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# Investigation of Obtaining Shaped Yarns by Heat Exposure to Chemical Yarns

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**ANNOTATION.** The article investigates the properties of the raw materials selected for the production of shaped threads and the properties of the obtained shaped threads. For the production of shaped threads, chemical threads were selected and their effect on heat treatment was studied. The effect of the selected polyester, pliamide and rayon yarns on heat treatment at different processing times was studied. According to the results of the study, the maximum contraction of the yarn in length was observed in the polyester yarn for 60 minutes. Then, from the selected threads, samples of twisted threads with a twist of 150, 200 and 400 tr/m were obtained. The effect of heat treatment on the resulting twisted yarns was studied at different times of duration. The physical and mechanical properties of the resulting twisted threads were checked. As a result of research, the maximum reduction in length was observed within 60 minutes in twisted yarns with a twist of 150 tr/m and amounted to 34-56%.

**KEYWORDS:** chemical yarns, twists, twisted yarns, heat, time, shrinkage.

## I. INTRODUCTION

Nowadays, the demand for shaped yarns is increasing. Renewal and improvement of the range of fabrics and knitwear products is achieved through the use of shaped yarns. Shaped yarns vary in structure, linear density, color, and other properties. Shaped yarns are divided into two main groups according to the method of production, which include shaped yarns produced on spinning and ordinary spinning machines with a single flat spinning, and shaped yarns obtained on spinning machines producing special shaped yarns.

Shaped yarns are widely used in suits and dresses, thick and lace fabrics, non-woven fabrics, which are mainly outerwear. Shaped yarns are also used in the production of decorative fabrics, giving them a special structure and useful operational properties.

## II. METHODOLOGY

The combination of components used in shaped yarns is not limited. Therefore, we aimed to expand the range of shaped yarns by increasing the number of components and combining them. The method of obtaining the shaped yarn we offer is carried out by heat treatment using thermoplastics of synthetic yarns. Accordingly, the raw materials used in the production of shaped yarn were selected and the effect of heat on them was studied. At the same time, samples of each raw yarn were taken and heat treated. The studies were conducted using dry hot air. The air temperature was carried out in an environment of 50<sup>0</sup>S to 100<sup>0</sup>S. In this case, the reduction of the selected raw material by heat was observed. However, it was observed that the greater amount of curl was mainly at a temperature of 100<sup>0</sup>S. Reduction in length was observed in all selected raw materials. But the greatest shrinkage was observed in polyester and polyamide yarns. The viscose strip showed the least shrinkage. Our first phase study was conducted in a 100<sup>0</sup>S temperature environment. Table 1 shows the results of the initial study of the selected raw materials.



**Table 1**  
**Physico-mechanical properties of heat-treated raw materials selected for shaped yarn**

Indications	Polyester				Polyamide				Viscose			
Linear density, tex	19,3				8,17				14,5			
Temperature, °S	100 <sup>0</sup> S				100 <sup>0</sup> S				100 <sup>0</sup> S			
Processing time, min	15 min	30 min	45 min	60 min	15 min	30 min	45 min	60 min	15 min	30 min	45 min	60 min
Reduction,%	22	35	42	53	15	28	35	48	5	5	7	7

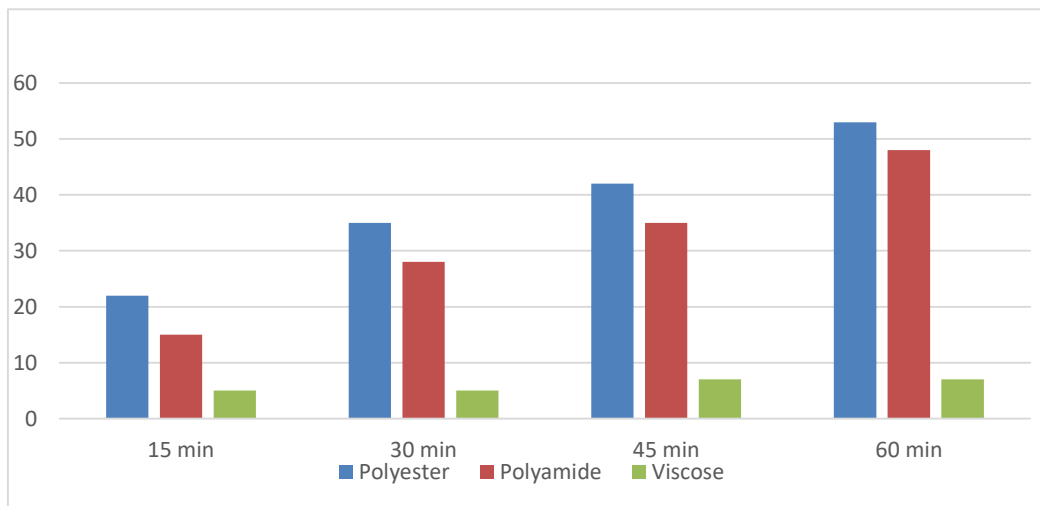


Figure 1. Time dependence diagram of yarn shortening used in the production of shaped yarns

**III. RESULTS AND DISCUSSION**

As can be seen from the diagram in Figure 1, polyester and polyester yarns are reduced by 15-53% in length depending on the duration of heat treatment. Viscose yarn showed a much shorter shrinkage than synthetic yarns and was 5-7%.

After receiving the results of our initial research, the process of joining and twisting our yarns was done. In two different variants, yarns were selected and twisted. In option 1, polyester and polyester yarn were added, and in option 2, polyamide and viscose yarns were added in the blending machine. The threads are refueled with sufficient tension. Depending on the strength of the threads, the speed is set, the cone is wrapped around the reels. The added yarns were twisted on a VTS-07-08-09 twisting baking machine. The yarns were given 150 tr/m, 200 tr/m and 400 tr/m. The physical and mechanical properties of the spun yarn samples were checked. The results obtained are presented in Table 2.

**Table 2**  
 Physical and mechanical properties of spun yarns after heat treatment

Indications	Polyester+ Polyamide			Polyester+ Viscose		
Linear density, tex	18,7	18,85	19,01	16,25	16,5	16,7
Number of turns, tr/m	141	203	407	148	221	412
Breaking force, sN/tex	15,37	16,69	17,91	9,73	10,98	12,08



The spun yarn samples were rewrapped from spool to yarn on an MG-1 rewinding machine. The rewinding speed was adjusted according to the linear density of the yarn. 5 places of yarn taken from the yarn were sewn with cotton thread. The yarns obtained in the yarn were processed in a hot environment at a temperature of 100<sup>0</sup>S. Along with the shortening of the threads, the process of balancing the twists was also carried out. The results obtained by heat treatment of spun yarns are given in Table 3.

Table 3  
Physico-mechanical properties obtained by heat treatment of spun yarns

Indications	Polyester+Polyamide			Polyester+Viscose		
Linear density, tex	18,7	18,85	19,01	16,25	16,5	16,7
Number of turns, tr/m	141	203	407	148	221	412
Temperature, <sup>0</sup> S	100 <sup>0</sup> S			100 <sup>0</sup> S		
Reduction, %, 15 min	51	43	40	35	32	29
30 min	53	51	44	42	37	32
45 min	56	53	45	44	39	34
60 min	56	56	45	46	42	34

From the data in Table 3, it can be seen that the highest values were achieved by 56% reduction of polyester+polyamide yarns at 141 tr/m for 60 minutes at 100<sup>0</sup>S, and 46% reduction of polyester+viscose yarns at 141 tr/m for 60 minutes at 100<sup>0</sup>S. By studying the results of the study, the best results were obtained at a temperature of 100<sup>0</sup>S for 60 min.

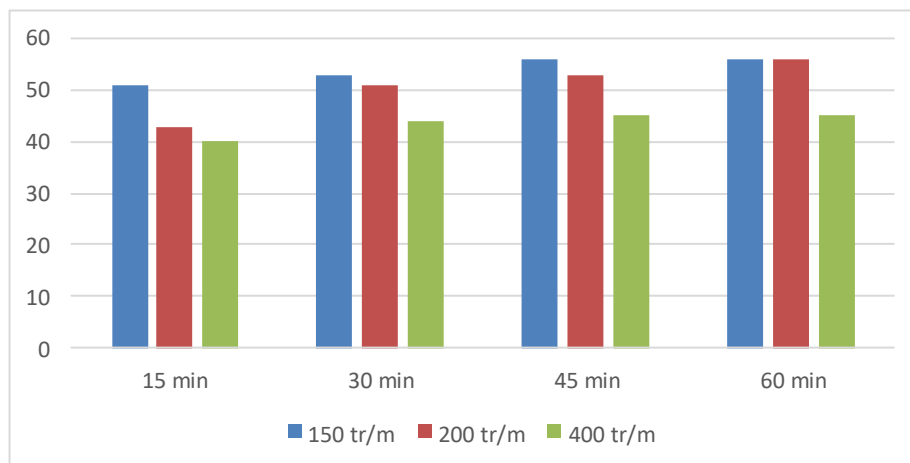


Figure 2. Heat shrinkage diagram of twisted yarns with different twists on polyester+polyamide yarns

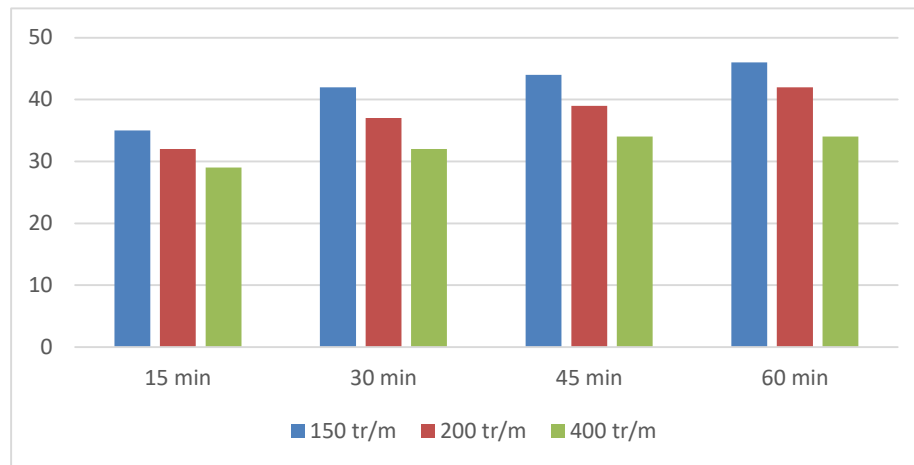


Figure 3. Heat shrinkage diagram of twisted yarns with different twists on polyester+viscose yarns

#### IV. CONCLUSION

As can be seen from the diagrams in Figures 2.3, the rate of contraction in the yarns decreased as the number of twists applied to the sampled yarns increased. Hence, the increase in twists had an effect on the free shortening of the threads. From this, the smaller the number of twists, the lower the obstacle to the free contraction of the threads.

In conclusion, it was found that artificial and synthetic yarns shrink under the influence of heat and are directly affected by time and twist. The time dependence of the shrinkage of yarns under the influence of heat was studied. In this case, the yarns were exposed to heat for 15, 30, 45 and 60 minutes. After 60 minutes, the shortening of the threads did not change. When the effect of twisting on yarn shortening was also studied, it was observed that the shortening of yarns decreased as the number of twists increased. Hence, it is expedient to give 150 tr/m to the yarns in the production of shaped yarns from chemical yarns. It has been found that it is also possible to obtain shaped yarns by applying heat treatment.

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