European Scholar Journal (ESJ)
Available Online at: https://www.scholarzest.com
Vol. 2 No. 3, March 2021,
ISSN: 2660-5562

ANALYSIS OF PHYSICAL AND MECHANICAL PROPERTIES OF MIXED FIBER YARNS USED IN THE MANUFACTURE OF HIGHLY ELASTIC FABRIC

Nabijon Maksudov
Head of the Department of Construction and technology of goods of light industry, Namangan Institute of Engineering and Technology, Namangan, Uzbekistan maqsudovnabijon@mail.ru
Ergashev Jamoliddin
Doctor of Technical Sciences, Namangan Institute of Engineering and Technology, Namangan, Uzbekistan ergashev64@mail ru.
Mukhtarov Abbos
Senior Lecturer Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Rakhmonov Doston
Senior Lecturer Namangan Institute of Engineering and Technology, Namangan, Uzbekistan

Article history:

Received: 28th February 2021
Accepted: 7th March 2021
Published: 30th March 2021

Abstract:

This article describes the mixed yarn of a mixture of polyester and polyurethane fibers. The indicators of the mechanical properties of elastic threads are determined. Based on the analysis of the properties of the new yarn, recommendations were developed for elastic materials developed from it.

Keywords: Elastic materials, polyester, spandex, lycra, deformation, dacron, elongation.

INTRODUCTION

Currently, there is a growing demand for elastofiber mixed yarns and textile materials produced from them. They are widely used in the production of household, special sports and medical products. It is proved that elastic materials (fabrics and knitted fabrics) compress human muscles in clothing, reduce muscle fatigue and heart rate for some time, have the property of temperature stabilization, and have a positive effect on the circulatory system [1,2]. These materials are also necessary for the manufacture of compression clothing for children with disabilities with limited motor capabilities to maintain muscle tone and prevent injuries of the musculoskeletal system.

To give materials compression properties, elastic fibers - lycra-are added to their composition. Elastomeric filaments produced on the basis of polyurethane rubbers (spandex, lycra, etc.) have become important in recent years [1-3]. On the basis of elastomeric threads, in combination with conventional types of threads, various textile structures are produced - secondary non-uniform twisted and twisted threads with unevenly loaded components. In this case, the clothing acquires flexibility and becomes more stretchable, reducing crease and increasing comfort. Of them are made of elastic fabric and knitted fabric of various kinds.

The main distinctive feature of elastic materials is high extensibility and elasticity (recoverability), both in the transverse and longitudinal direction, due to the high mobility of the internal elements of the structure of the polyurethane fiber. All this has led to an increase in popularity in the modern world market of high-tensile clothing (underwear, bathing suits, fashionable and functional sportswear, compression products). Therefore, research aimed at a detailed study of the properties of elastic materials and expanding the scope of their application is certainly relevant.

Lycra threads are extremely thin (in the range of linear densities of 2.2-125 Tex), which allows you to add them to fabrics without changing their structure. In this case, the appearance, strength and elasticity of the material increases. The range of polyurethane threads is determined by their purpose. They can serve as auxiliary when splicing (joining together) or are available as wound with other types of threads. Depending on the purpose of the material, the percentage of elastane in its composition is determined. The effectiveness of using polyurethane fibers is shown in increasing the many advantages of the fabric to which it is added. When stretched 8 times, the density (1.1 – 1.3 g/kub.sm) of lycra remains the same without changing the original data. Although lycra belongs to the category of synthetics, its fibers have good breathability.

It is known from world experience that the use of high-tensile yarn in a mixture with polyester fibers (polyester and lycra) makes it possible to produce convenient and comfortable hygienic properties, elastic and compression products for sports and therapeutic and preventive purposes [4].

LITERATURE SURVEY

Polyester (PE) fibers are synthetic fibers formed from polyesters. In industrial use, they are called "polyester" and "Dacron" [9]. Lavsan-is characterized as a strong, elastic, low-creep fiber that has the following properties: moisture absorption at 20°C at 65% relative humidity is 0.3-0.4%; preservation of strength in the wet state is 100%, in the loop 80-90%, the thread density is 1.38-1.4 g / cm3, the modulus of elasticity is 2.5-3 GPa. The positive properties of polyester fibers are shown in optimal mixtures: 50-67% PE fiber and 50-33% cotton, 68% polyamide and 32% elastane [5-6], 75% cotton, 18% polyamide and 7% elastane, 75% nylon and 25% spandex, 30% TENCEL® and 70% polyester [7]. These materials are best suited for making sports tops, t-shirts, breeches and trousers. These fabrics are comfortable to wear, easy to care for, do not lose their original shape for a long time — they do not shrink and do not stretch [8].

EXPERIMENTAL RESULTS

Experimental studies were conducted at the Tashkent Institute of textile and light industry in order to obtain a fabric that meets the requirements for sports and medical and preventive products.

Elastic yarn in several additions with the same tension was wound on a cane machine of the Italian company "FADIS". Twisting is given on a twisting machine of the company " Saurer", VTS-08-0-S Czech Republic.

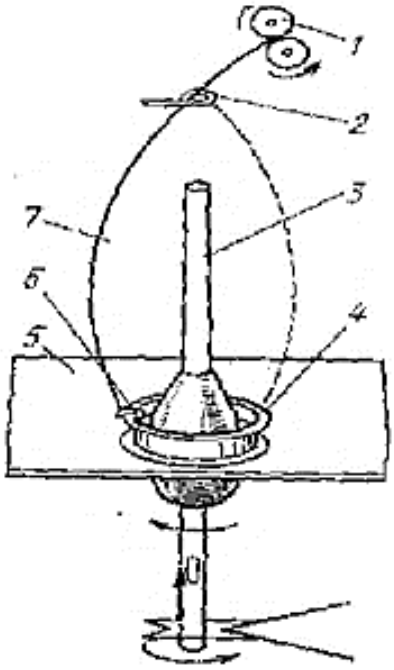

Figure 1. The scheme of the twisting and winding mechanism of the ring spinning machine: 1 - exhaust pair; 2 - thread conductor; 3 - spindle; 4 - ring; 5 - strip; 6 – slider

Creating fabrics for compression products with high compression effect and strength requires high quality yarn. To develop a pilot mixed fabric, 2 versions of yarn were prepared using the following components:

1 st option-95.0% polyester fiber with a linear density of 17.0 Tex x3 and 5.0% lycra 4.5 Tex x2, the number of twists 150 kr/m;

2 nd option-92.0% polyester fiber with a linear density of 17.0 Tex x3 and 8.0% lycra 4.5 Tex X3, the number of twists 150 kr/m;

In the 1 st option, an elastic yarn of linear density 69.6 Tex is used as a basis in three additions of yarn of linear density 20.7 Tex x3.

In the 2 nd option, 58.0 Tex yarn was produced by adding three polyester yarns with a linear density of 17.0 Tex x3 with three threads of lycra with a linear density of 4.5 Tex.

As can be seen from table 1, the average breaking load of the first variant of the sample of elastic yarn is 1464.4 cN, for the second variant 1699.2 cN. Figure 2 shows a graph of elongation versus sample deformation.

The quality of the experimental yarn was evaluated on the basis of physical and mechanical parameters of the yarn (table.1).

Table 1. Indicators of physical and mechanical properties of mixed yarn

№ option's	Raw material composition	Nominal linear density, Tex	Breaking load, F (sN)			Relative breaking load, (sN/tex)			Elongation at break, ε (%)		
			Average	Dispersion	Coefficient of variation	Average	Dispersion	Coefficient of variation	Average	Dispersion	Coefficient of variation
1	95 % PE 5% Lycra	69,6	1464,4	276,2	18,86	84,16	15,8	18,86	21,28	8,95	42,06
2	92 % PE 8% Lycra	58,0	1699,2	40,85	2,40	29,30	0,70	2,40	22,16	0,97	4,39

Analysis of the test results of experimental samples showed that the breaking load of the yarn produced in the first version is 1464.42 SN, and the relative load is 84.16 SN / Tex; the elongation is 21.28%. In the second variant, the breaking load is 1699.2 SN, the relative breaking load is 29.30 SN / Tex, and the elongation is 22.16%.

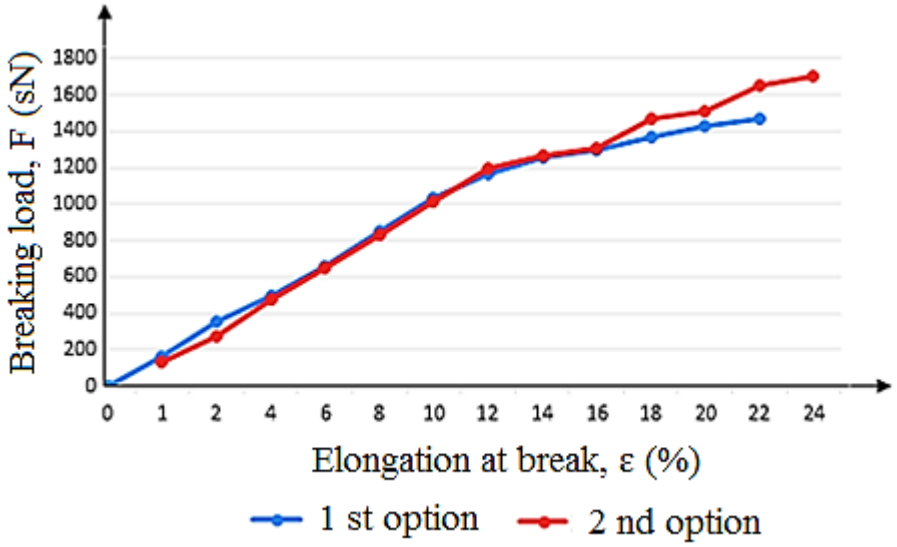

Figure 2. Schedule of elongation of samples of experimental blended yarn

Based on the study of physical and mechanical parameters of mixed yarn, it can be concluded that the yarn produced by adding different fibers is generally elastic and elastic. In both versions of the yarn, the elongation indicators increase with increasing breaking load in a linear order and practically differ little from each other. Verification of experimental samples of elastic fabric produced from these types of yarn determined the purpose of these yarns.

CONCLUSION AND FUTURE WORK

The 1 st and 2 nd versions of mixed yarn made of polyester and elastane fibers meet the requirements for materials for the manufacture of compression clothing and can be used in the development of compression fabric for sports and medical products. Moreover, the 1st version of the yarn is recommended for high-density fabrics with a greater thickness (surface density from 300 to 400 g/m^2), and the 2 nd version-for medium – density fabrics (surface density from 200 to 300 g/m2). The development of elastofiber mixed yarns will increase the range of functional textile materials with specified properties.

REFERENCES

1. Ashdown S., Improving Comfort in Clothing, Chapter 11: Improving body movement comfort in apparel, The Textile Institute, Woodhead Publishing Limited, England, 2011, 459 p.
2. Jeong Seon Sang , MeeSik Lee "Structural effect of polyester SCY knitted fabric on fabric size, stretch properties, and clothing pressure" Sang et al. Fashion and Textiles (2015) 2, 34-38.
3. Sadek R., El-Hossini A. M., A. S. Eldeeb, A. A. Yassen Effect of Lycra Extension Percent on Single Jersey Knitted Fabric Properties Journal of Engineered Fibers and Fabrics Volume 7, Issue 2 – 2012

4. Nigmatova F, Maksudov N, Kasimova A, Shin E "Compression Clothes for Sports-Critical Review" International Journal of Advanced Research in Science, Engineering and Technology. - Vol. 5. - Issue 12, December 2018
5. Manshahia& Dasa M. A. Thermo-physiological comfort of compression athletic wear Indian Journal of Fiber & Textile Research Edition, 39, June 2014, pp.139-146,
6. Maksudov, N.B .; Nigmatova, F.U .; Yuldashev, J.K .; Abduvaliev R.R. (2018) Analysis of the deformation properties of highly elastic knitted fabrics for designing sportswear. Universum: technical sciences. No. 9 (54) September 2018. https://cyberleninka.ru/article/n/analiz-deformatsionnyh-svoystv-vysokoelastichnyh-trikotazhnyh-poloten-dlya-proektirovaniya-sportivnoy-odezhdy.
7. Bayazit Marmarali A. (2003): Physical and Dimensional Properties of Cotton/Spandex Single Jersey Fabrics, Textile Research Journal, Vol.1. 11-14
8. Yakovleva T. V., Artamonova N. M. analysis of the advantages of polymer textile materials.- Kazan: Vestnik 2011. - Pp. 105-110
9. Nigmatova, F.U; Maksudov, N.B; Kasimova, A.B; and Xolikov, K.M (2019) "To the question of the design of functional clothes with compression effect to the question of the design of functional clothes with compression effect to the question of the design of functional clothes with compression effect" *Textile Journal of Uzbekistan*: Vol. 3 : No. 1, Article 24. https://uzjournals.edu.uz/titli/vol3/iss1/24.