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RESEARCH OF THE PHYSICO-MECHANICAL PROPERTIES OF THE MELANGE YARN SPUN BY COMPACT METHOD

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ABSTRACT

The article presents the results of research on melange yarn sampling in the RoCoS mechanical compact yarn spinning device of Rotorcraft. During the research, samples of yarn with linear density T=14.7 (Ne=40) tex and T=20 (Ne=30) tex were produced in the carding and combing spinning system. The physico-mechanical properties of the compact melange yarns obtained in the experiment were analyzed by comparing them with the properties of the spinning factory's ordinary melange yarns. According to the results of the research, it was found that the melange yarn obtained in the RoCoS compact device is competitive in terms of its properties.

Keywords: compact yarn, ring spinning, hairiness, twisting, unevenness, strength, product, quality, mélange, combing, spindle.

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Introduction

At the present time, if we provide further processing of raw cotton itself in textile and other sectors of light industry, and sell dyed yarn, knitted fabric and fabrics, then we can achieve great efficiency if we adopt modern technologies and design for the production of finished textile products. President Sh.M. Mirziyoev: "My main goal is to provide people with a source of income and employment [1].

One of the main conditions for economic development is regular improvement of product quality. Improving product quality, expanding assortments, and meeting consumer demand are important requirements of the current market economy. In order to ensure the product quality level, it is necessary to carry out regular control work depending on the normative requirements of standards and technical conditions [2].

The role of textiles and light industry in the development of our country's economy is of great importance. In recent years, the number of private enterprises is increasing as a result of the great attention paid to small business and private entrepreneurship. In recent years, the demand for products made of knitted fabrics is increasing sharply compared to woven fabrics.

Methodology

Yarns produced in spinning enterprises are mainly made in pneumomechanical and ring spinning machines. The best quality of these finished yarns are made on ring spinning machines. One of the most common ways to increase competitive yarn production on a ring spinning machine is to produce low-twist knitted compact yarns. Compact yarn production has been developing rapidly in recent years. In addition, the production of other compact, Siro, melange types of yarn is gaining great importance.

Most of the spinning enterprises in our republic, equipped with modern machines, prepare yarns for knitted products, which are in great demand. One of the more popular yarns is the melange yarn used in knitwear. Because the production of melange yarn is somewhat complicated both economically and organizationally, there are few melange yarn enterprises in our republic. While ordinary yarns are dyed in the form of kalava, in the preparation of melange yarns, the fibers are first dyed and then sent to the spinning process, and melange yarns are made from fibers of different colors.

ISSN: 2776-0987 Volume 4, Issue 4 April 2023

o dye the fiber, the product goes through several stages of the dyeing process. This leads to an increase in the cost of the product. Products made of melange threads are distinguished by their good color retention. Therefore, leading sewing companies prefer to use melange threads, even if the cost is high, in order to maintain the quality of their products. The leading enterprises of Chel El are sharply increasing orders for melange yarn.

The production of melange yarns is important in the production of competitive products by expanding the assortment. But the curliness of the fibers increases during the dyeing and drying processes of cotton fibers. It is known that after dyeing yarns, their stiffness is 1.5-4%, elongation is 7.5-11%, elasticity is reduced by 20-40% compared to undyed yarns [3].

In order to further improve the quality of yarn, the designers of spinning machines have recently been actively working on creating compact devices that spin the yarn tightly and reduce hair on the surface of the yarn. The principles of operation of these devices consist in obtaining a compact thread by exerting a pneumatic, mechanical action on the fibers on both ends of the thin tuft coming out of the stretching device. The current main manufacturers of compact spinning machines are well-known engineering firms such as Zinser, Rieter and Suessen. The compact spinning machines they produce are Air-Com-Tex 700 (Comp ACT3) (Zinser), K44 (Com 4) (Rieter), Elite (Suessen). Cognetex, Rotorcraft and Officine Gaudino companies offer their projects in the market of spinning machines [4].

Rotorcraft's RoCoS compact spinning device is one of the latest inventions. Rotorcraft's RoCoS device is notable for not requiring additional power, air ducts, motors, fans, perforated surface plates or drums, unlike other manufacturers' devices. Using the compact yarn spinning devices of these companies, initial experimental works were conducted at the foreign LLC "OSBORNtextil" enterprise. This enterprise is currently the only melange thread manufacturing factory in the Republic.

The RoCoS device is placed on the front cylinder of the ring spinning machine stretching tool. Its feature is that it has two loading rollers on the front cylinder and a compactor that compacts the output fluff width. It is important to note that the compactor is in contact with the cylinder because it is on a permanent magnet plate. As the two loading rollers cover the front cylinder, the height of the cooking triangle also decreases, and changes in thread formation occur [5].

INNOVATIVE TECHNOLOGICA
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ISSN: 2776-0987 Volume 4, Issue 4 April 2023

In ring spinning, the central fiber tension in the tuft exiting the drawing tool is lower than the peripheral fiber tension. The main reason for this is the difference in the distance from the clamp of the fiber stretching tool to the point of yarn formation.

Results and Discussion

Positive results can be achieved by reducing the height and width of the cooking triangle. For this purpose, the RoCoS compact yarn spinning device of Rotorcraft was installed on the German Zinser 351 ring spinning machine installed at the foreign company "OSBORNtextil" LLC, and experiments were conducted. During the experiments and in the re-carding system, samples of linear density T=14.7 (Ne=40) tex and T=20 (Ne=30) tex were taken without changing the speeds of the yarn and the cooking. During the research, yarn was spun from a mixture of IV type 1 varieties of Bukhara-102 and Mehnat cotton selections. Preliminary studies were carried out at 950 and 800 rpm and a spin speed of 14000 min-1.

Physico-mechanical properties of the yarn samples were studied using test equipment in the enterprise's laboratory, and the obtained results were summarized in the table.

Table 1. Linear density T= 14.7 (Ne 40) tex and T= 20 (Ne 30) tex threadsphysical and mechanical indicators of

No	Thread Number (Ne)	Spinning method	The frequency of rapid rotations is x103, min-1	Practical cooking, Ka, b/m	Tensile strength of thread, (R)	Elongation at break, e, (%)	Dustiness, H, (%)	Unevenness, CV, (%)
1	40	Simple re-combed melange	14000	950	16.60	3.6	5.5	13.7
2		Recombed melange compact	14000	950	20.02	3.9	3.3	12.0
3	30	Plain, snow, melange	14000	800	14.28	4.12	6.05	16.66
4		Karda, melange compact	14000	800	17.84	4.22	4.7	15.99

INNOVATIVE TECHNOLOGICA
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Analyzing the table indicators, it can be seen that the compact yarn meets the high demand for all quality indicators.

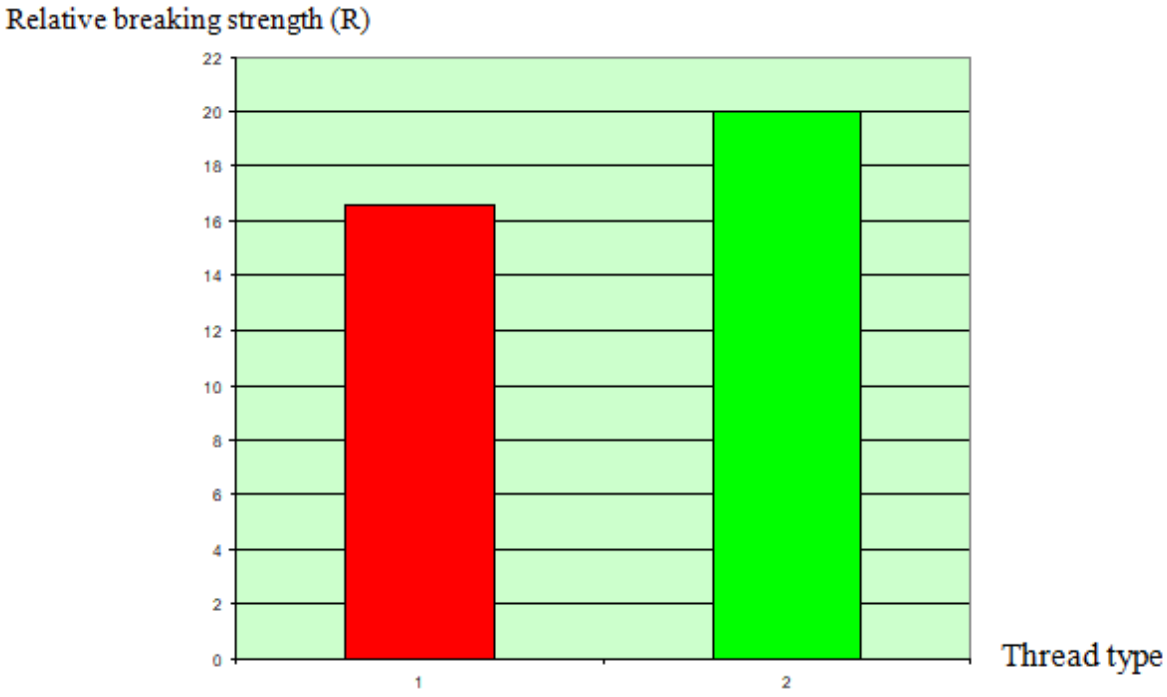

Figure 1. The rotation frequency of the spindle is 14000 m-1, the density is 950 b/m, the thread linear density is 14.7 (Ne 40) and the breaking strength of the thread (Rkm).

1 - Simple re-combed melange thread; 2 - Recombed mechanical compact mélange yarn.

Tensile strength is determined by the value of the force that the material can withstand before breaking. The tensile strength indicates the absolute strength of materials [6], and the tensile strength of the yarn is one of its important quality indicators. Taking this into account, the relative tensile strength of the thread was analyzed from the experimental results obtained in the re-carding system (Fig. 1). The breaking strength of the yarn obtained in the compact device was found to be up to 4 sN/tex (18 %) stronger than that of the ordinary re-carding yarn. When determining these indicators, they were determined using the international standard method in the USTER TESTER 4 device installed in the company's laboratory.

INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
ISSN: 2776-0987 Volume 4, Issue 4 April 2023

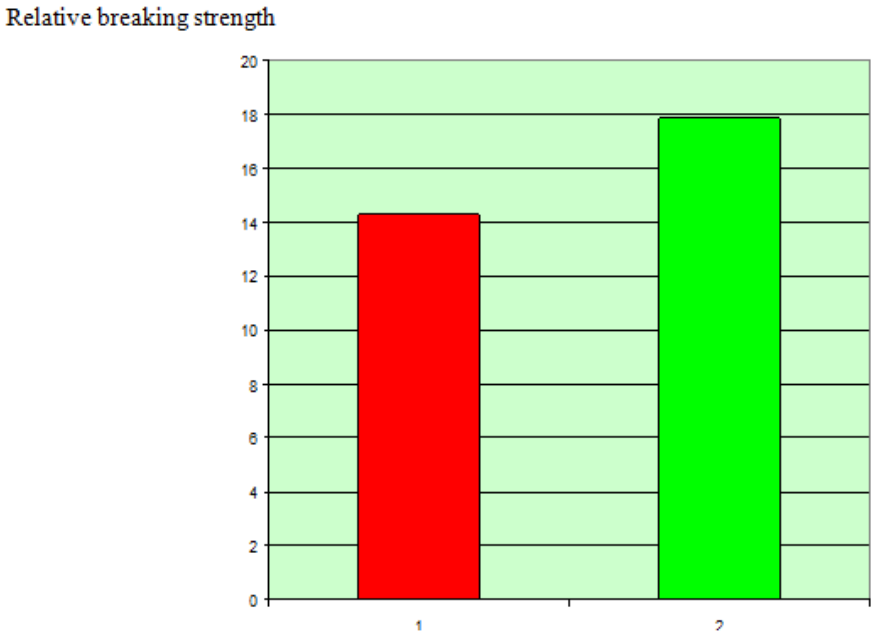

Figure 2. The rotation frequency of the spindle is 14000 m-1, the density is 800 b/m, the thread linear density is 20 (Ne 30) and the breaking strength of the thread (Rkm).

1 - Simple snow melange thread; 2 - Karda mechanical compact melange thread.

The relative breaking strength of the melange yarn obtained from Karda, i.e. medium fiber yarn, and the melange yarn obtained in the compact device was compared (Fig. 2). It was found that the specific breaking strength of the thread obtained in the compact device is up to 3.5 sN/tex (20%) higher than that of the ordinary snow thread. This shows that knitted fabrics made from melange yarns supported by a compact device are slightly higher (18-20%) than those obtained from ordinary melange yarns.

One of the important indicators of thread quality is hairiness. To remove the hairiness of the threads, some companies burn the thread, while others use paraffin. Taking this into account, hairiness indicators of yarn samples were analyzed.

INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
ISSN: 2776-0987 Volume 4, Issue 4 April 2023

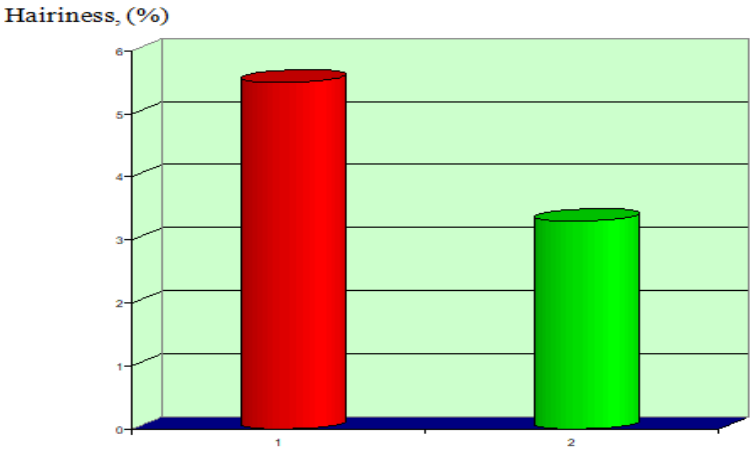

Figure 3. The frequency of rotations of the spindle is 14000 m-1, the density is 950 b/m, the linear density of the thread is 14.7 (Ne 40), and the hairiness index of the thread is (%).

1 - Re-combed melange thread; 2 - Recombed compact melange thread.

The hairiness of re-combed melange yarns was found to be higher (by 40%) than that of melange yarns supported by the RoCoS compact device. This compact device has a significant effect on the quality of the yarn by reducing the turbidity (Fig. 3).

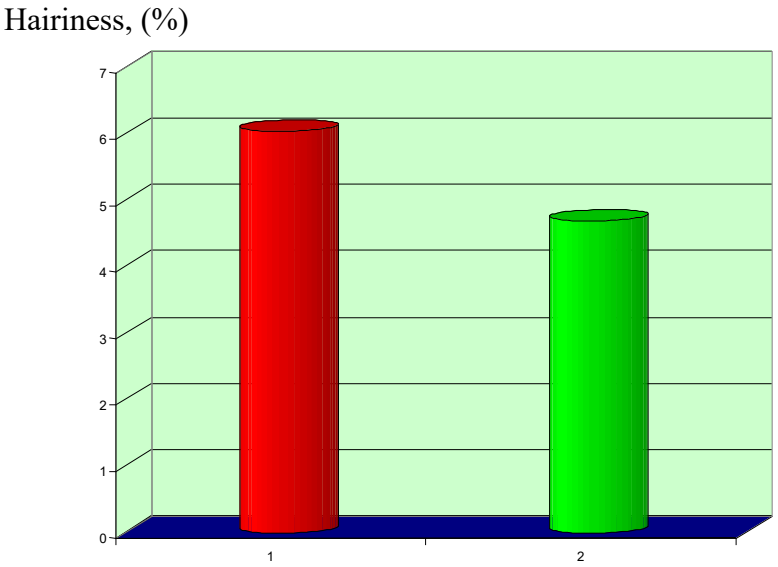

Figure 4. The frequency of rotations of the warp is 14000 m-1, the density is 800 b/m, the linear density of the thread is 20 (Ne 30), and the hairiness index of the thread is (%).

INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
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1 - Simple snow melange thread; 2 - Karda mechanical compact melange thread.

It was found that the hairiness of melange yarn obtained in Karda spinning system is 6.05%. The same indicator was found to be 4.7% when using a compact device (Fig. 4). As a result of the use of the compact device, hairiness has decreased by 22%. This leads to an increase in the quality of the product in the subsequent processes, in the preparation of the product.

The properties of these analyzed compact and simple factory yarns are important parameters in improving the quality of the finished product. The product is repeatedly bent, bent, stretched, and rubbed during operation. In such processes, compact yarn retains its shape compared to regular yarn. In compact yarns, the fibers are parallel, and due to the arrangement and orderliness of the gypsum, all the fibers in it participate equally in the twist, which leads to the improvement of the yarn structure. As a result, the thread's resistance to stretching increases, in ordinary threads many fibers are not fully involved in the twist. Therefore, the tensile strength of ordinary yarn is low, and the hairiness is high compared to compact yarn.

Among the physico-mechanical properties of the thread, an important indicator is its unevenness. This indicator is included in the requirements of USTER, and enterprises buying yarn will definitely pay special attention to unevenness. Taking this into account, manufacturing enterprises regularly monitor the unevenness indicators of their products.

The unevenness values of the linear density of the threads obtained as a result of the experiment were compared (Fig. 5). It was found that the normal melange thread of the factory has the highest index of unevenness (Fig. 5, 1), and the unevenness of the melange thread in the snow with the compact device is relatively low (5 %) (Fig. 5, 2). It is natural that the yarns obtained by the re-combing method (Fig. 5, 3, 4) are less uneven than the carded yarns. Recombed compact mélange yarn obtained using RoCoS compact yarn spinning device (Figure 5, 4) was found to have less unevenness (5-13%) than all obtained yarns. This situation is related to the structural changes of the yarn and showed the feasibility of using the RoCoS compact yarn spinning device in reducing the unevenness of the yarn.

INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
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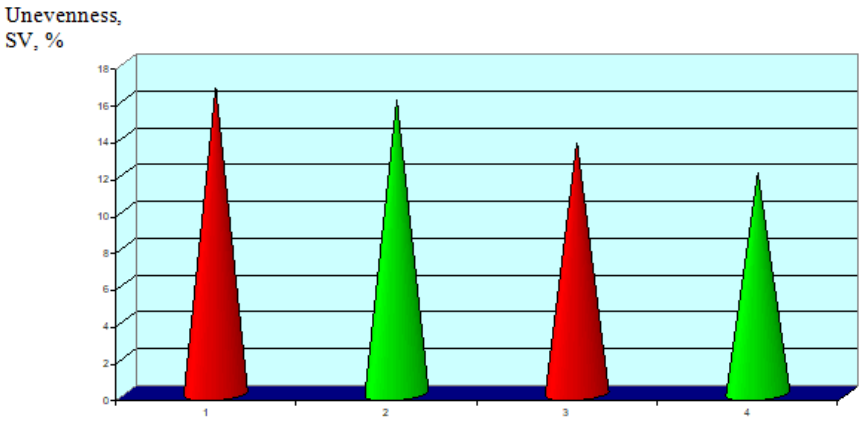

Figure 5. Unevenness (CV, %) indicators of carded and re-combed melange yarns.

1- Ordinary snow melange thread; 2 - Compact mélange yarn in ordinary snow; 3 - Re-combed melange thread; 4 - Recombed compact (RoCos) melange yarn.

Conclusion

The relative breaking strength of the yarns obtained in the experiments was determined by the USTER TESTER 4 device installed in the company's laboratory. Compact mélange yarns re-combed with regular mélange yarn obtained in re-combing methods with Ne 40 were compared. In this case, it was found that the specific breaking strength of the compact device-supported yarn was up to 4 sN/tex (18%) stronger than that of the ordinary re-carding yarn. It was found that the strength of the compact melange yarn obtained by the ordinary carding method increased by 20% compared to the company's ordinary melange yarn.

Hairiness of yarns obtained by carding and re-combing method was compared with yarns obtained by compact device. It was found that the hairiness of the compact melange yarn is reduced by 22% compared to the melange yarn. Recombed compact mélange yarn has been shown in experiments to have 40% less pile than normal recombed mélange yarn.

As a result of the experiment, the unevenness values of the linear density of the yarns were compared. Factory re-combed melange yarn and snow melange yarns were found to have reduced unevenness (5% to 13%) compared to compact melange re-combed and plain melange yarns supported by the RoCoS device.

ISSN: 2776-0987 Volume 4, Issue 4 April 2023

The RoCoS device has also been proven to be useful in reducing thread roughness.

Based on these obtained indicators, it can be said that the products made of compact yarn are competitive in terms of physical and mechanical parameters, keep their shape well, meet consumer demand, and it is inevitable that the advantages of compact yarn properties will be manifested in the production of competitive products.

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