STUDY OF PHYSICAL AND MECHANICAL PROPERTIES OF KNITTED FABRICS IN THE NEW STRUCTURE

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ABSTRACT
The article presents the results of the analysis of physical and mechanical properties of new knitted fabrics in order to determine the quality of knitted fabrics made of cotton and silk yarn on two-needle machines with efficient use of local raw materials..

Keywords: Variant, method, raw material, local, physico-mechanical, tensile strength, reversible, irreversible, abrasion resistance, plastic, elastic, fiber.

INTRODUCTION
The textile and garment industry is a world leader. The production of textiles and garments is increasing day by day due to the increase in the level of consumption worldwide. The global textile industry market is expected to reach about 1.207 billion by 2025. Growth to the U.S. dollar, with the average annual growth rate between 2019 and 2025 expected to be around 5%. Research work is being carried out to create innovative technologies for the textile industry, which provide for the effective use of modern scientific and technical achievements, to improve existing ones. Nowadays, the consumption of raw materials for knitted products is low, the structure, composition of the fabric, the production process is one of the important tasks in the development and scientific substantiation of the laws affecting product quality. [1].

METHODS
At the modern stage of accelerating knitwear production, obtaining fabrics with low consumption of raw materials is in three directions:
- Obtaining lightweight two-layer knitted fabric on two-needle machines;
- Obtaining a single-layer knitted fabric on single-needle machines;
- Research has been conducted on the production of light single-layer tissue in two-needle machines [5].

For efficient use of raw materials prof. I.I. Shalov suggested the use of single-layer fabrics instead of double-layer fabrics in the production of knitted fabrics, the main directions of the use of low-density yarns and incomplete knitted fabrics. In order to expand the range of knitted fabrics, improve the quality of knitted fabrics and effectively use the technological capabilities of the Hanma-type circular needle machine, 5 variants of rubber-based mixed knitted fabric were created and produced. yarn, polyester, viscose, artificial silk were used.
The authors conclude that the reduction of bulk density, increase of shape retention properties and improvement of the quality indicators of knitted fabric have been achieved due to the inclusion of glad and productive glad rows in the structure of rubber knitted fabric.

Technological parameters and physical-mechanical properties of 5 variants of knitted knitted fabric samples obtained on the basis of tires were determined and analyzed experimentally on modern equipment installed in the knitting test laboratory of NamMTI [13]. Their results are presented in Table 1.

Physico-mechanical properties of knitted fabrics

Table 1

Indicators		**versions**					**According to the standard**
		1	**2**	**3**	**4**	**5**	
Types of yarns, linear density and % amount in fabric	Cotton thread 20 tex	50	85		100	50	
	silk 20 tex		15	15			
	Polyester 20 tex					50	
	Viscose 20 tex	50		85			
Air permeability B (sm^3 / sm^2 · sec)		59,7	62,5	89,3	64,57	84,88	Outerwear 40 -100 GOST 31410-2009
Breaking force P (N)	height	416	478	742	303	478	At least 80N GOST 28554
	width	112	174	228	94	147	
Elongation L (%)	height	37,15	43,15	49,45	29,7	44,75	6N and 40% each 1 group 6 N to 40-100% each2 group GOST 28554
	width	221,9	136,15	150,35	101,55	136,7	
Irreversible deformation en (%)	height	7	15	18	10	7	Not more than 15-20% GOST 28882
	width	4	4	6	6	4	
Reversible deformation e_o (%)	height	93	85	82	90	93	
	width	96	96	94	94	96	
Fabric Introduction K (%)	height	4	2	2	5	4	With most 6-8% GOST 26667
	width	3	1	2	4	2	Not more than 8-10%
Friction resistance И (thousandth circle)		48000	39000	46500	44000	47700	30-60 od-y 61-120 solid GOST 16486

DISCUSSIONS

The air permeability of knitted fabrics is the air permeability of these materials themselves, which is measured by the air permeability coefficient. The higher the porosity of the material, the lower the weight filling and the higher the air permeability. Air permeability is characterized by a coefficient indicating the amount of air passing through 1 sm^2 of fabric in 1 second at a given pressure difference on both sides of the material. The air permeability of woven knitted fabrics was tested on equipment YG461E in accordance with GB / 5453 (ISO 9237). According to GB / 5453 (ISO 9237), the pressure for ready-made garments was tested under normal conditions with a pressure of 100 Pa and a range of ∅ 8.0 mm. The air permeability coefficient V (sm^3 / sm^2*sec) is determined by the following formula.

$$B = \frac{V}{S \cdot T} \text{ sm3/sm2*sec} \qquad (1)$$

where: V is the amount of air passing through the fabric at a given pressure difference
ΔP,$см^3$;

S - fabric area, sм^2;

T` - the time of passage of air through the fabric, sec.

Air permeability depends on the fiber content of the materials, the type of finish and the density.

The air permeability of knitted fabrics can be measured using several instruments [14].

According to the results, the best air permeability was observed in option 3 (89.3 sm^3 / sm^2*sec). This figure is 49.5% higher than in Option 1. The air permeability of patterned knitted patterns was lower in option 1, i.e., the heat retention property of the knitted fabric was increased.

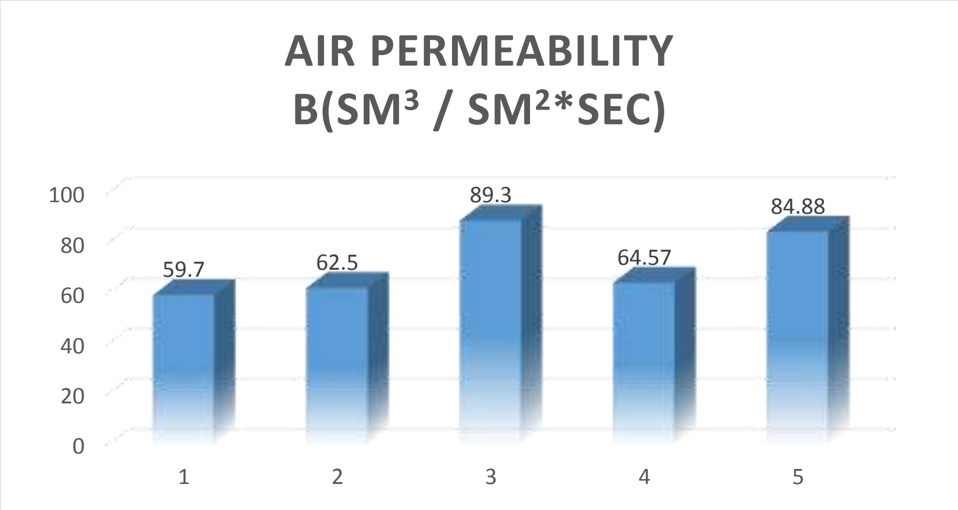


Figure 1. Histogram of air permeability change of knitted fabric.

The tensile strength characteristic is an acceptable key indicator for assessing the quality of knitted fabrics. All GOST and TSH applicable to knitted fabrics include normative indicators on elongation and tensile strength. Breaking force is the force required to break a specimen at a given size and speed.

The breaking force is expressed in Newtonian units. The strength of materials depends on their fiber composition, the structure of the forming yarns and the linear density, weave, density, type of finishing. The thicker and denser the yarn, the stronger it is. Simultaneously with the determination of the tensile strength, the elongation at elongation of the specimens is also determined. Elongation at elongation is understood as the difference between the initial length of the specimens and the length at elongation before breaking [3].

The breaking strength of the submitted samples was determined using a standard method using a dynamometer YG-026T.

The tensile strength index varies from 303 N to 478 N in length, from 94 N to 174 N in width and meets the requirements of GOST 28554.

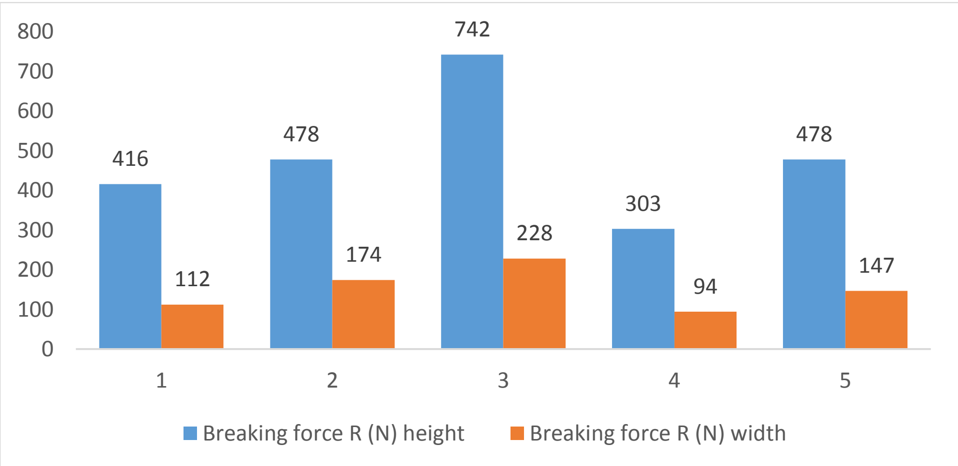


Figure 2. Histogram of change in tensile strength of knitted fabrics

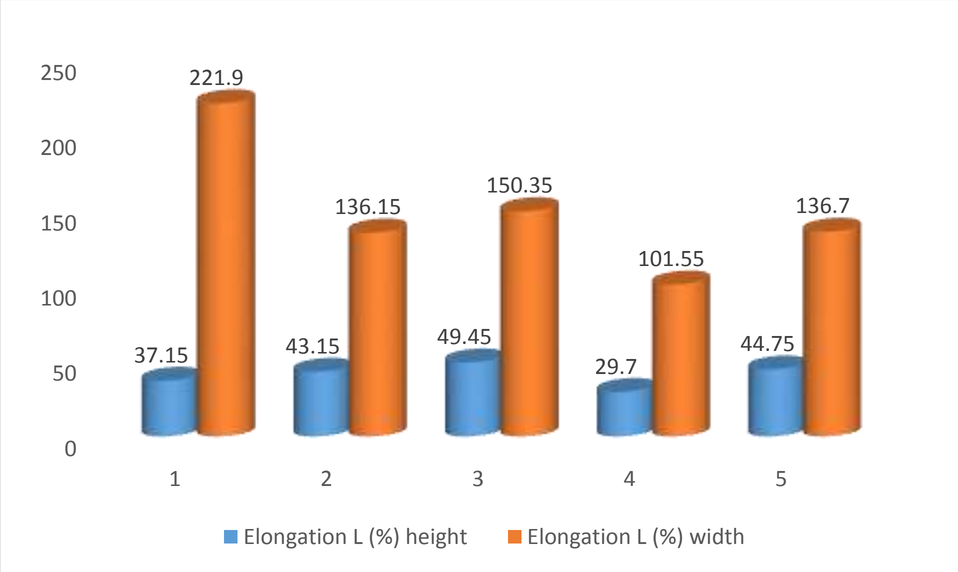


Figure 3. Histogram of the change in the elongation of the knitted fabric until it breaks.

When designing products, it is important to know what elastic properties knitted fabrics have [4].
The complete deformation e consists of the following parts: the flexible part eq rotates at high speed after the loads are removed from the samples being tested; elastic deformation ee develops at a small rate, associated with the passage of the relaxation process; plastic deformation ep, does not return after removal of loads from samples.

$$\varepsilon = \varepsilon_{\kappa} + \varepsilon_{\text{э}} + \varepsilon_{n}, \% \qquad (2)$$

The deformation of the knit varies with the elasticity of the yarn, the stiffness, and the change in the number of loops. Not only the description of the deformation, but also the state of the knitting is determined by the internal, two main forces: the elastic force of the yarn bending into the ring tends to straighten the yarn and change its shape. The result is a frictional force between the threads, which prevents the placement of the threads in the loop, and interferes with the structure of the knitted fabric.According to the results obtained, the longitudinal irreversible deformation in the knitted fabric samples ranged from 7 % to 18 %, and the transverse from 4 % to 6%.

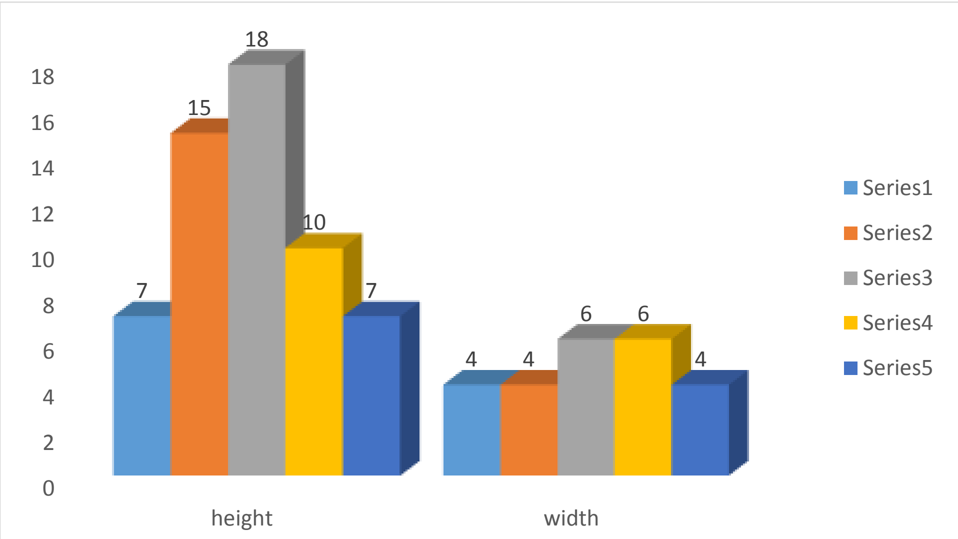


Figure 4. Histogram of change in the irreversible deformation of knitted knitwear.

The proportion of reverse deformation along the length of the tested knitted fabric sample ranged from 94 % to 96 %, while the proportion of reverse deformation across the width ranged from 82 % to 93 % (Table 1, Fig. 5).

Such indicators of the proportion of back deformation indicate that the knitted fabric quickly returns to its original position after stretching.

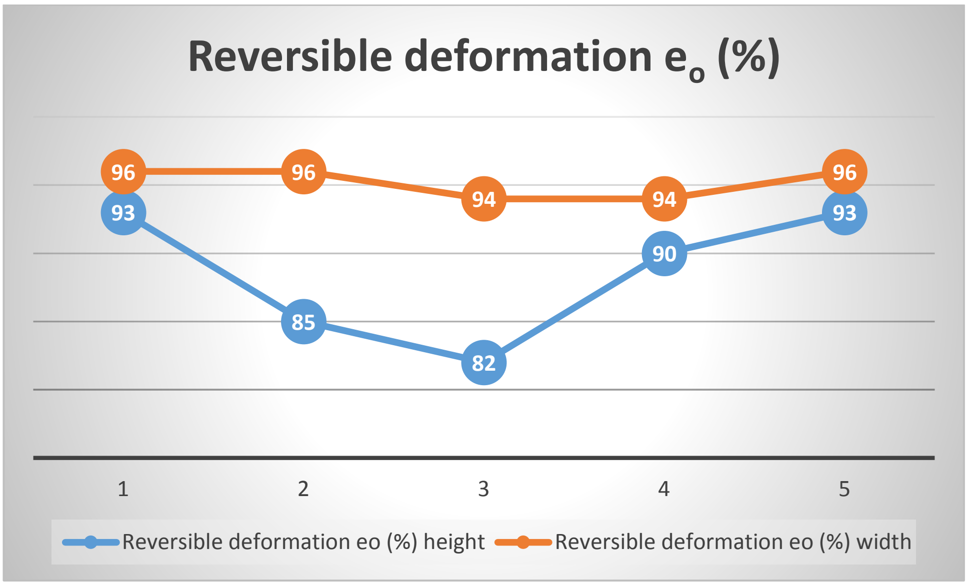


Figure 5. Histogram of change in the deformation of knitted knitwear

In the process of wet processing of knitted fabrics (washing, drying) the decrease in size is called penetration, and the increase is called tensile.

Knitted fabrics have a significantly higher elongation than woven fabrics and have a highly elastic structure, even under the influence of small stresses. The principle of operation of machines for finishing knitted fabrics is almost no different from machines designed for finishing woven fabrics. It has been noted that one of the main reasons for high penetration is excessive deformation of knitted fabrics in finishing operations. When knitted fabrics are processed, the less the knit enters, the higher its shape-retaining properties. Research has been conducted to study the effect of the amount of cotton and silk yarns in the composition of cotton-silk knitted fabrics on the elasticity. The results of the study of the penetration process of cotton-silk knitted fabric samples showed that the penetration varied from 2 % to 5 % in height and from 1 % to 4 % in width (Fig. 6).

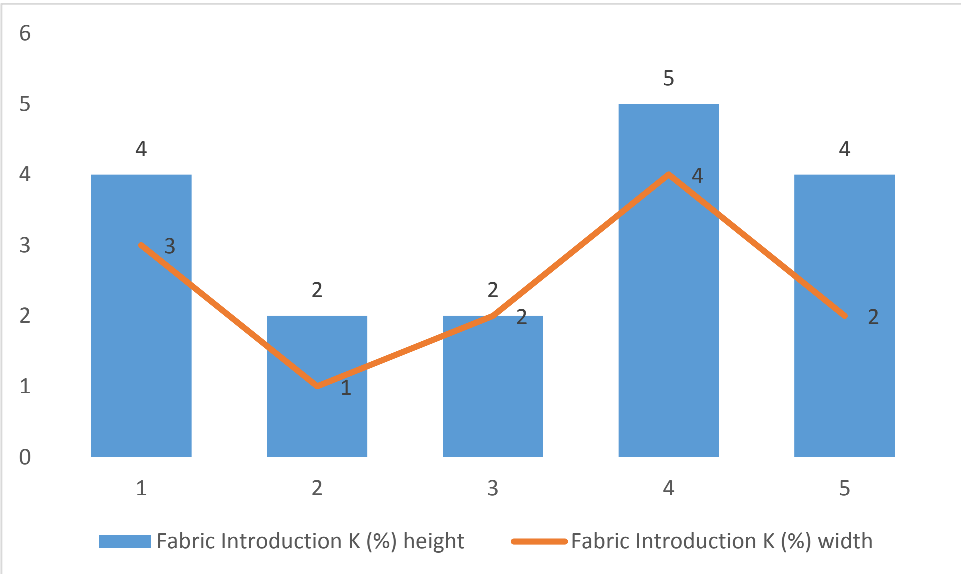
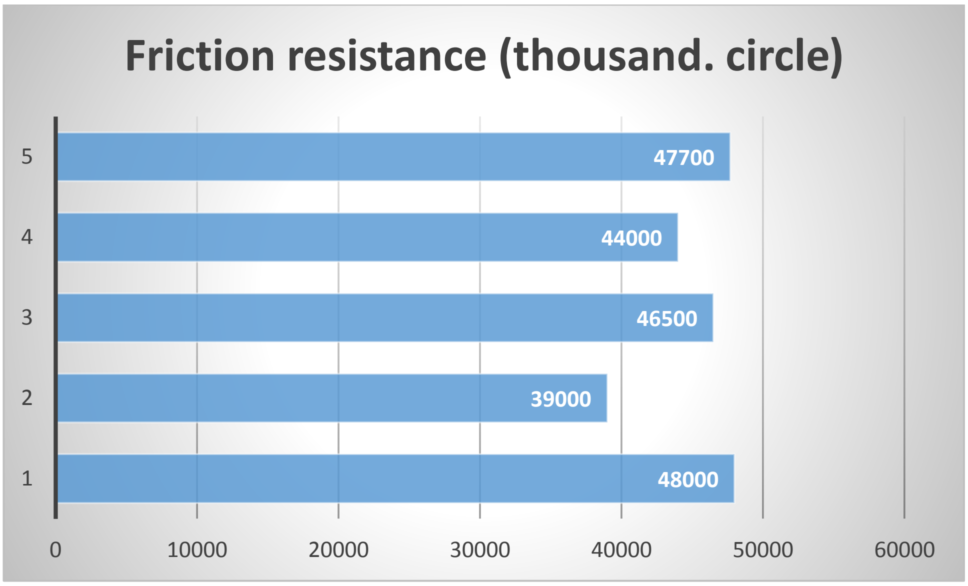


Figure 6. Histogram of permeability of cotton-silk knitted fabrics

During the use of knitted products, the fabric is subject to abrasion when in contact with surrounding objects, and some parts of the product change shape, resulting in wear and tear.



7-picture. Histogram of change in abrasion resistance of knitted fabrics

The variants with the highest abrasion resistance of the resulting knitted fabric are options 1 and 5. Option 1 has a friction resistance of 48,000. The friction resistance of option 5 is 47.7 thousand units. formed.
The above analysis of the physical and mechanical properties of knitted fabrics shows that the increase in the composition of the fabric, the amount of spun cotton, viscose, artificial silk and polyester yarns has a positive effect on the air permeability, toughness, elongation and abrasion resistance of knitted fabrics, hygienic and shape retention. high properties, toughness and beautiful appearance allow you to get knitted products.

CONCLUSION

In conclusion, we can see from the above histograms that the quality indicators of the fabric have significantly improved due to the addition of silk threads to the composition of the knitted fabric. The physical and mechanical properties of our 2 samples obtained from spun cotton yarn and silk yarn are higher than the remaining samples. Therefore, the appearance, toughness, hygienic and shape retention properties of our cotton-silk yarn sample have been improved.

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