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Make Harmony Between Technology and Nature, and Your Mind will Fly Free as a Bird
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STUDY ON STRENGTH AND BREAKING ELONGATION FOR YARNS AND KNITTED FABRICS USED TO MAKE SOCKS

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Abstract:*Resistance to different applications is a main center for assessing the quality of yarn used in knitting socks. During processing, textile yarn is subjected to mechanical stress of different nature and different intensity. The most common types of requests are traction, which usually does not exceed 25 to 30% of breaking strength. To these forces the twisting, bending, compression, friction or shear forces are added. The resistance of threads in these applications is determined by the nature of raw material, the fineness of the yarn, spinning system.*
A first parameter for assessing the quality of yarns and knitted fabrics made from them is the tensile strength and elongation at break by default. In the present work the tests were made on cotton yarns, straight or twisted, with different fineness. Also has been tested the tensile strength and breaking elongation for a few structures of knitted fabrics. In the process of achieving knitted products, strength and breaking elongation are decisive factors who affecting the parameters of winding, warping, knitting, finishing.
Key words: *strength, elongation, yarns, knitted fabric, socks*

1. INTRODUCTION

Strength and elongation at break values are influenced both by the test samples on the device, such as specimen length, speed and rate of extension, and environmental conditions: temperature, humidity, air flow speed.(Budulan, 2009).
If the thread tension is too high during processing, the thread may break and if too small, in this case can be defective products - spool too soft (at winding), irregular knitted eye (at knitting).
It is important to know the physical-mechanical properties of the yarns, because they depend heavily on properties of knitted fabrics, both in terms of processing and their exploitation.

2. EXPERIMENTAL

This study used cotton yarns with different yarn counts and knitwear obtained from these yarns – socks – with different structures (table 2).
Focused characteristics are tensile strength and extension at break. These characteristics have been measured throughtesting method according to specific standard(Vladet all, 2009). The conditioned samples are employed before the preparation stage technology.
Tensile strength and extension at breakof the yarns and knitwear were determined using a dynamometer type Titan2 - Universal Strength Tester, based on two standards:
- For yarns: EN ISO 2062 – Yarns from packages. Determination of single-end breaking force and elongation at break.Jaw separation: 250 mm, pretension: 0.500cN/tex, break detection: 50.00%, specimens 20, rate of extension: 250mm/min.(Technical book of Titan[2]).
- Forknitted fabrics: SR EN ISO 13934-1:2002 – Textiles - Tensile properties of fabrics - Determination of maximum force and elongation at maximum force using the strip method.Jaw separation: 100 mm, pretension: 100gf, break detection: 50.00%, specimens 20,specimen dimensions: 50mm x 300mm.
Titan's software has been pre-programmed with British (BS), European (EN), International (ISO), American (ASTM) and Retailers' Standards (e.g. Next, M&S), the instrument's software is easy to follow and makes testing both quick and easy.(Technical book of Titan[2]).

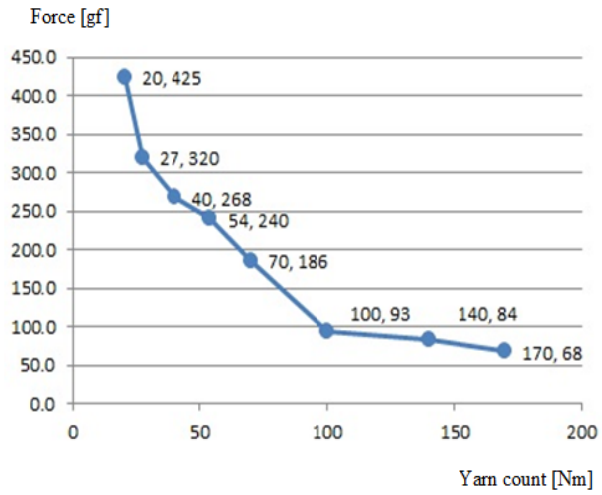

Fig. 1. Graphical representation for breaking strength – single yarn

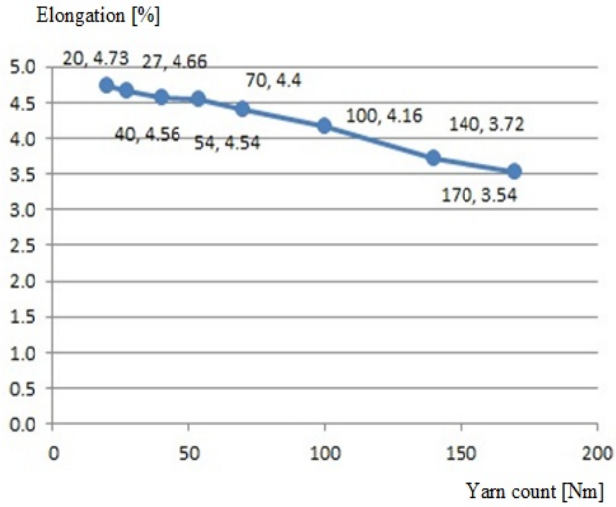

Fig. 2. Graphical representation for elongation at break – single yarn

Based on table 1 we graphically represented the breaking load (figure 1) and elongation at break (figure 2) for cotton yarns.
Figure 1 is observed that the higher number is yarn count, the breaking load is less. Also, elongations at break values are inversely proportional to the yarn counts.

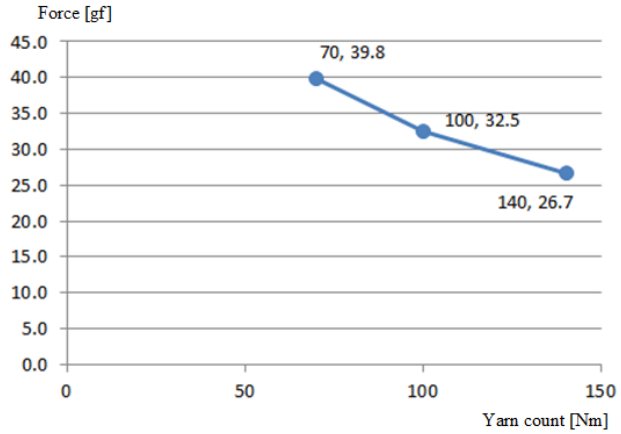

Fig. 3. Graphical representation for breaking strength – finished single jersey knits, twisted yarns.

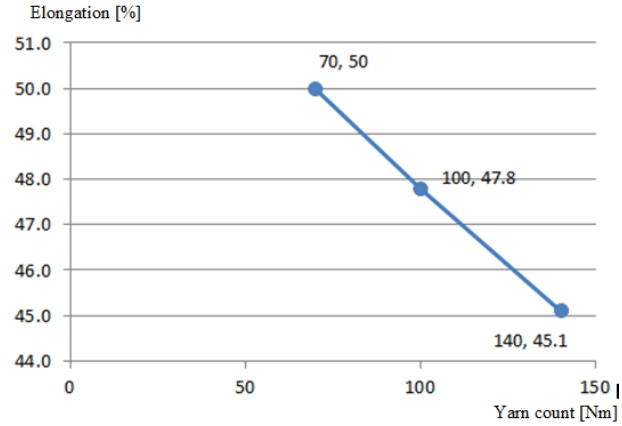

Fig. 4. Graphical representation for elongation at break – finished single jersey knits, twisted yarns.

3. RESULTS AND DISCUSSION

Type of Yarn	Yarn count [Nm]	Mean Force [gf]	Mean Elongation [%]
single	20	425	4.73
	27	320	4.66
	40	268	4.56
	54	240	4.54
	70	186	4.40
	100	93	4.16
	140	84	3.72
	170	68	3.54
twisted	40/2	435	4.22
	70/2	280	4.20
	100/2	206	4.06
	140/2	179	3.94
	170/2	151	4.00
dyeing	40/2	318	4.21
	70/2	266	4.14
	100/2	200	4.04
	140/2	171	4.00
	170/2	132	3.96

Tab. 1. Results of tests for cotton yarns

Also from Table 1, weconclude that, if twisted, breaking load is twice the breaking load of yarn. Yarn elongation is lower than that of twisted yarn.
After the dyeing process, the tensile strength of cotton yarn decreased. This is explained because the painting is done at high temperatures, which weaken the intermolecular forces.

Tipe of knits	Yarn count [Nm]	Knitted structures	Mean Force [gf]	Mean Elongation [%]
unfinished	70/2	single jersey	44.2	56
	70/2	double jersey 2:2	46.8	58
	100/2	single jersey	36.6	46
	100/2	links-links	37.2	50
	140/2	double jersey 1:1	30.2	43
finished (dyeing)	70/2	single jersey	39.8	50
	70/2	double jersey 1:10	41	53
	100/2	single jersey	32.5	47.8
	140/2	single jersey	26.7	45.1
	140/2	double jersey 2:8	28	46.8

Tab.2. Results of tests for knitted structures

Whatever yarn count and finishing, tensile strength is higher by 5.5% in case of double jersey and lynx compared with single jersey structure.
For the same yarn count, tensile strength for the finished knits is 10% lower than the unfinished knits.
Whatever yarn count and finishing, elongation at break is higher by 5 % in case of double jersey and lynx compared with single jersey structure.
For the same yarn count, elongation at break for finished knits is 10.8% lower than the unfinished knits.

4. CONCLUSIONS

Comparing results from tables 1 and 2 shows that the properties of yarns are reflected in the properties of knitted fabrics used to make socks. For knitted fabrics made from thinner yarns, the breaking load and elongation were lower than thicker yarns.
During finishing, yarns and knits so reduces its strength and elongation at break. This can be improved by treatment with substances to increase their tensile strength - for example mercerization of cotton yarn.
Using thin yarns for knitting are obtained socks with low tensile strength, which means a shorter wearing time. It is recommended to use plain plating knits - for example cotton + polyamide.

5. REFERENCES

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EN ISO 2062 – Yarns from packages. Determination of single - end breaking force and elongation at break.
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