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The Relationship of the Composition of Sorting Components with The Properties of Multicomponent Yarns Obtained by Fibrous Waste Cluster Management in Textiles

Ismailov Nurulla Tuychiboevich[1]*, Khaidarov Khabibullo Hamidullaevich[2]

[1]Department of Engineering, Namangan Engineering and Technology Institute, Namangan, Uzbekistan
[2]Department of General Technical Disciplines, Namangan Engineering and Technology Institute, Namangan, Uzbekistan

Research Article

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***For Correspondence:** Dr. Ismailov Nurulla Tuychiboevich , Department of Engineering, Namangan Engineering and Technology Institute, Namangan, Uzbekistan

E-mail: innnt027@gmail.com

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ABSTRACT

The article suggests the methods of processing multicomponent raw materials and obtaining investigated the relationship of the composition of sorting components, with the properties of multicomponent yarns obtained from fibrous waste cluster enterprises in textile production. To solve the problem, we used the matrix of lattice planning of cause-and-effect relationships of information theory, solved the problems of dependence, physical and mechanical parameters of the raw material and the specified properties of the product. Empirical dependences on the nature and mechanism of relationships between factors were obtained, which allowed us to build a theory for controlling and predicting the behaviour of the system. The methods of evaluation used in this work allow us to expand the information database in relation to these indicators and use them in the manufacture of fabrics and yarns with specified properties.

component yarn; Linear density

INTRODUCTION

One of the most promising areas of interaction between the compositions of sorting components, with the properties of multicomponent yarns obtained from fibrous waste from cluster enterprises in the textile industry of the Republic. In this case, laboratories of research institutes and spinning enterprises have developed many technologies for the production of yarn with different percentages of different types of waste. For the most part, these technologies allow the production of yarn with a linear density of 100 to 200 Tex and up to 50% of various types of cotton waste using low-quality cotton fiber [1]. One of the important problems facing the Republic in building a market economy is the rational use of raw materials, waste and secondary material resources. First of all, this problem should be solved in the most material-intensive sectors of the economy, including the cluster sector of the textile industry. For more efficient use of material resources, it is necessary to increase the efficiency of using raw materials, to introduce scientific and technical achievements aimed at creating the necessary equipment, machines, high-efficiency low-waste and reduced waste-free technologies.

MATERIALS AND METHODS

Types of yarns consisting of several components are very diverse. Properties and applications of yarns determine their structure and fiber composition of the mixture. Multicomponent yarn in contrast to conventional or mixed yarn produced on spinning machines and consisting entirely of fibrous materials evenly distributed throughout the volume, two methods first produce a core, and then apply an outer layer called a braid to it. Any natural and chemical fibers, a wide range of complex yarns, as well as all possible fiber waste from the textile industry can be used as components of reinforced yarn [1-9].

Analysis of the physical and mechanical properties of fibrous waste

To expand the range of yarn, the geometric properties of fibrous waste were studied. In the studies, it was proposed to use the fibrous waste of the direct group released in the production environment. As you know, this enterprise used cotton, viscose and polyester fibers. Therefore, the main attention was paid to these fibers and, accordingly, their spun waste was studied-nut and fluff trephine ST N 3, carded comb (ST N II) and comb comb ST ST 17. Fibrous wastes by structure and composition were studied in a production laboratory by a standard method. The tests were carried out in three agility. After checking the homogeneity of the variance of the average indicators.

By analyzing this table, one can be sure that the fibers are completely spinning along the length. Card tow has a maximum average length (35.2 mm). The breaking load of the fibers in the carding web also has a maximum value (27.8). As for viscose fibers, on the contrary, the carding has a shorter fiber length (35.4 mm *versus* 36.2 mm) than in a cracked nut.

The tensile load of the fibers in the carding is less than 1.2 mm compared to the nut. The corresponding indicators of polyester fiber were also determined, which are distinguished by their strength of 46.3 cn/tex in nuts and 47.8 in carded fiber. Thus, the fiber of three types is at the same level in length, and in linear density the magnitude of the value is 0.02 tex, therefore, they can well be mixed. Given the production conditions, the mixing of the components was carried out at the first transition of the tape machines.

Rationalization of the composition of the sorting of single and reinforced yarn

Experimental studies were carried out in the conditions of a production laboratory on a PR-150-1 machine, where further production of single and reinforced yarn makes it possible to ensure the same spinning and reinforcement conditions. Since the simplex of lattice matrices is saturated (the number of experiments is equal to the number of determined coefficients in the polynomial), there are no degrees of freedom for checking the adequacy. Therefore, to test the adequacy of the obtained models (I), additional experiments are carried out at some control points of the factor space. The number of control points and their location on the simplex depend on the complexity of the experiment and the high cost. Most often, control points are chosen either in the area of the factor space that is most interesting for the researcher, or so that, if necessary, they can be used to construct a polynomial of a higher degree (Figures 1 and 2).

Figure 1. The acquired value of relative breaking load.

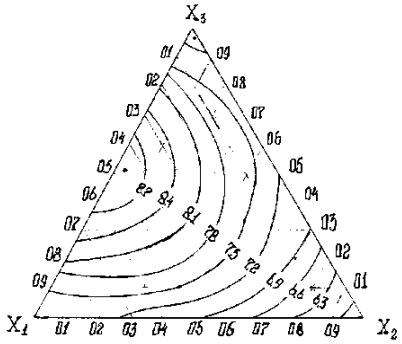
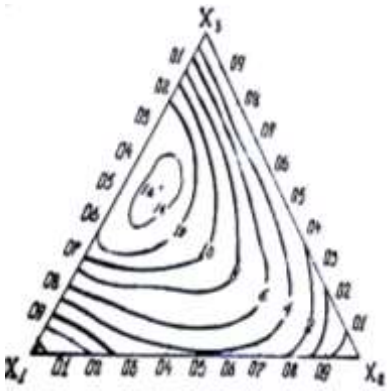


Figure 2. The acquired value of Square unevenness of the breaking load.



To select the optimal zone of the fraction of components, interpolation of the experimental results is recommended. To this end, curves were constructed that represent diagrams of the composition of properties, on which, within the simplex, a family of contours is shown, showing the nature of the change in the parameters of the mixture of properties. It is known that the properties of reinforced yarn, consisting of a core thread to the outer braid layer, depend on the combination of the fibrous composition of the components to their values.

When forming reinforced yarn on PR-150-1, the braid layer completely covers the core thread, forming the outer layer, while the fibers in the braid are sealed to the core by torsion, which creates a friction force that resists breaking forces. Considering that the friction force depends not only on the twist, but also on the properties of the braid fibers, the dependences of the main properties of the reinforced yarn on the sorting composition in the presence of a core were investigated.

RESULTS AND DISCUSSION

At present, valuable fibers are used in the production of pile fabrics from reinforced yarn. However, these fabrics can be obtained from reinforced yarn produced from fibrous waste on a rotary machine. This, in turn, leads to the saving of valuable raw materials and the reduction of technological processes of spinning [10].

To carry out a comparative analysis, sortings were compiled. From these sortings were obtained semi-finished products, tape to roving.

To achieve the goal, a reinforced fiber waste yarn was developed, consisting of 50% of a core thread made of valuable fiber and 50% of an upholstery layer consisting of fibrous waste of spinning and spinning and rotor machines. After that, the physicomechanical properties of the obtained yarn were fully studied [11]. It can be seen from that the yarn produced by the rotor method in its properties exceeds the performance of the yarn produced by the ring method. In addition, a slight twist of yarn makes it possible to obtain more pile fabric.

CONCLUSION

The experiments showed that when developing reinforced yarn from fibrous waste, the rotor spinning method makes it possible to obtain a flannel-type pile fabric. The use of spinning waste at the same time allows save valuable raw materials, shortening the technological process of yarn production, and also increasing labor productivity and equipment. From the above analysis of the production of reinforced yarn, it turned out that its quality is largely influenced by the core thread. Further research is aimed at studying the methods for supplying the core thread.

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