STUDY OF TECHNOLOGICAL INDICATORS OF DOUBLE-LAYER COTTON-SILK KNITTWEAR

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Abctract. *The article provides research and analysis of the technological parameters of double-face cotton silk knitwear.*

Keywords: *cotton and silk yarns, knitting, width of loop, height of loop, length of loop, density, volume density.*

ИССЛЕДОВАНИЕ ТЕХНОЛОГИЧЕСКИХ ПОКАЗАТЕЛЕЙ ДВУХСЛОЙНОГО ХЛОПКОВО-ШЕЛКОВОГО ТРИКОТАЖА

Аннотация. *В статье приводится исследования и анализ технологических параметров двухслойного хлопка шелкового трикотажа*

Ключевые слова: *хлопчатобумажная и шелковая нить, трикотаж, высота петли, петельный шаг, длина нити в петли, плотности, объемная плотность.*

INTRODUCTION

At the modern stage of the acceleration of knitting production, obtaining fabrics with low consumption of raw materials is in three directions:

- production of light double-face knitted fabrics on double knitting machines;
- obtaining single-layer knitted fabrics on single knitting machines;
- it is reflected that research is being carried out on obtaining light single-layer fabrics on double machines.

MATERIALS AND METHODS

Russian scientist prof. I.I. Shalov on effective use of raw materials in the production of knitted fabrics, proposed the main directions of using single-layer fabrics instead of double-layer fabrics, using yarns of low linear density and incomplete knitted fabrics.

Scientists of the Institute of Scientific Research of Latvia have shown that lightweight fabrics can be obtained by combining two-color incomplete jacquard fabric with other fabric elements, for example, rib stitch elements. In this case, high-volume yarns are placed on every fourth needle, as a result of which it is possible to obtain a knitted fabric with a porous structure. Making knitwear in the above-mentioned way made it possible to reduce the consumption of raw materials by 10-15%. The mixed fabrics has a higher bulk density than the base sample (ribana, interlock), which prevents their wide use. It is desirable to consider methods of reducing the bulk density while maintaining other advantageous aspects of mixed knitted fabric [1-2]. One of the ways to reduce the bulk density of a mixed knitted fabric is to obtain mixed knitted fabrics based on incomplete knitting (at the expense of turning off the needles). Because in this case, the length of the yarn used for the rows of loops of the knitted fabric is reduced.

In order to expand the assortment of double-face cotton silk knitted fabric, reduce the consumption of raw materials, and increase the influence of the linear density of raw materials on the technological parameters and physical-mechanical properties of knitting, as well as to increase the shape retention properties, the new variants produced on the 14 gauge"LONG

XING" flat double knitting machine (made in China). The structure and production method of 8 variants of double-face cotton-silk knitted fabric, differing in density, was developed.

RESULTS

In order to compare the technological indicators and physical-mechanical properties of the double-face cotton silk knitted fabric samples, a double-face cotton samples was produced based on the plain and cardigan stitches as the base sample (Fig 1).

100% cotton yarn with a liner density 20 tex x 3 was used to obtain the I-variant knitted sample. The structure (a) and graphic representation (b) of the produced double-face cotton-silk knitted fabric sample are presented in Figure 1. The technological indicators and physical-mechanical characteristics of the samples were determined by the standard methods in the "CENTEXUZ" test laboratory at Tashkent Institute of Textile and Light Industry, and the obtained results are presented in Table 1.

Traditionallythe surface density of the fabric shows the consumption of raw materials.

It is known that reducing the surface density of knitted fabric leads to changes in its operational and hygienic properties. Therefore, the bulk density indicator, which describes the raw material consumption and quality indicators of the fabric at the same time, is included.

The bulk density of knitted fabric indicates the amount of textile yarn per unit volume.Fabrics with a low consumption of raw materials include fabrics that havesignificant thickness and porosity compared to the base sample and are called lightened fabrics. When comparing the bulk density of double-face cotton-silk knitted fabrics with different structures, it was found that the presence of silk thread in the double-face knitted fabric not only decreased the bulk density of the fabric, but also increased the shape-keeping properties of the knitted fabric.

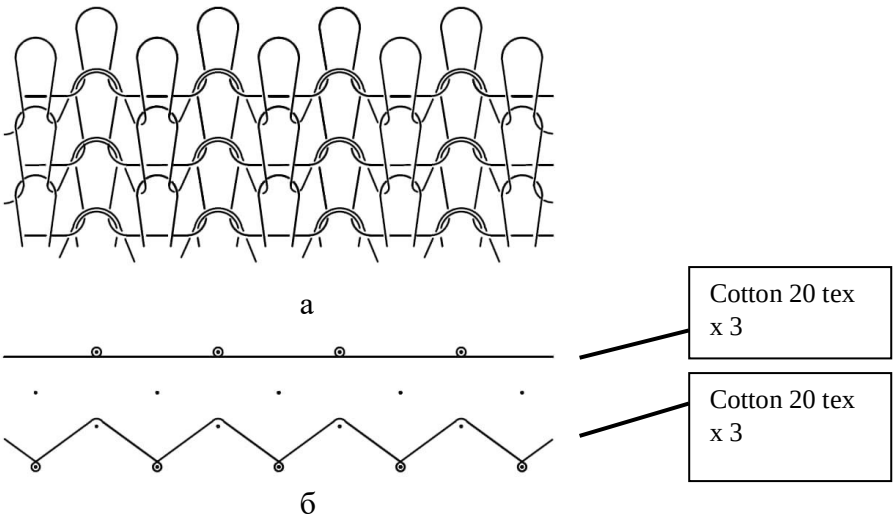

Fig.1. (a) structure and (b) graphic repre sentation of double face knitted fabric

The analysis of research results carried out by many scientistsimproved that reducing the surface density of knitwear within a certain limit leads to a decrease in raw material consumption and is not so dangerous for its toughness properties, because the absolute magnitude of the toughness of knitted fabrics is high, and in the process of using the product, it affects the breaking strength. it faces increases of no more than 20%. Raw material consumption criteria have traditionally been calculated based on the surface density of the fabric. It is known that

reducing the density of the knitted surface leads to a change in operational and hygienic properties. Therefore, it was included an indicator that describes both the consumption of raw materials and the quality indicators of the fabric at the same time. Such an indicator is an indicator of the lightness of the knitted structure, in which, in addition to surface density, its thickness is taken into account. Forexample, the bulk density can be taken as an indicator of the lightness of the knitted structure;

$$\delta = M_S/T[mg/cm^3]$$

where: δ- volume density, mg/cm^3

M_S- surface density, g/m^2

T- thickness, mm

As the knitted fabric has a three-dimensional structure characterized by length, width and thickness, the criteria for the analysis of this structure should be determined not by two-dimensional (surface density) criteria, but by three-dimensional (bulk density) criteria.

The bulk density of the knitted fabric indicates the amount of textile yarn in a volume unit. The concept of "lightening" is expanded when using bulk density as a criterion of ease-stretching in the knitted structure. Fabrics with reduced consumption of raw materials are such fabrics, in which their bulk density is less compared to the base sample produced from yarn with the same optimal module as the loop (Table 1).

If the surface density M_s= 193.5 g/m^2 and the thickness T = 1,35 mm of the double face knitted fabric from cotton thread, its bulk density is equal to 143 mg/cm^3. The surface density of the silk double-face knitted fabric is M_s = 193.7 g/m^2, and when its thickness is 1.50 mm, its bulk density is 129.1 mg/cm^3. However, the surface density of double-face knitwear woven from cotton and silk threads is equal to 192.7 g/m^2, and when its thickness is equal to 1.80 mm, its bulk density is at least 107.0 mg/cm^3.

In this case, the actual bulk lightness relative to the base sample is determined as follows;

$$\Delta\delta = \delta_a - \delta_T = 143{,}3\text{-}107{,}0 = 36{,}3 mg/cm^3$$

That is, the actual bulk lightness index of the knitted woven with the III-variant compared to the I-variant base knitted is equal to 36.3 mg/cm^3.

The relative bulk lightness indicator is determined as follows;

$$\theta = (1-\delta_T/\delta_a \text{ x } 100\ \%) = (1- 107{,}0/143{,}3\text{x } 100\%) = 26\%$$

where:θ - is the relative bulk lightness of the knitted fabric, %.

In this case, the relative bulk lightness of the fabric woven with variant III compared to the base sample of variant I is 21%, that is, it can be seen that the consumption of raw materials of fabric woven with variant III is 21% less than that of base sample of variant I. This is because the bulk density of silk threads in the fabric is lighter compared to the bulk density of cotton threads. The actual bulk lightness and relative bulk lightness of the remaining five variants of the received cotton-silk double-face knitted fabric were calculated based on the above-mentioned formulas, and the obtained results are presented in Table 1.

Due to the increase in the thickness of the double-face cotton-silk knitted fabric, it can be seen that the bulk density index in the II-variant is reduced by 10% compared to the base fabric, in the III-variant by 25.3%, and in the IV-variant by 18.5% (Figure - 2). The bulk density of the knitted can be explained by the decrease in relation to the base knitted, how much or less the

loop rows in the knitted are woven with silk threads, and the linear density of the silk threads can be explained by numerical indicators.

DISCUSSION

The histograms in Fig. 2 show the bulk lightness values of the double-face cotton-silk knitted fabrics compared to the double-face base fabric. The analysis of the bulk density of double-face cotton-silk knitted fabric showed that the bulk density of knitted samples from variant I to variant VI can be seen to decrease, that is, variant I decreases compared to the base fabric, depending on the inclusion of silk threads in the fabric. Because the bulk density or bulk weight of silk threads is lighter than that of cotton threads.

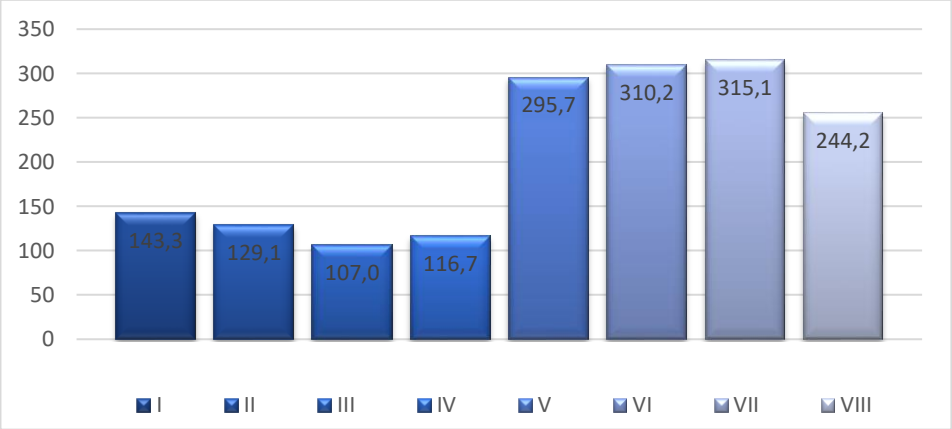

Fig2. Bulk density of double-face cotton-silk knit fabric

1-Table

A study of the technological parameters of cotton-silk double-face knitted fabrics

Variants	Linear density of raw materials (tex)		The amount of threads in the fabric (%)		Loop width A, (mm)	The row high B, (mm)	Knitted density		The length of the loop thread L_k (mm)	Surface density of knitted fabric, Mg/m²	Thickness of the fabric, T (mm)	Bulk density of the fabric, δ (mg/cm³)	True bulk lightness Δ δ mg/cm³	Relative bulk lightness, θ, %
	Stitch type in layers and Linear density (tex) of raw materials	Linear density of fabric and raw materials (tex)	Cotton(%)	Silk(%)			Density along the horizontal, Rg (loops in 50 mm)	Density along the vertical, Rv(loops in 50 mm)						
1	2	3	4	5	6	7	8	9	10	11	12	12	13	14
I	**Plain, Cardigan** Cotton 20 tex x 3	-	100		2,3	1,24	21	40	4,8	193,5	1,35	143,3		
II	-	**Plain, Cardigan** Silk 16.7 x 4		100					5,3	193,7	1,50	129,1	14,2	10
III	**Plain** Silk 16.7 x 4	**Cardigan** Cotton 20 tex x 3	31,75	68,25	2,45	1,3	20	38	5	192,7	1,80	107,0	36,3	26
IV	**Plain** Cotton 20 tex x3	**Cardigan** Silk 16.7tex x 4	48,59	51,40	2,45	1,3	20	38	5	192,7	1,65	116,7	26,6	19
V	**Plain** Cotton 20 tex x1 Silk 16.7 tex x2	**Cardigan** Cotton 20 tex x 1 Silk 16.7 tex x 2	29,69	70,30	1,26	0,78	50	67	3,1	443,6	1,50	295,7	-152	-100
VI	**Plain** Cotton 20 tex x2 Silk 16.7 tex x1	**Cardigan** Cotton 20 tex x2 Silk 16.7 tex x1	65,11	34,88	1,15	0,8	44	65	3,3	428,1	1,38	310,2	-166,9	-110
VII	**Plain** Cotton 20 tex x1 Silk 16.7 tex x2	**Cardigan** Cotton 20 tex x2 Silk 16.7 tex x1	42,55	57,44	1,26	0,78	50	67	3,1	456,9	1,45	315,1	-171,8	-119
VIII	**Plain** Cotton 20 tex x2 Silk 16.7 tex x1	**Cardigan** Cotton 20 tex x1 Silk 16.7 tex x2	48	52	7,15	0,8	44	65	3,3	415,3	1,70	244,2	-100,9	-70

Вертикальная ось (значений)

Variant I of double-face knitted fabric is made of 100% cotton yarn, i.e., the Plain and Cardigan loop rows of the fabric are knitted from cotton yarn with a lineardensity 20 tex x 3, while the Plain and Cardigan loop rows of variant II are knittedfrom 100 % silk yarn with a linear density of 16.7 tex x 4. Comparing the bulk density of the fabric obtained in these two

variants shown in Figure 2, the bulk density of variant II was 14.2 mg/cm^3, and it can be seen that less raw materials were used.

When comparing these variants according to their relative lightness, it can be seen that variant II is 10% lighter, variant III is lighter by 26%, and variant IV is lighter by 19%.

This condition in the fabric can be explained by which rows of loops in the fabric are knitted from silk threads.

CONCLUSIONS

So, based on the analysis of the results obtained above, it can be said that the bulk density of the double-face knitted fabric is decreasing, increasing the amount of silk threads in the fabric and in the knitting of silk threads by changing their linear density and replacing their places in the structure of the fabric.

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