

Investigation of Effective Use of Cotton Yarn in Knitting

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ABSTRACT

The article represent the results of researching opportunities to use a cotton yarn with a Lycra yarn instead of filament in the knitwear producing. For this investigation were knitted most common knitted stitches: plain (supreme), rib (ribana) and interlock using synthetic polyester yarns, cotton yarns and cotton yarns adding a Lycra thread.

KEYWORDS: *cotton, polyester, Lycra, knitted fabric, hygienic properties*

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Currently, products with the trademark "Made in Uzbekistan" are exported to more than 65 countries, including the EU, CIS and Latin American countries, the Republic of Korea, China, Singapore, Iran, Israel, the United States and others.

Over the past year, new markets have been developed - Pakistan, Georgia, Croatia, Nigeria and several others. In order to expand the range of products export, the enterprises of «Uztextileindustry» Association take an active part in international fairs in Germany, the Republic of Korea, China, Russia, Belarus, Latvia and other countries.

Today, the industry has become one of the leading places in the domestic real sector of the economy. The introduction of new production technologies, the using of high-performance modern equipment in combination with effective management ensure high labor productivity in the textile industry enterprises, an increase in the volume of industrial production and improving the quality of products [1].

In order to improve the form stability of knitwear, synthetic threads are often used in its knitting. Knitwear made from synthetic yarn have good form

stability. However, its hygienic properties are significantly worse than those of natural yarn types. Special requirements for textile materials, conditioned by specific climatic conditions, make the high hygienic properties of cotton irreplaceable, and lightness and beauty contribute to the constant demand for products from it. Clothing made from synthetic yarn is not suitable for children's range, for people suffering from allergies or skin diseases. Also, clothes made from synthetic yarn do not meet consumer requirements for use in hot climates. Even in mixed yarn, the share of synthetic fibers is at least 15%, and most often it reaches 50%.

In recent years, especially increased consumer interest in textiles with high hygienic properties, related to the category of "Natural", "Ecologically clean", "Hypo allergenic." The jerseys are made of cotton yarn have good hygienic properties and the attractive price to consumers.

The Republic annually produces cotton fiber. Deep processing of local raw materials makes it possible to obtain textiles with high hygienic properties at an

affordable price. However, knitwear from cotton yarn with all the advantages of low mold resistance.

In order to increase the dimensional stability of knitted, keeping it hygienic properties, research opportunities to use a cotton yarn with a Lycra yarn instead of filament in the producing of knitwear, developed knitted most common knitted stitches: plain (supreme), rib (ribana) and interlock using synthetic polyester yarns, cotton yarns and cotton yarns adding a lycra thread.

It is known that lycra thread has unsurpassed elastic properties.

The advantage of using, instead of lycra yarn filament as polyester, that the Lycra yarn is very thin and its content in the knitwear does not exceed 5%. Furthermore, when used together with a Lycra yarn cotton yarn due to the structural features of Lycra thread as it rolls in cotton yarn and the finished web is not peeking at the web surface. This means that the synthetic lycra thread will not come into contact with the body when it is worn [2-3].

Experimental samples were obtained on the PROTTI-242 (Italy) flat knitting machine of 14 class. The raw materials used polyester yarn linear density 16,7teks (300 denier) x 4, cotton yarn linear density of 20 tex x 3, and cotton yarn linear density of 20 tex x 3 with the addition of Lycra yarn 7.8 tex (70 denier).

I-III variants are produced by interlacing the smooth surface - one of the most common knitted fabrics in knitted fabrics. In this case, the I-variant is made of cotton yarn, the II-variant is made of polyester yarn with a linear density of 33 tex x 2, the III variant is made of cotton yarn with a linear density of 20 tex x 3 together with a lycra yarn with a linear density of 7.8 tex.

IV-VI variants are worked out by interlacing the eraser - the most common in knitwear production is a

double weave. The IV variant is made of cotton yarn, the V-variant is made of polyester yarn with a linear density of 33 tex x 2, the VI variant is made of cotton yarn with a linear density of 20 tex x 3 together with a lycra yarn with a linear density of 7.8 tex.

VII-IX variants are developed by interlacing, imitating interlock, which is also very wide in knitting production. The VII variant is made of cotton yarn, the VIII variant is made of polyester yarn with a linear density of 33 tex x 2, the IX variant is made of cotton yarn with a linear density of 20 tex x 3 together with a lycra yarn with a linear density of 7.8 tex.

The purpose of the study is to analyze the possibility of applying cotton yarn together with lycra yarn instead of synthetic polyester yarn. For this, it is necessary to compare the technological parameters and the physical and mechanical properties of knitted fabrics made from cotton yarn, polyester yarn and cotton yarn together with lycra thread. When developing experimental samples for more objective comparison, a yarn of approximately equal linear density approximating 60 tex was used.

Technological parameters and physical and mechanical properties of the knitwear samples studied are determined by experimental methods in the accredited certification laboratory at TITLI CENTEX UZ, the results of measurements are given in Table 1.

On the basis of the analysis of technological parameters, it should be noted that the loop pitch in samples made of polyester yarn and cotton yarn has similar values, and in samples made of cotton yarn together with lycra thread the hinge pitch decreases, and consequently the density increases horizontally. The vertical density also increases in samples with a lycra filament. Thus, it can be argued that the inclusion of lycra yarn in knitwear, regardless of the type of weave, leads to an increase in the density of knitwear.

Table 1 Technological parameters and physical and mechanical properties of knitwear

Variants	Indicators	Surface density, g/m ²	Thickness, mm	Volume density, mg/sm ³	Air permeability, sm ³ /sm ² sec	Abrasive resistance, thous. turns	Break force, N		Break elongation, %		Permanent deformation, %		Reversible deformation, %		Shrinkage, %	
							By wale	By course	By wale	By course	By wale	By course	By wale	By course	By wale	By course
Plain																
1	241	0,8	301	188,6	23,8	239	123	56	138	32	38	68	62	13,3	7,3	
2	320	0,76	421	171,1	28,0	426	267	75	93	33	27	77	73	-3,3	6,9	
3	365	1,15	317	50,9	26,7	369	214	122	182	16	18	84	82	7,7	8	

Rib															
4	394	1,43	275	122,9	35,8	673	253	88	313	38	25	62	75	15,3	-6,7
5	496	1,4	354	130,5	54,2	917	470	79	189	6	15	94	85	4	-2
6	423	1,5	282	56,5	42,8	729	361	168	304	8	14	92	86	6,2	1,3
Interlock															
7	509	1,45	351	92,1	33,0	610	348	74	192	33	33	67	67	17	-2,7
8	603	1,5	402	104,7	57,1	1006	618	99	197	11	24	89	76	-1,3	0,9
9	582	1,85	314	51,98	53,6	824	509	205	224	10	13	90	87	7,4	6

The increase in the density of knitwear horizontally in samples made of cotton yarn with the addition of lycra yarn compared to the samples produced from cotton yarn amounted to 48% for the smooth surface, 16% for the eraser, 22% for the interlock; Compared to samples produced from polyester yarn for smoothing 53%, for the eraser 12%, for interlock 15%.

An increase in the density of knitwear leads to an increase in its surface density and thickness.

The knitwear single weave surface of the surface density of the sample, generated from a cotton yarn with the addition of Lycra yarn is greater than that of the samples of cotton and polyester yarn, and a knitted fabric of double stitches surface density of the sample, generated from a cotton yarn with the addition of Lycra yarn is greater than Samples from cotton, but less than samples made from polyester yarn.

An increase in the thickness of knitwear containing a lycra filament is observed in all kinds of weaves. For smoothing, the thickness of the sample containing the lycra filament (version 3) was 51% higher than that of the sample produced from polyester yarn (2nd variant) than the sample produced from cotton yarn (1st variant) by 43%.

In the eraser weave samples, the thickness of the sample containing the lycra yarn (6th variant) was 7% higher than that of the sample produced from polyester yarn (version 5) than that of the sample produced from cotton yarn (4th variant) by 5%.

For the weave that imitates the interlock, the thickness of the sample containing the lycra yarn (version 9) was higher than that of the sample produced from polyester yarn (version 8) by 23%, compared to the sample produced from cotton yarn (version 7) by 27%.

Considering a knitted fabric as a three-dimensional structure, i.e. Taking into account the surface density and the thickness of the knitted fabric, the bulk density can be judged most fully on the material capacity of knitwear.

The bulk density of knitwear containing a lycra filament is larger than that of samples from cotton yarn and is smaller than that of samples from polyester yarn. The change in the material consumption, depending on the change in the structure of knitwear, is shown in Fig. 1.

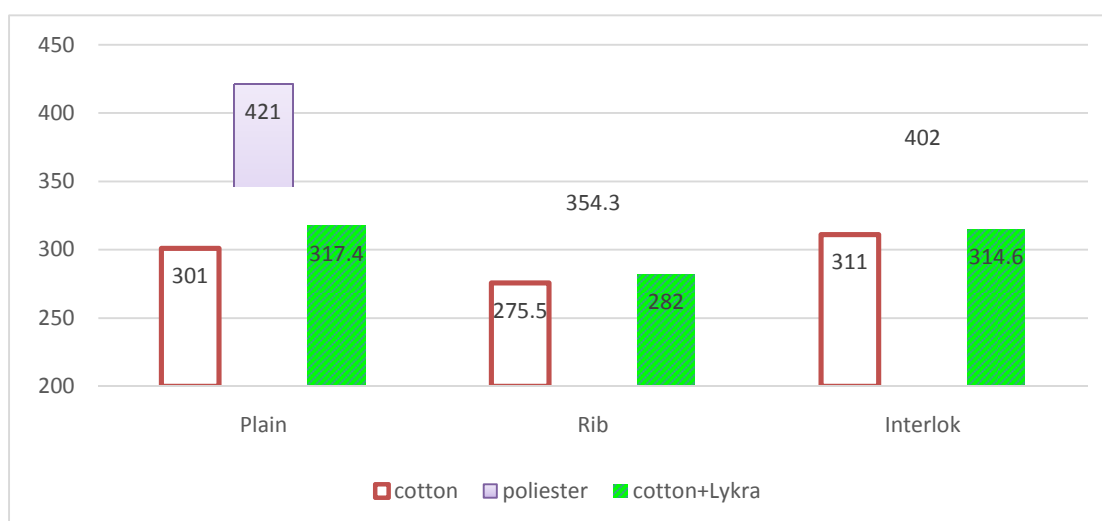


Fig 1 Histogram of changes in the material consumption of knitwear

In samples of smoothness, the bulk density of 3 variants is greater than in case 1 of the variant by 4.8%, and less than in 2 variants by 32.6%.

For the eraser, the bulk density of the 6th variant is greater than in the 4 variants by 2.3%, and less than in the 5th variant by 25.6%.

In interlacing, the bulk density of the 9th variant is greater than in the 7th version by 1.14% and less, than in the 8th variant by 27.8%.

From the analysis of the bulk density of the samples under study, it can be concluded that the material capacity of knitwear produced from cotton yarn with the addition of lycra yarn up to 5% increases by 1.14-4.8% compared to knitted cotton yarn and decreases by 25.6-32.6% compared to knitwear from polyester yarn.

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