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# Research influence of the size of the circle and share of the silk fiber in the mixture on the qualitative indicators of cotton silk yarn

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**ABSTRACT:** This article presents a study of the physicomechanical properties of the produced blended cotton silk yarn according to GOST 6611.0-73, 6611.1-73, 6611.2-73, 6611.3-73. During the study, linear density, half and one cycle characteristics, twist and twist on the twist, and other indicators of mixed cotton silk yarn obtained from the waste of silkwool cotton wool were determined. In terms of physical and mechanical properties of blended cotton-silk yarn are within normal limits, and in terms of relative breaking load, they exceed the control ones. Other blended yarns also improved. However, the tearing coefficient largely influences the breaking behavior of the resulting yarn. Therefore, further studies determined the relationship between the twist coefficient, twist and linear density of the blended cotton silk yarn. In order to study the effect of the twist coefficient on the physicomechanical properties of blended yarn, we investigated samples produced on a spinning machine with a spindle speed of 9000 rpm and a twist of 315, 998, 1011, 1015 and 1035 cr / m.

According to the experimental data of the experimental yarn, the critical twist zone occurs at 1020 cr / m.

**KEY WORDS:** Physico-mechanical properties, blended cotton silk yarn, research, GOST, linear density, half and one cycle characteristics, twist and uneven twist, metric number, breaking load, breaking elongation, relative breaking load.

## I. INTRODUCTION

In the period of intensification of production, one of the main tasks is the economical use of expensive cocoon raw materials, the introduction of low-waste technological processes and the disposal of waste generated during the cultivation and unwinding of cocoons.

## II. LITERATURE SURVEY

One of the types of fibrous waste of natural silk includes silkworm waste - vata-sdir. Vata-sdir is considered to be non-recyclable and cheap raw material, and is thrown out together with the cocoons during the collection of cocoons [1,2].
In order to expand the raw material base of the textile industry, we explored the possibilities of using this silkworm waste in other sectors of the textile industry and obtained mixed cotton and silk yarns [3,4].

## III. RESEARCH METHOD

The physicomechanical properties of the produced blended cotton silk yarn were investigated according to GOST 6611.0-73, 6611.1-73. 6611.2-73, 6611.3-73 in the testing laboratory of the Chinabad spinning and weaving mill and the textile materials science laboratory of the Andijan machine-building institute [5]. At the same time, linear density,

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half and one cycle characteristics, twist and roughness in twist and so on were determined. The test results are presented in table-1.

Table-1
Physico-mechanical properties of cotton silk yarn

| Показатель | Indicator Statistical Characteristics | | | | | |
|---|---|---|---|---|---|---|
| | Mixture 1 | | | Mixture 2 | | |
| | X | *G* | C | X | *G* | C |
| Linear density, tex | 18,5 | 0,4 | 2,2 | 18,3 | 0,4 | 2,2 |
| Metric number, m/g | 54,9 | 1,4 | 2,6 | 54,6 | 1,4 | 2,6 |
| Breaking load, cN | 233 | 22,8 | 9,8 | 225 | 23,2 | 10,3 |
| Elongation at break, % | 32,0 | 3,4 | 10,6 | 33,3 | 3,3 | 9,9 |
| Relative breaking load, cN/tex | 12,8 | 1,8 | 9,5 | 12,5 | 1,9 | 9,7 |
| Spin (actual) cr/m | 915 | 68,6 | 7,5 | 916 | 69,5 | 7,6 |

**Note:** X - root mean square value;
G - standard deviation;
C - the coefficient of variation.

From table 1 it is seen that the physicomechanical parameters of the yarn are within normal limits, and in terms of relative breaking load exceed the control ones, i.e. the experimental batch has a relative breaking load of the blended yarn 1 mixture 12,8 and 2 mixture -12,5 cN/tex (11,3 cN/tex in the control). Other blended yarns also improved. However, the tearing coefficient largely influences the breaking behavior of the resulting yarn. Therefore, the relationship between the twist coefficient, twist and linear density of the blended cotton silk fibers was determined.

## IV. THE OBTAINED RESULTS

**Twist**

$$K = \frac{1000}{h} \qquad (1)$$

**Where:** h - height or pitch, mm.

Expanding in the plane a coil formed by the fiber, we obtain a triangle (Fig. 1).

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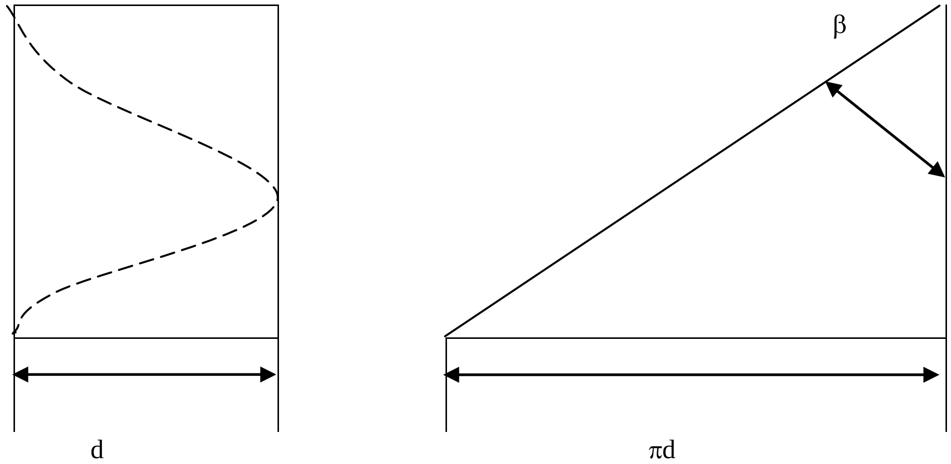

Fig. 1. The coil formed by the fiber, deployed in a plane.

The angle of inclination of the fibers and the axis of the product is denoted by then from this triangle we get:

$$tgB = \frac{\pi \cdot d}{h} \quad \text{or} \quad h = \frac{\pi \cdot d}{tgB} \qquad (2)$$

**where:** d - is the diameter of the yarn, mm.

Solving equations (1) and (2) together, we obtain:

$$K = \frac{1000 \cdot tgB}{\pi d} \qquad (3)$$

A product of length L has a mass of:

$$m_n = V\gamma, \quad \text{or} \quad m_n = \frac{\pi \cdot d \cdot l}{4} \cdot \gamma \qquad (4)$$

**where:** V - is the length of the product;
$\gamma$ - average density of the product, mg / mm3

However

$$\frac{m_n}{l} = \frac{T}{1000} \qquad (5)$$

**where:** T - linear density of yarn, tex.

According to this, we determine the mass through linear density

$$\frac{T}{1000} = \frac{\pi \cdot d^2}{4} \cdot \gamma \qquad (6)$$

then

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$$d = \sqrt{\frac{4T}{(1000 \cdot \pi\gamma)}} = \frac{2\sqrt{T}}{\sqrt{1000 \cdot \pi d}} \quad \text{or} \quad d = 0{,}0357\sqrt{\frac{T}{\gamma}} \qquad (7)$$

Substituting the value of d in (3), we obtain:

$$K = \frac{1000tgB}{\pi \cdot 0{,}0357} \cdot \sqrt{\frac{\gamma}{T}} \quad \text{or} \quad 89{,}21\sqrt{\frac{\gamma}{T}}tgB \qquad (8)$$

Transforming (8), we write it as follows:

$$K = \frac{89{,}21tgB\sqrt{\gamma} \cdot 100}{\sqrt{T}} \qquad (9)$$

The value $d_T = 89{,}211 \cdot tgB \cdot \sqrt{\gamma}$ is called the twist coefficient.
then

$$\sqrt{\gamma} = \sqrt{\gamma_{\frac{x}{b}}(1 - \frac{d_1}{100})} + \sqrt{\gamma_{шелк}(1 - \frac{d_2}{100})} \qquad (10)$$

**where:** $d_1$ , $d_2$ - fractional content of components,%.
So twist:

$$K = \frac{d_1 \cdot 100}{\sqrt{T}} \qquad (11)$$

## V. CONCLUSIONS

In order to study the effect of the twist coefficient on the physicomechanical properties of blended yarn, we investigated samples produced on a spinning machine with a spindle speed of 9000 rpm and a twist of 315, 998, 1011, 1015 and 1035 cr/m.

The test results of the yarn are shown in table 2. According to the experimental data of the experimental yarn, the critical twist zone occurs at 1020 cr/m.

Table- 2.
Physico-mechanical characteristics of cotton silk yarn depending on the number of torsions.

| Index | The number of torsions, cr/m | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Composition 50 to 50% | | | | | Composition 75 to 25% | | | | |
| | 915 | 999 | 1011 | 1015 | 1035 | 915 | 999 | 1011 | 1015 | 1035 |
| Linear density tex | 18,2 | 17,9 | 18,2 | 18,7 | 18,8 | 18,0 | 18,4 | 18,6 | 17,9 | 18,4 |
| Metric number, m/g | 54,9 | 55,9 | 54,9 | 53,5 | 53,2 | 55,5 | 54,3 | 52,8 | 55,7 | 54,3 |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| The coefficient of variation in linear density, % | 2,6 | 3,4 | 1,6 | 3,6 | 2,0 | 2,7 | 3,1 | 2,3 | 2,5 | 2,1 |
| Breaking load, gs | 233 | 240 | 250 | 267 | 257 | 225 | 235 | 239 | 258 | 250 |
| Tensile elongation, mm | 5,5 | 6,2 | 6,4 | 6,6 | 6,4 | 6,1 | 6,3 | 6,3 | 6,8 | 6,5 |
| Actual twist, cr/m | 915 | 1004 | 1008 | 1010 | 1031 | 916 | 1006 | 1009 | 1019 | 1028 |
| The coefficient of variation in twist, % | 6,8 | 6,4 | 6,0 | 6,0 | 7,1 | 6,7 | 6,9 | 6,1 | 6,6 | 7,0 |

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