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Highly elastic fabrics with polyester and cotton blends

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ABSTRACT: The paper considers the experience of manufacturing fabric with elastic properties for compression products for sports purposes. In the production of fabric samples, 100% cotton threads with a linear density of 25 x 2tex were used as the main threads, and for weft from a mixture of polyester, cotton fibers with a linear density of 17.3 x3, and with elastane 1.7% lycra 4.5tex x2.

KEY WORDS: weaving, fabric, elastic, cotton, polyester, lycra.

I. INTRODUCTION

The intensive socio-economic development of the Republic of Uzbekistan necessitates the development of new technologies aimed at expanding the range of consumer goods with high performance properties, import independence and export orientation. One of the promising areas in this aspect is the production of modern textile products in market conditions. Currently, there is an increasing demand for highly elastic textile materials, which are widely used for the production of household, special, sports and medical and preventive products. Compression clothing is becoming a popular attribute with athletes and gym goers.

It is known that compression clothing has a positive effect on the functional activity of a person, it compresses the muscles, slightly reduces their fatigue and heart rate, has the properties of temperature stabilization, and the circulatory system [1,2].

II. LITERATURE REVIEW

The main suppliers of sports compression products in the Uzbek market are foreign companies, mainly from China, the USA, Russia, Germany, etc.

Therefore, the development and expansion of the range of compression fabrics with a highly elastic property for all sports, replacing imported products, is very relevant.

It is known from world experience that the use of high-stretch yarn from polyester and lycra fibers makes it possible to produce comfortable and hygienic, elastic and compression products. The study of foreign experience shows that natural fibers, such as wool and cotton, are little used in products for active sports [3]. They are often blended with other synthetic fibers or used in the outer side of a fabric. Polyester is the most common fiber used for sportswear.

It is known that the best positive properties of polyester fibers are manifested in optimal mixtures: 50-67% PE fiber and 50-33% cotton, 68% polyamide and 32% elastane [4, 5], 75% cotton, 18% elastane polyamide 7% nylon 75% and spandex 25%, TENCEL 30% and polyester 70% [6].

Woven materials using optimal mixtures of polyester fibers 50-70% and 50-33% cotton fibers, as well as a mixture of 84% polyamide fibers with 16% elastane, are gaining great popularity. The creation of domestic blended fabrics makes it possible to give sports products from them sufficient comfort, elasticity and significantly improve consumer properties in comparison with pure cotton raw materials [7].

III. RESULTS AND DISCUSSION

The main difference between high stretch textile fabrics and traditional fabrics is that they contain elastomeric yarns. It is advisable to use woven elastic materials for compression products with a high compressive effect that do not change their dimensions after use. They provide the necessary compression (compression) and a tight fit with a localized warming effect, they are distinguished by a smooth surface, resistance to ultraviolet radiation. Due to the high

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density, compression products should have a micro-massage effect on human skin, which is a positive quality in the process of sports training. Therefore, they can be used as tight-fitting material for sportswear.

The paper considers the experience of manufacturing fabric with elastic properties for compression products for sports purposes. Experimental studies were carried out at the Tashkent Institute of Textile and Light Industry at the departments of "Spinning Technology", "Technology of garments" and "Technology of textile fabrics". In the production of fabric samples, 100% cotton threads with a linear density of 25 x 2tex were used as the main threads, and weft from a mixture of polyester, cotton fibers with a linear density of 17.3 x3, and with elastane 1.7% lycra 4.5tex x2.

For the development of an experimental mixed fabric, 3 variants of yarn were prepared using the following components:

1st variant 43.3% polyester fiber with a linear density of 17.3x3tex, 55% cotton fiber 25x2tex and 1.7% lycra 4.5 x2tex;

2nd variant 37.6% polyester-elastane yarn 20.7 x2 tex, 62.4% cotton fiber 25 x2 tex;

3- variant 47.3% polyester-elastane yarn 20.7 x3 tex, 52.7% cotton fiber 25 x2 tex.

The most widely used in the world practice of manufacturing compression fabrics is twill weave with a small repeat. Due to shorter and more frequent overlaps on fabrics, an increase in wear resistance, water resistance and surface smoothness is achieved.

Based on the results of the study, a technical calculation of the fabric was made, and initial parameters of the fabrics were selected (Table 1). According to the calculated filling parameters, experimental fabric samples for compression sports products were developed. When developing experimental samples - No. 1, cotton yarn with a linear density of 25 * 2 tex was used for the warp threads, mixed three-component yarn, 17.3 x3 tex each and elastane with a linear density of 4.5 * 2 tex, were used for weft threads.

When developing experimental samples - No. 2, for the main threads, cotton yarn with a linear density of 25 * 2 tex was used, for the weft thread, a mixed three-component yarn was used (62.4%; PE-33, 2%; PU-4.4%) with a linear density of 20 .70*2 tex.

In the development of experimental samples - No. 2, cotton yarn with a linear density of 25 * 2 tex was used for the main threads, a mixed three-component yarn (52.7%; PE-41.6%; PU-5.7%) with a linear density of 20 .70*3 tex.

Table 1.

Initial parameters of the new fabric

The name of indicators	Options for finished fabrics and their raw material composition for weft		
	variant -1	variant -2	variant -3
Raw composition: - warp - weft	55 % cotton 43,3% polyester 1,7% lycra	62,4 % cotton 33,2% polyester 4,4% lycra	52,7% cotton 41,6% polyester 5,7% lycra
Linear density, tex - warp - weft	 25*2 55,6	 25*2 42,2	 25*2 69,6
Pattern	Twill 1/3		
Number of threads per 10 cm - warp - weft	 240 200	 240 240	 240 180
Surface density, g/m^2	387,0	428,5	329,5

When developing experimental fabric samples, studies were carried out to determine the effect of the ratio of weft threads from inelastic and highly elastic yarns on the technological shrinkage of finished fabrics. All samples were produced in 1/3 twill weave.

The physical-mechanical and consumer properties of prototype fabrics were studied, a comparative analysis was made with standard fabrics for this purpose of the product. The results of the study are shown in Table 2.

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Table 2.
Physic-mechanical and consumer indicators of prototype fabrics

The name of indicators	Options for finished fabrics and their raw material composition for weft		
	variant -1	variant -2	variant -3
Tensile strength fabric 50x200 mm N(kgf) - warp - weft	 661,0 456,6	 585,7 467,5	 765,0 503,0
Elongation at Break, % - warp - weft	 4 % 6 %	 6,5 % 8 %	 8 % 12 %
Fabric abrasion resistance	Over 25000	Over 25000	Over 26000
Breathability cm^3/cm^2 sec	17,7	5,56	6,39
Change in linear dimensions after washing, % - warp - weft	 -2% -4%	 0 -2%	 0 -2%
Changing linear dimensions after finishing, % - warp - weft	 -4% -8%	 + 4% -3%	 -4% -12%

The analysis of the table shows that the 3-variant fabric sample has a breaking load of 765.0 N in the warp and 503.N in the weft at a surface density of 329.5 g/m2. The fabric belongs to warp and weft unbalanced in terms of thread density, where it has a fabric density of 240 threads/dm in warp and 180 threads/di in weft. According to the tissue structure, it belongs to the YI phase of the tissue structure. Under the structure of the fabric, it is customary to understand the relative position of the warp and weft threads, which depends on the following factors: the type of raw material used; diameters of warp and weft threads and their ratios; density of the fabric on the warp and on the duck and their ratios; the type of weave of threads in the fabric; warp and weft tensions and tension ratios; technological parameters and production of fabrics.

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