spun. Details of the wool roving linear density, spinning draft and composition of each yarn are given in Table I.

Knitting

The yarns were knitted directly from the spinner's package without clearing or waxing. The 16 and 18 tex yarns were knitted into interlock fabric on a 28 gg Jumberca 4TJ double jersey machine. The 24 and 28 tex yarns were knitted into Punto-di-Roma fabric on an 18 gg Wildt Mellor Bromley 8 RD double jersey machine. Both machines were equipped with trip-tape positive yarn feed. The yarns were knitted at a machine tightness factor (MTF) of 13,9 and a dial height of 1,4 mm . Approximately 25 metres of fabric were knitted from each lot of yarn.

Dyeing and Finishing

The fabrics were winch scoured at 40°C for 20 mins, rinsed and dyed at 98°C, dried at 100°C and heat set at 160°C. Fabrics containing nylon were dyed to solid shades. In the case of fabrics containing polyester, only the wool component was dyed.

Fabrics 1 to 4 (Table II) containing untreated wools were each divided into two parts and one part from each fabric was shrink-resist treated by padding at a wet pick up of 80% in a solution containing:

1,0% ® Synthappret BAP } o.m.f.
1,0% ® Impranil DLN }
2,9 g/ℓ ® Tergitol TMN-6
5,0 g/ℓ sodium bicarbonate
20 g/ℓ ® Persoftal SWA.

For convenience, the application level was kept constant for each of the four fabrics and this process was followed by drying at 100°C and curing at 140°C for 3 mins. The fabrics were scoured at 40°C for 15 mins, rinsed and dried at 100°C. These four fabrics were then numbered 13—16.

All 16 fabrics were subsequently steamed and decatised.

Physical tests

The physical properties of yarns and finished fabrics are given in Tables II and III, respectively. The fabrics were subjectively graded for handle and appearance.

TABLE II
FINISHED FABRIC PROPERTIES

Fabric Lot No	Knitted structure	Wool content (%)	Mass (g/m^2)	Bursting Strength (kN/m^2)	Martindale		Drape** Coefficient (%)	ICI* snagging rating (after 600 cycles)	AREA SHRINKAGE %	
					Mass loss (after 10 000 cycles) (%)	Pill* rating (after 2 000 cycles)			(IWS TM186)	(IWS TM185)
1	Interlock	74	251	839	4,5	3,0	39,7	4,9	7,4	26,9
2	Interlock	62	255	1090	1,9	4,8	32,5	4,2	0,7	9,6
3	Punto-di-Roma	53	244	1029	1,9	3,3	42,0	3,3	8,3	31,5
4	Punto-di-Roma	80	296	937	5,3	3,0	43,6	2,8	18,3	40,5
5	Interlock	74	254	883	3,9	2,8	38,1	4,5	3,1	2,8
6	Interlock	61	276	988	1,2	3,5	47,7	4,3	−0,5	1,8
7	Punto-di-Roma	52	255	1143	1,2	3,3	53,0	3,0	2,9	2,3
8	Punto-di-Roma	80	295	981	5,6	2,6	44,6	2,6	6,0	1,3
9	Interlock	74	259	863	4,7	3,3	41,9	4,4	4,2	2,1
10	Interlock	59	281	980	2,3	3,7	39,3	5,0	0,7	2,0
11	Punto-di-Roma	54	282	1142	1,0	3,3	51,2	2,9	2,9	1,8
12	Punto-di-Roma	80	301	977	5,5	2,4	39,3	4,6	7,9	1,4
13	Interlock	74	251	842	2,2	5,0	39,1	4,5	4,0	2,7
14	Interlock	62	253	1002	0,7	5,0	41,4	4,5	1,7	1,6
15	Punto-di-Roma	53	237	1126	0,2	5,0	50,6	3,1	3,4	1,8
16	Punto-di-Roma	80	299	934	2,0	4,8	49,6	3,0	6,0	5,9

* 5 = Good
1 = Poor

** = 24 cm dia. disc

TABLE III
YARN PHYSICAL PROPERTIES

Yarn Lot No	Yarn linear density (tex)	Breaking strength (cN)	Tenacity (cN/tex)	Extension (%)	Irregularity (CV%)	Thin places (per 1000 m)	Thick places (per 1000 m)	Neps (per 1000 m)	Hairiness (hairs/ m)	Friction (cN)
1	15,6	202	13,4	23,9	22,8	662	487	195	18	33-35
2	17,6	285	16,2	26,0	21,7	469	370	207	14	30-31
3	23,3	406	17,4	30,7	19,1	100	148	76	14	31-33
4	27,3	230	8,4	28,2	19,0	169	108	20	20	38-40
5	15,1	204	13,5	26,5	22,9	690	514	229	20	22-24
6	17,0	282	16,6	25,0	22,5	569	483	283	17	26-27
7	22,8	432	19,0	29,8	18,6	124	120	108	17	24-26
8	27,4	218	8,0	28,2	18,8	154	109	39	18	24-26
9	15,1	204	13,5	27,7	22,7	535	413	143	23	25-27
10	16,2	279	17,2	26,0	21,8	416	360	166	18	22-24
11	24,0	450	18,8	28,9	18,1	75	84	60	20	28-30
12	26,9	226	8,4	28,2	18,6	112	83	44	24	26-28

RESULTS AND DISCUSSION

Yarn properties

Table II shows, as expected, that the 16 and 18 tex yarns were more irregular and contained more thick and thin places and neps than the 24 and 28 tex yarns. In general, the yarns spun from SAWTRI shrink-resist treated wool tops (9—12) were more even and had fewer thick and thin places and neps than the other yarns. Tenacities of the RWS yarns were lower than the RWCS yarns, but there was little difference in the yarn extension values.

Knitting Performance

All the yarns knitted without difficulty. Fly build up was low and had no adverse effect on the knitting performance.

Fabric Properties

The appearance of the various fabrics produced was highly acceptable. The drape values given in Table II show that the various shrink-resist treatments did not markedly affect the stiffness of the fabrics. Fabrics shrink-resist treated in fabric form had the highest resistance to abrasion and pilling. The fabrics containing shrink-resist treated wools had low area shrinkages (IWS-TM185), with the exception of fabric No. 16 which was shrink-resist treated in fabric form and had the highest wool content (80%). The shrinkage of this fabric could be improved by increasing the polymer concentration.

Fabrics produced from similar types of yarns but differing in the shrink-resist process applied, were compared in terms of handle by subjective assessment. Of 12 assessors, 10 graded all the fabrics which had been shrink-resist treated in fabric form as having the harshest handle. The assessors appeared to have difficulty grading the other three fabrics in each group and it was therefore concluded that there was no significant difference in handle between those fabrics containing wools which had been shrink-resist treated in top form and the untreated fabrics.

SUMMARY AND CONCLUSIONS

Repco wrapped core-spun (RWCS) yarns and Repco wrapped spun (RWS) yarns incorporating textured filament yarns were spun to nominal linear densities of 16, 18, 24 and 28 tex from untreated tops, polymer treated tops pretreated by the conventional sodium hypochlorite/sulphuric acid process and also the new SAWTRI gaseous chlorine process. The yarns were knitted directly from the spinner's packages into medium and fine gauge double jersey fabrics, which were then dyed and finished. Each of the dyed fabrics containing untreated wools, was halved and one half shrink-resist treated using ®Synthappret BAP — ®Impranil DLN. The yarns and finished fabrics were tested for their physical properties.

In general, yarns spun from SAWTRI shrink-resist treated wool tops had fewer thin and thick places and neps than the other yarns. The appearance and physical properties of all the fabrics were considered to be acceptable. The fabrics which were shrink-resist treated in fabric form had the highest resistance to pilling and abrasion.

In terms of handle, the fabrics knitted from yarns spun from untreated and also shrink-resist treated wool tops were preferred to the fabrics shrink-resist treated in fabric form.

It was concluded that using shrink-resist treated wool tops, RWCS yarns as fine as 16 tex and also RWS yarns could be spun at a speed of 220m/min and knitted on fine and medium gauge double jersey machines, producing fabrics with good handle and physical properties.

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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 other similar products.

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Fig. 1: 28gg/Interlock Fabric (74% Wool/26% Nylon) knitted from 16 Tex RWCS yarn spun from shrink-resist treated wool tops.