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Influence of Twists on Physico-Mechanical Properties

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ABSTRACT:The linear density of raw silk samples from emulsification has been studied, as well as the change in geometric dimensions as a result of fusion and unraveling. A spinning plan was developed for the selected raw silk assortments, and spun yarns were produced. The physical and mechanical parameters of the obtained spun silk samples were determined. -900 twist/meter yes 484-497 sN, 3,23x4 teks 600 twist / meter yes 776 sN, 3,85x4 teks 600-900 twist / meter yes 776-699 sN, 4,65x4 teks 600-1200 twist / meter was 806-775 sN.

KEYWORDS:Silk, spun silk, number of twists, yarn radius, yarn diameter, number of yarns.

I. INTRODUCTION

The yarns are twisted to give them certain properties, increase their toughness, prepare them for weaving and knitting, and improve their performance. According to the use of spun yarns are divided into those used in the manufacture of textiles and knitwear, and those used in the technique. Such yarns are produced in special spinning mills, in the spinning mills of silk mills. Spun products are made of natural silk, artificial and synthetic yarns. Natural silk raw material has complex properties, that is, textile products made from it represent its high level of physical-mechanical and consumer properties. Natural silk yarns will have a perfectly shiny look. It depends on the breed of the cocoon, how the silkworm is cared for, how it is steamed, how the silk is washed and dried. The geometric dimensions, mechanical properties and uniformity of the yarns depend on the components of the deformation and the ability of the welded yarns to withstand various, repetitive stresses and, to a certain extent, the magnitude of the elongation value. Raw silk does not have heat and electrical conductivity properties, so it is used as an insulating material in the electrical industry. Silk has good mechanical properties. The relative tensile strength varies between 26-38 sN / tex depending on the type of silk raw material, navigation and the method of spinning the yarn, and the elongation before breaking varies from 15 to 23%.

II. ANALYSIS OF EXISTING FILTERING MATERIALS AND RESEARCH RESULTS

Raw silks of different linear densities were selected for the production of spun yarn. The following technological sequences are used in the preparation of raw silk for re-wrapping: preparation of silk for soaking in the bath; soaking raw silk in a bath; squeezing, squeezing, drying after drying; rest on raw silk is done. The following recipe is used to emulsify raw silk. Olein soap-100 g; castor oil-100 g; Vaseline oil-50 g; OP-50 g. Soap softens the sericin. Vaseline and castor oil soften the silk. Soaking silk in a bath takes 3.5 liters of water for 0.5 kg of silk. The selected emulsifiers are of great importance. This is because during the wrapping process, the yarns may become tense and cracks may appear in the yarn.

The raw silk comes in yarn and is rewrapped from the yarn into a two-flange spool. The purpose of wrapping raw silk from yarn to spool is to prepare it for weaving. During rewinding, the yarns are inspected, cleaned, and the tangled knots and thin areas of the yarn are removed.

The rewinding process is carried out on the machine MT-85, installed in the laboratory of the department "Silk Technology". Adding more than one thread at a time is called adding-growing. The goal of this process is to twist by



adding a few strands. The yarns from the rewinding machine are routed to the MT-CW-D / T spinning machine, where the required twist is given.

In the production of silk from natural silk, its length is reduced when twisting the yarn. The shrinkage of silk affects its density. The shortening in the twisted yarns is calculated using the G.N. Kukin formula. This formula is as follows:

$$U=I \cdot 100\%$$

Where *I*- is the reduction factor.

$$I = 1 - \frac{1}{\sqrt{\left(\frac{2\pi Rk}{10^6}\right)^2 + 1}}$$

Where *k*- is the number of turns, br / m.

R- yarn radius, mk.

Depending on the diameter of the thread and the number of threads being added.

$$\text{If: 4 pieces of silk } R = \frac{d}{\sqrt{2}}$$

The diameter at which the threads grow is calculated by the following formula.

$$d = 0,0357 \sqrt{\frac{T}{\gamma}}$$

where *hajm* is the volume weight of $\delta - 1.1 \text{ g / cm}^3$

T-calculated linear density.

The calculated linear density of the spun yarns is found as follows:

$$T_h = \frac{T_n \cdot m}{\left(1 - \frac{\Pi}{100}\right) \left(1 - \frac{\alpha}{100}\right) \left(1 - \frac{U_k}{100}\right)}$$

Here: *T_n* – nominal linear density

m - the number of threads being added.

Π - weight gain after silkworms, %

α -the amount of rings, %. *U_k*- shortening of the thread from swelling, %

III. EXPERIMENTAL RESULTS

2.33 tex for the experiment; 3,23tex; Raw silk samples of 3.85 tex and 4.65 tex were taken. Physico-mechanical parameters of the obtained raw silk samples were determined.

Table 1
Physical and mechanical properties of raw materials

Lineardensity, tex	Interruptionpower,sN	Elongationatbreak,%	Relative tensile strength sN / tex
2,33	66,17	19,82	28,4
3,23	93,73	19,18	29,02
3,85	147,33	18,80	38,27
4,65	185,81	18,64	39,96

The results obtained showed that the increase in linear density of raw silk led to an increase in tensile strength and relative tensile strength. The elongation at break was observed to decrease slightly.



Wetting raw silk before spinning is a necessary measure to soften the glued areas of the yarn and reduce the electrification of the silk. Silk - the raw material softens and becomes flexible after wetting, which facilitates subsequent processing. However, as a result of emulsification, the weight of the yarn increases and the linear density changes. Therefore, the linear density change of the raw silk obtained from the sample obtained after emulsification was determined.

Table 2
Calculated linear density after emulsification of the obtained raw silk samples

Density of raw silk line, tex	Calculated linear density, tex
2,33	2,37
3,23	3,26
3,85	3,89
4,65	4,68

The results obtained showed that the calculated linear density also increased due to the linear density emulsification. The plan of spinning in spinning mills is the basis for the development of technological maps, which provide all the technological parameters and tastes of the spun product. Growth and technological plans are developed separately for each type of yarn. On this basis, a growth plan for the production of yarns that meet high quality standards at low cost will be developed and high technical and economic indicators will be achieved, including labor productivity and low product costs. Accordingly, a growth plan was developed for the selected raw silk assortments.

Table 3
Growth plan for the production of raw silk yarn

Technological processes	Workshop brand	Technological parameters		
1. Sorting and grouping	onhand			
2. Specific	AZShS-2	T=40-42 ⁰ C t=60-120min		
3. Compression	TsentrafugaTs-150	t=15min		
4. Adjustment and correction	manually			
5. Drying	KC-2	T=40-45 ⁰ C t=60-120 min		
6. Rest	Intheroom	T=22-26 ⁰ C W=65-75 % t=3-8 hour		
7. Wrapping	MT-85	V=180 m\min		
8. Addition *	MT-CW D/T VTS-08-0S	K, (S,Z) tw/m	V, m\min	n _y
		600	15	9000
		900	10	9000
		1200	7,5	9000
		1500	6	9000
9. Balancing and relaxing the twists	SC-750 intheroom	T=65-70 ⁰ C t=30 min T=22-26 ⁰ C; W=60-70%		
10. Re-wrapping the yarn	DM-3	V=180 -240 m\min		
11. Drying and resting	intheroom	T=22-26 ⁰ C W=60-70 % T=12-18 hour		
12. Wrapping in consumer packaging				
13. Control and storage		Warehouse		



* **Appendix:** Working parameters on linear density: 2.33 x2S 600 x 2Z 600; 2.33 x2S 900 x 2Z 900; 2.33 x2S 1200 x 2Z 1200; 2.33 x2S 1500 x 2Z 1500; 3.23 x2S 600 x 2Z 600; 3.23 x2S 900 x 2Z 900; 3.23 x2S 1200 x 2Z 1200; 3.23 x2S 1500 x 2Z 1500; 3.85 x2S 600 x 2Z 600; 3.85 x2S 900 x 2Z 900; 3.85 x2S 1200 x 2Z 1200; 3.85 x2S 1500 x 2Z 1500; 4.65 x2S 600 x 2Z 600; 4.65 x2S 900 x 2Z 900; 4.65 x2S 1200 x 2Z 1200; 4.65 x2S 1500 x 2Z 1500.

In order to produce a new range of yarns, the raw material was produced by screwing 600, 900, 1200, 1600 twist/meter into 4 pieces. As a result of the addition, the linear density of the threads depends on the number of rings, the increase in weight as a result of emulsification and the reduction in wear. Therefore, the calculated linear density of the added and worked yarns was determined.

Table 4
The calculated linear density of the added and worked yarns

Calculated linear density of raw silk after emulsification, tex	The calculated linear density of the yarn after joining and joining, tex
2,37	10,7
3,26	13,5
3,89	15,6
4,68	19,3

The geometric dimensions of the yarns change as they are added and worked. Therefore, the geometric dimensions of the raw material and its shrinkage were determined.

Table 4
Geometric dimensions of yarns and shortening from wear

Indicators	Assortment of spun yarn			
	2,33x4	3,23x4	3,85x4	4,65x4
Diameter	0,30	0,41	0,49	0,60
Radius	0,21	0,29	0,34	0,54
Number of turns	Reduction coefficient, %			
600	1,3	2,1	2,9	3,7
900	2,9	3,6	3,7	4,7
1200	5	6,2	6,4	6,8
1500	6,9	9	9,9	12

The results obtained showed that an increase in the number of twists and linear densities applied to the yarn led to an increase in the geometric dimensions and an increase in the shrinkage coefficient. The physical and mechanical properties of the spun yarns were studied.

Table 5
Research of physical and mechanical properties of twisted yarns

Raw materials	The planned growth rate is $K_{tw/m}$	Somribason	Physical and mechanical properties of the test strip					Shrinkage as a result of growth, %	Yarn strength, sN	Elongation at thread break, %
			$K_{x_{max}}$ tw/m	K_{max} tw/m	K_{min} tw/m	σ , tw	C, %			
1	2	3	4	5	6	7	8	9	10	11



2,33x4	600	10	650	672	637	12,7	2	1,3	484	17,9
	900	10	945	975	924	17,6	1,9	2,9	497	20,5
	1200	10	1229	1254	1213	15,2	1,2	5,0	470	19,4
	1500	10	1519	1525	1514	16,4	3,9	6,9	430	16,3
3,23x4	600	10	608	624	583	14,1	2,3	2,1	606	19,29
	900	10	932	960	902	20,6	2,2	3,6	582	19,80
	1200	10	1226	1259	1216	21,4	1,9	6,2	486	14,36
	1500	10	1527	1536	1514	22,1	1,8	9,0	456	14,16
3,85x4	600	10	631	652	616	14	2,2	2,9	776	20,34
	900	10	931	959	911	18,1	1,9	3,7	699	21,69
	1200	10	1282	1333	1254	27,9	2,2	6,4	603	18,86
	1500	10	1546	1556	1502	29,5	1,8	9,9	559	18,36
4,65x4	600	10	643	651	621	15,2	2,3	3,7	806	21,4
	900	10	921	932	910	15,4	1,9	4,7	775	20,9
	1200	10	1232	1235	1216	15,8	1,8	6,8	743	19,9
	1500	10	1556	1558	1504	16,4	1,6	12,0	699	18,9

The readings were taken on a STATIMAT-C device. Accordingly, the best performance is at 2.33x4 tex 600-900 tw/m, 3.23x4 tex at 600 tw/m, 3.85x4 tex at 600-900 tw/m, and 4.65x4 tex at 600-tw/m. was found to be As a result of adding and twisting the threads, the amount of elongation was 20.5-21.69% at 600-900 tw/m.

IV. CONCLUSION AND FUTURE WORK

2.33 tex for the experiment; 3,23tex; Raw silk samples of 3.85 tex and 4.65 tex were studied to increase the linear density of yarns from emulsification, as well as to change the geometric dimensions as a result of joining and unraveling.

A spinning plan was developed for the selected raw silk assortments, and spun yarns were produced accordingly.

The physical and mechanical properties of the obtained spun silk samples were determined. 497 sN, 3,23x4 tex 600 tw/m,776 sN, 3,85x4 tex 600-900 tw/m,776-699 sN, 4,65x4 tex 600-1200 tw/m,806-775 sN ni formed.

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