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STUDY OF THE INFLUENCE OF SYNTHETIC COMPONENT IN MIXTURES WITH WOOL ON THE PHYSICAL-MECHANICAL PROPRIETIES

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Abstract: *The main physical-mechanical properties of the yarns are: linear density (Tex), tensile strength, tenacity, elongation at break, twisting and mechanical work of fracture, there is a strong correlation between them. The tensile properties are the basic characteristics of yarns, influencing how they behave in the technological processes of mechanical processing (preparation for weaving or knitting, proper weaving or knitting) determining the technological parameters of equipment adjusting during the technological processes and also their productivity. The tensile properties of yarns constitute qualitative characteristics, because their value depends on the quality of the yarn and also on the finite product obtained from processing yarns.*
In this paper was done a comparative study of the tensile properties of two batches of mixed woolen yarns (wool with polyester and wool with polyamide), the mixture being in the same proportions, but the yarns have different fineness and have very close twist values, both batches of yarns were designed for knitted products. Batch I consists of 70% wool yarns and 30% polyester, linear density Ttex = 55.56 tex and twist of 350 twists/meter. Batch II consists of 70% wool yarns and 30% polyamide, a linear density of Ttex = 71.34 tex and twist of 330 twists/meter (so a thicker yarn than the one from batch I).
Following the analysis between the two batches is clear that the woolen yarns in batch II have much higher tensile properties.

Key words: *Fibers, fineness, tensile proprieties, tensile strength, quality, uniformity, wool*

1. INTRODUCTION

In this paper was done a comparative study of the tensile properties of two batches of mixed woolen yarns (wool with polyester and wool with polyamide), the mixture being in the same proportions, but the yarns have different fineness and have very close twist values, both batches of yarns were designed for knitted products. Batch I consists of 70% wool yarns and 30% polyester, linear density Ttex = 55.56 tex and twist of 350 twists/meter. Batch II consists of 70% wool yarns and 30% polyamide, a linear density of Ttex = 71.34 tex and twist of 330 twists/meter (so a thicker yarn than the one from batch I).

Textiles (knitted fabrics, unconventional textile, knitting, etc.) are formed of yarns that are arranged in a certain order, called structure [1], [2]. The yarn is the element underlying the formation of a textile product, and the product structure is the way in which the yarn or yarns are combined. In order to diversify the variety of textile structures, a diversification of the yarns types is realized and

several variants of blended yarns are produced. The mixed yarns are called heterogeneous yarns, which are yarns made of fibers or filaments of different nature [3] [4].

2. THE EXPERIMENTAL PART

In order to study the tensile proprieties of the yarns the following physical-mechanical characteristics are analyzed: yarns tensile strength, elongation at stretch, effort-elongation diagram and irregularity of such caracteristics [5]. The tensile strength tests were performed for ten samples of each batch of yarns for the comparative study of the tensile properties. To determine the experimental samples was used USTER® TENSOJET 4 device presented in Figure 1.

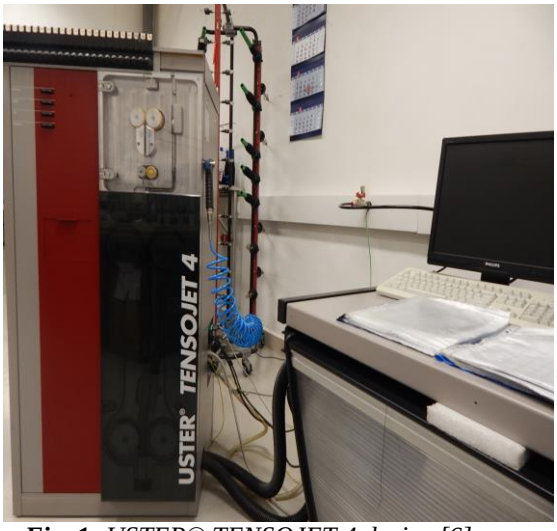

Fig. 1: *USTER® TENSOJET 4 device [6].*

After conducting these tensile strength tests the values of tensile characteristics were obtained: tensile strength, elongation at break, tenacity and the mechanical work at break and also the mathematical statistical processing of the these values by calculating the coefficient of a square variation (cv%) for these values. / We also conducted effort-elongation diagrams and charts variation of the unevenness variation of these two parameters.

For batch I of 70% woolen yarns and 30% polyester we obtained the average value tensile force at break of 696.3 cN and elongation at break averaging 16.09%. Having a linear density of Ttex = 55.56 tex it results an average tenacity of 12.53 cN/tex, and the average work of fracture (Work) is 3937 cN.cm.

As a result of the yarn tests in the two batches we obtained the following.

In Figure 2 is represented the dispersion diagram of tear resistance of the yarns in batch I, rendering the irregularity of tear resistance for the ten samples of yarns from batch I.

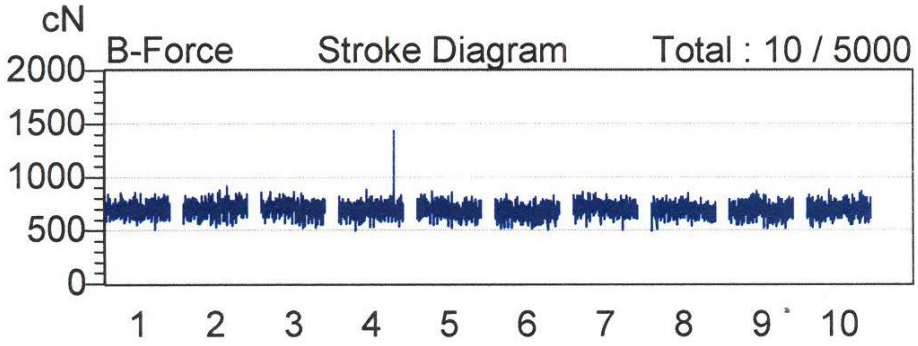

***Fig. 2**: Dispersion diagram of tear resistance for the yarns in batch I*

In Figure 3 is represented the diagram of elongation at break of yarns in batch I, rendering the irregularity of elongation at break for the ten samples of yarns from batch I

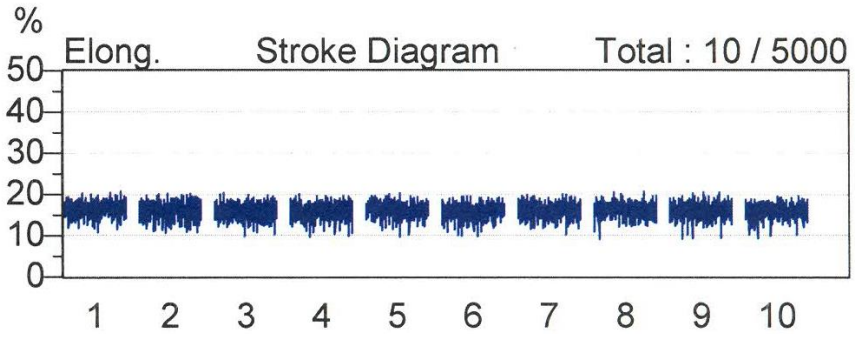

***Fig. 3**: Dispersion diagram of elongation at break for yarns from batch I*

In Figure 4 is represented the effort-elongation diagram that shows the variation of tensile force and elongation at break for the ten yarns in batch I.

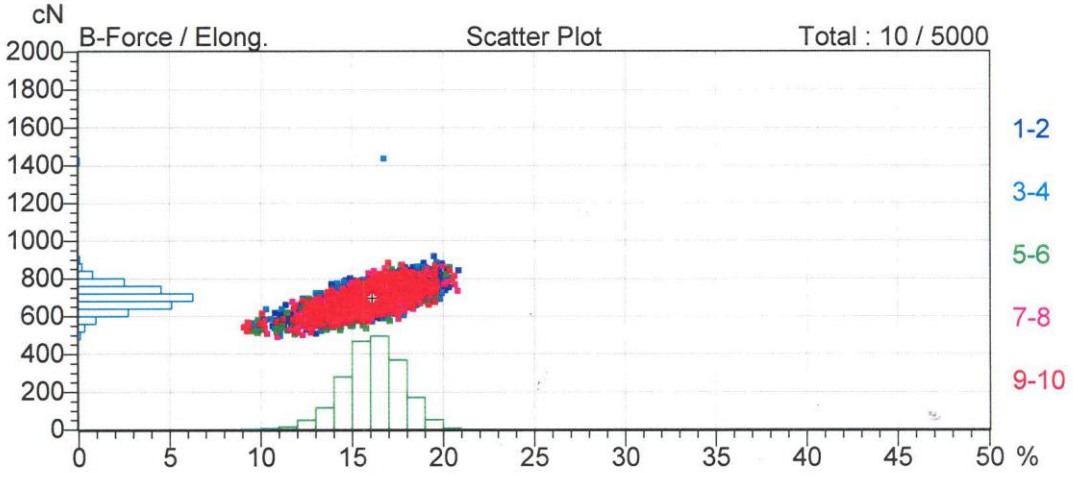

***Fig.* 4:** *Effort-elongation diagram of yarns from batch I*

In Table 1 are found the individual values for the tensile forces of the ten samples of yarns and the elongation at break corresponding to these forces. Based on these data is achieved the statistical and mathematical processing of this individual data thus obtaining: tenacity, arithmetic mean, coefficient of variation for the yarns in - Batch I

***Table 1**: Statistical and mathematical processing of individual data of yarns – Batch I*
Total10/5000 Sigle test (4)

Nr.	B-force cN	Elong %	Tenacity cN/Tex	B-Work cN cm
1/500	704.5	196.46	12.68	4072
2/500	711.4	16.10	12.8	4008
3/500	704.0	15.93	12.67	3920
4/500	695.1	15.94	12.51	3916
5/500	696.2	16.18	12.53	3961
6/500	674.6	15.96	12.14	3789
7/500	709.2	16.21	12.77	4053
8/500	684.5	16.19	12.32	3901
9/500	685.8	16.07	12.34	3871
10/500	697.7	15.86	12.56	3876
Mean	696.3	16.09	12.53	3937
Cv	8.66	10.24	8.66	16,68
s	60.29	1.65	1.09	656,6
Q95	1672	0.05	0.06	18,20
Min	491.4	9.07	8.84	1633
Max	1435	20.83	25.83	8070
Po.o1(0)				
P0.05(2)	501.2	9.23	9.02	1727
P0.1 (5)	509	9.36	9.16	1777
P0.5(25)	532.1	10.79	9.58	2074

For batch II of yarns with 70% wool and 30% polyamid we obtained an average tensile force value at break of 938.5 cN and average elongation at break of 28.4%. With a linear density Ttex = 71.34 tex results an average tenacity 13.15cN/tex and average mechanical work of fracture (Work) is 9237 cN.cm.

In Figure 5 is represented the dispersion diagram of tear resistance for yarns in batch 1, rendering the irregularity of tear resistance for the ten samples of yarns from batch II.

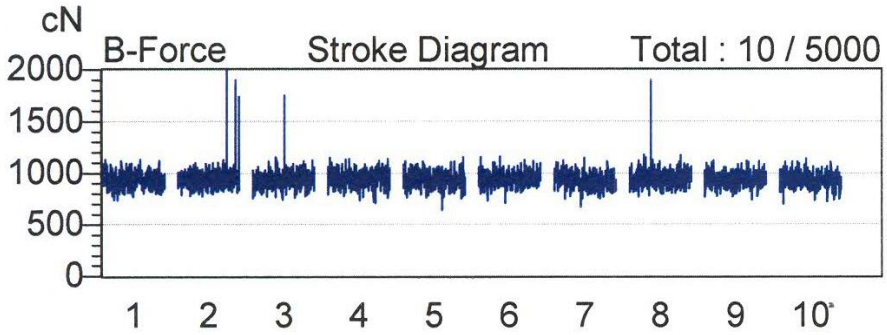

***Fig. 5**:* Dispersion diagram of tear resistance for the yarns in batch II

In Figure 6 is represented the dispersion diagram of elongation at break of the yarns from batch II, rendering the irregularity of elongation at break for the ten samples of yarns from II

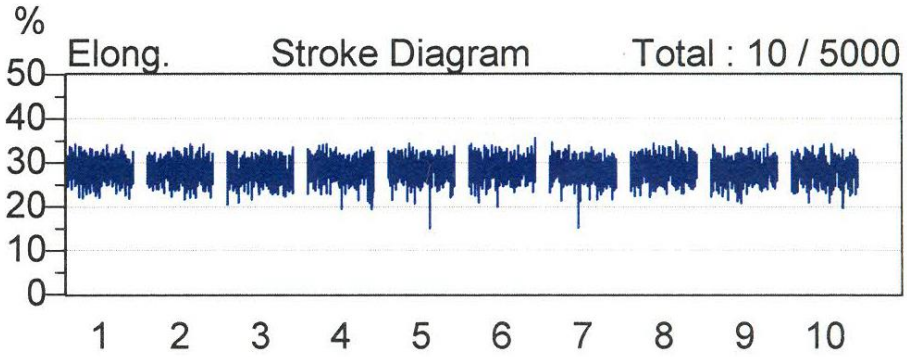

***Fig. 6**: Dispersion diagram of elongation at break for yarns in batch II*

In Figure 7 is represented the effort-elongation diagram that shows the variation of the tensile force and elongation at break for the ten yarns in batch II.

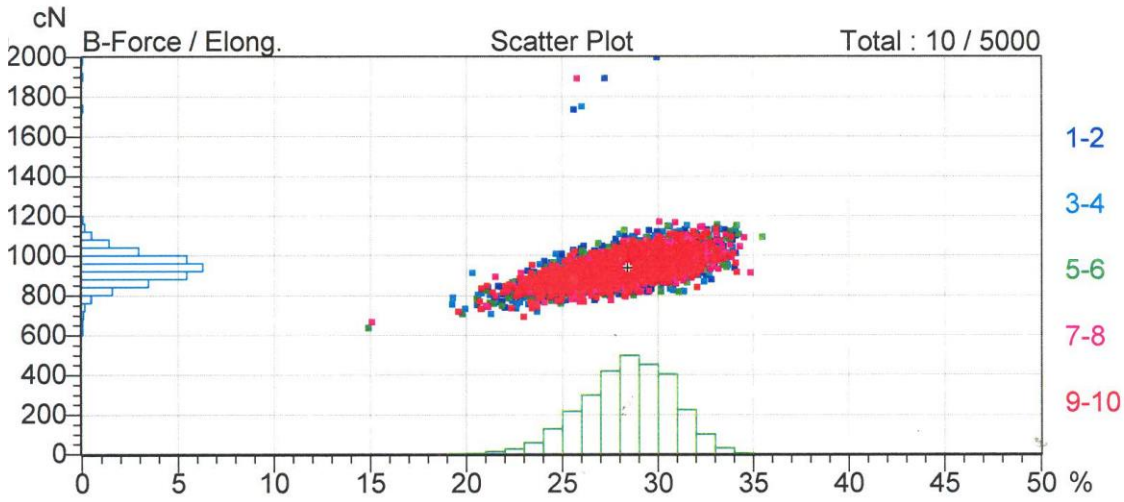

***Fig. 7:** Effort-elongation diagram of the yarns from batch II*

In Table 2 are found the individual values of the tensile forces of the ten samples of yarns and the elongation at break corresponding to these forces. Based on these data is achieved the statistical and mathematical processing of these individual data thus obtaining: tenacity, arithmetic mean, coefficient of variation for the yarns in – Batch II

***Table 2:** Statistical and mathematical processing of individual data of yarns – Batch II*
Total10/5000 Sigle test (4)

Nr.	B-force cN	Elong %	Tenacity cN/Tex	B-Work cN cm
1/500	937.8	28.44	13.13	9242
2/500	946.8	28.16	13.25	9253
3/500	936.3	27.9	13.11	9105
4/500	945	28.43	13.23	9325

5/500	934.2	28.51	13.08	9213
6/500	942	27.71	13.19	9357
7/500	927.2	28.38	12.98	9118
8/500	951.7	28.85	13.32	9472
9/500	930.8	28.30	13.03	9134
10/500	932.9	28.25	13.06	9151
Mean	938.5	28.40	13.14	9237
Cv	7.94	8.36	7.94	13.88
s	74.5	2.37	1.04	1282
Q95	2066	0.07	0.03	35.53
Min	634.6	14.89	8.88	3331
Max	1996	35.47	27.94	20190
Po.o1(0)				
P0.05(2)	689.7	19.22	9.66	4927
P0.1 (5)	704.8	19.55	9.87	5159
P0.5(25)	755.9	21.34	10.58	5927

Comparing the tensile properties values that were determined we obtained for Batch 1: average tensile strength of 336.6cN and average mechanical work of fracture cN.cm 2198 and for batch 2: average tensile strength of 337.3 cN and average mechanical work of fracture 2255 cN.cm. We notice that the second batch of yarns has slightly higher values for these tensile properties.

3. CONCLUSIONS

As a result of these comparative analyses of yarns tensile properties of the two batches and in particular the values of tenacity represents the fact that the woollen yarns from batch II - 70% wool and 30% polyamid have much higher tensile properties - better than batch I consisting of 70% wool and 30% polyester. Decisive is the synthetic component of polyamide which confirms once again its superior qualities in terms of tensile properties.

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