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### Abstract

The article presents the results of studying the technological parameters of knitted fabrics made from PAN yarn. Parameters such as loop pitch, loop row height, horizontal and vertical density, surface and volumetric density, yarn length in the loop, and knitted fabric thickness were analyzed.

**Keywords:** knitwear, PAN yarn, assortment, quality, loop pitch, horizontal density, vertical density, surface density, volumetric density.

### Introduction

Creating new types of knitted fabrics, expanding the production of consumer goods through the use of local raw materials, and manufacturing import-substituting, competitive, high-quality knitted products that meet the requirements of domestic and foreign markets are among the pressing issues of today[1].

In the textile industry, entirely new materials and fabrics are being created based on chemical and synthetic fibers. Textile materials are being applied in the fields of environmental protection, geotextiles, radar, communications, medicine, and agriculture.

Yarn with the addition of chemical fibers has high bulk, softness, low sorption properties, and low density. Knitted products made from it have high resistance to pilling formation, as well as high dimensional stability.

Nitron fiber is produced from polyacrylonitrile. Polyacrylonitrile is obtained in chemical industry enterprises by polymerizing acrylonitrile using reaction accelerators.

Foreign and domestic scientists are conducting scientific research on the production of a wide range of knitted fabrics from various types of raw materials.

Analysis of knitted fabrics allows not only to study the types of knitted fabrics created but also to create various knitted fabrics with new structures and expand the range of knitted products.

D.M. Mirzarakhmetova studied the properties and structure of nitron-cotton yarn, as well as the quality of knitted products made from it. It has been established that the shape-retaining properties of products made from nitron-cotton yarn are more stable and resistant to friction compared to products made from cotton yarn. It has been proven that fabrics made from nitron-cotton yarn surpass fabrics made from pure nitron in terms of hygienic properties [2].

Many such scientific studies can be cited.

Expanding the use of local raw materials while fully utilizing the technological capabilities of modern knitting machines is one of the main tasks for our country.

Expanding the range of knitted fabrics, saving raw materials, and producing knitted fabrics with high quality indicators is one of the urgent challenges.

To address these issues, samples of 4 variants of plain, derivative plain, rib, and interlock knitted fabrics were produced from PAN yarn with linear density 31tex\*2 on a "LONG XING" flat knitting machine in the laboratory of the "Textile Technology" department at TTESI. The technological indicators of the produced knitted fabrics were determined using standard methods in the laboratory of the "Uzbek-Turkish Test Center." The technological indicators of knitted fabrics are presented in Table 1.

The main requirements for knitted products are directly related to the technological parameters of the fabric. The results of the analysis of the research conducted on determining the technological indicators of knitted fabrics reveal that these are the factors that determine the quality indicators of knitted fabrics.

**1-Table Technological indicators of knitted fabrics**

Indicators	1 (plain)	2 (derivative plain)	3 (rib)	4 (interlock)
Type of raw material, linear density, tex	PAN 31*2 tex	PAN 31*2 tex	PAN 31*2 tex	PAN 31*2 tex
Loop pitch, A (mm)	2	2.2	2.4	2.6
Loop row height, V (mm)	1.3	1.4	1.6	1.8
Horizontal density, Rg	19	21	28	26
Vertical density, Rv	36	30	42	30
Loop yarn length <i>l</i> , mm	4.6	5.4	6.4	7.0
Surface density of knitted fabric, Ms, g/m <sup>2</sup>	160	200	365	380
Thickness, T mm	0.8	1.15	1.65	1.8
Volume density of knitted fabric, $\delta$ mg/cm <sup>3</sup>	205.6	170.7	232.6	211

The surface density, horizontal and vertical density, loop yarn length, loop pitch, loop row height, and thickness indicators describe the structure of knitted fabrics. If a new type of raw material or loop elements are changed in the composition of knitted fabric, the structure, indicators, and physical-mechanical properties of the fabric change. Traditionally, the most important factor of raw material consumption in the fabric is considered to be the surface density of the knitted fabric. The surface density of knitted fabrics is one of the main technological indicators. One of the primary characteristics of knitted fabric is its low raw material consumption. In this case, surface density, thickness, and volume density are taken into account. Surface density depends on the type of yarn used in the fabric, its linear density, as well as changes in the percentage of yarns [3-6].

If the surface density of the single-layer plain fabric of variant I made from PAN 31tex\*2 yarn is  $MS=160 \text{ g/m}^2$  and the thickness  $T=0.8 \text{ mm}$ , then its bulk density is  $200 \text{ mg/cm}^3$ , as shown in Table 1.

If the surface density  $MS=200 \text{ g/m}^2$  and the thickness  $T=1.15 \text{ mm}$  of single-layer derivative plain knitted fabric of variant II from PAN 31tex\*2 yarn, then its bulk density is  $170.7 \text{ mg/cm}^3$ .

If the surface density of the two-layer rib fabric of variant III, obtained from PAN 31tex\*2 yarn, is  $MS=365 \text{ g/m}^2$  and the thickness  $T=1.65 \text{ mm}$ , then its bulk density is  $232 \text{ mg/cm}^3$ , as shown in Table 1.

If the surface density  $MS = 380 \text{ g/m}^2$  and the thickness  $T = 1.8 \text{ mm}$  of the two-layer interlock knit fabric variant IV made from PAN 31 tex\*2 yarn, then its bulk density is  $211 \text{ mg/cm}^3$ .

The surface density of the 1st variant plain fabric was  $160 \text{ g/m}^2$ , the surface density of the 2nd variant derivative plain fabric was 25% less than  $200 \text{ g/m}^2$ , the surface density of the 3rd variant double-layered rib fabric was  $365 \text{ g/m}^2$ , and the surface density of the 4th variant interlock fabric was 0.4% less than  $380 \text{ g/m}^2$ .

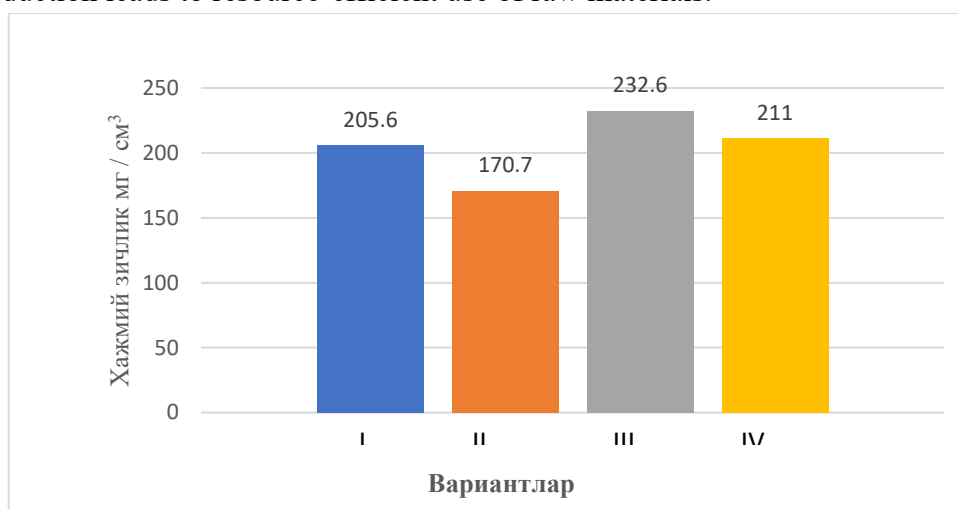
V-I plain; PAN 31*2 tex Spun yarn 24x3	160 g/m <sup>2</sup>
V-II derivative plain; PAN 31*2 tex Spun yarn 24x3	200 g/m <sup>2</sup>
V-III rib; PAN 31*2 tex Spun yarn 24x3	380 g/m <sup>2</sup>
V-IV interlock; PAN 31*2 tex Spun yarn 24x3	356 g/m <sup>2</sup>

#### Surface density of knitted fabrics.

We can observe the raw material consumption by considering the surface density, thickness, and bulk density of knitted fabrics.

Bulk density is an indicator that fully reflects the raw material consumption of knitted fabric. This indicator shows the consumption of raw materials in the production of knitted products, taking into account not only the surface area of the knitted fabric but also its thickness [7-10].

As a result of the study of knitted fabrics, variant II with a single-layer derivative plain stitch has the lowest volumetric density of  $170.7 \text{ mg/cm}^3$  and a thickness of 1.15 mm, which is 20% less than variant I with a volumetric density of  $205.6 \text{ mg/cm}^3$  and a thickness of 0.8 mm. It was established that the volumetric density of the rib knit sample of variant III with a thickness of 1.65 mm and volumetric density of  $232.6 \text{ mg/cm}^3$  is 10% higher than the interlock sample of variant IV with a thickness of 1.8 mm and volumetric density of  $211 \text{ mg/cm}^3$ . This indicates that using variant II derivative plain stitch and variant IV interlock fabrics in production leads to resource-efficient use of raw materials.



**Histogram of volumetric density of knitted fabrics.**

### Conclusion

1. Scientific research of knitted fabrics made from PAN yarn creates opportunities for widespread use of local raw materials.
2. The production of knitted fabrics on flat-bed knitting machines increases the technological capabilities of the machine and expands the range of fabrics and products.
3. The histogram of changes in the volumetric density of the proposed knitted fabrics shows that the volumetric density indicators of variant I plain stitch and variant III rib knit fabrics are significantly higher. This leads to resource-efficient use of raw materials when variant II derivative plain stitch and variant IV interlock fabrics are used in production.
4. Variant II derivative plain stitch and variant IV interlock knitted fabrics made from PAN yarn are recommended for outerwear knitted products.

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