ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

INDEX COPERNICUS INTERNATIONAL

Volume 9
Issue 3
2024

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SLIB.UZ Scientific library of Uzbekistan

I PRIMARY PROCESSING OF COTTON, TEXTILE AND LIGHT INDUSTRY

PRACTICE OF PRODUCTION OF POLYCOMPONENT THREAS FROM A MIXTURE OF NATURAL AND CHEMICAL FIBERS

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Abstract: This article presents the results of the practice of producing poly-component threads from a mixture of natural and chemical fibers in the production conditions of spinning factories and the production of fabrics and knitted products from them in weaving and knitting enterprises using the technology created at the Uzbek Research Institute of Natural Fibers. The mixtures of polycomponent threads used silk wool from fibrous waste of natural silk, cotton, wool and chemical fibers in the form of viscose, polyester fibers, as well as lycra. From the obtained polycomponent threads, suit and dress fabrics are produced at weaving enterprises, as well as women's knitwear at knitting enterprises. As a result of experimental studies, recommendations have been developed for the production of multicomponent threads and fabrics and knitted products from them in the production conditions of enterprises.

Keywords: polycomponent, bicomponent, natural silk, cotton, wool, viscose, polyester, lycra, fabric, knitwear, assortment, shares, quality.

Introduction. Currently, the share of natural fibers in the balance of textile raw materials is decreasing year by year. Therefore, in many countries of the world with developed textile production, technologies for the production of bicomponent and polycomponent yarns mixed with natural fibers and chemical fibers are developed and applied to production. Yarns made from a mixture of two fibers are called bicomponent yarns, and yarns made from a mixture of three or more fibers are called polycomponent

yarns**.** The amount of chemical fibers in bicomponent or polycomponent yarns produced by foreign companies is 60% or more, the share of natural fibers in bicomponent or polycomponent yarns produced in our republic is 60% or more. Therefore, the properties of mixed fiber yarns produced in our republic are close to the properties of natural fibers, and the properties of polycomponent or bicomponent yarns produced by foreign companies are close to the properties of chemical fibers [1].The amount of chemical fibers in bicomponent or polycomponent yarns produced by foreign companies is 60% or more, the share of natural fibers in bicomponent or polycomponent yarns produced in our republic is 60% or more. Therefore, the properties of mixed fiber yarns produced in our republic are close to the properties of natural fibers, and the properties of polycomponent or bicomponent yarns produced by foreign companies are close to the properties of chemical fibers [1].

It is known that the purpose of obtaining mixed fibers by mixing different fibers is to obtain the quality of the finished product by improving the effect of mixed fibers. Thus, fiber yarns mixed with three or more fibers are called multi-component yarns. Polycomponent and two-component yarns are mainly made from natural and comfortable yarns. Their ratio in the mixture can be different[2].

From 2023, at the Scientific Research Institute of Natural Fibers of Uzbekistan, the following new types of polycomponent spun yarns with the participation of silk fluff obtained from natural and chemical fiber wastes of natural silk will be introduced: cotton+silk+viscose; cotton+silk+lycra; cotton+silk+wool; cotton+silk+polyester; cotton + silk + wool + polyester; silk + wool + polyester; scientific research works are being conducted in the direction of creation of silk + cotton + polyester production technologies. Based on the results of research carried out at the institute, it is recommended to use textile fibers in the following composition and proportions for the production of polycomponent yarns at the spinning industrial enterprise: 1st mixture - cotton fiber - 60% + silk fluff fiber - 20% + viscose fiber - 20%; 2nd mixture - cotton fiber - 80% + silk wool fiber - 20% (in addition, 3-5% lycra in knitting); 3rd mixture - cotton fiber - 50% + silk fluff fiber - 10% + wool fiber - 40%; Mixture 4 - cotton fiber - 70% + silk fluff fiber - 15% + polyester fiber - 15%; Mixture 5 - cotton fiber - 50% + silk fluff fiber - 10% + wool fiber - 20% + polyester fiber - 20%; Mixture 6 - silk wool fiber - 20% + wool fiber - 50% + polyester fiber - 30%; Mixture 7 - silk wool fiber - 20% + cotton fiber - 50% - polyester fiber - 30% [3].

From the analysis of the mixtures presented above, it can be seen that various natural and chemical fibers are involved in the proposed mixtures, but all the mixtures contain silk wool produced from natural silk waste. Silk wool from natural silk waste is produced in FLOSS looms created by scientists of the People's Republic of China [3, 4]. Second-pass silk wool is obtained from unwashable cocoons and silkworms produced by the production of silk wool with the help of technology and machines created at the Scientific Research Institute of Natural Fibers of Uzbekistan [4, 5, 6, 7].

Before processing, the silk wool contained in the polycomponent yarns produced by UzTTITI technology is prepared for combing based on special chemical or biochemical

methods, that is, the sericin contained in them is removed. When boiling silk wool, it is necessary to use the recipes and regimes developed by UzTTITI specialists [4,8,9]. This requires cooking the fiber waste of natural silk in groups. The duration of boiling the fiber waste of natural silk in groups is from 130 to 185 minutes. [4].

According to the recipes and regimes of cooking unwashable cocoons, cocoons, and premature cocoons developed by the experts of the institute, the processing regimes of natural silk fiber waste by groups differ from each other in the recipes of chemicals, processing temperature and duration. For example, the first group 130 minutes are spent on processing cocoons, and 185 minutes are spent on processing cocoons of the third group. After cooking, the cocoons are washed two or three times in boiling and hot water. During washing, sodium alcohol or gemethophosphate is added to the water. According to the recipes and regimes of cooking unwashable cocoons, cocoons, and premature cocoons developed by the experts of the institute, the processing regimes of natural silk fiber waste by groups differ from each other in the recipes of chemicals, processing temperature and duration. For example, the first group 130 minutes are spent on processing cocoons, and 185 minutes are spent on processing cocoons of the third group. After cooking, the cocoons are washed two or three times in boiling and hot water. During washing, sodium alcohol or gemethophosphate is added to the water.

Mechanized cooking barques or specially designed natural silk fiber waste cooking apparatus can be used to cook unwashable cocoons.

During silking from pre-spun cocoons and bolls, most of the sericin and fatty substances in the silk wool are washed away, and this type of fiber waste can be prepared for the next step by light cooking and washing.

Therefore, cooking recipes and regimes for degreasing and degumming of manufactured silk mats and other types of fiber waste produced during cocooning process have been developed by experts and scientists of UzTTITI [9] and they are listed in Table 1 below.

Table 1. Suggested mode and recipes for boiling and cooking natural silk fiber waste.

Naming of technological processes	Solution rN indicator	Processing mode		The composition of the bath	
		Temperature° C	Duration, min.	Chemical substances	Quantity, g/l
1	2	3	4	5	6
Cocoon thread group - silk thread, knot, test mats, raw silk ring, etc.					
Freezing	6,0-6,5	40-45	10	-	-
1	2	3	4	5	6
Cooking	10,25	95-100		72% soap	5,6
			25	Calcium carbonate	2,5
First wash	4,0-4,5	90-95	10	Acetic acid. 30% solution	2
Second wash	6,0-6,5	40-45	10	-	-
The total duration of the procedure is 55 minutes.					
Unfit for spinning, under-spinning cocoons and silk mats from the borer					
Freezing	6,0-6,5	40-45	10	-	-

				72% soap	4,6
Cooking	10,25	95-100	20	Calcium carbonate	
First wash	4,0-4,5	90-95	10	Acetic acid. 30% solution	1,5 2
Second wash	6,0-6,5	40-45	10	-	-
The total duration of the procedure is 50 minutes.					

If cooking according to the suggested mode and recipe based on the analysis of the table indicators given above, the duration of cooking will be reduced by 2.5-3.5 times. This creates a basis for maintaining the unique technological-mechanical, chemical-technological indicators of natural silk at a high level.

The produced polycomponent or bicomponent yarns are used for the production of various types of fabrics and knitted products [10, 11, 12, 13, 14].

In the production of polycomponent yarns, their dyeing and finishing are of great importance, because different fibers in the mixture require different finishing technologies. Therefore, in the production of polycomponent yarns, it is correct to dye the fibers separately.

MAIN PART. The production of polycomponent yarns from optimal mixtures of natural and chemical fibers, developed at UzTTITI and tested in laboratory conditions, was carried out in the production conditions of cotton spinning enterprises. Polycomponent yarns from natural and chemical fibers were produced from seven different mixtures recommended. The composition of the fiber mixture for the production of polycomponent yarns is given in Table 2 below.

Table 2. The proportions of natural and chemical fibers in the mixture for the production of polycomponent yarns.

S/n	Naming of fibers	Mixture number and the amount of fiber in it, %						
		I	II	III	IV	V	VI	VII
1	Cotton fiber	60	80	50	70	50	-	50
2	Wool fiber	-	-	40	-	20	50	-
3	Silk fluff	20	20	10	15	10	20	20
4	Viscose fiber	20	-	-	-	-	-	-
5	Polyester fiber	-	-	-	15	20	30	30
6	Lykira	-	3-5	-	-	-	-	-

As can be seen from the fiber mix in the table above, natural silk lint was present in all the blends, while cotton fiber was present in six of the seven blends. Therefore, it is appropriate to use the production technologies of cotton spinning enterprises in the production of polycomponent yarns. Some parameters of natural and chemical fibers prepared for mixing before production of polycomponent yarns were determined by laboratory testing. The average values of the fibers determined in the results of laboratory tests are presented in Table 3 below.

Table 3. Average indicators of laboratory test results of natural and chemical fibers in polycomponent spun kalava yarns planned for production.

S/n	Naming of fibers	Naming of indicators		
		Linear density, tex	Relative breaking strength, sN/tex	Elongation at break, %
1	Wool fiber	0,36	11,6	23,5
2	Natural silk fiber	0,21	26,8	18,8
3	Cotton fiber	0,34	4,9	7,3
4	Polyester fiber	0,24	32,4	40,2
5	Viscose fiber	0,31	23,1	27,8

The analysis of the indicators of the fibers presented in Table 3 shows that the indicators of the natural and chemical fibers participating in the mixtures are quite different from each other.

For example, the linear densities of fibers range from 0.21 tex (silk lint) to 0.36 tex (wool fiber), the relative tensile strength from 4.9 sN/tex (cotton fiber) to 32.4 sN/tex (PEV fiber), and the elongation at break is 7 It ranges from .3% (cotton fiber) to 40.2% (PEV fiber). Therefore, the main goal of the production of polycomponent yarns is to fully use all the positive properties of the fibers involved in the mixture and eliminate some of their negative properties.

From the analysis of the composition of the mixtures recommended for the production of polycomponent, it can be seen that silk wool fibers are included in the composition of all mixtures, and cotton fiber is present in six out of seven mixtures. Therefore, it was recommended to produce polycomponent yarns according to the cotton spinning technology and to cut the fibers involved in the mixture to the length of the cotton fiber staple. According to the sixth mixture, it will be possible to produce polycomponent yarns by wool spinning technology, because the length of the fibers participating in this mixture has a sufficient length. Kalava threads spun by cotton spinning technology were produced according to the technological scheme presented in Figure 1 below.

"OsbornTextile" LLC yarn spinning enterprise in Tashkent region operates according to the technological scheme of this mentioned cotton spinning system. According to this technological scheme, for the production of polycomponent yarns, the staple lengths of the fibers involved in the mixture are determined and they are cut to the staple length of the cotton fiber. The staple length of the cotton fiber that we used in the mixture was 38 mm, and the remaining fibers were cut to the same staple length. In this case, the silk wool was cut to 35 mm, because the fibers in silk wool are not arranged in a flat, parallel state, they are straightened during the process of combing and combing and are stretched by 3-5 mm compared to the initial length.

After all fibers were stapled, they were held in mechanized labs for 24 hours at 22°C and 65% humidity. After that, polycomponent threads are produced according to the composition of the above mixtures. The stapled and blended fibers are first mixed and

Resting all the fibers involved in the mixture on the lips and preparing a mat for mixing from them

combed in Trutzschler DK803 cord combing machines, then combed in a cord combing system and made into skeins of a given weight.

Figure 1. Technological scheme of production of polycomponent kalava yarns spun by cotton spinning technology

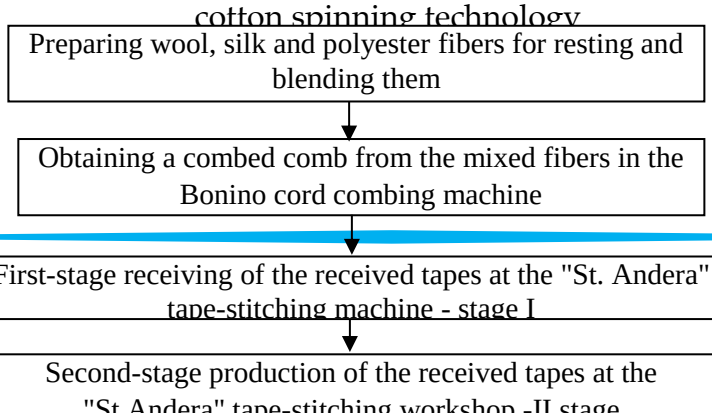

Figure 2. Technological scheme of production of polycomponent kalava yarns spun by wool spinning technology.

Combed hair can be taken in combs or combs. Then the wicks are processed in 2 passes of "Trutzschler" and "Rieter" wick adding machines. In this process, the fibers in

the skein are parallelized, straightened and the skein becomes thinner, the skein is flattened in linear density. Polycomponent yarns spun on the "Zinser RM 350" spinning machine are produced from the braids straightened and thinned in this way.

The spun polycomponent yarns are rewound into a bobbin on the "Murata" rewinding machine, and 2 single-ply spun polycomponent yarns are added on the "SSM" yarn adding machine. Then, the 2-ply polycomponent yarns are twisted at the rate of 550 br/m on the "Saurer" sewing machine. is given. At the same time, two-layer spun polycomponent kalava yarns are obtained according to technological scheme above.

The quality and technology of all produced polycomponent yarns were determined in the institute's testing laboratory, and their results are presented in Table 4 below.

Table 4. Physico-mechanical parameters of polycomponent kalava yarns made from a mixture of natural and chemical fibers.

S/n	Naming of indicators	A mixture of fibers for the production of polycomponent yarns						
		I	II	III	IV	V	VI	VII
1	Nominal linear density of thread, tech	30 tex x 2	30 tex x 2	30 tex x 2	30 tex x 2	30 tex x 2	30 tex x 2	30 tex x 2
2	Determined horizontal line density of thread, tech	58,90	59,36	58,70	58,30	59,70	60,00	59,70
3	Coefficient of variation in linear density, %	3,65	3,24	3,05	2,55	2,35	2,10	2,45
4	Relative tensile strength, sN/tex	19,02	16,56	18,75	21,05	23,65	27,10	26,75
5	Elongation at break, %	23,20	19,50	24,90	26,85	29,50	30,05	30,55
6	Number of turns, br/m	558	550	545	548	555	550	545
7	Coefficient of variation in the number of turns, %	1,70	1,25	1,27	1,05	1,25	1,05	1,14
8	Number of interruptions per 1000 urch/h, pcs	195	165	167	145	156	140	145

From the analysis of the results of laboratory tests presented in Table 4, it can be seen that the quality indicators of the obtained polycomponent yarns are much higher than those of the existing spun yarns for all mixtures. For example, 100% wool yarns with a nominal linear density of 30tex x 2 have a linear density variation coefficient of 4.25%, a relative breaking strength of 17.32 sN/tex, an elongation at break of 28.6%, The number of interruptions per 1000 urch/h is 245 units.

From the produced polycomponent yarns, women's shirt fabrics, men's costume fabric, and women's and children's jumpers were produced at the textile enterprise.

Conclusions and suggestions.

1. The share of natural fibers in the balance of global textile fibers is decreasing every year, but the demand of the world population for products made from natural fibers is increasing every year. To do this, it is necessary to save natural fibers or combine them with chemical fibers.

2. Technologies of mixing natural fibers with chemical fibers have been used in the practice of the world textile industry for many years. In this case, natural fibers, especially silk, wool, cotton fibers were used in a mixture with chemical fibers, especially viscose, polyester, nitron fibers. Various fabrics and knitted products are mainly produced from them.

3. Currently, the production of polycomponent and bicomponent mixed yarns is widely used in the global textile industry. Polycomponent yarns are made from a mixture of 3 or more yarns, while bicomponent yarns are made from a mixture of 2 different yarns. Polycomponent and bicomponent yarns mainly use polyester synthetic fiber, the indicators of these fibers are close to the indicators of natural fibers, and their share in the balance of textile fibers is also very large.

4. At the Scientific Research Institute of Natural Fibers of Uzbekistan, scientific research work was carried out on the creation of technologies for the production of several assortments of polycomponent yarns from natural and chemical fibers, and as a result, several assortments of polycomponent yarns and their production technologies were created with the participation of silk wool obtained from natural silk waste.

5. Polycomponent yarns produced from a mixture of natural and chemical fibers in various variants have high quality indicators, the coefficient of variation in their linear density is from 2.10% to 3.65%, the relative breaking strength is from 16.56 sN/tex Up to 27.10sN/tex, elongation at break from 19.5% to 30.55%, number of breaks per 1000 hr. from 140 to 195 pieces. The same parameters were used as a control option in yarns spun from 100% wool fiber with a nominal linear density of 30tex x 2. The coefficient of variation in linear density was 4.25%, the relative breaking strength was 17.32 sN/tex, and the elongation at break was 28.6 %, the number of interruptions per 1000 urch/h is 245 pieces.

6. It is recommended to apply the results of the conducted research to the production of yarn spinning, textile and knitwear production enterprises of the association "UZTO'QIMACHILIKSANOAT".

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