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Preparation of Raw Materials for Knitted Products from Natural Silk

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Annotation: The article presents the evaluation indicators by selecting raw silk for the manufacture of knitted products, comparing its quality. Raw silk from Navruz-1 and Chinese hybrids, which are currently grown in the country, was used to make yarn. The technology of making twisted yarns for use in knitting has been proposed. In order to ensure the softness and elasticity of the spun yarns, a recipe for boiling them is recommended. The amount of residual sericin was calculated taking into account the properties of the added yarns and the value of a certain degree of growth, the reduction of sericin content in the yarn during boiling has a sharp effect on their ability to withstand various repetitive stresses of geometric dimensions, uniformity, mechanical properties. The strength characteristics of the spun yarns before boiling and after removal of the sericin are given. Since the initial recommended 350 tw/m values did not fully provide strength, it was found that the requirements for it were fully met when the number of turns was increased by 25%. One of the main technological features of raw silk is the ability to rewind from yarn to spool, which affects its quality, cost and the appearance of the rings. The raw silk used for the production of knitted products was inspected by organoleptic method before testing the condition of the yarns, and a special emulsion was sprayed on the yarns with the sticky parts. The ability to rewind raw silk was tested on a rewinding machine MT-85 (Japan) at a speed of 140-5 m / min. It was rewrapped for 90 minutes in accordance with the requirements of the standard, taking into account the rings.

Keywords: cocoon, liquid medium, cocoon thread, immersion, unwinding, rotation.

INTRODUCTION

At present, the silk industry is developing on a large scale in our country, so the demand for cocoon yarn is growing, and great attention is paid to improving the quality of raw silk and its products through the use of new technologies. In the research aimed at improving the efficiency of cocooning, production of raw silk and yarn, as well as improving the technology to ensure the competitiveness of products, the creation of new types of products for the country in the production of knitted products from natural silk is of particular importance. Therefore, the creation of technologies and methods of production of knitted products from natural silk, its new range remains one of the important tasks. Resolution of the President of the Republic of Uzbekistan PF-5989 dated May 5, 2020 "On urgent measures to support the textile and clothing industry" also sets out other normative legal acts in this area.

The aim of the study is to improve the methods and technologies of preparation of raw materials for the production of silk knitwear, to expand the range of competitive finished silk knitwear and silk products by introducing them into high-quality raw silk and twisting them.

Materials and methods: Raw silks are woven from double cocoons, which are used to create new ornaments on the body threads. The article describes the properties of spun yarns obtained by bottom-up and top-down spinning methods [1]. The research provides information on the silk cluster in the Karnataka region of India and the spinning machines used in silk processing in Ramanagaram [2].

The mulberry silkworm cocoon is a wonderful invention that allows humanity to create delicate and luxurious fabrics. However, American scientists have designed durable and natural fiber for other purposes. After simple processing, they can be used as optical devices. Such applications allow the safe management of many processes

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in a living organism. Why exactly is silk preferred? First, silk fiber is the most durable (within natural fibers), moreover, the protein content of this natural product is soluble in the human body without any health complications. The creation of silk-based devices does not require processing with sharp and toxic chemical bonds, does not require the use of high temperatures.

In Europe (England, France), the United States, Israel and Japan, intensive parallel work is underway to create a synthetic protein fiber that mimics the structure of a spider fiber with physical and mechanical properties similar to other fibers. Using a similar protein from other products (microorganisms, plants) for production, a soft and ultra-strong polymer protein called "Spider Silk" with a thickness of 100 nm was obtained. Spider silk has a wide range of applications, including surgical strips, light and strong bronchials, light hooks, and fishing nets. The emerging nanotechnologies make it possible to assemble the crystals of the required properties of individual atoms in the details of the constructors by observing physical methods. That is, placing and viewing the size of individual atoms in a billionth of a meter. [3, 4].

The range of spun yarns is varied, made from chemical yarns and silk raw materials. The main types of silk weaving products are: backing, tanda, grenadine, muslin, crepe-thin fabric, moskrep, crepe granite, shaped-patterned yarns, sewing thread, surgical and technical yarns, insulating yarns, textured yarns, various binding yarns . All of these yarns are given different twists and the direction of the twists is also different. Reproduction of different types of yarns is important in the creation of a new range of consumer goods [5-7]. Crude silk (fibroin) contains more than 20 amino acids in the human body. The fact that silk from nature has antiseptic and hygienic properties has a positive effect on the transfer of oxygen and moisture to the human body. For this reason, it is advisable to create new types of knitted yarns from natural silk and use them widely in practice [8-10].

This research has reported that this model of yarn does not lead to some differences or improvement in results when compared to other approaches, but also reflects an important and useful methodology for viewing complex systems based on statistical balancing methods, unlike other approaches. [11, 12].

In this work, the classification of knitted yarn assortments is based on the following characteristics: the purpose of the yarn, raw material composition, finishing method, as well as structural parameters such as the number of joints, twist direction, linear density (thickness) and others [13, 14]. It was found that the number of twists (br / m) varied by as much as 10-20% compared to the given, because the yarns in the old brand spinning machines, which used multi-process technology in the production of knitted yarn from natural silk, moved through the belt [15, 16].

One of the main factors in improving the socio-economic situation in the country is to improve the technology of preparation of raw materials, increase the efficiency of processing and establish production in a system of interconnected industries to quality finished products [17, 18].

According to the above-mentioned literature, the preparation of raw materials for the production of knitted products from natural silk is one of the most pressing issues.

Research results. The ability to rewind raw silk depends on the adhesion of the yarn, the flatness of the yarn, its tensile strength and elongation, adhesion, cleanliness. According to the analysis of the results, the number of rings in both hybrids was 6.0-7.0 and 6.0-6.0, respectively, in the experiments of Navruz-1 and Chinese hybrids. The actual linear density of the raw silk from the yarns in the rewinded reels was used to calculate the coefficient of variation. The results of the comparison of raw silk samples from both hybrid dry cocoons show that the coefficients of variation in linear density are 4.5-5.2% in the Navruz-1 hybrid and 4,2-4,8% in the Chinese hybrid. compliance with the standard requirement was determined.

In addition to the strength of individual cocoons, their number, the degree of adhesion of sericin, the coefficient of adhesion of cocoons, the frictional force and moisture of the threads, the method and mode of spinning also have a

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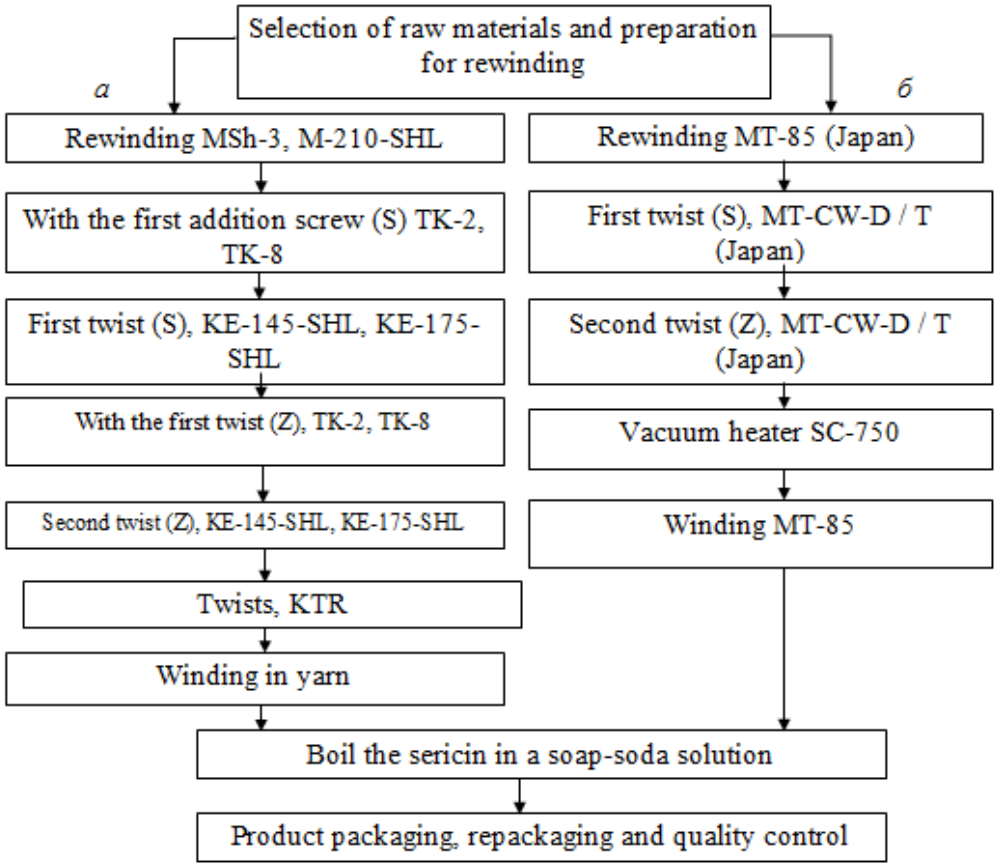
great influence on the breaking strength of raw silk. Typically, a yarn that has been soaked in hot water will be stronger than a non-adhesive yarn. Twisting the threads increases its strength during the cocoon spinning process. The relative strength of raw silk is higher than that of single cocoon yarn. The reason is the reduction of the cross-sectional unevenness along the length due to the adhesive property of sericin and the addition of several cocoon strip ends. The tensile strength and elongation before breaking of raw silk are important for the production of knitted yarns. Raw silk from Navruz-1 and Chinese cocoons was tested in accordance with the standard requirements of the established procedure.

The specific tensile strength of raw silk spun from the cocoon of the experimental Navruz-1 hybrid is 36,6 sN / tex, the relative elongation is 18,4%, respectively in the control – 34,3 sN / tex; 16,1%. In the Chinese hybrid, the figure was 36,9 sN / tex, 18,6% in the experiment, and 34,7 sN / tex, 17,0% in the control.

Natural silk cannot be used directly in the production of knitted fabric, the main reason being the sericin substance it contains. Experiments have shown that the content of sericin in the yarn is 7-8% to give the yarn the required elasticity and softness. Excess sericin was removed according to the recipe recommended in the classic method of boiling silk. It was found that the number of twists (bur/m) varied by as much as 10-20% compared to the given, as the yarns in the old brand spinning machines used in multi-process technology in the production of natural silk knitting yarn moved through the belt. The main reason for this is that the strips are eaten and the rotation of the ribs is different. Continuing the experiments, we took a sample of raw silk knitted yarn using modern equipment, which is housed in the department of "Silk Technology" and offered a technology with reduced cross-sections.



a) available; b) new;

Figure 1. Technology of production of knitted silk yarn

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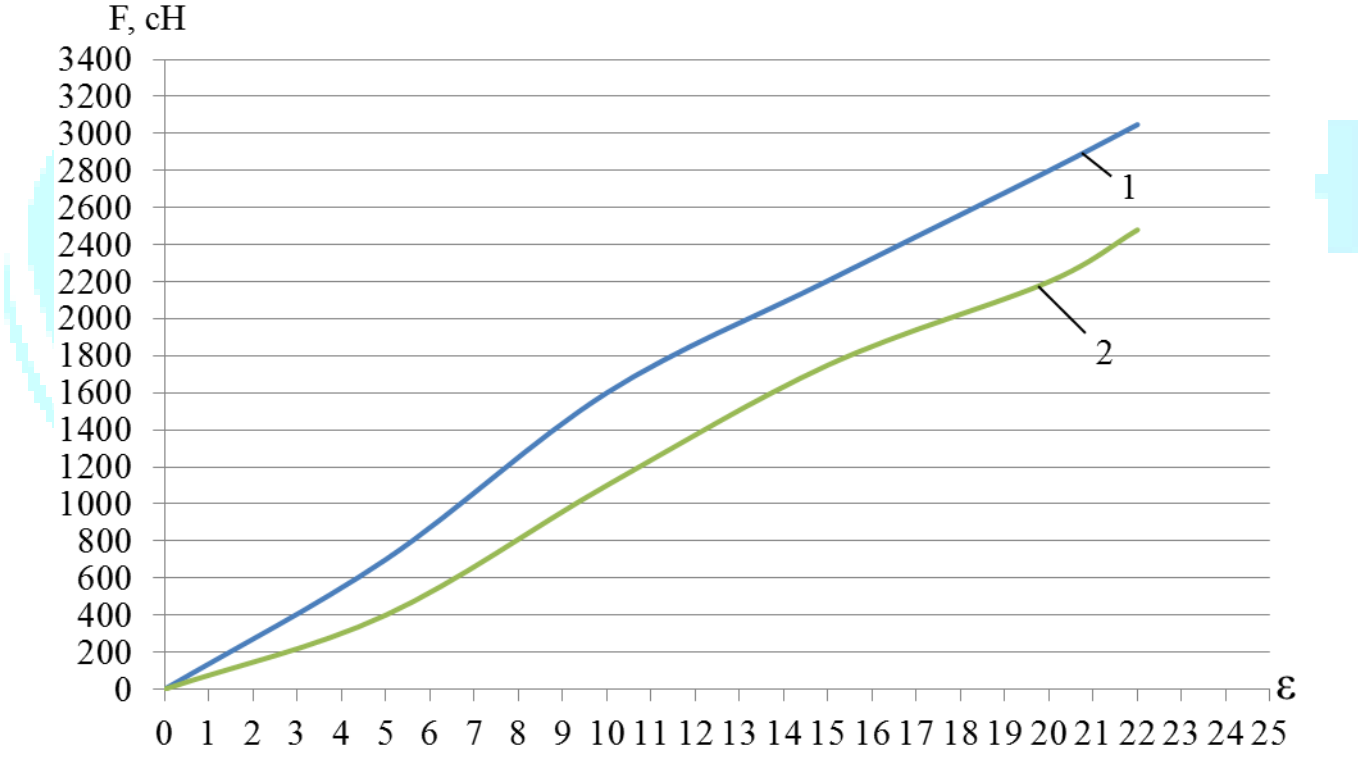
When designing knitted yarns on the basis of preliminary calculations, it is necessary to take into account the fact that they are subject to mechanical loads, elongation, stresses during use. The structure of yarn extraction recommended by us is given below (Table 1).

Table 1.

Structure and linear density, tex	
2,33 tex	3,23 tex
2,33 x 4 S 350	3,23 x 3 S 350
2,33 x 6 S 350	3,23 x 4 S 350
2,33 x 6 S 350 x 2 x 450 Z	3,23 x 3 S 350 x 3 x 450 Z

The number of elemental fibers and the properties of the raw material determine the properties of the complex yarns. That is, with the increase in the number of elementary yarns, the relative strength of complex yarns increases and has a positive effect on the various deformations of yarns during operation. The strength (specific tensile strength) of raw silk is a key indicator in the design of knitted yarn.



1- 25 tex unboiled; 2- 25 tex boiled; - new assortment;

Figure 2. Characteristics of breaking twisted 25 tex silk boiled and unboiled knitted yarns

The properties of silk and the value of a certain degree of growth, a decrease in the amount of sericin in the yarn during boiling have a sharp impact on the ability of spun yarns to withstand repetitive stresses of different geometric dimensions, uniformity, mechanical properties.

In determining the tensile strength of complex yarns using the M.N. Belitsyn formula, the strength of yarns is calculated using the number of elemental yarns, the breaking strength and the coefficient of use of their strength in complex yarns and the coefficient of the effect of twists on the strength of yarns.

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$$P = \frac{n \cdot T_o}{\left(1-\frac{\alpha}{100}\right)\left(1-\frac{\beta}{100}\right)}$$

The produced knitted yarn was boiled in the classical method to remove sericin. In the classical method, the yarns are boiled using a soap-soda solution according to the following recipe, g / l:

household soap (60%) - 1.0-2.0

soda ash - 2.0-4.0

bath modulus - 50: 1

process temperature - 90-95^{o}C

Duration - 50 minutes

The water is heated to a temperature of 80 °C by pouring water into the pot with a hardness of 4.0 mg.eq./l. A soap-soda solution is prepared in an enamel bowl until the water is hot and poured into a boiling pot. When the temperature reaches 90-95°C, the yarn in the yarn state is put in a pot and boiled for 50 minutes. The yarns are then rinsed in water at 85-90 °C for 5-8 minutes and in water at 40-45 °C for 3-5 minutes. The cleaned yarn is squeezed and dried at room temperature.

Knitted yarns are subject to significant mechanical loads when used in the weaving process. That is why it is necessary to keep perfect calculations in its design. This, in turn, allows you to predict the properties of knitted yarn, save raw material consumption and improve the growth process.

In the process of knitting yarn, more tension is applied along the axis of the yarn. In this regard, it is necessary to calculate and design the tensile strength of yarn in the production of knitting yarn.

The choice of raw materials is the most important in the design of silk knitted yarn. Physico-mechanical properties of silk yarns of different linear densities are given in Table 2.

Table 2.

Physical and mechanical properties of silk yarn (raw material)

Indicators	Linear densities of yarns, tex				
	Cocoon thread	Raw silk	Wrapped silk thread		
	0,302	3,23	9,72	13,45	29,17
Relative tensile strength, sN / tex	28,0	35	38,3	41,4	43,7
Relative hardness,% Knots in the wet state	- -	85 92	87 93	88,5 94	90 95
Interruption elongation,%	17	18	20	21,5	23
Намликда чўзилиши,%	34	36	40	43	46
Flexibility modulus 10^7 Pa	-	13000	19500	25200	31400
The strength of the cocoon yarn, the degree of use in raw and spun silk	-	1,1	1,15	1,18	1,2

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The lower the initial elongation modulus of the fiber, the higher the reversible, elastic deformation of the silk.

When choosing raw materials, it is necessary to take into account the change in their hardness in the wet state, the number of fibers in the knots.

Conclusion. In the improved method, taking into account the occasional breakage of knitted yarns during weaving, add 12 and 9 of raw silk of 2.33 or 3.23 text, respectively, increasing the number of twists by 25%, ie 440 tw / m instead of 350 tw / m based on a new composition of newly twisted knitted yarns with improved strength on the basis of giving.

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