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New Assortment of Natural Silk Products

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ABSTRACT: This article is devoted to the development of the basis of the production technology of a new range of natural silk. The limit of the coefficient of uniformity of cotton-silk knit structures is theoretically and experimentally substantiated. Technological parameters and their evaluation of medical silk gauze production are grounded and the results of clinical approbation of the new material are given.

KEY WORDS: silk thread, raw silk, twisting, sewing thread, linear density, sericin, parameter, boiling, rewinding, method.

I.INTRODUCTION

The Republic of Uzbekistan is among the top five producers of raw silk in the world. By organizing industrial feeding and breeding of the silkworm, improving the technology and technology of cocoon reeling, expanding the range of raw silk threads, ready-made fabrics, knitwear, various clothes, technical, household, medical products and other competitive materials, in general, creating waste-free silk technology is huge reserves.

It is worth noting that the feed base is already expanding in the first place, plant feeds are being created, and silkworm feeding in two and three replications in the spring and autumn is going everywhere. This made it possible to restore declining branches of the branch during the years of the establishment of the independence of the Republic and the transition to a market economy. The company "Bukhara brilliant Silk" having mastered the technology began to produce classic crepe fabrics.

II.ANALYSIS OF EXISTING FILTERING MATERIALS AND RESEARCH RESULTS

Technologists and production methods of various national fabrics such as “Khan Atlas”, “Bekasab”, “Shoyi”, “Adras” and silk carpets unique to the artwork with ornaments were restored. All this allowed in a short time to almost double the export potential of the industry.

Our scientists are developing new and improving existing production technologies for the production of a wider range of products that are in demand both in the domestic and international markets.

It is known that in Japan, China and India in knitted production as raw material used silk yarn obtained from the fibrous waste of natural silk, formed during the unwinding of silk cocoons during the production of raw silk and woven products. In the available literature sources, a description of the technological parameters of the production of knitwear from silk yarn is not available. Also in publications, or in practice, did not encounter the use of spun silk from raw silk in knitwear.

Indeed, raw silk with a high content of 20-30% adhesive substance - sericin, gives high rigidity to twisted threads. Experimental research has shown that in the production of knitwear, rigid silk threads in the process of looping create difficulties, such as the release of needles and the knitwear defect in the form of a thread break (Figure 1).

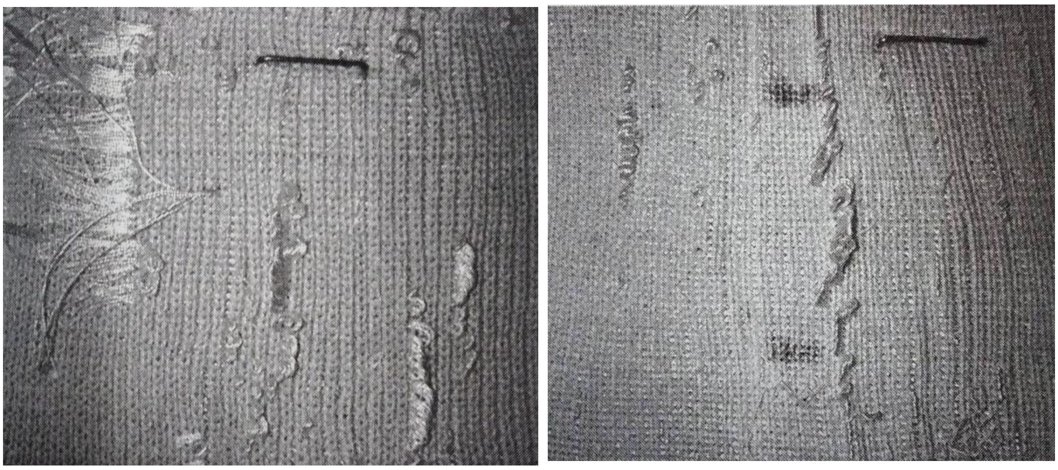

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Fig. 1. Weave knit weaving based on an eraser

III. LITERATURE SURVEY

We have developed a method of boiling sericin and justified an emulsion recipe for this purpose. On the basis of theoretical and experimental research, a method for the production of cotton-silk knitwear with a homogeneous structure has been developed. By studying the deformation properties of cotton yarn and silk twisted yarn, taking into account their physic-mechanical properties, the relative deformation rates were estimated, respectively, marking the cotton yarn (index 1) and silk yarn (index 2)

$$\varepsilon_1 = \frac{F_1}{(E_1 \cdot S_1)} \ ; \ \varepsilon_2 = \frac{F_2}{(E_2 \cdot S_2)} \qquad (1)$$

Where

$$F_1 = \frac{F \cdot n_1}{(n_1 + n_2)} \ ; \ F_2 = \frac{F \cdot n_2}{(n_1 + n_2)}$$

F1, F2 - tension force attributable respectively to cotton yarn and silk thread; F is the total tensile strength of the combined raw material; n2 and n1 - the number of additions of yarn and thread; E1 and E2 - longitudinal elastic modulus; accordingly, E1 = 1.35 GPa (cotton), E2 = 3 GPa (silk).

When calculating by formulas (1), it is necessary to take into account the total cross-sectional area of the raw material with additions n1 and n2:

$$S_1 n_1 \ \text{и} \ \ S_2 n, \ \text{где} \ S_1 = \frac{0{,}001\, T_1}{\delta_1} \ \text{и} \ S_2 = \frac{0{,}001\, T_2}{\delta_2}$$

T1 and T2 - linear density, respectively, of cotton yarn and silk thread.

δ1 = 1.25 mg / mm2; δ2 = 1.35 mg / mm2 - bulk density (δ1 - cotton, δ2 - silk).

In the first approximation, assuming during knitting equal degrees of relative deformation for cotton yarn and silk yarn, we get:

$$F = \frac{F_1 (n_1 + n_2)}{n_1} = \frac{F_2 (n_1 + n_2)}{n_2} \qquad (2)$$

Or taking into account the expressions for the area S1 and S2 after transformations

$$\frac{T_1 \cdot n_2}{T_2 \cdot n_1} = \frac{\delta_1}{\delta_2} \cdot \frac{E_2}{E_1} \cdot \frac{\varepsilon_2}{\varepsilon_1}$$

The last relation shows the interrelation of the parameters of yarn and thread (linear density, tex and number of additions) with their mechanical properties. In our opinion, expression (2) can be clarified if we take into account the

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plastic deformability of the raw material that makes up the structure of the knitted fabric, i.e. the ratio of the plastic components of the total deformation of the silk thread (0.39) and cotton yarn: (0.64) i.e.

$$\frac{T_1 \cdot n_2}{T_2 \cdot n_1} = \frac{\delta_1}{\delta_2} \cdot \frac{E_2}{E_1} \cdot \frac{0,39}{0,64} = \frac{1,25}{1,35} \cdot \frac{3}{1,35} \cdot \frac{0,39}{0,64} = 1,25$$

The resulting ratio can be expressed using a certain coefficient Rc - the coefficient of uniformity of the raw structure of the knitwear, taking into account the properties and linear density of the combined raw materials.

$$\frac{T_1 \cdot n_2}{T_2 \cdot n_1} = \frac{\delta_1}{\delta_2} \cdot \frac{E_2}{E_1} \cdot \frac{\varepsilon_{n(2)}}{\varepsilon_{n(1)}} \qquad (3)$$

The results of the study of indicators of experimental and industrial designs confirmed the adequacy of the theoretical coefficient of which was Rc = 0.4 ÷ 1,25. With an increase in Rc>1,25, the quality of cotton-silk knitwear deteriorates. It should be noted that with an increase in the content of silk yarn in relation to cotton yarn, there is a dramatic improvement in the quality indicators of knitwear, a noticeable effect of silky sheen and softness of the canvas. In Fig.2. Samples of cotton-silk knitwear are shown with varying degrees of uniformity coefficient of the raw structure.

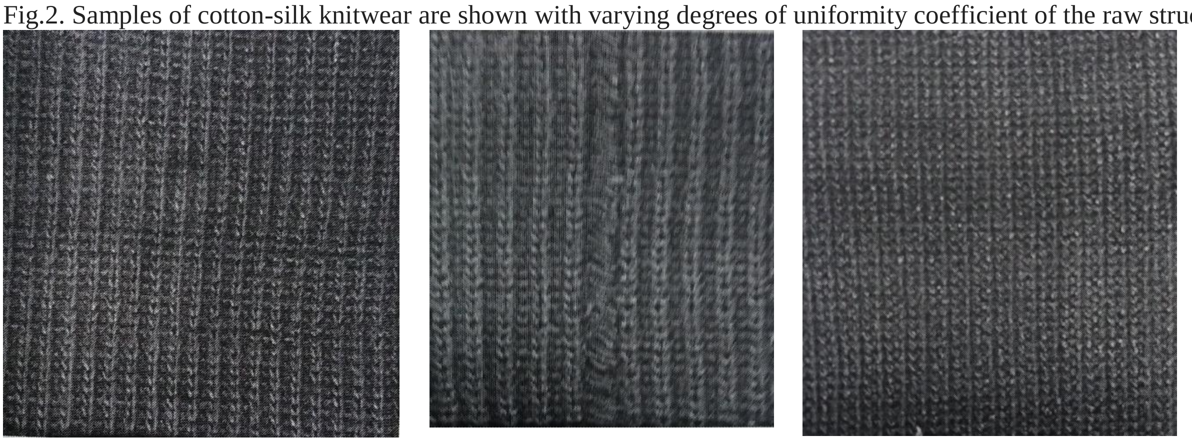

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Figure 2. Cotton-silk knitwear: a) weft interlacing on the basis of a full eraser, Rc = 0,48; and b) Rc = 0,8; c) weft interlacing on the basis of the incomplete eraser Rc = 1,2.

The developed technology was introduced in the conditions of small knitwear enterprises of the Republic.

The main components of the cocoon thread are fibroin (70-80%) and sericin (20-30%). Fibroin is a natural high-molecular protein substance.

Research has shown that natural silk contains all the essential amino acids that exist in the human body. This prompted us to develop a method for the preparation of raw materials and the production of medical silk gauze.

The study showed that cotton gauzes and bandages, which are widely used in medicine, due to the increased mass capacity, especially when applying a gauze bandage in several layers, worsens the process of granulation and epithelialization of the wound surface as a result of which initial contamination increases (the number of microorganisms disseminated products). In addition, cotton gauze has a low breaking load, both on the base and on the weft, and there are no natural antiseptic properties.

The silk gauze freed completely from sericin becomes soft and is easily modeled into wipes, tampons and turunds. Natural silk (fibroin), which consists of natural protein and has antiseptic properties [2] does not allow the development of microorganisms, especially in their use on the burn surface of the skin.

New medical gauzes are made with plain weave: the first sample on the basis of silk yarn with a linear density of 14,28 tex, a weft of raw silk 3.23 tex; the second sample of the warp and weft of raw silk 3,23 tex. The surface density of gauze is 18-19,7g/m^2, the breaking load in the first embodiment on the basis of 90-122 N, weft 125-132 N; capillarity of samples not less than 7 cm/h, wettability rate not more than 5,0 s; pH of the aqueous extract is neutral, air permeability is 388 cm^3/cm^2 s; whiteness 83%; mass fraction of sulfate salts is not more than 0,02%, with natural antiseptic properties.

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V. EXPERIMENTAL RESULTS

The results of clinical use have shown that dressings from new medical silk gauze have a fairly uniform structure and are well wetted with biological fluids and drug solutions. When using gauze in the form of napkins for treating wounds and draining the operative field and the burn surface, it has been established that it effectively absorbs and retains wound discharge. As part of the ointment dressings, gauze satisfactorily absorbs the ointment on both fat and hydrophilic basis. Gaps and other defects of appearance in the gauze are not marked. Changes in the structure and properties after steam, ultrasound, radiation (Co60) and thermal sterilization were not detected. Upon contact with the wound surface and intact skin, no allergic or irritant defects were noted. Especially, on the burn surface of the skin was not observed the development of microorganisms, due to the natural antiseptic properties of silk.

VI. CONCLUSION AND FUTURE WORK

A state standard has been developed and approved by the relevant authorities in the prescribed manner. The industrial production of medical silk gauze was organized. This product is export oriented and patented for the method of producing silk gauze in Republic of Uzbekistan No. IAP05210.

Methods and technologies have been developed for obtaining a new assortment of silk sewing thread, medical suture materials by twisting and weaving their novelty confirmed by patents IAP04078, IAP05253. Have been obtained Patents for new samples of silk fabric and clothing No. SAP01254, SAP01350.

The widespread introduction into industrial production of new methods, production technology and designs contributes to the expansion of the range of competitive natural silk products.

Developed new methods and technologies and their widespread introduction into industrial production will expand the range of competitive silk products in both domestic and international markets.

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