Analysis of the physical-mechanical properties of t-shirt fabric with different fiber composition

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Abstract. The physical and mechanical parameters of shirt fabrics with different fiber composition are analyzed in the article. According to the analytical results, the results of the penetration, breaking strength, breaking elongation, wrinkle resistance, air permeability, friction resistance of shirt fabrics after washing are presented, and the changes of the results of these indicators are described in the graphs. According to the analytical results, it was determined that the quality of shirting fabrics is affected not only by its fiber composition, but also by its weaving. As a result of the comparative analysis of physical and mechanical parameters of fabrics with different fiber content in six options, it was found that the fabric with 35% polyester and 65% cotton fiber content in option 4 is higher than other options. In textile enterprises, it is recommended for the production of shirt fabric of the fourth option, which has high air permeability, high strength, no wrinkling, and low shrinkage after washing.

1 Introduction

The republic, which for many years exported only cotton fiber, today has unlimited opportunities to gain a high position in the world textile market, not only as a supplier of cotton fiber, but also as an exporter of textile products, especially finished products.

The implementation of changes in the economy of Uzbekistan, the steady transition of our country's economy from the direction of raw materials to the production of competitive products, the expansion of the country's export potential, are putting new tasks before each field of production. In particular, the development of the textile industry, providing our people with high-quality products is one of the important tasks facing the employees of the textile industry. The intended goal is to increase the volume of production of textile products in our country, to meet the needs of the population for thread and fabric, to expand the production types, to introduce new types of fabrics, advanced technologies that enter the development of the textile industry, to create new projects in fabrics and clothes [1-3].

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2 Materials and methods

In Uzbekistan today, great changes are being made in the textile industry. Previously, more raw materials were exported abroad, but now a great deal of attention is paid to their reprocessing and production of ready-made products. Our country specializes in the production of more cotton products, and it is of great importance to get quality products in its processing. Keeping this in mind, research has been conducted to produce a new range of shirting fabric that is in high demand.

Research work was carried out on a PICANOL type loom, and Tt =20 texel yarns with different fiber content were used for the production of a new range of fabrics. The research work produced shirt fabric in 6 variants, the fabric in variant 1 is 100% polyester (PE), variant 2 is 100% cotton, variant 3 is 100% viscose, variant 4 is 35% Pe, 65% cotton, variant 5 40% Pe, 65% cotton, 45% Pe and 55% cotton fibers were obtained in the 6th option [4-7]. The physico-mechanical and hygienic parameters of the fabrics obtained from the research work were determined and the results are presented in Table 1.

Table 1. Results of physico-mechanical parameters of shirt fabrics with different compositions.

№	Indicator name	Options for the fiber composition of the shirt fabric				
		100% cotton	**100% Viscose**	**25% Pe, 65% cotton**	**30% Pe, 65% cotton**	**35% Pe, 55% cotton**
1	Surface density, g/m^2	123.1	124.8	123.3	123.1	123.3
2	Mowing	Canvas	Canvas	Mixed	Along the way	Canvas
3	mani density, Yarn/10cm Warp Weft	 310 212	 310 212	 310 212	 310 212	 310 212
4	Penetration after washing, % Warp Weft	 -3.5 +2.6	 -8.5 +2.5	 -2.1 1.3	 -3.5 2.2	 -3.1 2.4
5	Breaking strength, N Warp Weft	 188 137	 195 148	 255 194	 239 177	 212 162
6	Elongation at breaking strength, % Warp Weft	 7.4 6.5	 7.9 6.8	 10.7 10.0	 9.6 8.9	 8.3 7.5
7	No creasing, % Warp Weft	 44.4 45.1	 51.6 53.3	 66.6 63.3	 48.6 44.8	 46.6 43.5
8	Air permeability, cm^3 /cm^2·sec	97.7	133.6	91.69	75.50	60.5
9	Abrasion resistance, cycle	12800	15300	22000	20400	18200

3 Results and discussions

The changes in the parameters of shirt fabrics with different compositions considered in the experiment are reflected in the following graphs (Figures 1-6).

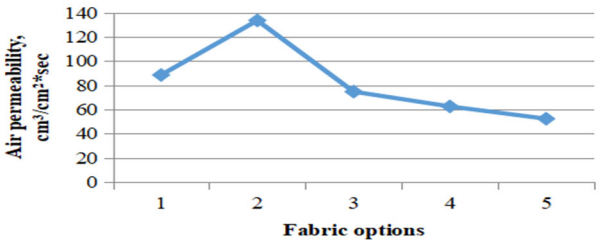
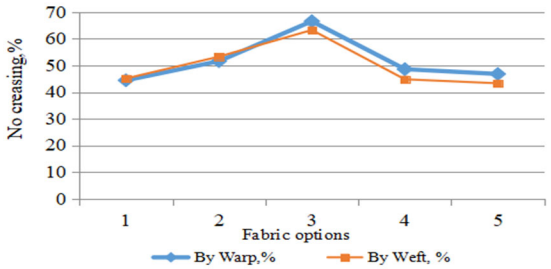


Fig. 1. Air permeability of fabrics.



1-bywarp; 2- by weft

Fig. 2. Changes in the wrinkle resistance of fabrics.

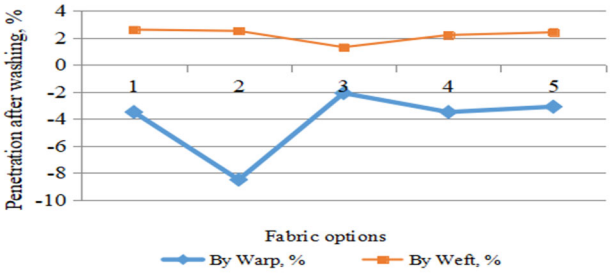


Fig. 3. Changes in the penetration of fabrics after washing.

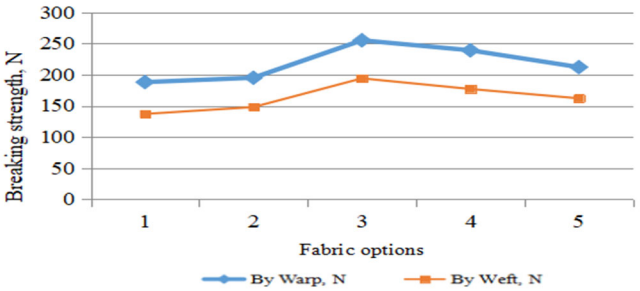


Fig. 4. Change in tensile strength of fabrics.

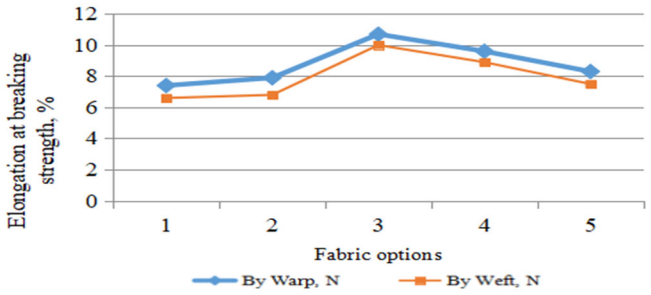


Fig. 5. Change in the elongation of fabrics by breaking force.

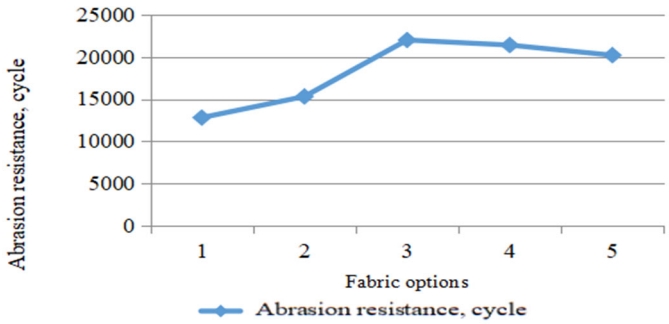


Fig. 6. Change in abrasion resistance of fabrics.

Based on the analysis of the results of the experiment, it can be concluded that the shirt fabric of the 3rd option has 1.5 times less penetration after washing compared to the fabrics of the other options. The tensile strength of the body and hem is 26.3% and 29.4% compared to the 1st option, 23.5% and 23.7% compared to the 2nd option, 6.3% and 8 compared to the 4th option. .8%, 16.9% and 16.5% higher compared to option 5. Elongation in terms of tensile strength on the body and hem in shirt fabric of option 3 is 30.8% and 35% compared to option 1, 26.2% and 32% compared to option 2, 10.3% and 10.3% compared to option 4. 1%, 22.4% and 25% increase compared to option 5 was observed [8,9].

The non-creasing of shirt fabric in the 3rd option is 33.3% and 28.7% compared to the 1st option, 23.4% and 15.8% compared to the 2nd option, 27% and 28.2% compared to the 4th option. It was found that it increased by 30% and 31.3% compared to the 5th option.

The air permeability of the shirt fabric is 2.5% lower in option 3 compared to option 1, 20.7% lower compared to option 2, 17.7% higher than option 4, and 34% higher compared to option 5, abrasion resistance 1 41.8% higher than option 2, 30.5% higher than option 2, 7.3% higher than option 4, and 17.3% higher than option 5.

4 Conclusion

The shirt fabric should be very soft and attractive in appearance. One of the main advantages of shirt fabric is its high strength and durability. In addition, the shirt fabric has excellent air permeability, which allows the skin to breathe even in conditions of high humidity and high temperature. This fabric allows you to prevent the appearance of sweating and allergic reactions due to various reasons. It does not absorb sweat, it does not penetrate after washing, it is easy to remove dirt from it. Such fabric is soft and thin, with high color fastness and is pleasant on the body and comfortable to wear. Due to these properties, the product made of shirt fabric should retain its original appearance and original properties for a long time. Such

characteristic indicators are embodied only in the 35% polyester and 65% cotton fabric of the shirt in the 3rd option compared to other options. In the process of production and operation of shirt fabric, it is necessary to pay attention to the group of properties according to certain indicators when reviewing and evaluating its quality. Fabric dimensions: width, thickness, characteristics of its structure, i.e. linear thickness of threads, fabric density, weaving, phase structure determine the service life of fabrics. Therefore, we researchers recommend for the mass production of shirt fabric with 35% polyester and 65% cotton fiber content of the 3rd option, which has air permeability, high strength, non-creasing, and low shrinkage after washing.

References

1. Salokhiddin Mardonov et al., International Journal of Advanced Science and Technology **4,** 4957-4968 (2020)
2. N. Safarov, A. Abrorov, L. Abdullaev, Journal of Physics **2573** 012036 (2023)
3. D.R. Giyasova, S. Khamrayeva, D.S. Kazakova, Processing of local wool fiber and technology of obtaining threads of mixed composition Modern Innovations, Systems and Technologies **2(1)**, 83-93 (2022)
4. F. Ismoyilov et al., E3S Web of Conferences **390** 01010 (2023)
5. D.S. Kazakova, S.A. Khamrayeva, Z. Bekmuratova, E3S Web of Conferences **486** 07008 (2024)
6. S.E. Mardonov, L.I. Toshpulotov, Q.M. Muminov, Journal of Physics: Conference Series **2388** 012168 (2022)
7. S.E. Mardonov, L.I. Toshpulotov, D.J. Erjanova, N.H. Karimova, Modern Innovations, Systems and Technologies **2(1)**, 76-82 (2022)
8. Sh.R. Khurramov, G.A. Bahadirov, A. Abdukarimov, J. Izv.Vyss. Ucheb. Zav. Tech. Tekstil.Prom **1(397)** (2022)
9. Sh.R. Khurramov, F.Z. Kurbanova, IOP conf. Series: Earth and Environmental Science **614** 012098 (2020)