ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

INDEX COPERNICUS INTERNATIONAL

Google Scholar

Crossref doi

SLIB.UZ Scientific library of Uzbekistan

Volume 10
Issue 4
2025

DIFFERENCE OF THE INDIVIDUAL YARNS IN THE COMPOSITION OF A WRAPPED YAR ON THE QUALITY OF THE YAR AND DETERMINATION OF ACCEPTABLE VALUES OF THE MAIN FACTORS AFFECTING THEIR PRODUCTION

ATAMBAEV DILMUHAMMAD

PhD, Namangan State Technical University, Namangan, Uzbekistan
Phone.: (0533) 519-8989, e-mail.: dilmuhammad8988@gmail.com

Abstract: In this paper, the influence of the difference in the length of individual threads on the quality of the thread during the winding process was determined. These values were plotted on a graph and analyzed for the influence of the machine on the stiffness of the yarn. The boundary parameters of the main factors affecting the operation of the improved working part of the yarn-winding machine were determined, and their optimal values were determined using the mathematical planning method. Graphs were constructed and analyzed on the effect of these values on the yarn tightness during machine operation.

Keywords: textile, warp, spinning, yarn, yarn boiling, twisting, yarn tension, yarn winding speed, length.

Introduction. Considering that the quality of 3-ply yarn is increasingly important in the production of new products, one of the most important issues in the textile industry today is to pay more attention to the process of rewinding. An analysis of modern requirements for textile and light industry products in the world market shows that at present, in order to increase the range of these products, there is a need to sharply increase the types and properties of single, twisted and 3-ply yarns used as raw materials. As is known, any twisted yarn is produced by combining several single or monofilaments and giving them the necessary twist to provide the expected properties of the yarn.

Considering the increasing attention paid to the quality of the yarn in the production of new products, we can see that more attention is paid to the process of rewinding single yarns, which is considered a crucial stage in ensuring the main quality indicators of the yarn. Practical experience shows that the rewinding process is very important, especially in the production of expensive products [1,2,3,4,5].

Are studying the techniques and technologies of combining and cooking fibrous materials and improvement according to b scientific research works on If they are working , this and from cooked yarn fabric working output and types k to multiply take comes [6] . Current on the day t o k i m a n t in enterprises mainly cooked double- twisted yarn in cars working in our country . in spiral baking machines cooked various measures aimed at increasing the assortment of yarn and ensuring its competitiveness doing research is going.

Research work Namangan region "Popfen" Textile At the LLC enterprise was carried out on twisted yarns prepared on the SSM TW2-D twine winding machine and Saurer Compact Twisting twisting machines. During the experiments, twisted yarns with linear densities T_{ip}=36×3 tex and T_{ip}=29.5×3 tex were taken and the difference in length of single yarns was determined. For this, using a known methodology [7], in order to determine the difference in length of single yarns under a certain initial tension applied to the yarn longitudinally, the twisted yarn twists with an initial length of 500 mm between the clamps of the KU-500 twist detection device were completely unwound and the single yarns were brought to a parallel state. The clamps holding the ends of the individual threads, which are brought to a completely parallel position, are released, that is, the clamps on the left side, and the lengths of each individual thread are measured when the indicator on the scale of the device deviates from the "zero" position. After that, having visually estimated the length of the individual threads, the thread that was in a more tense state was cut, and then the length of the individual thread remaining in the device was determined.

The percentage difference in length of individual threads in the cooked yarn composition of the sample was calculated relative to the cross sections clamped in 500 mm long clamps. Most experts believe that the difference in length of individual threads in cooked yarns should not exceed 2.5% [7]

Comparing the histograms shown in Figures 1 and 2, it can be concluded that during the process of winding single yarns, the tensioning device is considered to be uncontrolled in the unloaded state of the yarns and the yarn tensions are different, so the differences in length of single yarns in the yarns wound on different twists remain large in all variants. Therefore, the uncontrolled nature of single yarns during the winding process leads to a large difference in length of single yarns in the yarns wound.

Also, in the process of adding yarn T_{ip} = 36×3, when a load of 8 and 16 g is applied to the tensioning device, the difference in length of the individual yarns in the cooked yarn is lower. This is considered good. On the contrary, in the process of adding yarn without a load on the tensioning device and when a load of 24 g is applied, the difference in length of the individual yarns in the cooked yarn remains high in all results, i.e. in the thread T ip = 36×3 (33 and 27 mm), and in the thread T_{ip} = 29.5×3 (22 and 25 mm).

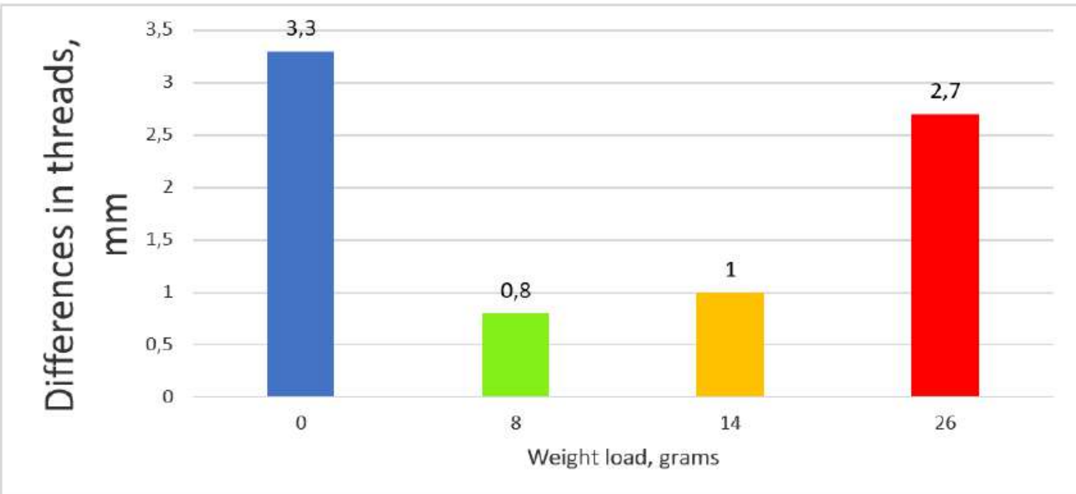

Figure 1. $T_{=}$36×3 tex in a cooked yarn
(number of twists K=490 br/m) is the difference in length of individual threads as a result of a change in weight load.

During the splicing process, when a load of 8 and 16 g is applied to the tensioning device on the yarn of type T = 29.5×3, the difference in length of the individual yarns in the spun yarns is lower, that is, in the yarn of type T = 36×3 (8 and 10 mm), and in the yarn of type T = 29.5×3 (4 and 6 mm). This situation is considered good.

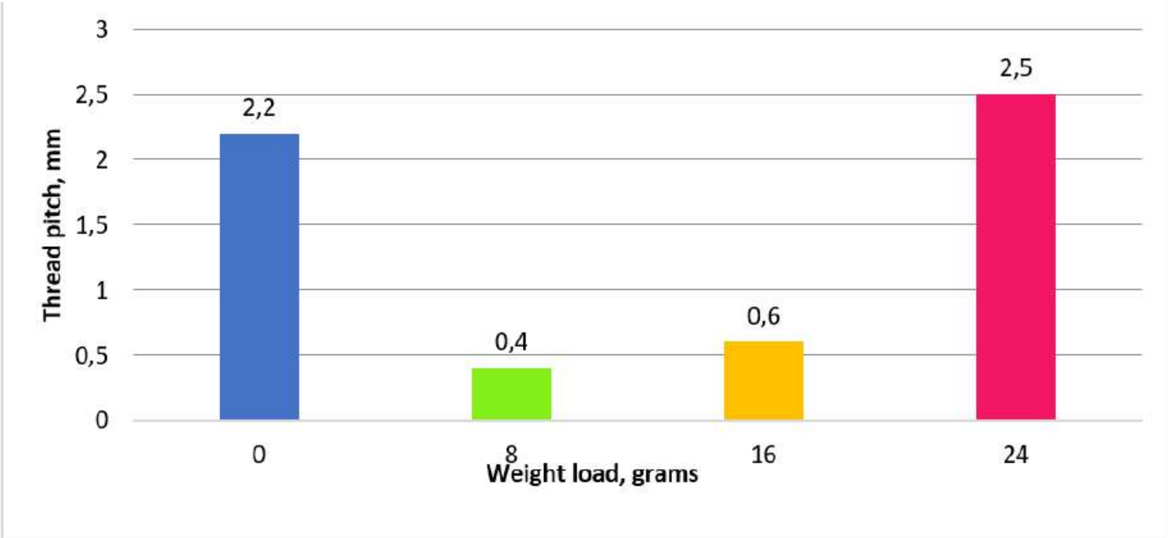

Figure 2. The difference in length of individual yarns as a result of changing the weight load in a cooked yarn of T ip = 29.5×3 tex (number of twists K=490 br/m).

No.	Indicators	Single thread length 500 mm A thread, br/m 490			
1	Weight of the puck, grams	0	8	16	24
1	36x3	533mm	508mm	510mm	527mm
2	29x3	522mm	504mm	506mm	525mm

Therefore, excessive loading of the tensioning device during the splicing process, depending on the linear density of the yarn, will inevitably lead to negative effects, because excessive loading of the tensioning device during the splicing process will lead to an increase in the length difference of the individual yarns being spliced due to the elongation of the fibers in the spliced yarns. This, in turn, will cause the yarns to become corky during the splicing process.

In a situation with different tensions, the thread with a looser tension wraps around the thread with a higher tension, which leads to one of the defects of the spun thread - corkscrewing.

The purpose of optimizing the technological parameters of the winding process is to reduce the unevenness of the spun yarns, increase their abrasion resistance, improve their strength and elasticity. Therefore, it is a necessary process for the production of yarn with uniform tension. As a result of the analysis of the characteristics of the techniques and technologies for preparing yarn for spinning, it was found that the main drawback of the techniques and technologies for preparing yarn for spinning, taking into account the fact that different assortments of yarns are produced on machines of different designs, is the lack of sufficient recommendations and developments on adjusting the devices for the uniform tension of single yarns being prepared for spinning. From the results of this study, we can conclude that in order to achieve the required quality result, it is important to pay attention to the tension of the yarns during the splicing process, and in order to maintain the same yarn tension in the tensioning devices, it is advisable to provide a tension between 8 gr and 16 gr for yarns with a linear density of T_{ip} = 36×3 and between 8 gr and 16 gr for yarns with a linear density of T_{ip} = 29.5×3.

The quality of the yarn joining process is assessed by the fact that the yarn is joined together at the same length and tension. Factors that affect the technological process of joining are x_1 - yarn tension, sN , x_2 – yarn winding speed, m/min, x_3 – puck weight , grams, were obtained. The selection of the levels and ranges of change of the factors under study is presented in Table 2.

Table 2. Selection of levels and ranges of change of the factors under study

Name and designation of factors	Change levels			Replacement interval
	-1	0	+1	
x_1 - thread tension, sN,	250	400	550	150
x_2 - yarn winding speed, m/min,	350	500	650	150
x_3 - weight of the puck, grams,	14.2	20.1	26	5.9

The test results were used to determine the strength and elongation at break of the studied yarn. The test results were evaluated based on the central non-compositional experimental matrix, 15 different test runs with 3 destructive factors were accepted for analysis and evaluated according to the test results (Table 3).

Table 3. Central non-compositional experience matrix

No.	Factors			x_1x_2	x_1x_3	x_2x_3	x_1^2	x_2^2	x_3^2	Y 1	Y 2	$S_u^2(Y_1)$	$S_u^2(Y_2)$
	x_1	x_2	x_3										
1	+	+	0	+	0	0	+	+	0	1185	3.8	68.4	0.98
2	+	-	0	-	0	0	+	+	0	921	6.8	29.8	1.2
3	-	+	0	-	0	0	+	+	0	951	7.2	48.9	0.68
4	-	-	0	+	0	0	+	+	0	695	11.5	62.7	1.26
5	+	0	+	0	+	0	+	0	+	1105	7.8	39.4	1.4
6	+	0	-	0	-	0	+	0	+	958	8.2	74.6	1.9
7	-	0	+	0	-	0	+	0	+	924	7.6	68.4	0.89
8	-	0	-	0	+	0	+	0	+	768	11.6	49.7	0.62

9	0	+	+	0	0	+	0	+	+	1108	5.8	52.7	0.14
10	0	+	-	0	0	-	0	+	+	995	7.8	72.6	0.97
11	0	-	+	0	0	-	0	+	+	820	8.2	67.4	0.78
12	0	-	-	0	0	+	0	+	+	701	10.5	94.2	0.38
13	0	0	0	0	0	0	0	0	0	1105	6.8	82.4	0.02
14	0	0	0	0	0	0	0	0	0	1128	5.9	76.9	0.14
15	0	0	0	0	0	0	0	0	0	1139	6.1	98.4	0.11

In determining the regression coefficients, Student's and Fisher's tests were used to check whether the mathematical model was adequate or not. As output factors, Y 1–Root maturity (N) selected by [4] .

Based on the experimental results, we search for a second-order regression multifactor mathematical model. As a result of this experiment, we can obtain a regression model with the following general form:

$$Y_R = b_0 + \sum_{i=1}^{M} b_i x_i + \sum_{\substack{i=j=1 \\ j\neq 1}}^{n} b_{ij} x_i x_j + \sum_{i=1}^{M} b_{ii} x_i^2$$

Or, since three factors are involved in our experiment, the above expression takes the form:

$$Y_R = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_{12} x_1 x_2 + b_{13} x_1 x_3 + b_{23} x_2 x_3 + b_{11} x_1^2 + b_{22} x_2^2 + b_{33} x_3^2$$

Taking into account the determined regression coefficients, the equation is written as follows:

$$Y_{R1} = 1124 + 103{,}88 x_1 + 137{,}75 x_2 + 66{,}88 x_3 + 2 x_1 x_2 - 2{,}25 x_1 x_3 - 1{,}5 x_2 x_3 - 77{,}75 x_1^2 - 94{,}12 x_2^2 - 93{,}75 x_3^2$$

It is known that if the calculated value of the criterion is less than the tabulated value, then that coefficient is not significant and is removed from the equation. In studies b_{12}, it was found that the coefficients b_{13}, , $b_{23}$are insignificant for the parameters under study:

The equation with significant coefficients is rewritten:

$$Y_{R1} = 1124 + 103{,}88 x_1 + 137{,}75 x_2 + 66{,}88 x_3 + 77{,}75 x_1^2 + 94{,}12 x_2^2 - 93{,}75 x_3^2$$

Determine the significance of the regression coefficients on the resulting Y 1 - yarn maturity Checking the adequacy of the equations by. The check is carried out using the Fisher criterion. The calculated value of the Fisher criterion is determined. The calculated value of the factor being optimized is calculated by substituting the coded values of all columns of the equation matrix (–1, 0 and +1) into Y_1. The values are obtained row by row, not column by column. YThe calculation for the formula is as follows, and the calculation results are given in Table 4.

Table 4. The calculation results of the values encoded in the equation for adequate dispersion

No.	Y_{1i}	Y_{1i}	$(Y_{1i}-Y_{R1i})$	$(Y_{1i}-Y_{R1i})^2$	$Y2i$	$Y2i$	$(Y_{2i}-Y_{R2i})$	$(Y_{2i}-Y_{R2i})^2$
	Y_1 – Yarn density (N)				Y_2 - By elongation at break (%) of the yarn			
1	1185	1194	8.8	76.7	3.8	4.89	1.09	1.19
2	921	918	-2.7	7.5	6.8	7.99	1.19	1.42
3	951	986	35.0	1225.0	7.2	7.71	0.51	0.26
4	695	711	15.5	240.3	11.5	10.8	-0.69	0.48
5	1105	1123	18.3	333.4	7.8	6.99	-0.81	0.66
6	958	990	31.5	992.3	8.2	7.37	-0.83	0.69
7	924	916	-8.5	72.3	7.6	8.01	0.41	0.17
8	768	782	13.7	188.8	11.6	12	0.39	0.15
9	1108	1141	32.8	1073.2	5.8	5.59	-0.21	0.04
10	995	1007	12.0	144.0	7.8	7.77	-0.03	0.00
11	820	865	45.3	2048.5	8.2	8.69	0.49	0.24
12	701	732	30.5	930.3	10.5	10.9	0.37	0.14

$$\sum_{u=1}^{N-N_s+1}(Y_{R1.u}-\overline{Y}_{1u})^2 = 7332{,}146 \qquad \sum_{u=1}^{N-N_s+1}(Y_{R2.u}-\overline{Y}_{2u})^2 = 5{,}428$$

$$S^2_{nad}\{Y_1\} = \frac{7332{,}146}{4} = 1833{,}04 \qquad S^2_{nad}\{Y_1\} = \frac{5{,}428}{4} = 1{,}36$$

It is known that if the calculated value of the criterion is less than the table value, then that coefficient is adequate and proves that the calculations were carried out correctly [5,6]

$$F_{R1} = \frac{S^2_{nad}\{Y\}}{S^2\{\overline{Y}\}} = \frac{1833{,}04}{128{,}85} = 14{,}2 \qquad F_{R2} = \frac{S^2_{nad}\{Y\}}{S^2\{\overline{Y}\}} = \frac{1{,}36}{3{,}135} = 10{,}01$$

$$F_j\left[P_D = 0{,}95;\ f\left\{S^2_{nad}\{Y\}\right\} = 15-6-(3-1) = 5; f\{S^2_u\} = 3-1 = 2\right] = 4{,}74$$

$$F_{R1} = 14{,}21 < 19{,}25 = F_j \qquad F_{R2} = 10{,}01 < 19, = F_j$$

Therefore, the resulting regression mathematical models represent the studied process with sufficient accuracy.

Research results. Since the equation constructed to determine the characteristics of the output parameter for the study is three-dimensional, it is considered as one of the input factors in the analysis $X_i = 0$(central position), and we construct a two-dimensional graph by transforming the models into 3 equations [7].

$$Y_{R1} = 1124 + 103{,}88x_1 + 137{,}75x_2 + 66{,}88x_3 + 77{,}75x_1^2 + 94{,}12x_2^2 - 93{,}75x_3^2$$

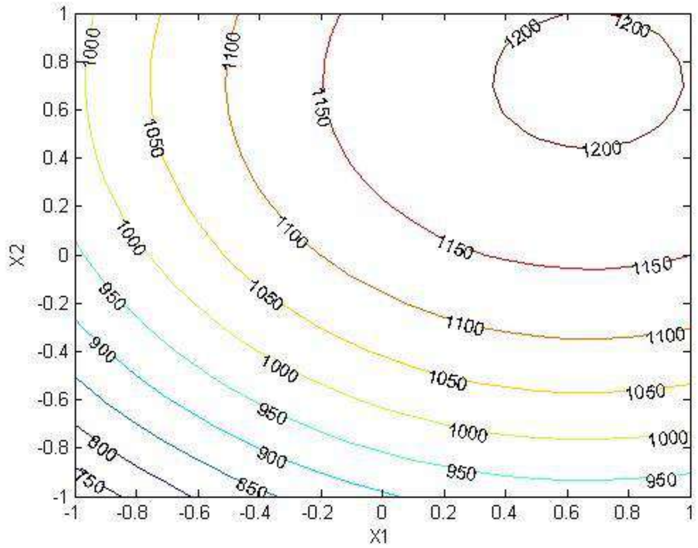

Figure 3. Graphs of the model of the dependence of yarn tension on yarn winding speed

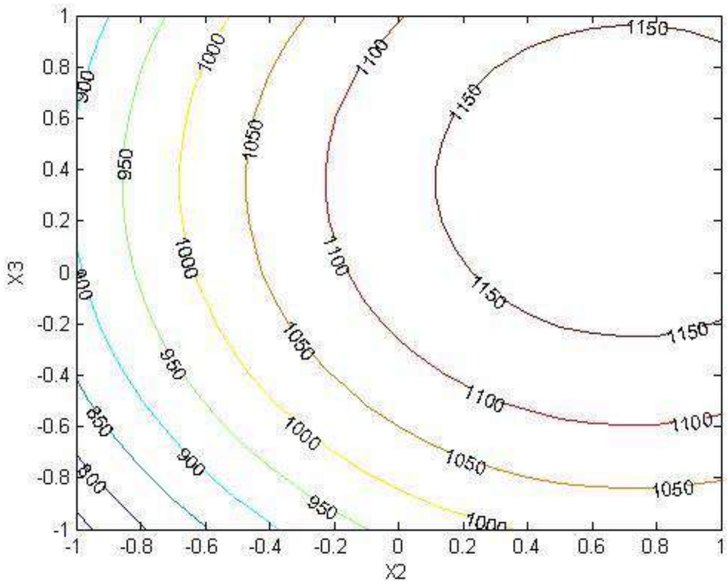

Figure 4. Graphs of the model of the dependence of the weight of the puck on the speed of the yarn winding

The graphs in Figure 3 depict the effects of two variables x_1 (yarn tension) on yarn stiffness as a function of x_2 (yarn winding speed). As in every experiment, the influence of input factors was investigated in this study. The output parameter Y_1 values should be chosen in the maximizing condition.

The graphs in Figure 4 illustrate the effect of two other main factors x_2 (yarn winding speed) on yarn tightness depending on x_3 (spool weight). In this case, the effect of the two factors on the output parameter was studied using the method of small experiments, and the main values were determined through optimization.

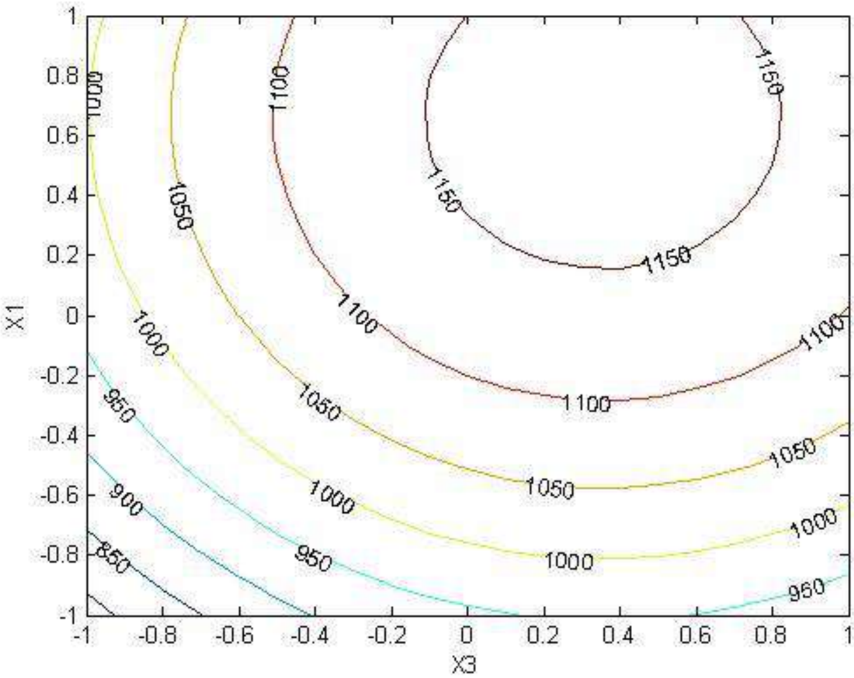

Figure 5. Graphs of the model of the dependence of yarn tension on the weight of the puck

The graphs in Figure 5 depict the effect of x_1 (yarn tension) on yarn stiffness as a function of x 3 (spool weight). We determine the output parameter values for all cases.

Conclusion. In this study, the dependence of the yarn tension (sN) , yarn winding speed (m/min) and pulley weight (grams) on the yarn tightness of the obtained yarn is depicted by the deviation of the isolines. As can be seen from the graphs, the maximum tightness is achieved when the yarn tension is $X_1 = 400$ sN , the yarn winding speed is $X_2 = 500$ m/min and the tension pulley weight is $X_3 = 20.1$ grams.

Literature

[1]. XAalimova, XXIbragimov, Q.Jumaniyazov. Production of spun yarn and yarn products. Textbook. T., TTESI, 2003, 247 p.

[2]. QG'.Gafurov and others. Spinning technology and equipment of foreign companies. T., TTESI, 2002.

[3]. XA Alimova, VAUsenko. Unwinding Silk. T., “Teacher”, 2001.

[4]. Sevostyanov AG and others. Mechanical technology of textile materials: Textbook for universities – M.: Legprombytizdat, 1989. – 512 p. LAAmzaev, QJ Jumaniyazov, SLMatismailov. Scientific foundations of research and technological process optimization. Textbook. - T.: TTESI. 2008. - 147 p.

[5]. UX Meliboev, Fundamentals of modeling technological processes in the textile industry, Textbook, Sparks of Literature, Namangan, 2020.

[6]. AG Sevostyanov, Methods and means of mechanical engineering and technological processes of textile industry. - M.: MGTU im. AN Kosygina, 2007. - 648 p.

[7]. Sultanov Mirzaolim Obidov Avazbek. Investigation of working parts of fixed device designed to separate spinning fibers from fibrous waste that can be spun . Journal of Critical Reviews 7 (19), 5614-5623

[8]. Obidov Avazbek Azamatovich, Sultanov Mirzaolim Mirzarahmatovich, Khamidov Sardor Dilmurod o'g'li, Begmatov Ohunjon Sodiqjon o'g'li. Journal of Hunan University (Natural Sciences). Vol. 48. No. 12. December 2021

[9]. J. Yuldashev, M. Mirkhojaev, D. Atambaev, D. Raimberdieva. Analysis of modern sportswear materials. International Journal of Advanced Research in Science, Engineering and Technology Vol. 6, Issue 3, March 2019

[10]. D. Atambaev. Analysis of Fibrous Waste Generated in the Preparation Departments of Spinning Mills and Cotton Processing. International Journal of Advanced Research in Science, Engineering and Technology Vol. 7, Issue 9, September 2020

CONTENTS

CHEMICAL SCIENCES

TECHNICAL SCIENCES: MECHANICS AND MECHANICAL ENGINEERING

ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION

ECONOMICAL SCIENCES