

MUHANDISLIK

& IQTISODIYOT

*ijtimoiy-iqtisodiy, innovatsion texnik,
fan va ta'limga oid ilmiy-amaliy jurnal*

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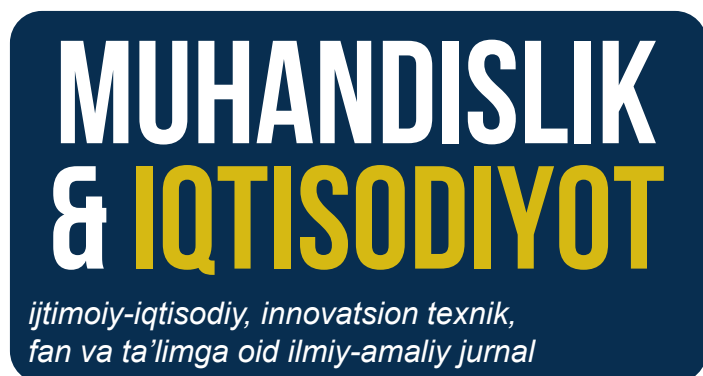
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05.01.00 – Axborot texnologiyalari, boshqaruv va kompyuter grafikasi
05.01.01 – Muhandislik geometriyasi va kompyuter grafikasi. Audio va video texnologiyalari
05.01.02 – Tizimli tahlil, boshqaruv va axborotni qayta ishlash
05.01.03 – Informatikaning nazariy asoslari
05.01.04 – Hisoblash mashinalari, majmualari va kompyuter tarmoqlarining matematik va dasturiy ta'minoti
05.01.05 – Axborotlarni himoyalash usullari va tizimlari. Axborot xavfsizligi
05.01.06 – Hisoblash texnikasi va boshqaruv tizimlarining elementlari va qurilmalari
05.01.07 – Matematik modelashtirish
05.01.11 – Raqamli texnologiyalar va sun'iy intellekt
05.02.00 – Mashinasozlik va mashinashunoslik
05.02.08 – Yer usti majmualari va uchish apparatlari
05.03.02 – Metrologiya va metrologiya ta'minoti
05.04.01 – Telekommunikatsiya va kompyuter tizimlari, telekommunikatsiya tarmoqlari va qurilmalari. Axborotlarni taqsimlash
05.05.03 – Yorug'lik texnikasi. Maxsus yoritish texnologiyasi
05.05.05 – Issiqlik texnikasining nazariy asoslari
05.05.06 – Qayta tiklanadigan energiya turlari asosidagi energiya qurilmalari
05.06.01 – To'qimachilik va yengil sanoat ishlab chiqarishlari materialshunosligi
05.08.03 – Temir yo'l transportini ishlatish
05.09.01 – Qurilish konstruksiyalari, bino va inshootlar
05.09.04 – Suv ta'minoti. Kanalizatsiya. Suv havzalarini muhofazalovchi qurilish tizimlari
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10.00.04 – Yevropa, Amerika va Avstraliya xalqlari tili va adabiyoti

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08.00.02 - Makroiqtisodiyot
08.00.03 - Sanoat iqtisodiyoti
08.00.04 - Qishloq xo'jaligi iqtisodiyoti
08.00.05 - Xizmat ko'rsatish tarmoqlari iqtisodiyoti
08.00.06 - Ekonometrika va statistika
08.00.07 - Moliya, pul muomalasi va kredit
08.00.08 - Buxgalteriya hisobi, iqtisodiy tahlil va audit
08.00.09 - Jahon iqtisodiyoti
08.00.10 - Demografiya. Mehnat iqtisodiyoti
08.00.11 - Marketing
08.00.12 - Mintaqaviy iqtisodiyot
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08.00.14 - Iqtisodiyotda axborot tizimlari va texnologiyalari
08.00.15 - Tadbirkorlik va kichik biznes iqtisodiyoti
08.00.16 - Raqamli iqtisodiyot va xalqaro raqamli integratsiya
08.00.17 - Turizm va mehmonxona faoliyati

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ANALYSIS OF THE CHARACTERISTICS OF FABRIC SAMPLES WHEN SELECTING FABRICS FOR WORKING CLOTHES FOR SPINNERS

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Abstract: This article examines the selection of optimal fabric types for developing workwear intended for spinners in textile enterprises. A systematic review of scientific sources and regulatory standards, such as GOST 11209-2014, was conducted to identify key physical and hygienic properties required for protective clothing. The classification of workwear was developed based on functional purpose, protection level, and potential hazards. Experimental evaluations were carried out on 13 denim-based fabric samples grouped by fiber composition (100% cotton, mixed fibers with 20% synthetic content, and 20–50% synthetic content). Parameters such as tear strength, shrinkage, abrasion resistance, air and moisture permeability, and wrinkle resistance were tested in certified laboratories. Findings reveal that fabrics with balanced cotton and synthetic fiber composition offer improved durability, comfort, and safety for spinners. Recommendations are provided for selecting optimal fabrics based on a comprehensive quality assessment method. These results contribute to the creation of safer, more ergonomic workwear for the spinning industry.

Keywords: workwear, fabric composition, textile testing, spinners, physical properties, occupational safety.

Annotatsiya: Ushbu maqolada yigiruvchilik korxonalarida ishlovchilarga mo'ljallangan maxsus ish kiyimlari uchun optimal mato turlarini tanlash masalasi o'rganiladi. GOST 11209-2014 kabi standartlar asosida himoya kiyimlarida zarur bo'lgan fizik va gigiyenik xossalar aniqlanib, mavzuga oid ilmiy manbalar tizimli tarzda tahlil qilindi. Ish kiyimlari funksional maqsadi, himoya darajasi va potensial xavflarga qarab tasniflandi. Tajriba asosida tarkibi turlicha bo'lgan 13 ta jinsi asosidagi mato namunasi sinovdan o'tkazildi (100% paxta, 20% gacha va 20–50% sintetik tolali). Matolarning yirtilishga chidamliligi, cho'zilish darajasi, ishqalanishga bardoshlilik, havoni va namlikni o'tkazuvchanligi, ajinlanishga qarshiligi laboratoriyalarda sinovdan o'tkazildi. Tahlillar shuni ko'rsatdiki, paxta va sintetik tolalar muvozanatli qo'shilgan matolar chidamlilik, qulaylik va xavfsizlik jihatidan ustunlikka ega. Kompozitsiyalangan sifat baholash metodikasi asosida eng maqbul matolar tavsiya qilindi. Natijalar yigiruvchilar uchun ergonomik va xavfsiz ish kiyimlarini ishlab chiqishga xizmat qiladi.

Kalit so'zlar: ish kiyimi, mato tarkibi, tekstil sinovlari, yigiruvchilar, fizik xossalar, mehnat muhofazasi.



Аннотация: В данной статье рассматривается выбор оптимальных типов тканей для разработки специальной рабочей одежды для прядильщиков на текстильных предприятиях. Проведен систематический анализ научных источников и стандартов (например, ГОСТ 11209-2014) для определения ключевых физических и гигиенических свойств защитной одежды. Разработана классификация рабочей одежды по функциональному назначению, степени защиты и видам угроз. В лабораторных условиях испытаны 13 образцов джинсовых тканей, разделенных на группы по составу волокон (100% хлопок, до 20% и 20–50% синтетических волокон). Измерены показатели прочности на разрыв, усадки, износостойкости, воздухопроницаемости, влагопоглощения и устойчивости к смятию. Результаты показали, что ткани с комбинированным составом из хлопка и синтетики обеспечивают лучший баланс между долговечностью, комфортом и безопасностью. На основе комплексной оценки качества предложены рекомендации по выбору тканей для рабочих условий прядильщиков.

Ключевые слова: рабочая одежда, состав ткани, текстильные испытания, прядильщики, физические свойства, охрана труда.

INTRODUCTION

This article addresses key challenges in the development of specialized workwear for employees in spinning shops, emphasizing its role in enhancing labor productivity and protecting workers from high humidity, dust, and elevated air temperatures. To support the design of optimal and comfortable workwear, data on the number of cotton-textile clusters, spinning enterprises, and the total number of workers involved in the spinning process within the republic were analyzed.

In selecting appropriate fabrics for spinner workwear, the properties of various fabric samples were examined based on the technical requirements outlined in GOST 11209-2014. Cotton fiber fabrics are known for their high air permeability and hygroscopicity. However, they also possess certain disadvantages, such as water permeability, susceptibility to creasing, lower resistance to tearing and abrasion, and limited color fastness [1–2].

To address these shortcomings, blending cotton with synthetic fibers such as polyester and spandex has become common. Polyester increases tear and abrasion resistance while reducing creasing. Spandex, on the other hand, enhances elasticity and deformation properties, improving the fabric's shape retention.

Given these advantages, denim—a fabric originally made from cotton—is widely used globally as a workwear material since the early 19th century. Nowadays, denim is typically manufactured from a blend of cotton and synthetic fibers, which improves its physical and mechanical performance by compensating for the limitations of pure cotton.

Since 2017, large-scale denim fabric production has been established in Uzbekistan by companies such as “BCT” LLC and “Afrosiyob Jeans Textile” LLC. “BCT” LLC, the primary site of this study, produces over 200 types of denim fabrics with varying fiber compositions, weaves, and finishes. From this range, 13 fabric samples meeting SanPiN 0294-11 standards were selected for experimental testing.

These recommended samples were categorized based on their fiber composition and tested for quality in the fabric quality control department of “BCT” LLC and in the CentexUz laboratories affiliated with the Tashkent Institute of Textile and Light Industry. The grouping of samples, in accordance with GOST 11209-2014, is as follows:

Group 1: 100% cotton fabrics,

Group 2: Mixed fabrics containing $\leq 20\%$ synthetic fibers and $\geq 80\%$ cotton,

Group 3: Mixed fabrics containing 20–50% synthetic fibers.

This analysis evaluates the physical and hygienic properties of thirteen denim fabric samples intended for use in workwear for spinners. The fabrics are classified into three groups based on their fiber composition: 100% cotton, mixed fibers with up to 20% synthetic content, and mixed fibers containing between 20% and 50% synthetic fibers. The properties studied include tear strength, shrinkage, abrasion resistance, wrinkle resistance, air permeability, and hygroscopicity, all measured

in accordance with national (GOST) and international (ISO) standards. The results show that cotton-based fabrics, particularly the samples labeled Sason and BCT-0315 New, demonstrated the highest tear strength values, with 650/490 N and 550/410 N in warp and weft directions respectively. In contrast, fabrics with higher synthetic content showed a notable decrease in tear resistance. Shrinkage levels in 100% cotton fabrics were minimal, consistently 1% in both directions, while fabrics with greater synthetic fiber content exhibited higher shrinkage, with the Samurai sample reaching up to 8% and 9%. Regarding abrasion resistance, mixed fiber fabrics, especially those containing small percentages of spandex, such as BCT-0360-1, displayed the best performance, registering up to 19,000 abrasion cycles, suggesting enhanced durability. Wrinkle resistance also improved significantly with increased synthetic fiber content. The Venus sample, for instance, showed exceptional wrinkle resistance with values of 67.2% and 80.6% in the warp and weft, respectively. Air permeability was most pronounced in 100% cotton fabrics, with the Goksu sample reaching 33.3 cm³/m²s, confirming the superior breathability of natural fibers. However, this parameter decreased as synthetic fiber content increased. Hygroscopicity results revealed that some mixed fiber fabrics surpassed pure cotton fabrics in moisture absorption, as demonstrated by the BCT-0366 sample, which achieved a value of 10.2%. This indicates that with the right fiber blend, synthetic components can enhance moisture handling capabilities. In conclusion, while cotton fabrics offer high breathability and dimensional stability, their performance in terms of wrinkle and abrasion resistance is relatively limited. Blending cotton with polyester and spandex improves mechanical durability, shape retention, and overall functionality. Therefore, mixed fiber fabrics, especially those with low to moderate synthetic content, are recommended as the most effective material for spinner workwear, providing an optimal balance between comfort, safety, and performance (Table 1).

Table 1. Results of the experiments conducted in the testing laboratories of “BCT” LLC and CentexUz on determining the physical-mechanical and hygienic properties of recommended fabrics for working clothes for spinners.

No.	The fabrics Warp		Tear strength of the fabric, N (1N= 0.1kg)		Shrinkage of the fabric, %		Fabric abrasion resistance, cycles	Fabric wrinkle resistance, %		Air and moisture permeability (hygroscopicity) of the fabric	
			Weft	Warp	Weft	Cycle	Warp	Weft	Air, (cm ³ / m ² s)	Moist, %	
1	2		6	7	8	9	12	13	14	15	16
	GOST 11209-2014		GOST 21790-2005		GOST 11209-2014		GOST 12945-2022	GOST 19204-73		ISO 9237-2013	GOST 3816-80
1	Cotton fiber – group 1	Ariba	475	330	1	1	11000	52.8	61.1	19.4	8.6
2		Sason	650	490	1	1	12000	55.6	63.9	15.8	6.6
3		BCT-0315 New	550	410	1	1	15200	71.1	63.9	14.3	8.4
4		Goksu	313	287	1	1	12550	70.0	74.4	33.3	7.6
5		BCT-0524	425	295	1	1	14600	52.2	61.1	15.8	8.2



6	Mixed fiber – group 2	BCT-0360	384	297	3	5	13300	64.4	75.0	5.2	7.3
7		Lola	444	311	3	6	18000	56.1	63.9	12.1	8.6
8		Leyla	452	309	4	4	13500	47.2	44.4	12.7	8.8
9		BCT-0360-1	365	287	5	4	19000	55.6	66.7	5.2	9.8
10		BCT-0366	292	261	3	4	11300	50.0	76.7	13.2	10.2
11	Mixed fiber – group 3	BCT-0369	285	251	4	4	13500	50.0	72.8	15.8	7.9
12		Venus	325	300	6	7	15100	67.2	80.6	24.6	8.5
13		Samurai	351	247	8	9	15700	50.6	60.6	6.3	5.1

1. Effect of thickness variation on fiber composition of the fabric

LITERATURE REVIEW

The development of specialized workwear for spinners has attracted growing attention in recent years due to the increasing demands for occupational safety, comfort, and productivity in textile enterprises. Researchers emphasize that the selection of suitable fabrics must consider not only mechanical and physical parameters but also the specific working conditions of spinning shops.

In a recent study, Khujayeva and her colleagues conducted a comprehensive assessment of the requirements of spinning enterprises in Uzbekistan and analyzed the prevailing working conditions of spinners. Their findings highlight that high air temperature, dust concentration, and exposure to moisture are among the critical environmental challenges faced by workers. These factors necessitate the use of specialized garments made from breathable and durable materials tailored to the production context. The study underscores the need for industry-specific clothing that enhances protection while ensuring ergonomic suitability.

Gafurova, in her monographic work on the theoretical foundations of fabric development for workwear, argues that the structural properties of fabric such as fiber type, weave density, and finishing method are decisive for achieving both hygienic and protective functions. Her research stresses the importance of balancing strength characteristics with comfort indicators, such as air and moisture permeability, especially in environments with fluctuating thermal and mechanical loads.

A practical approach to workwear innovation is offered by Arho Happonen, who applies design thinking methodology to optimize the environmental performance and functional sustainability of textile-based workwear. His research at Lappeenranta–Lahti University of Technology presents evidence that eco-design strategies, fiber recycling, and composite material usage not only reduce environmental impact but also contribute to longer fabric life cycles and enhanced wearer satisfaction. This aligns with global sustainability goals in the textile sector.

Furthermore, in a more focused investigation, Khujayeva and her co-authors explored the creation of specialized outfits for spinners based on both technical parameters and end-user feedback. Their 2024 article emphasizes the integration of user-centric design in fabric selection and garment structure, ensuring that the final product reflects the real needs of spinning shop workers. Their findings support the idea that direct consultation with workers and experts can yield more functional and acceptable workwear solutions.

Together, these studies form a foundational knowledge base for advancing the scientific design of spinner workwear. They illustrate the relevance of combining experimental textile testing with field-based research, enabling evidence-based decisions in fabric selection and garment engineering for hazardous and high-demand work environments.

RESEARCH METHODOLOGY

In this study, data were obtained through laboratory testing of 13 denim fabric samples selected from local textile manufacturers. The samples were grouped by fiber composition and analyzed according to GOST and ISO standards. Physical and hygienic properties, including tear strength, shrinkage, air permeability, and abrasion resistance, were measured using certified instruments, and results were statistically compared.

ANALYSIS AND RESULTS

The thickness of fabric samples with different fiber composition was determined using a fabric thickness measuring instrument - a thickness gauge according to GOST 10878-70. The test results are presented in Table 1 and Fig 1.1 in graphical form.

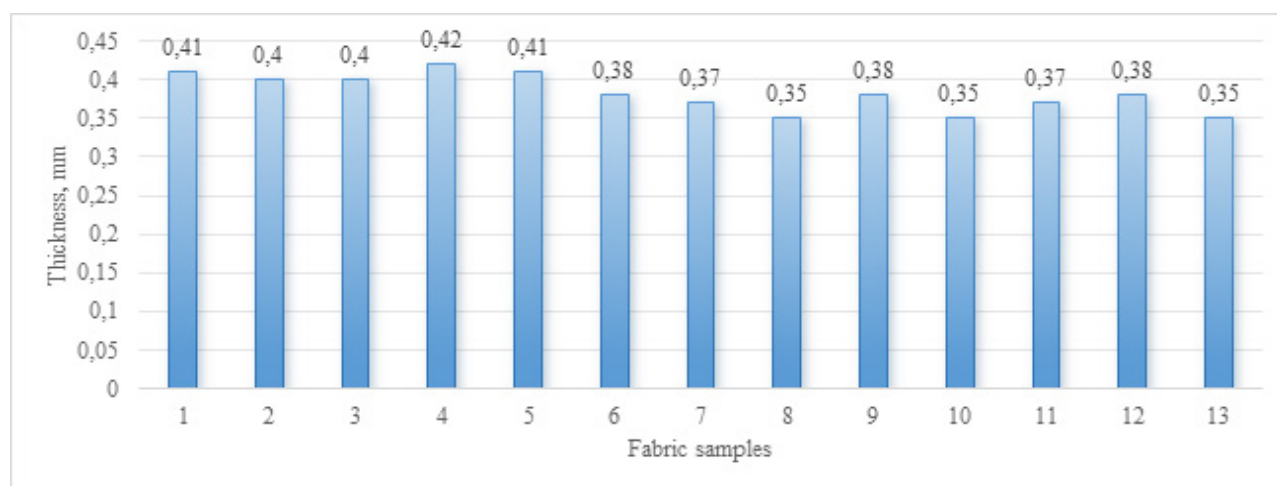


Fig. 1.1 Variation in thickness of the fabric according to its fiber composition (GOST 10878-70).

The 1st group of fabric samples was found to have a higher thickness due to the fact that they were made of 100% cotton fiber and the thickness of the weaving yarns, i.e., cotton fiber fabrics were thicker than mixed fiber fabrics due to their structural composition;

The 2nd group of mixed fiber fabric samples had an average thickness due to the thinness of the weaving yarns and their dense arrangement, i.e., when a low percentage of thin spandex fiber was added, the thickness of the fabric decreased;

The 3rd group of fabric samples showed that the thinness of the thin polyester and spandex fibers increased due to the high percentage of thin polyester and spandex fibers.

2. CHANGE IN THE LINEAR DENSITY OF THE YARNS ACCORDING TO THE FIBER COMPOSITION OF THE FABRIC

Linear density of cotton and mixed fiber fabrics was measured in accordance with the requirements of GOST 4.8-2003. The tests were measured using the TS EN ISO / IEC 17025 EURO LAB device, and the following results were obtained.

The fabric samples of the Group 1 have a low density because the warp and weft yarns are thicker than the other groups of yarns;

The fabric samples of the Group 2 have a high density because the yarns are thinner than the other groups of yarns;

The fabric samples of the Group 3, although they consist of 100% cotton fiber in the warp, is fundamentally different because of the mixture of polyester and spandex in the warp. The difference between the warp and weft yarns in this group is also high (Fig 2.1).

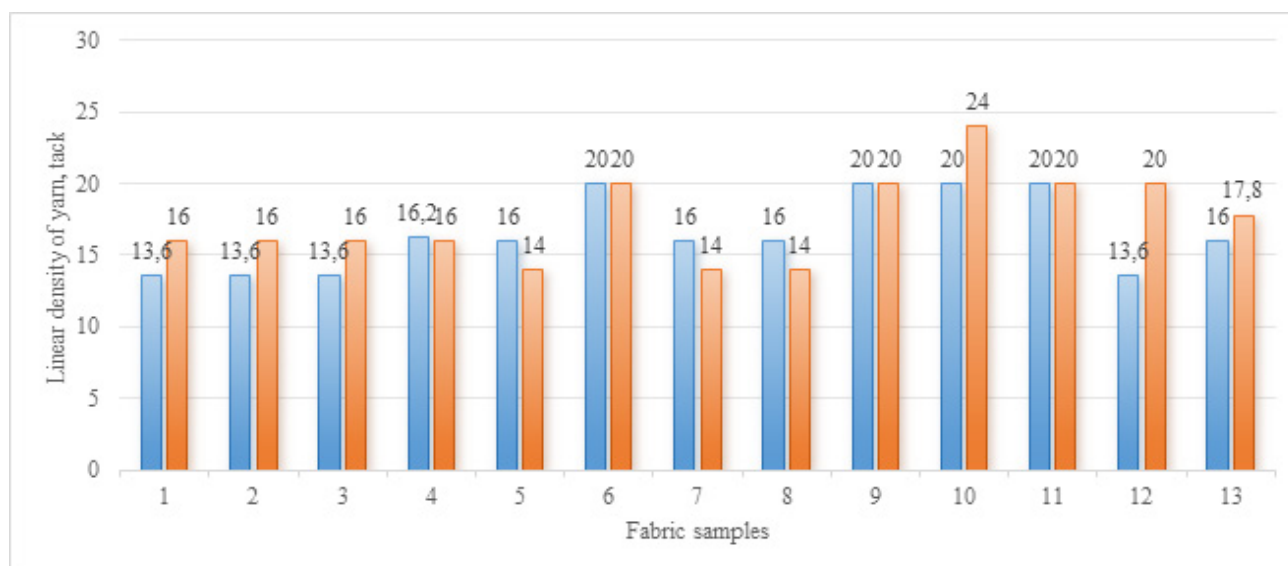


Fig. 2.1. Variation of yarn linear density depending on the fiber composition of the fabric (GOST 4.8-2003)

The linear density of the fabric samples according to the fiber composition is presented. The graph above shows that group 2 shows the highest result among the three groups of samples. This means that the higher the percentage of artificial fiber mixed into the warp yarn, the greater the linear density effect.

3. VARIATION IN TEAR STRENGTH DEPENDING ON THE FIBER COMPOSITION OF THE FABRIC

Tear strength of fabric samples with different fiber composition was measured in accordance with GOST 21790-2005 using an electronic tester ASTM D1424-09-2003 ELMA TEAR (James Heal). The test results are presented in graphical form in Table 1 and Fig 3.1

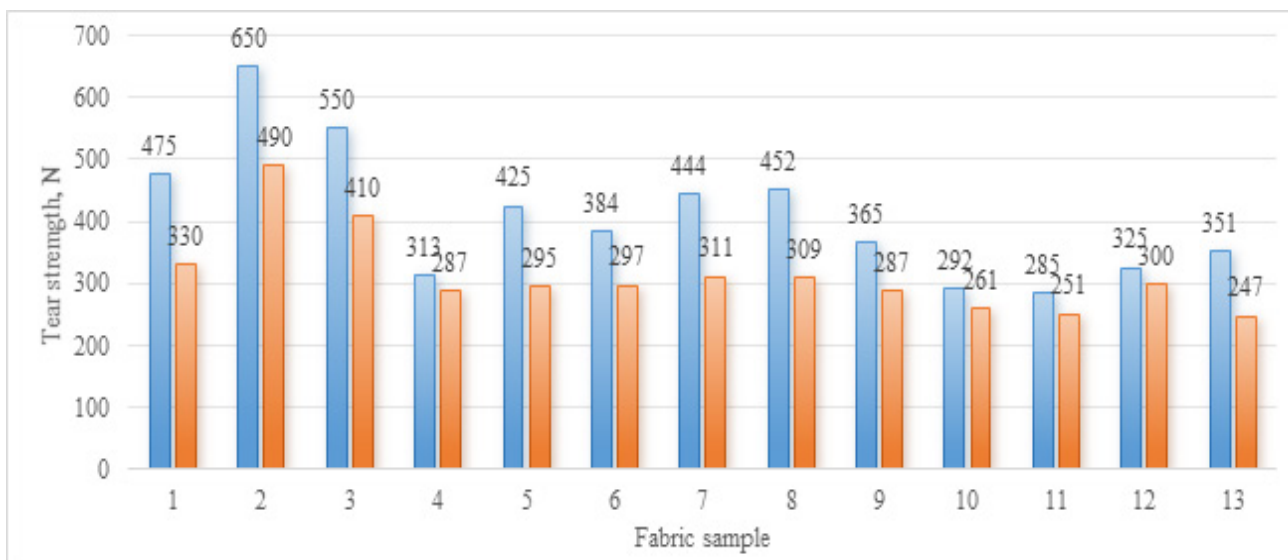


Fig. 3.1. Variation in tensile strength depending on the fiber composition of the fabric (GOST 21790-2005)

In the fabric samples of Group 1, high tear strength was noted in the warp, and in the weft, it showed an average level among the three groups of fabric samples, that is, in cotton fiber fabrics, the tear strength in the warp is high due to the density and thickness of the threads;

In the fabric samples of Group 2, the tear strength showed average values, that is, the tear strength of the selected fabric samples woven from densely located thin spandex fiber mixed yarns is average.

In the fabric samples of Group 3, it was found that the tear strength in the warp is higher than in the weft, that is, an increase in the strength of denim fabric was observed when polyester fiber was mixed in a large percentage

4. VARIATION IN ABRASION RESISTANCE DEPENDING ON THE FIBER COMPOSITION OF THE FABRIC

Fabric samples with different fiber content were tested on a Martindale M-235 (China) testing machine based on the requirements of GOST 12945-2014 and ISO 12947-2014. The test results are presented in graphical form in Table 1 and Fig. 4.1.

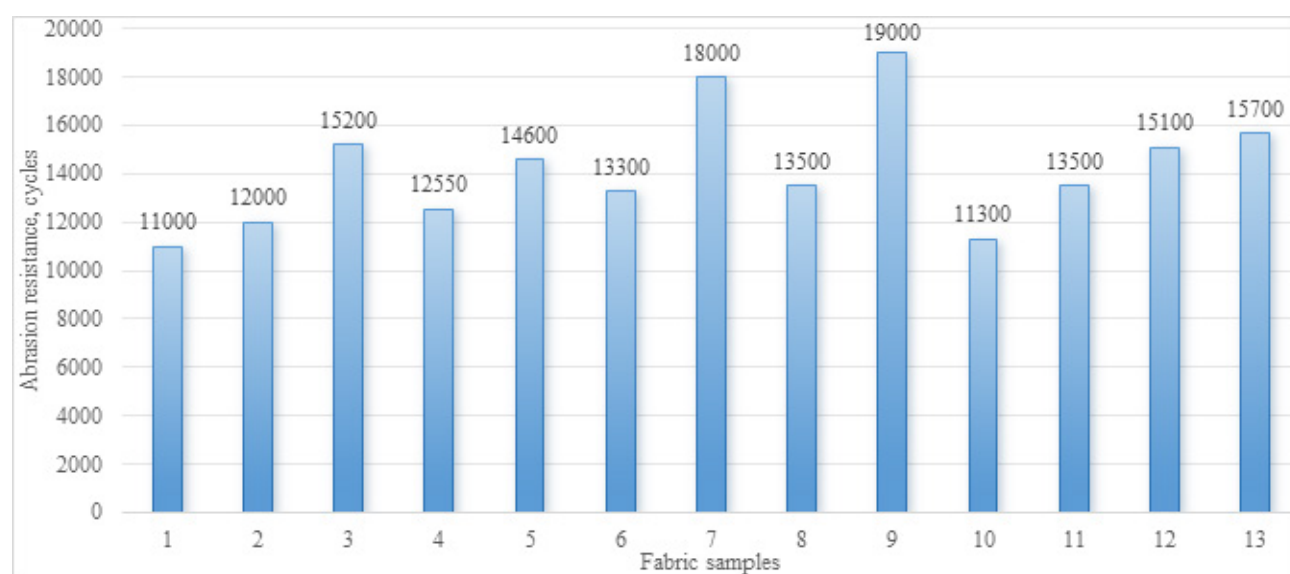


Fig. 4.1. Variation in abrasion resistance depending on the fiber composition of the fabric (GOST 12945-2014).

The strong cotton fiber fabrics of the group 1, despite not having elasticity, recorded an average level among the other groups of samples. The lowest indicator was 11,000 cycles, and the highest indicator was 15,200 cycles;

The fabric samples of the group 2 showed a high level of abrasion resistance due to the inclusion of spandex fiber, which provided elasticity. Among all the fabric samples, the fabric sample with the number 9, consisting of 98% cotton and 2% spandex, showed an average level of abrasion resistance of 19,000 cycles;

The fabric samples of group 3 with a mixed fiber composition showed an average level compared to the group 2. It is noteworthy that the samples in this group recorded almost the same results.

The fabric samples with a mixed fiber composition are more abrasion resistant than the samples with a different type of fiber composition. The results of this study were found to be superior to the abrasion resistance values (1000÷19000 cycles) given in GOST 11209-2014.

5. VARIATION IN COLOR FASTNESS DEPENDING ON THE FIBER COMPOSITION OF THE FABRIC

The color fastness of fabric samples with different fiber contents was tested on an AATCC-8 Crocmaster (Jeames Heal) electronic tester based on the requirements of ISO 105-A04-2022 and ISO 105-A01-99. The test results are presented graphically in Table 1 and Fig. 5.1

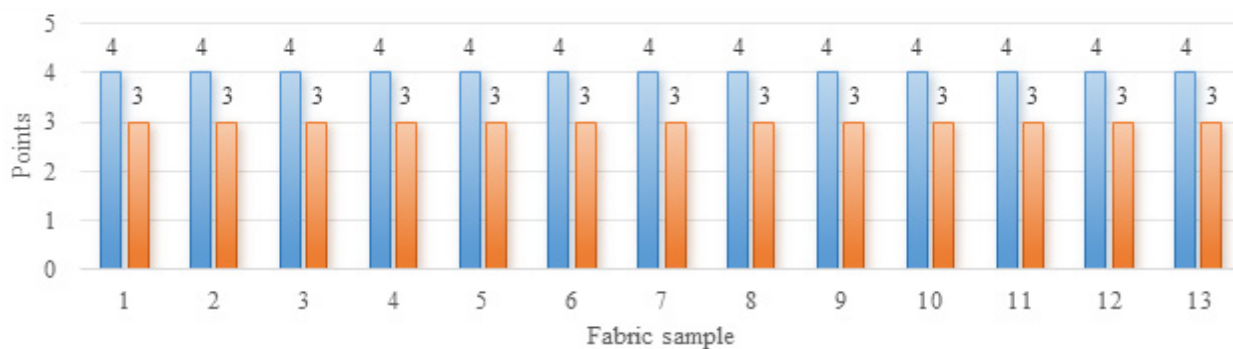


Fig. 5.1. Variation in color fastness depending on the fiber composition of the fabric (ISO 105-A04-2022)

As can be seen from the graph, the denim fabric samples were rated 4 points for color fastness when dry, and 3 points for wet test results, as they were resistant to color fastness.

Since denim fabrics are made with natural dyes and undergo high-quality processing, it is clear that the color is resistant to color fastness.

Consumer demand increases despite the color of denim fabrics fades during washing and use.

6. VARIATION IN SHRINKAGE OF THE FABRIC DEPENDING ON ITS FIBER COMPOSITION

The shrinkage of fabric samples with different fiber composition was tested after washing in laboratory conditions based on the requirements of GOST 11209-2014 and GOST 8710-84. The test results in graphical form are presented in Table 1 and Fig 6.1.

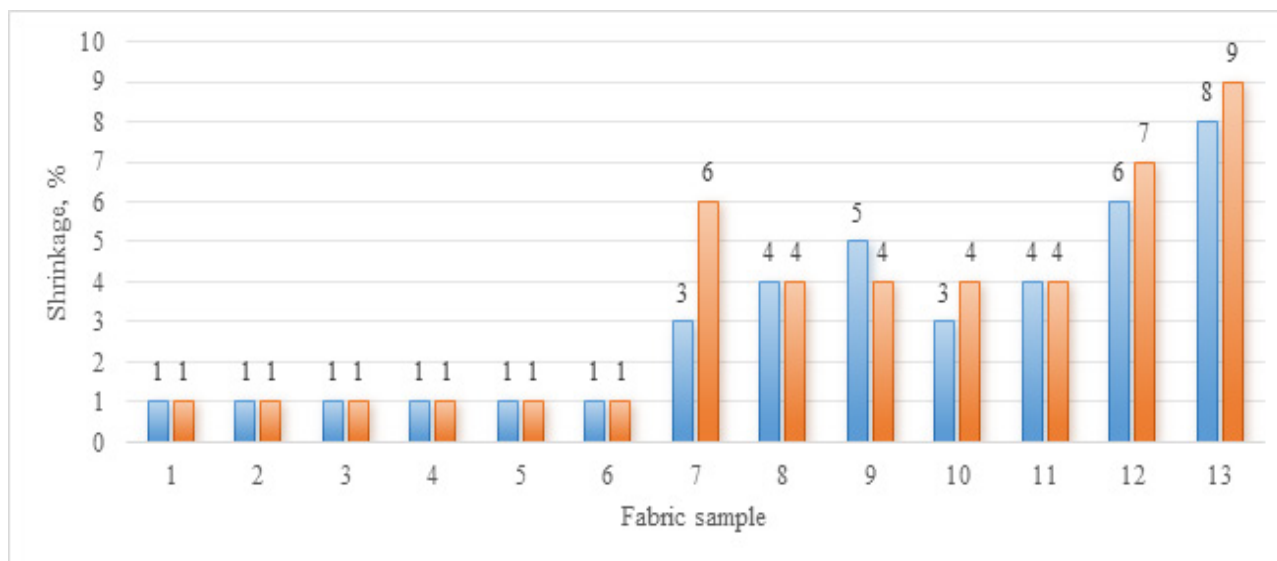


Fig. 6.1. Variation in shrinkage of the fabric depending on its fiber composition (GOST 11209-2014)

The shrinkage of fabric samples of Group 1 is very low due to the fact that they contain cotton.

The shrinkage of fabric samples of Group 2 is higher than that fabric samples of Group 1 due to the fact that they contain mixed fibers, but less than that of Group 3 fabric samples.

The shrinkage of fabric samples of Group 3 is high due to the fact that they contain less cotton and differ in thickness and linear density. In particular, the fabric sample marked with serial number 13 recorded the highest permeability.

It was proved that the permeability of fabric samples containing mixed fibers after washing is higher than that of cotton fiber fabrics.

7. VARIATION IN WRINKLE RESISTANCE ACCORDING TO THE FIBER COMPOSITION OF THE FABRIC

The wrinkle resistance of cotton and mixed fiber fabric samples was tested on a JIS-L-1059-1 (ISO 2313) device based on GOST 19204-73 standards. The test results are presented in graphical form in Table 1 and Fig. 7.1.

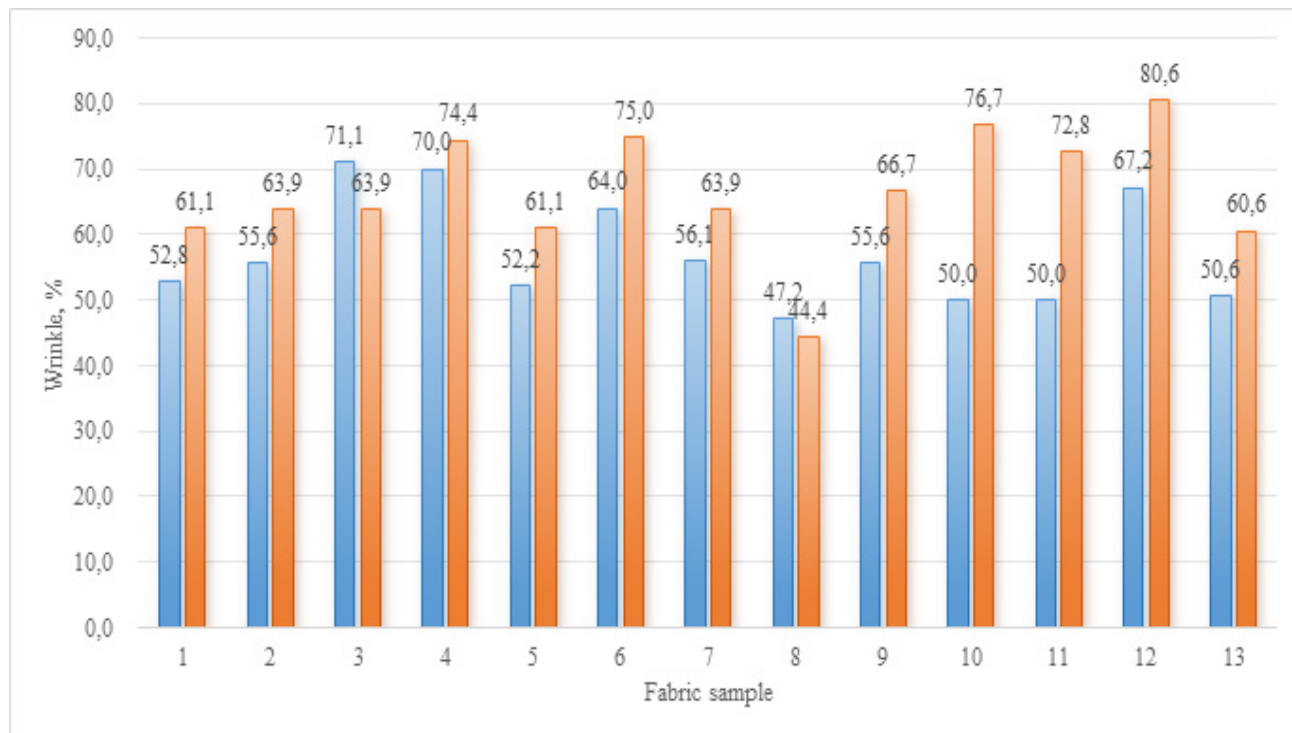


Fig. 7.1. Variation in wrinkle resistance according to the fiber composition of the fabric (GOST 19204-73)

Fabric samples of Group 1 showed medium and high results compared to other group samples. The difference between warp and weft yarn indicators is also very close.

Fabric samples of Group 2 showed low and medium results. The mixed fiber content significantly affected the wrinkle resistance of the fabric sample.

Fabric samples of Group 3 showed high results. In particular, the fabric sample marked with serial number 12 recorded the highest wrinkle resistance value.

Mixed fiber fabric samples recorded higher wrinkle resistance values than the fabric with cotton fiber. Due to the increased wrinkle resistance when polyester and spandex are mixed into the fabric, fabrics with such a composition wrinkle less.

8. VARIATION IN AIR PERMEABILITY DEPENDING ON THE FIBER COMPOSITION OF THE FABRIC

The air permeability of the fabric samples grouped by fiber composition was determined using the AP-360 SM device based on the requirements of ISO 9237-2013 and GOST 12088-77. The test results are presented in Table 1 and Fig 8.1 in graphical form.

The air permeability of each fabric sample was calculated using the following formula:

$$B = \frac{V_{cp} \cdot 10000}{S}, \quad \text{cm}^3 / \text{cm}^2 \cdot \text{s} \quad (8.1)$$

Where: V_{cp} – average air permeability for one sample, $\text{cm}^3 \cdot \text{s}$;
 S – test sample area, cm^2

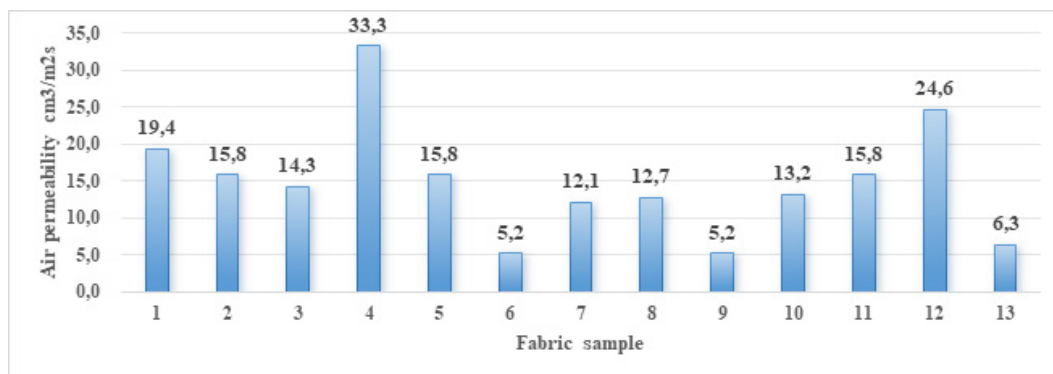


Fig. 8.1. Variation in air permeability depending on the fiber composition of the fabric (ISO 9237-2013)

Fabric samples of Group 1 showed the highest air permeability due to their 100% cotton, i.e., natural fiber content. In particular, the fabric sample marked with the serial number 4 showed the best results. Air permeability is directly dependent on many factors of the fabric (fiber composition, thickness, weave, linear density, etc.). For this reason, fabrics made of natural fibers showed high air permeability;

Fabric samples of Group 2 showed an average level due to their low mixed fiber content (2% spandex);

Fabric samples of Group 3 showed different results. It was found that the 12-digit fabric sample, which has a relatively high cotton fiber content, has an air permeability of 24.6 cm³/cm²s due to its high linear density (thin yarn) and 2/1 twill weave.

9. VARIATION IN HYGROSCOPICITY OF THE FABRIC DEPENDING ON ITS FIBER COMPOSITION

Hygroscopic (moisture-permeable) tests of various fabric samples according to their fiber composition were performed on MD-6P and FD-600 test devices based on the requirements of GOST 3816-80 and GOST 6611.4-73. The test results in graphical form are presented in Table 1 and Fig 9.1.

The moisture permeability of fabric samples was determined by the following formula:

$$W_o = \frac{m_n - m_{q,e}}{m_n - m_q} \times 100\%, \quad \% \quad (9.1)$$

Where: m_n – wet mass of the fabric sample, g;

m_q – wet mass of the fabric sample, g.

$m_{q,e}$ – mass of the sample stored in a dry desiccator for 4 hours, g.

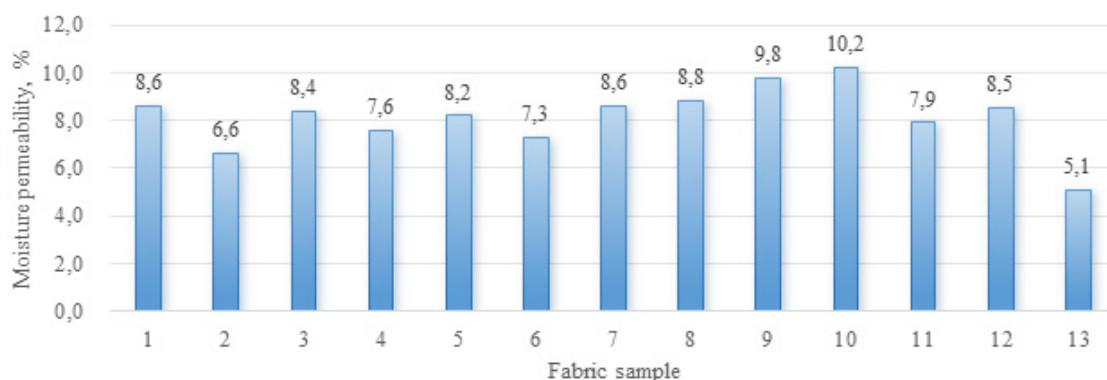


Fig. 9.1. Variation in hygroscopicity of the fabric depending on its fiber composition (GOST 3816-80).

Fabric samples of Group 1 showed average results;
Fabric samples of Group 2 showed high results;
Fabric samples of Group 3 showed low and medium results.

Fabric samples with a low mixed fiber content have better hygroscopicity than other fabric samples. Dyeing and finishing processes worsen the moisture permeability of fabrics. Nevertheless, mixed fabrics have improved hygroscopicity indicators. They are superior to pure cotton fabric samples in this indicator, the excess is about 20%. This is a great positive property of clothing fabrics for high temperatures in terms of hygroscopicity

10. COMPREHENSIVE EVALUATION OF FABRIC SAMPLES

The work on assessing the quality of fabric samples was carried out in accordance with the methodology. Differential assessment of natural quality indicators "X" is shown in the upper part of Table 10.1. The second part of the table presents the rating assessments of quality indicators.

- X¹ - Thickness of the fabric, mm;
X² - Linear density of the warp yarn of the fabric, tack;
X³ - Linear density of the weft yarn of the fabric, tack;
X⁴ - Tear strength of the fabric along the warp yarn, N;
X⁵ - Tear strength of the fabric along the weft yarn, N;
X⁶ - Shrinkage of the fabric along the warp yarn, %;
X⁷ - Shrinkage of the fabric along the weft yarn, %;
X⁸ - Color fastness of the fabric in the dry state, points;
X⁹ - Color fastness of the fabric in the wet state, points;
X¹⁰ - Abrasion resistance of the fabric, cycles;
X¹¹ - Wrinkle resistance of the fabric warp, %;
X¹² - Wrinkle resistance of the fabric weft, %;
X¹³ - Air permeability of the fabric, cm³/m²s;
X¹⁴ - Hygroscopicity (moisture permeability) of the fabric, %;

Table 10.1

Fabric sample No.	Natural quality indicators													
	X ¹	X ²	X ³	X ⁴	X ⁵	X ⁶	X ⁷	X ⁸	X ⁹	X ¹⁰	X ¹¹	X ¹²	X ¹³	X ¹⁴
1	0.41	13.6	16	475	330	1	1	4	3	11000	52.8	61.1	19.4	8.6
2	0.4	13.6	16	650	490	1	1	4	3	12000	55.6	63.9	15.8	6.6
3	0.4	13.6	16	550	410	1	1	4	3	15200	71.1	63.9	14.3	8.4
4	0.42	16.2	16	313	287	1	1	4	3	12550	70	74.4	33.3	7.6
5	0.41	16	14	425	295	1	1	4	3	14600	52.2	61.1	15.8	8.2
6	0.38	20	20	384	297	3	5	4	3	13300	64	75	5.2	7.3
7	0.37	16	14	444	311	3	6	4	3	18000	56.1	63.9	12.1	8.6
8	0.35	16	14	452	309	4	4	4	3	13500	47.2	44.4	12.7	8.8
9	0.38	20	20	365	287	5	4	4	3	19000	55.6	66.7	5.2	9.8
10	0.35	20	24	292	261	3	4	4	3	11300	50	76.7	13.2	10.2
11	0.37	20	20	285	251	4	4	4	3	13500	50	72.8	15.8	7.9
12	0.38	13.6	20	325	300	6	7	4	3	15100	67.2	80.6	24.6	8.5
13	0.35	16	17.8	351	247	8	9	4	3	15700	50.6	60.6	6.3	5.1



Table 10.2

Fabric sample No.	Level assessment of quality indicators, R														R	Rank
	X ¹	X ²	X ³	X ⁴	X ⁵	X ⁶	X ⁷	X ⁸	X ⁹	X ¹⁰	X ¹¹	X ¹²	X ¹³	X ¹⁴		
1	2.5	11.5	8.5	3	3	11	11	7	7	13	8	10.5	3	4.5	103.5	9
2	4.5	11.5	8.5	1	1	11	11	7	7	11	6.5	8	5	12	105	10
3	4.5	11.5	8.5	2	2	11	11	7	7	4	1	8	7	7	91.5	5
4	1	5	8.5	11	9.5	11	11	7	7	10	2	4	1	10	98	6
5	2.5	7.5	12	6	8	11	11	7	7	6	9	10.5	5	8	110.5	11
6	7	2.5	3.5	7	7	7	4	7	7	9	4	3	12.5	11	91.5	4
7	9.5	7.5	12	5	4	7	3	7	7	2	5	8	10	4.5	91.5	3
8	12	7.5	12	4	5	4.5	6.5	7	7	7.5	13	13	9	3	111	12
9	7	2.5	3.5	8	9.5	3	6.5	7	7	1	6.5	6	12.5	2	82	2
10	12	2.5	1	12	11	7	6.5	7	7	12	11.5	2	8	1	100.5	7
11	9.5	2.5	3.5	13	12	4.5	6.5	7	7	7.5	11.5	5	5	9	103.5	8
12	7	11.5	3.5	10	6	2	2	7	7	5	3	1	2	6	73	1
13	12	7.5	6	9	13	1	1	7	7	3	10	12	11	13	112.5	13
	91	91	91	91	91	91	91	91	91	91	91	91	91	91		

The compared samples are arranged in the following order of their deterioration in quality: 9-10-5-6-11-4-3-12-2-7-8-1-13. The designation of fabric samples corresponds to the numbers of the finished samples in the table given (Table 1).

According to the scale proposed by A. B. Markovich and V. D. Shapovalov for comparing the rating assessments of the quality of objects in accordance with the data in Tables 1; 10.1 and 10.2 sample 7 receives a good rating, and samples 12 and 9 receive a satisfactory rating. However, samples 6 and 3 are rated as “bad” [3-4].

In order to select the optimal fabric option for a specific purpose in terms of composition and weave, a comprehensive rating quality assessment was used (Table 2.3.9.2).

The fabric sample designated by the serial number 12 is considered the most rational in terms of quality indicators (Table 10.2).

CONCLUSION

Compliance with regulatory requirements for special clothing is important to ensure the safety and health of workers, as well as to protect the environment. Regular inspections and standard updates help maintain high quality and safety requirements. The viability of a special garment is determined by the mechanical effects of the fabrics to be selected and the resistance to multiple washes.

In order to effectively manage physical and chemical risks in the production of spinning threads, it is necessary to carry out regular assessments of working conditions, the use of personal protective equipment (PPE), the organization of training and instructions for workers, as well as measures to improve working conditions. These activities will help reduce professional risks and ensure the safety of workers.

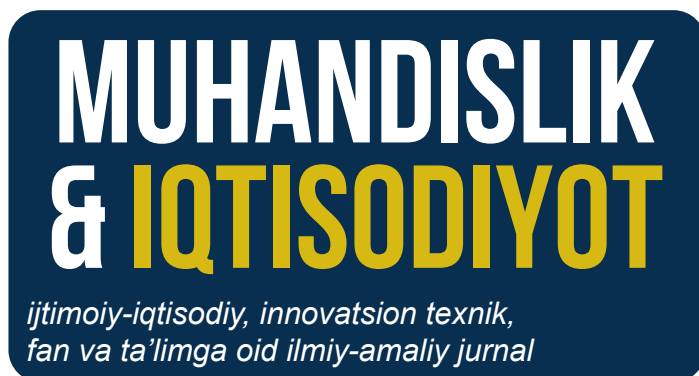
Assessment of working conditions requires an integrated approach in spinning factories, which includes physical, chemical, psychological and organizational aspects. It helps not only to improve the safety and health of workers, but also to increase the overall production efficiency and performance of the enterprise.



On the basis of social research carried out at spinning enterprises and the demand and suggestions of respondents, experts, information was collected that would be needed to create a new special set of clothing samples for spinners.

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