

# Development of a New Blended Fabric on the RIFA-RFJW-10 Machine and Performance Analysis

Sanovar Khamrayeva<sup>1\*</sup>, Dilbar Mirzanazarova<sup>1</sup>, and Dilrabo Nazarova<sup>1</sup>

<sup>1</sup>Tashkent Institute of Textile and Light Industry, 5, Shohjahon str., 100100 Tashkent province, Uzbekistan

**Abstract.** Effective condition for obtaining high-quality underwear fabrics with the required physical and mechanical properties is the formation of tissues of the required structure and structure. It should be noted that it is the improvement of the structure parameter and the change in tissue structure that makes it possible to improve them in the first place. In this article, it is stated that one of the textile products necessary for the daily life of the people of the whole world is bed linen, that there is a lot of demand for it, that it is widely used by all people regardless of the conditions, and the requirements of physical-mechanical, hygienic and technological characteristics are given to them. In addition, it is noted that fabrics intended for bed linen should be woven in linen or satin weaves, linens in linen weave should be light, soft and have an uneven surface, and sheets in satin weave should be smooth, coolness and air permeability are lower than linen, but they are pleasant in the process of relaxation. The results of an experimental study conducted at the "Urgut Textile" enterprise, comparing 100% polyester fabric with 100% polyester, 40% hemp yarn and 60% cotton fabric, are presented. Keywords: warp, weft, linear density, bedding fabric, fabric density, breaking load, breaking elongation, abrasion resistance, breathability, etc.

## 1 Introduction

The textile industry of our country faces an important task - to improve the quality of its products, including linen fabrics. An effective condition for obtaining high-quality underwear fabrics with the required physical and mechanical properties is the formation of tissues of the required structure and structure. It should be noted that it is the improvement of the structure parameter and the change in tissue structure that makes it possible to improve them in the first place [1-4].

It is known that the fabric has a very complex structure. It is formed by interlacing the warp and weft threads, creating a certain supporting surface. It is possible to study the properties of the formed body by studying the process of tissue formation, analyzing various factors that affect its structure and properties [5, 6].

Consideration of the parameters of the structure and structure of the tissue involved in many researchers. However, research in this area is still far from complete [7].

---

\* Corresponding author: [s.khamrayeva@titli.uz](mailto:s.khamrayeva@titli.uz)

If we talk about the main threads, they go quite a long way to the formation of a fabric element, i.e. from the warp to the edge of the fabric. The number of warp threads, their structure and other indicators determine the breakage of these threads and, consequently, the productivity of the equipment and the quality of the fabric produced [8, 9].

However, In the process of fabric formation, weft threads have a great influence on its structure. The nature of fabric formation is determined mainly by the properties of the weft - its elongation, flexibility and strength. The structure of the weft threads is of great importance [10, 11].

In order to achieve its predetermined structure and properties during fabric formation, it is necessary to change the weft structures and the composition of sizing materials for processing warp threads [12, 13].

In the world, large-scale research work is being carried out to improve the technique and technology for the production of finished high-quality products, and to create their scientific base. In this direction, much attention is paid, among other things, to the creation of effective technologies that improve the quality and competitiveness of textile products, the development of methods for optimizing textile characteristics, the creation of highly efficient technical means and technologies at textile enterprises [14, 15].

Therefore, obtaining high-quality threads and fabrics to meet the needs and tastes of consumers, not only by mixing cotton fibers with chemical fibers, but also by mixing them with fibers of plants growing in Uzbekistan, occupies an important place in the world market. In this regard, it is relevant to address the issues of ensuring further improvement in the consumer properties of fabrics by creating a technology for the production of fabrics with mixed natural fibers for bed linen or cotton yarn with artificial fibers, jute yarn with mixed natural fibers.

Fiber by using the sorghum plant and extracting the fiber from it and mixing it with cotton fiber. At the same time, to provide consumers with high-quality textiles, one of the most important issues is to occupy a place in the world market with finished linens with a competitive high base surface in exchange for the production of new content of bedding fabrics from yarn spun from a mixture of sorghum vegetable fiber and cotton fiber in various proportions [5]

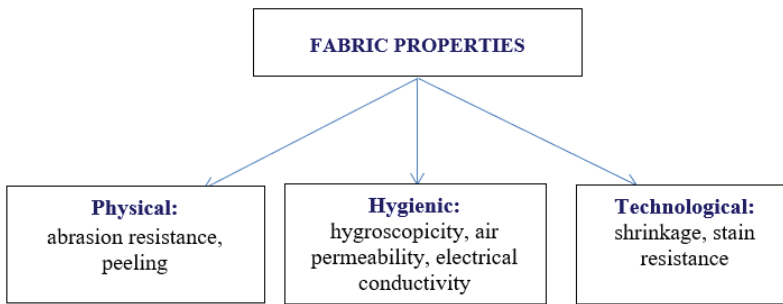
## **2 Materials and Methods**

In recent years, the weaving industry, which is one of the branches of the textile industry, has been rapidly developing. Weaving enterprises are equipped with modern machines with electric control. In the Urgut district of the Samarkand region (Uzbekistan) in August-September 2020, together with the scientific team of the Tashkent Textile and Light Industrial Institute. Currently, the company has launched the production of linen and shirt fabrics from polyester fiber.

Tanda yarn 8.3 tex and light polyester yarn 27.0 tex are used in the production of fabrics intended for bed linen and shirts. Bed linen is produced in two types of weaving: linen and satin. Linen fabrics are widely produced and can be made from cotton, linen, synthetic fibers. Satin kitchen towels are woven only from natural fibres. Since the length of the thread cover on the fabric surface is observed during the weaving process of the satin, and in the case of a synthetic fiber satin, the threads are pushed, as a result, the appearance of the fabric is disturbed. When mowing cloth, this situation is not observed. The surface density and thickness of linen satin sheets increases, and discomfort is felt when using it. Therefore, the production of bedclothes by mixing cotton and other natural fibers in cotton or satin weaving creates all-round convenience [7]

### 3 Results and Discussion

At the Tashkent Institute of Textile and Light Industry (Uzbekistan), large-scale research work is being carried out to obtain threads by mixing sorghum fiber with cotton fiber in various percentages and to produce fabrics from them. In order to apply this in production at the Urgut Textile enterprise, bedding and shirt products made of fabric from 100% polyester threads were studied, using which the service life or abrasion resistance can be high, but fabrics with such a content have a high charge, negatively affect human health. To solve this problem, a research work was carried out to determine its properties using 100% polyester tanned yarn and 22.2 tex yarn with 40% roving and 60% cotton fibers obtained at the Bukhara training and production enterprise owned by the Blind Uzbekistan Society in the production of fabric for bed linen [8] and based on a consumer survey, the main demand for bed linen revealed the following characteristics (Figure 1).



**Fig. 1.** Properties of linen fabrics.

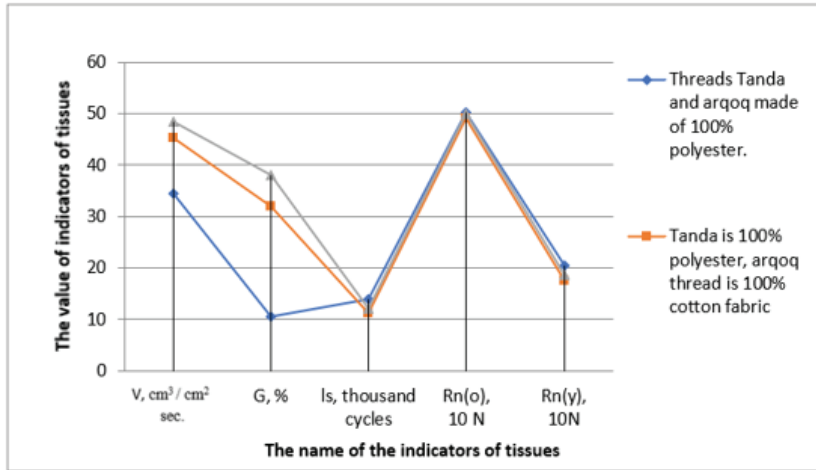
The physical and mechanical properties of a fabric with a new fiber content, made on a RIFA-RFJW-10 hydraulic loom (China), were tested in the CENTEXUS TTESI laboratory based on the international standard (GOST-292998-2005). The test results are presented in the following Table 1 [6, 9].

According to the comparative results shown in the table, compared with a 100% polyester fabric, the breathability of a fabric made of 100% polyester yarn, 40% hemp yarn and 60% cotton fiber increased by 40%, hygroscopicity increased by 18%. , the abrasion resistance increased by 14%, the abrasion resistance increased by 14%, the strength decreased by 8.8%, and the tensile strength did not change. Based on the requirements for other products, when using finished sheets, high hygienic properties and high hygroscopicity increase the quality of the product [10]. In addition, it should be noted that improving the quality of the product depends primarily on the composition of the yarn used, and its properties determine the quality of the product [11].

**Table 1.** Physical and mechanical properties of tissues of various compositions.

#	Name of the indicator	Units	Fabric composition and work results		
			100% polyester fabric	Tanda yarn is 100% polyester, arched yarn is 100% cotton	100% polyester yarn, 40% hemp yarn and 60% cotton fabric
1	Specific weight of yarn: Tanda Arqoq	Tex	8.3 27.0	8.3 27.0	8.3 27.0
2	Winding	-	linen	linen	linen
3	Surface density of fabric	g/m <sup>2</sup>	123.9	123.9	123.9
4	Breathability	cm <sup>3</sup> /cm <sup>2</sup> , sec	34.54	45.33	48.36
5	Abrasion resistance: after washing: After 5 washes	Cycle	14000 11890	11200 10675	12000 11900
6	Tensile strength: Tanda Arqoq	H	505.33 204.67	490.97 175.08	499.43 186, 78
7	Extension at a distance Tanda Arqoq	mm	31.33 49.33	30.57 22.83	30.87 29.67
8	Fabric Density Tanda Arqoq	Thread/10 cm	286 220	286 220	286 220
9	Fabric hygroscopicity	%	10	32	28
10	After washing: According to Tanda according to the Arqoq	%	0 0	0 2.9	0 0.5
11	Color fastness	point	5	5	5
12	Electric ability	V/min	2867	1191	1196
13	Peeling ability	10 cm/piece	285	72	70

Figure 2 presents the comparative results of the experimental and base sheet fabric. In this case, V is air permeability, cm<sup>3</sup>/cm<sup>2</sup>; G - hygroscopicity, %; Wear resistance, cycle; Rn(o) - ultimate tensile strength, N; Rn(y) - string breaking force, N. One of the requirements for bedding fabrics is air permeability, abrasion resistance, crease resistance and non-electrification during operation, the absence of knots (pills) on the surface of the fabric.



**Fig. 2.** Fabrics of various compositions of physical and mechanical characteristics.

Due to the 100% polyester fiber of textile fabrics produced by Urgut Textile, the electrification during their use is high. When such a fabric is used, the generation of charges and sticking to the human body, causing discomfort, means electrification.

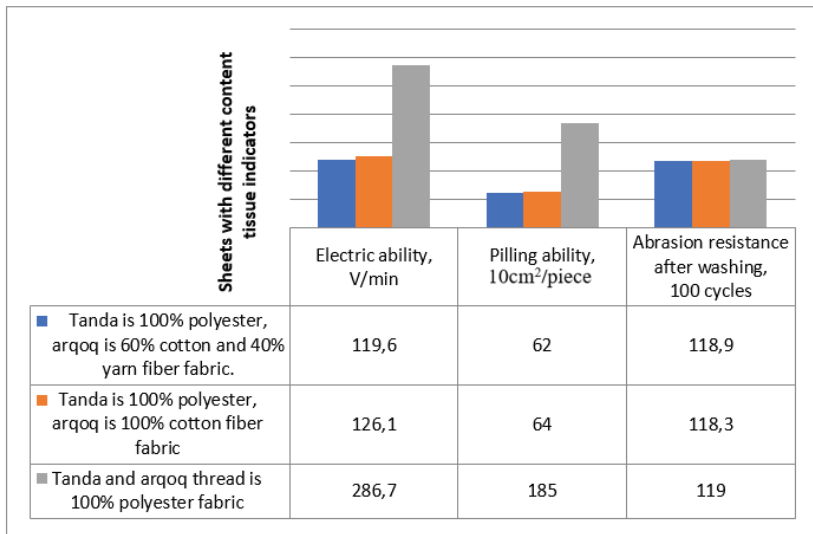
Electric ability - the ability of a fabric to accumulate static electricity on its surface. During friction, the process of generation and dissipation of electric charges is constantly going on. If charges arise and do not dissipate on the surface, a certain electric potential is formed - electrolysis occurs. Synthetic fibers with low hygroscopicity have the ability to strongly electrolyze, that is, they have high electrical insulating properties. The magnitude of the electric charge formed on the surface of the tissue, and its sign (positive or negative) have a biological effect on the body. Natural, viscose and polyamide (nylon) fibers contribute to the creation of a negative electric field on the human skin, which has a beneficial effect on the person. There are special synthetic fibers from which medical underwear is made, the action of which is based precisely on high electrification. Most synthetic fibers create a positive electric field that negatively affects a person. When developing new textile materials, electrification can be changed by rational selection of the components that make up the mixture of fibers. For example, a combination of fibers that accumulate charges of the opposite sign reduces electrification as a mixed fiber of cotton and cattail. In addition, granules (pellets) should not form on the supporting surface of the bed linen. The formation of pellets on the surface of the bed linen is unpleasant, because. which is called pilling [12, 13].

Pilling ability is the process of forming pills - coils, i.e. such a property of fabric threads, during the operation of which part of the fibers regularly falls out, intertwines, forming lumps. Fabrics with these properties are available to a greater and lesser extent. Some fabrics even after a short use are covered with spools. And this applies not only to dense fabrics, but also to other, even smooth materials. Surely everyone has met bed linen made of microfiber, polysatin, peeled. It looks rather unpleasant and not aesthetically pleasing. It should be noted that this process in fabrics subject to pilling begins from the very beginning of thread formation and occurs during the manufacture of the material, further tailoring of the product, during their operation and care (washing, drying, ironing) [14].

The properties of bed linen that cause discomfort and inconvenience to the human body in the prone position are the electrification of the tissue and the formation of knots (pellets) on its surface. The changes that occur on the surface of the fabric depend on its supporting surface and determine the wear process of the product [15]. In order to reduce or eliminate

these properties in bed linen fabrics, it was necessary to change the fiber content of the fabric and conduct research.

In the above table, compared with a fabric made of 100% polyester, the electrification of a fabric made of 100% polyester, 40% hemp yarn and 60% cotton fiber decreased by 58.3%, and the formation of knots (pellets) on the fabric surface also decreased by 58.3%. Tissues decreased by 76.67%. After 5 washes of the fabric, the finish of the 100% polyester fabric has frayed and abrasion resistance has decreased due to the movement of the fibers in the yarn relative to each other (Figure 3).



**Fig. 3.** Turley content bed sheets fabrics.

According to the results of experimental studies, as a result of mixing sorghum fiber with cotton fiber, the formation of knots on the surface of the fabric is reduced, abrasion resistance is improved after 5 washes, and electricity is reduced. It has been found that there is a high demand for tea bags made from 100% polyester yarn, 40% cotton yarn and 60% cotton fiber. Therefore, the widespread use of 40% hemp and 60% cotton yarn in the production of tea and silk fabrics produced by Urgut Textile will reduce cotton fiber by 40% to meet consumer demand and increase exports potential.

## 4 Conclusions

Based on the results of the studies presented above, it can be concluded that linen is produced at manufacturing enterprises without studying the requirements of consumers. Many consumers are misled by the low price of the fabric, not its composition. As a result, people lose their health and create problems for themselves. Thus, according to the results of research, the air permeability and hygroscopicity of a sheet fabric made of 100% polyester fiber is lower by 40%, and its electrical conductivity is lower by 58.3%, the formation of knots by 76.67% is noted higher in tissue. This exhausts the human body during the night's rest and reduces blood circulation, which can lead to nervous diseases. To avoid these problems, it is advisable to make sheets from 100% natural fibers or blended fabrics with a natural fiber content of 40-50%. According to the results of the physical-mechanical and hygienic properties of bed linen with different content, compared with 100% polyester bed

linen, tanda yarn is polyester, and the yarn is made of 60% polyester cotton and sorghum 40% fiber can be widely used for production.

## References

1. G. Bolch, S. Greiner, H. De Meer, K.S. Trivedi, *Queueing networks and Markov chains: modeling and performance evaluation with computer science applications* (John Wiley & Sons, 2006)
2. F. Gu, P. Hall, N.J. Miles, *Journal of Cleaner Production* **115**, 343-353 (2016)
3. N.B. Yusupova, D.T. Nazarova, S.A. Khamraeva, Z.F. Valieva, *International Journal of Advanced Research in Science, Engineering and Technology* **7(11)**, 131-137 (2018) ISSN: 2350-0328
4. S. Mardonov, S. Khamrayeva, K. Muminov, K. Rakhimov, E. Kuldoshev, *International journal of advanced sciences and technologies USA* **4.9(07)**, 70-77 (2020)
5. N.B. Yusupova, K.E. Razumeev, D.T. Nazarova, S.Sh. Tashpulatov, Zh.E. Danadilov, Z.B. Ongarbaeva, *News of universities. Technology of the textile industry* **5(383)**, 85-88 (2019) ISSN: 0021-3497
6. *Passport RIFA-RFJW-10 (Chinese) hydraulic loom* (2018)
7. M.R. Yunuskhodzhaeva, N.B. Yusupova, Sh.R. Umarova, *Problems of textiles* **17**, 97-104 (2015)
8. M. Rasulova, S. Mamasolieva, M. Babadjanova, G. Norboyeva, *AIP Conference Proceedings* **2430(1)**, 030007 (2022)
9. *INTERSTATE STANDARD GOST 29298-2005* (Standartinform, Moscow, 2006)
10. B.P. Torebaev, N.B. Yusupova, D.T. Nazarova, Sh.S. Khudaiberdieva, D.A. Ismailova, *V International Scientific and Practical Conference* **I**, 139-147 (2020)
11. F.R. Tangriberdiev, D.T. Nazarova, S.A. Khamrayeva, *Uzbek Textile Journal* **2**, 18-24 (2021)
12. G.N. Kukin, A.N. Soloviev, A.I. Koblyakov, *Textile materials science (Textile fabrics and products)* (Legprombytizdat, M., 1992)
13. *GOST 22183-76 Chemical threads. Method for determining the transverse electrical resistance*
14. *GOST 14326-73 Textile fabrics. Method for determining pilling ability*
15. N.B. Yusupova, S.A. Khamraeva, V.M. Dzhanpaizova, N.E. Botaboev, B.P. Torebaev, *International scientific journal "Science and Peace* **1.4 (32)**, 2488-2491 (2016)