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Study of the Effect of Local Raw Materials on the Physical and Mechanical Properties of Knitted Fabric

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Abstract
In this article, using the capabilities of flat two-needle knitting machines, local raw materials were gradually introduced, i.e. the percentage of cotton thread in the knitted fabric, and the production technology was developed, its physical and mechanical parameters were studied. 3 samples of knitted fabric were taken, their technological indicators and physical and mechanical properties were experimentally studied, presented in a table and analyzed. Experimental samples knitted fabrics were designed and built on a LONG-XING LXA 252 12G flat-needle machine (China).

Keywords: knitting, cotton yarn, patterned knitting, double knitting, yarn, yarn, flat, bulk density, yarn height, surface density, pattern, density, yarn length.

INTRODUCTION

The textile and light industries are important sectors of the economy that form the budget of many countries. Innovative opportunities are considered as a strategic resource that determines the place of the national economy in the system of the world economy. The application of the integration of scientific achievements into production is a necessary condition for improving the quality and competitiveness of local products, replacing imports and expanding the structure of exports.

It is strategically important to ensure high and stable growth rates of the textile, sewing and knitting industry in our republic by attracting and developing foreign direct investment, producing and exporting competitive products, modernizing enterprises, technical and technological renewal, and introducing improved technology. Cluster Model". Due to the implementation of the project, systematic work is being carried out aimed at creating new high-tech jobs.

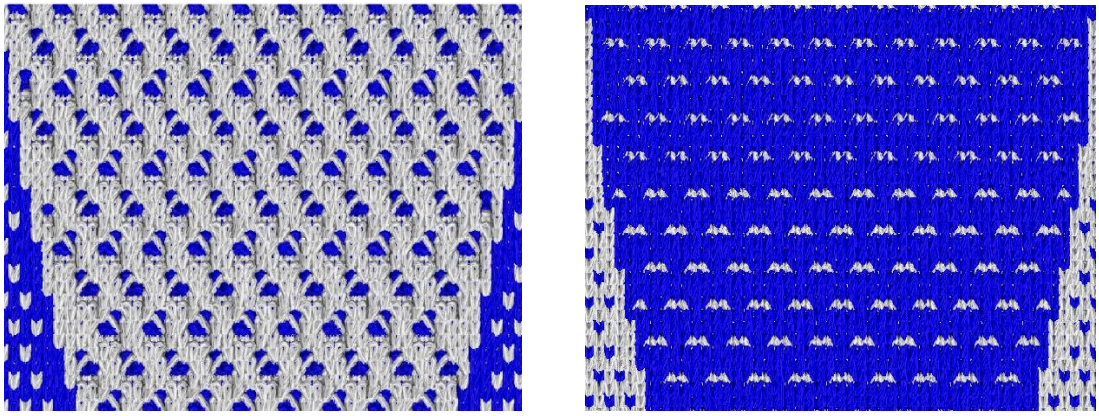
The production of knitwear with high hygienic properties, effectively using local raw materials in the production of knitwear, is one of the urgent problems. As the standard of living of people living on earth increases, the demand for textile products with high hygienic properties increases, so the knitting industry is considered the most important branch of the textile

industry today. Knitwear is modern, practical, convenient and affordable. The knitting industry has the following specific advantages:

- In the field of expanding the range of products, there is a wide possibility of obtaining various mixed fabrics that provide different properties and appearance of knitted fabric;
- A unique consumer feature of the knitted fabric: high resistance to conditions of repeated deformation, complex physical and mechanical properties, such as friction, crumpling, high hygienic properties (hygroscopicity, air permeability and properties that provide a number of comfort conditions), complex aesthetic indicators. ;
- Availability of a wide technological capability for regular and semi-regular production of products.

This makes it possible to develop new types of patterned knitted fabrics, increase the share of local raw materials in the composition of knitwear, expand the range of knitted fabrics, and also develop a technology for the production of patterned knitted fabrics in order to expand the technological capabilities of the flat two-needle machine LONG-XING LXA 252 12G (China) 3 samples were developed by changing the type and proportion of raw materials. The developed samples of knitted fabric differ from each other in the ratio of raw materials in the fabric. Technological parameters and physical and mechanical properties of patterned knitted fabric were determined by experimental method in the laboratory of the Namangan Institute of Engineering and Technology, the measurement results are presented in the table. As a result of practical research, the structure of the fabric, physical and mechanical properties and appearance, which characterize the quality indicators of the knitted product, were determined. The parameters that characterize the structure of knitted fabric include: surface and volume density, density of width and length (number of loops per unit of length), length of the loop thread, angle of intersection of rows of loops and columns of loops, thickness of the knitted fabric. A graphic record of the newly obtained two-layer knitted fabric is shown in Fig.

Cotton yarn 20 tex x 4, polyacrylonitrile yarn 35 tex x 2, polyester yarn 17 tex x 4 were used as raw materials.



Front Back

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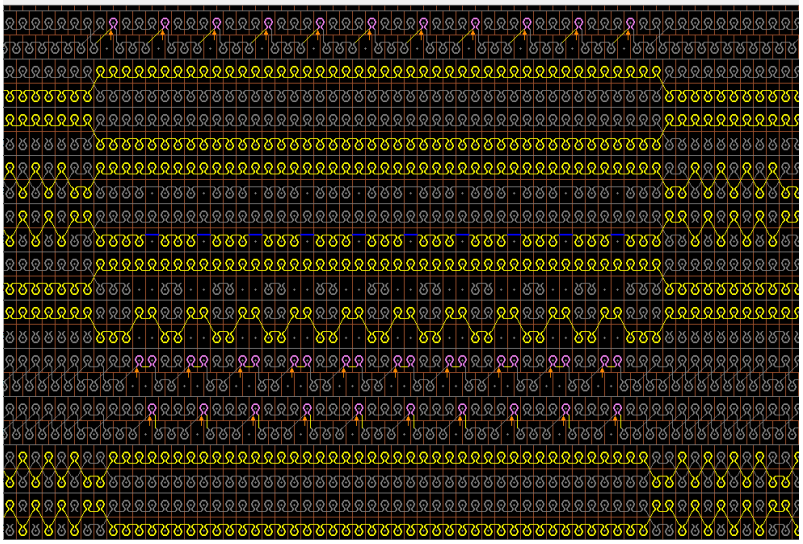


Figure 1. Graphic recording of knitted fabric in a new structure.

The LONG-XING LXA 252 12G Flat Two-Needle Knitting Machine automatically changes the position of the loops, the density, the length of the loop thread and a number of other parameters in the knitwear production process. This makes it easy to get a variety of knitted fabrics. On the front side of the resulting sample, mesh patterns were created to improve breathability. The connection of the front layer with the back layer is made of 2+2 elastic fabric. As a result, it was possible to obtain a knitted fabric with a unique pattern, improved shape retention and breathability. (Figure 1)

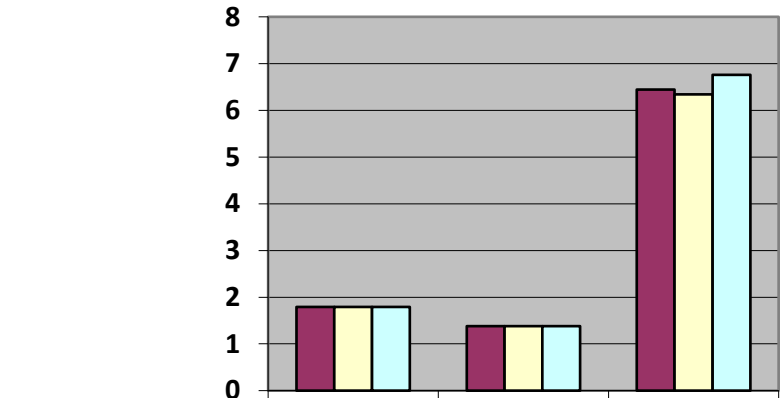
Due to the change in the percentage of local raw materials in the composition of patterned knitwear, it was found that the indicator of volumetric density of patterned knitwear of all samples changed significantly compared to the base fabric. The volumetric density of knitted fabric is one of the main technological indicators, which indicates the consumption of raw materials in the knitted fabric..

Technological indicators of knitted fabric Table 1

Indicators	Samples		
	1	**2**	**3**
Thread Type and Linear Density	**Twisted cotton thread 20 Tex x 4**	**Twisted cotton thread 20 Tex x 4**	**Twisted cotton thread 20 Tex x 4**
	Polyachrylonithryl 35 Tex x2	**Polyester 17 Tex x 4**	**Twisted cotton thread 20 Tex x 4**
Ring pitch A (mm)	1.79	1.79	1.79
Row B Height (mm)	1.16	1.16	1.16
Horizontal density Rg (number of rings)	28	28	28
Vertical density Pv (number of rings)	43	43	43
Ring bar length L (mm)	6.44	6.34	6.76

Knitted Surface Density Ms (g/m2)		524	575	643
Knitting thickness T (mm)		2.6	2.56	2.61
Bulk density δ (mg/cm3)		201.5	225	246.4
Air permeability		31.32	45.58	53.68
Destructive Power	height	573	580	595
	Width	430	444	447
Elongation at break (mm)	height	110.1	102.3	114.7
	Width	252.3	200.9	238
Stretch to rupture (%)	height	55.05	51.15	57.35
	Width	126.15	100.45	120
Power Consumption at Interruption (W)	height	20.3	31.9	33,6
	Width	29	37.2	40.2

Due to the fact that the structure of the knitted fabric and the linear density of the threads are close to each other, a number of technological indicators have been improved.



	Шаг кольца А (мм)	Высота ряда В (мм)	Длина кольцевой планки L (мм)
Крученая хлопковая нить/Полиакрилонитрил	1.79	1.38	6.44
Крученая хлопковая нить/Полиэстер	1.79	1.38	6.34
Крученая хлопковая нить/Крученая хлопковая нить	1.79	1.38	6.76

Figure 2. Histogram of warp pitch, warp row height and warp thread length of a knitted pattern.

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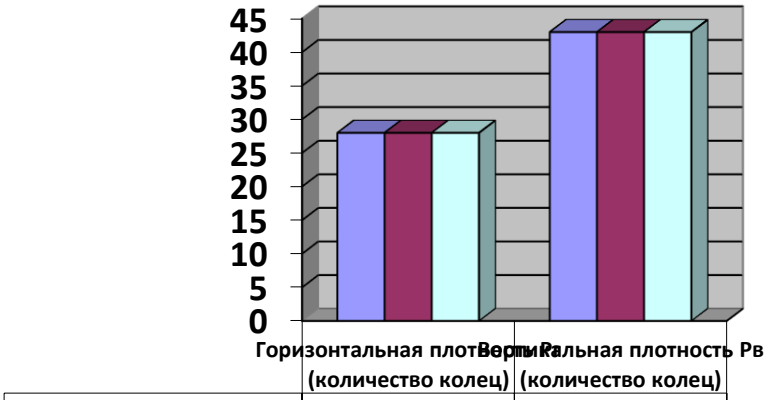
In all samples, the pitch is 1.79 mm and the row height is 1.38 mm. (Figure 2)



	Горизонтальная плотность Рв (количество колец)	Вертикальная плотность Рв (количество колец)
Крученая хлопковая нить/Полиакрилонитрил	28	43
Крученая хлопковая нить/Полиэстер	28	43
Крученая хлопковая нить/Крученая хлопковая нить	28	43

Figure 3. Histogram of horizontal and vertical density of patterned knitted fabric

The horizontal and vertical densities are the same in all samples, i.e. the number of rings 50 mm long is 28 and 43, respectively.
(fig. 3)

The lowest air permeability was observed in the sample of I-knitted fabric with a pattern and its value was 31.32 cm3/cm2□sec. The highest air permeability was observed in sample III of the knitted fabric samples and its value was 53.68 cm3/cm2□sec, which is 41.66% higher than that of the fabric (variant III). (fig. 4)

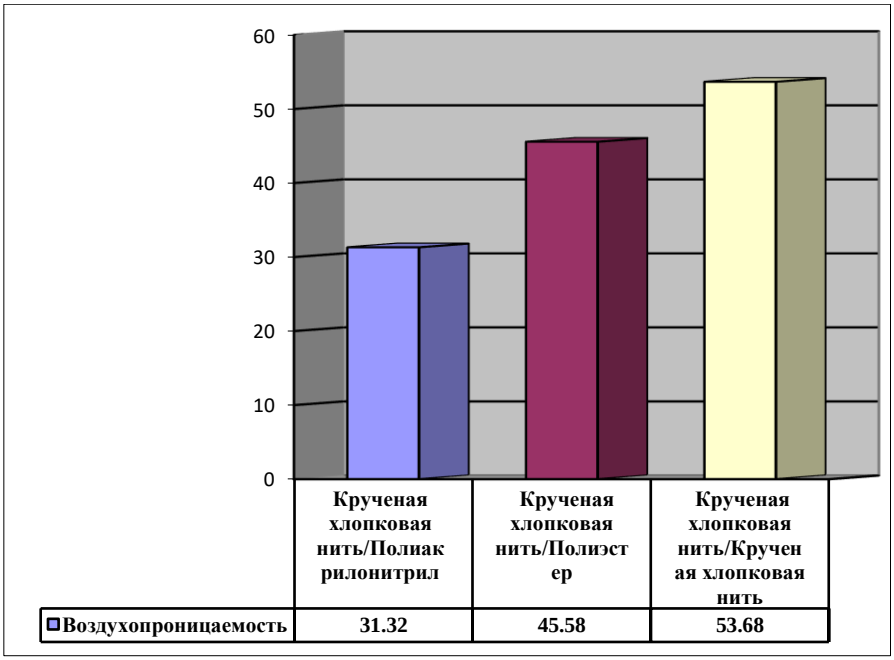


Figure 4. Histogram of air permeability of patterned knitted fabric

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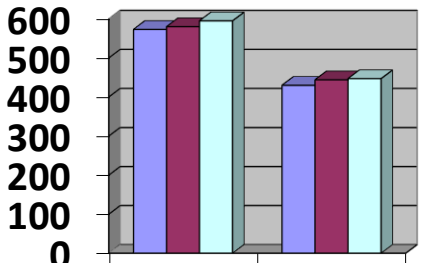
Fracture characteristic is the main parameter used to assess the quality of knitted fabrics. In all GOSTs and TShs used for knitted fabrics, the standard indicators for elongation at break and tensile strength are indicated. Tensile strength is the force by which a specimen breaks in tension at a given size and speed. The tensile force is expressed in Newtons (N). The tensile strength of the presented samples was determined using the YaG-026T dynamometer according to standard methodology.Analysis of the

viscosity of the fabric, i.e. tensile strength, shows that the stiffest fabric in terms of length is sample III, its index is 595 N, which is 3.4% higher than sample I (Table 1, Figure 5).

The stiffness of the fabric in width was also observed in sample III, the tensile strength of this fabric in width was 447 N, which is 3.2% more than in the fabric of sample I.



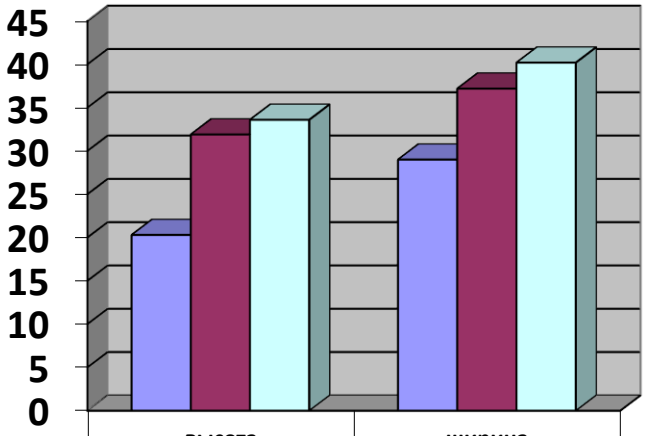
	высота	ширина
Крученая хлопковая нить/Полиакрилонитрил	573	430
Крученая хлопковая нить/Полиэстер	580	444
Крученая хлопковая нить/Крученая хлопковая нить	595	447

Figure 5. Histogram of the strength of a patterned knitted fabric

The estimated fracture energy is defined as the amount of energy expended to break a specimen when it is stretched with a given size and velocity. The energy stored at the break is expressed in Joule units (J). The nominal destructive energy of the presented samples was determined according to the standard procedure using the YaG-026T dynamometer.

Analysis of the stiffness of the fabric, i.e., the sum of the total energy at rupture, shows that the most mature tissue in length is specimen III, its average tensile energy is 33.6 J, and its hardness is set at 39.6. % higher than that of sample I (Table 1, Fig. 6).

Transverse tissue stiffness was also observed in the III-sample, the total tearing energy of the tissue along the width is 40.2 J, which is 28.1% more than that of the tissue of the I-sample.



	высота	ширина
Крученая хлопковая нить/Полиакрилонитрил	20.3	29
Крученая хлопковая нить/Полиэстер	31.9	37.2
Крученая хлопковая нить/Крученая хлопковая нить	33.6	40.2

Figure 6. Histogram of normalized tensile energy of knitted fabric

As a result of the analysis of the physical and mechanical properties of the knitted fabrics mentioned above, it was found that the change in the percentage of cotton raw materials in the fabric, as a result of the positive effect of the knitted fabric on the breathable properties, hardness and extensibility properties of the knitted fabric, enhanced the properties of preserving the shape of the knitted fabric.

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