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STUDY OF PHYSICAL-MECHANICAL INDICATORS OF PATTERN KNITTING FABRICS MADE IN A NEW METHOD

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Annotation

In this article, the physical and mechanical performance of a new structure of knitted fabric production technology has been developed using the capabilities of flat double-needle knitting machines. Three samples of the new structure of knitted fabric were taken, their technological parameters and physical and mechanical properties were studied experimentally, presented in the table and analyzed. Experimental samples of the new structure of knitted fabric were developed graphic notation is given.

Keywords: knitwear, spun cotton yarn, new structure knitwear, double-layered knitwear, hoop, yarn, flat, dimensional lightness, hoop height, surface density, pattern, density, hoop length.

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The textile and light industries are important sectors of the economy that shape the budgets of many countries. Innovative opportunities are strategic resource that determines the place of the national economy in the world economy. The application of the integration of scientific achievements in production is a necessary condition for improving the quality and competitiveness of domestic products that replace imports and expand the structure of exports.

It is strategically important to ensure high and stable growth rates in the textile and clothing industry, attracting and developing foreign direct investment, production and export of competitive products, modernization of enterprises, technical and technological renewal, introduction of an improved "cluster model". Systematic work is being carried out to create new high-tech jobs through the implementation of projects.

The production of knitted products with high hygienic properties, effective use of local raw materials in the production of knitted goods, is one of the current problems. As the living standards of the world's population improve, so does the demand for consumer goods and textiles with high hygienic properties. Therefore, the knitting industry is the most important branch of the textile industry now. Knitted products are characterized by modernity, practicality and affordability. The knitting industry has the following specific advantages:

- In the field of expanding the range of products there is a wide range of opportunities to obtain a variety of mixed fabrics that provide different properties and appearance of knitted fabrics;
- High consumer resistance to repeated deformation, complex physical and mechanical properties such as friction, wrinkling, high hygienic properties (hygroscopicity, air permeability and a number of comfort conditions), a unique consumer property of knitted fabric, which characterizes the complex aesthetic performance;
- Availability of a wide range of technological capabilities for the production of products in a regular and semi-regular manner.

Development of new types of knitted fabrics, expanding the range of knitted fabrics, as well as expanding the technological capabilities of the LONG-XING LXA 252 12G (China) flat double-needle machine, developing a new type of knitted fabric production technology 3 samples were produced by modification. Technological parameters and physical-mechanical properties of the new type of knitted fabric were determined by the experimental method in the laboratory of the Namangan Institute of Engineering Technology, the measurement results are given in the table. As a result of practical

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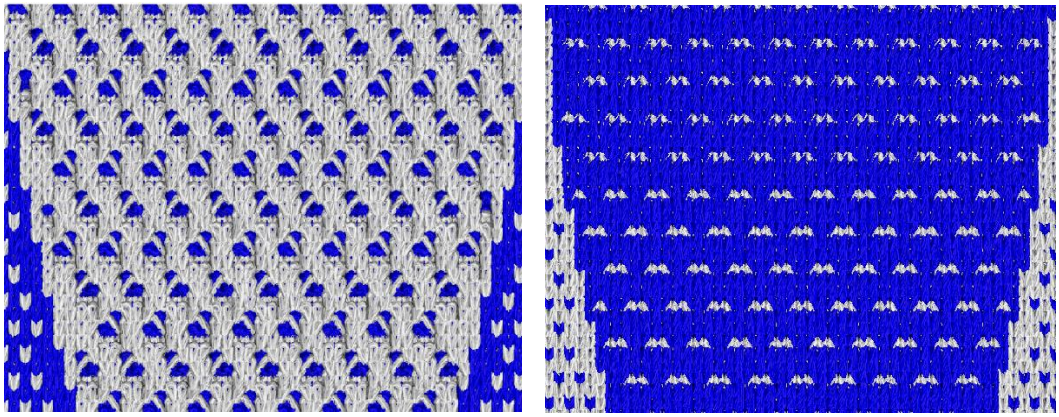
research, the texture structure, physical and mechanical properties and appearance, which characterize the quality indicators of knitted products, were identified.

Indicators that characterize the structure of knitted fabric are: surface and volume density, density in width and length (number of loops per unit length), length of loop thread, thickness of knitted fabric. A graphic representation of the newly produced two-layer knitted fabric is shown in the figure.

The raw material was 20 tex x 4 spun cotton yarn with linear density, 35 tex x 2 polyacrylonitrile yarn.



front view **back view**

Figure 1. Graphic inscription of knitted fabric in a new structure

In the production of knitted products on the LONG-XING LXA 252 12G flat double-needle knitting machine, the change of the position of the rings, densities, the length of the ring strip and a number of other indicators is done automatically. This makes easy

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to get a variety of knitted fabrics. In the obtained sample, eye-catching patterns were created on the front side in order to improve the air permeability. The merging of the front layer with the back layer was done using a rubber 2 + 2 texture. The result was a knitted fabric with a distinctive pattern, shape retention and air permeability. (Figure 1) Due to the change in the type and proportion of raw materials in the composition of the new structure of the knitted fabric, it was found that the volume density index of the new structure of the knitted fabric in all samples changed significantly compared to the base fabric. The volume density of knitwear is one of the main among the technological indicators, which shows the amount of raw material consumption in the knitted fabric.

Table 1Technological parameters of knitted fabric

Indicators		**Samples**		
		1	**2**	**3**
Thread type and linear densities		**Polyacrylonitrile 35 tex x2**	**Cotton 20 tex x4**	**Cotton 20 tex x4**
		Polyacrylonitrile 35 tex x2	**Polyacrylo nitrile 35 tex x2**	**Cotton 20 tex x4**
Ring step A (mm)		1.79	1.79	1,79
Row height B (mm)		1.38	1.38	1,38
Horizontal density R_h		28	28	28
Vertical density R_v		43	43	43
Ring strip length L (mm)		6.22	6.44	6,74
Knitted surface density Ms (gr/m^2)		362	473	543
Knitting thickness T (mm)		2.41	2.52	2.61
Volume density δ (mg/sm^3)		150.2	181.5	226.4
Air permeability		43.052	39.32	28.68
Breaking force	height	489	543	548
	width	264	403	432
Elongation at break (mm)	height	158,6	98,1	100,7
	width	234,4	239,3	231
Stretching to break (%)	height	79,3	45,35	48,35
	width	117,2	106,15	110,5
Consumption energy at interruption (J)	height	23,8	20	24,2
	width	17,7	29	30,2
Revensible deformation , $\varepsilon_н$, %	height	23,5	20,7	21,8
	width	34,3	31,5	28
Irrevensible deformation, $\varepsilon_о$, %	height	76,5	79,3	78,2
	width	65,7	68,5	72

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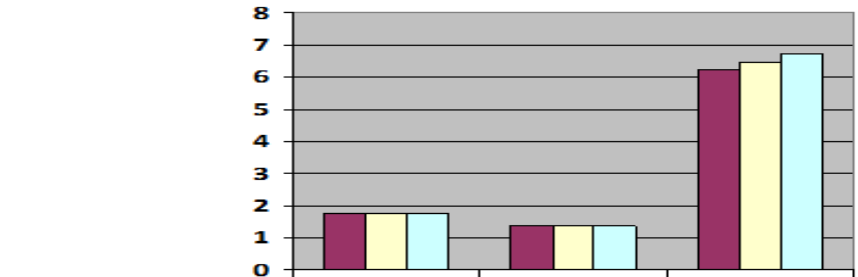
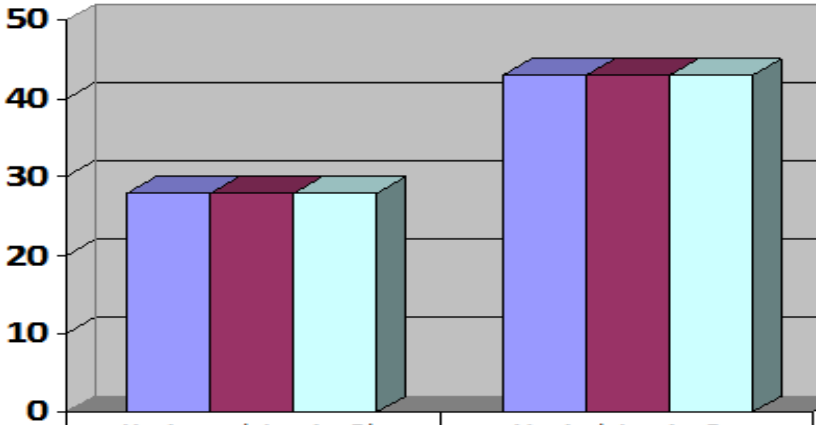
A number of technological improvements have been achieved due to the fact that the structure of the knitted fabric and the linear density of the yarns are close to each other, the raw material composition changes and the proportion in the fabric composition changes.



	Ring step A (mm)	Row height B (mm)	Ring strip length L (mm)
Poliacrilnitril/Poliacrilnitril	1,79	1,38	6,22
Poliacrilnitril/cotton	1,79	1,38	6,44
Cotton/ Cotton	1,79	1,38	6,74

Figure 2. Histogram of ring step, row height and ring strip length of knitted knitwear

In all samples, the ring step was 1.79 mm and the ring row height was 1.38 mm. We can see that the length of the ring strip has changed slightly due to the change in the raw material composition of the knitted fabric. (Figure 2)



	Horizontal density Rh	Vertical density Rv
Poliacrilnitril/Poliacrilnitril	28	43
Poliacrilnitril/cotton	28	43
Cotton/ Cotton	28	43

Figure 3. Histogram of densities on the horizontal and vertical of the knitted fabric

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The horizontal and vertical densities are the same in all samples, the number of rings with a length of 50 mm is 28 and 43, respectively. (Figure 3)

The lowest air permeability was observed in pattern III of knitted fabrics and its volume was 28.68 sm^3 / sm^2 *sec. The highest air permeability was observed in sample I of the knitted fabric samples, and its volume was 43,052 sm^3 / sm^2 *sec, which is 50.1% more than that of the fabric (variant III). (Figure 4)

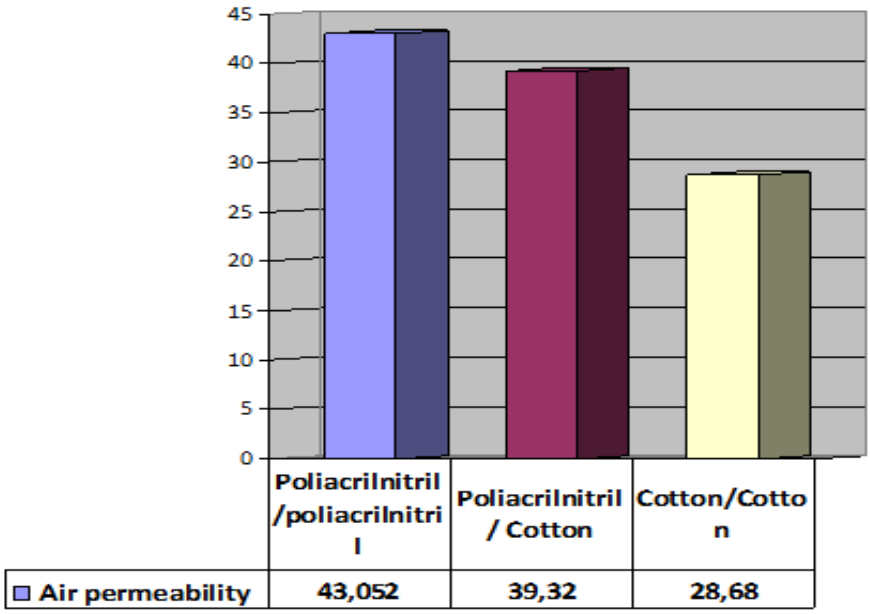

Figure 4. Air permeability histogram of knitted fabric

The description of the cut 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. Tensile force is the force required to break a specimen at a given size and speed. The breaking force is expressed in units of Newton (N). The tensile strength of the submitted samples was determined using the standard method YG-026T dynamometer.

Tissue toughness, tensile strength analysis, showed that the most mature tissue in height, specimen III, had an index of 548 N, which was 12.4% higher than specimen I (Table 1, Figure 5).

The strength of the tissue in width was also observed in sample III, which had a tensile strength of 432 N in width, which is 63.6% more than in tissue I.

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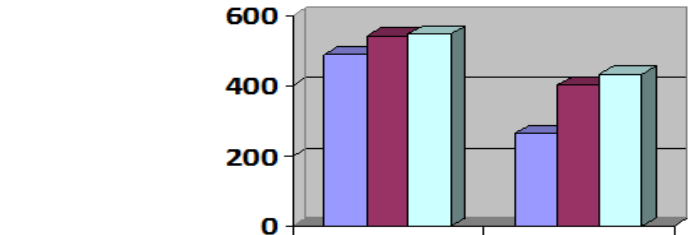


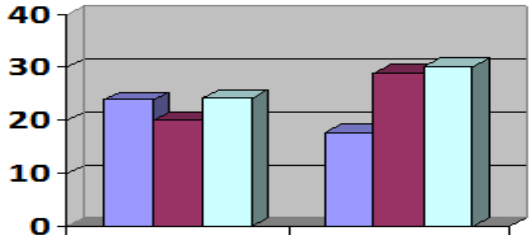
	height	width
Poliacrilnitril/Poliacrilnitril	489	264
Poliacrilnitril/cotton	543	403
Cotton/ Cotton	548	432

Figure 5. Histogram of tensile strength of knitted fabric

The energy dissipated in a break is the amount of energy expended to break it when the sample is stretched at a certain size and speed. The energy expended at the break is expressed in units of Joul (J). The breakdown energy of the submitted samples was determined using the standard method YG-026T dynamometer.

Tissue toughness, the analysis of the amount of energy consumed at rupture, shows that the most mature tissue type III in height, its energy consumption at rupture is 24.2 J, which is 1.6% higher than the I-sample (1 -table, Fig. 6).

The strength of the tissue in width was also observed in sample III, which consumed 30.2 J of energy in rupture across the width of the tissue, which is 70.6% more than in tissue I.



	height	width
Poliacrilnitril/Poliacrilnitril	23,8	17,7
Poliacrilnitril/cotton	20	29
Cotton/ Cotton	24,2	30,2

Figure 6. A histogram of the energy expended at the rupture of a knitted fabric

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The analysis of the physical and mechanical properties of knitted fabrics of the above-mentioned new structure showed that the shape of the knitted fabric was strengthened as a result of changes in the proportion of raw cotton in the fabric, a positive effect on the air permeability, toughness and elasticity of knitted fabrics. The wide range of knitted products with high shape retention properties, toughness, air permeability and beautiful appearance of the proposed new structure knitted fabrics has allowed to obtain new knitwear using this method.

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