**Ways to Improve Dimensional Stability in Women's Garment Components Made from Various Types of Fabric**

Nozima Artikbaeva1, а), Mastura Rasulova1, b), Gulnoza Buzrukhanova1, c) and  
Nargiza Musurmonova1

1*Tashkent Institute of Textile and Light Industry, 5 Shohjahon street, Tashkent, 100100, Uzbekistan*

*a) Corresponding author:* [*nozimaartikbayeva1984@gmail.com*](mailto:nozimaartikbayeva1984@gmail.com) *b)* [*mastura\_m@mail.ru*](mailto:mastura_m@mail.ru) *c)* [*buzrukxanova1985@gmail.com*](mailto:buzrukxanova1985@gmail.com)

**Abstract.** The article presents scientific research focused on individualized garment production based on modern fashion trends, the development of garments that align with current fashion demands, improvement of technologies for producing competitive sewn products, and the establishment of their scientific foundations. In addition, the process of shape formation and dimensional stability during the application of polymer compositions to textile materials and heavy knitted fabrics was studied. Recommendations were developed for the optimal concentration levels of polymer compositions applied to textile fabrics with different fiber compositions. The shape-forming ability and dimensional stability of fabrics treated with aqueous solutions of polyvinyl acetate (PVA) polymer compositions were analyzed. The study explains the strong correlation between shape retention indicators and selected mechanical properties such as stiffness and flexural-plasticity characteristics. To ensure shape stability in women's garment components, the traditional dublerin interlining fabric was replaced with a PVA-based composition. As a result, volumetric shaping and long-term shape retention in garment components were successfully achieved. The volumetric shapes commonly found in women’s jackets from 2019 to 2025 were analyzed, and a prototype garment was developed. The topography of PVA composition application in the structural zones of women’s garments corresponding to modern fashion trends was investigated. A new technology was developed to enhance shape stability in women’s garment components using polymer compositions. A technological process scheme for treating garment components was designed, and a new garment design was proposed. Finally, practical recommendations were formulated based on shape stability results and technological process indicators under production conditions.

**Keywords:** shape stability, technology, PVA composition, dublerin, suiting fabric, constructive design, technological process

# **INTRODUCTION**

The growing needs of consumers worldwide are pushing manufacturers to increase both the quantity and variety of their product assortments. From the perspective of industrial development, the light industry is considered one of the leading sectors globally, accounting for 5.7% of total industrial output. In recent years, the global demand for textiles, clothing, and footwear has risen by 90.5%, with increases of 99.3% in the United States and nearly twofold in Japan. China holds a 30% share of the global market in textile and light industry exports. For manufacturing enterprises, creating a range of models is a crucial task that also necessitates reducing the production time of each model. In the garment industry, particular attention is being paid to the development of new product assortments, improving quality, reducing raw material consumption, and lowering production costs by optimizing implementation processes [1].

In the global fashion industry, increasing attention is being paid to individualized garment production based on body shapes, the development of clothing that aligns with rapidly changing fashion trends, the improvement of technologies for manufacturing competitive garments, and the establishment of their scientific foundations. Scientific research is being conducted with a focus on identifying fashion trends, enhancing them by considering the properties of innovative fabrics, and improving technologies to increase the dimensional stability of modern garments through the use of new polymer compositions.

At present, one of the pressing scientific and practical issues is to ensure dimensional stability in garment components through a comprehensive approach — specifically, designing women’s suits using various newly structured fabrics that meet the requirements of rapidly changing fashion trends [2].

**MATERIALS AND METHODS**

In the production of light industry goods, garments hold a leading position. The quality of sewn garments remains a key issue in both domestic and international markets, especially given the increasing competition among various clothing manufacturers [3]. The production of garments is characterized by a high level of mechanization and automation, employing more standardized and unified manufacturing technologies. Today, consumers often prefer imported products, as they meet essential requirements such as appearance, quality, and service life, although these products are typically priced higher [4].

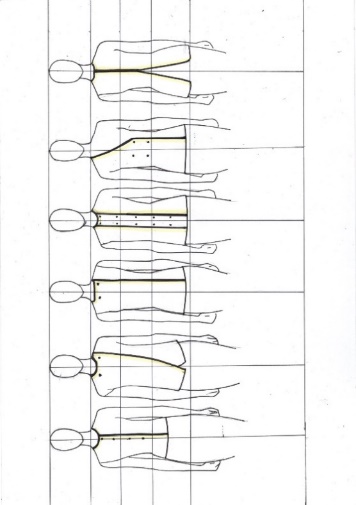
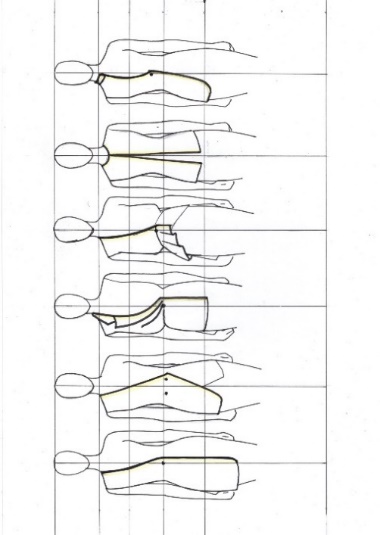
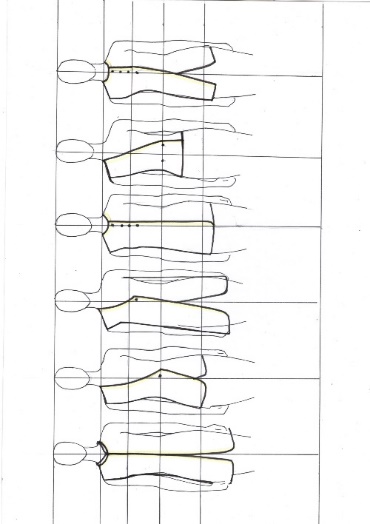
Women's garments often include components with complex three-dimensional shapes, which require the formation of specific contours and the retention of shape stability throughout the wear period. Therefore, this article investigates shape formation and dimensional stability properties in women's suits over the period of 2019–2025 [5]. In studying the external shape of women’s jackets, attention was given to elements and details that influence the shaping of the components (Figure 1).

|  |  |
| --- | --- |
|  |  |
| **FIGURE 1.** Formation of the Outer Shape of a Women's Jacket | |

The elements influencing the transformation of the outer shape of a women's jacket are primarily flounces, which are used in the sleeves and other components of the garment.

The core of a modern woman’s wardrobe, regardless of age, is often a jacketed ensemble. Such an outfit reflects taste, style, lifestyle, and sometimes even the woman’s age. The jacket is one of the most popular types of garments, representing different historical periods, design ideas, the uniqueness of designers, and aspects of national identity. Since its emergence, this type of clothing has continuously evolved in terms of details and fabric applications. The silhouette, proportions, fabric color and texture, shoulder shape, seam lines, hem and front edge configurations, as well as collar and pocket treatments, are all governed by certain standards and regulations based on the jacket's intended function [6. 7, 8, 9].

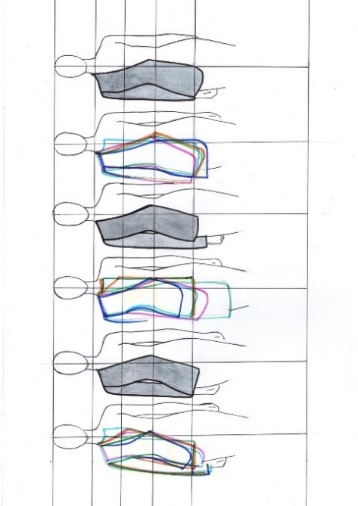
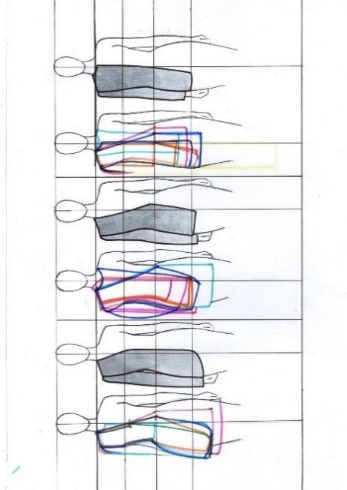
Considering the above, an analysis was conducted of the silhouette and proportion placement in relation to the main components of women's jackets in accordance with modern fashion trends (Figure 2). Based on the review of over 600 collections from the world's leading designers between 2019 and 2025—including Gucci, Armani, Dior, Dolce & Gabbana, and Chanel—a classification system of shaping elements in women's jackets was developed [3].



**FIGURE 2.** Elements influencing the silhouette shape in women's jackets

**This study examined various elements that influence the silhouette shape of women's jackets, including fastening types, collar shapes and styles, garment length, and the formation of the hemline. Jackets featured single-breasted, double-breasted, and asymmetrical button closures. The collar styles included tailored lapels and stand-up collars, while collarless designs were also frequently observed. The jacket length was predominantly above the hip, with only a few models extending below the hip. The hemline of the jacket was typically designed with a shaped or contoured finish [1, 2, 3].**

**Based on an analysis of over 600 collections created by leading fashion designers between 2019 and 2025, generalized structural models for shape formation in women's jackets were developed to assist in the design of new jacket styles (Figure 3).**



**FIGURE 3.** Generalized Model of Shape Formation in Women's Jackets [10, 11]

**The graphical representation of the model in a flat plane reflects the projection of volumetric shapes of system elements in either a static or dynamic state of the figure. It is used in 2D design to obtain a technical sketch that aligns with body contours [11, 12]. As a result, the modern parameters of the jacket are determined and serve as a foundation in the development of garment assortments.**

**Considering the above, the study sets the task of analyzing methods for forming three-dimensional shapes in garment components and exploring techniques for ensuring shape stability in clothing.**

**RESULTS AND DISCUSSION**

The rapid diversification of fabric assortments has generated significant interest among both garment manufacturers and consumers. One of the key characteristics of fabrics is their fiber composition, which defines their function and area of application. It is also a crucial factor in determining the structural features of garments and setting processing parameters during garment manufacturing. For apparel production, the functional purpose of the fabric—such as coat fabric, suiting fabric, dress-suiting fabric, shirt-dress fabric, or lining fabric—is of primary importance.

As the object of this research, 11 types of modern textile fabrics currently in high demand among consumers were selected. Their structural characteristics are presented in Table 1. The fabrics were classified into three groups:

1. Suiting fabrics;
2. Suiting fabrics containing elastane;
3. Dress-suiting and shirting fabrics.

Due to their similar fiber composition and texture, these fabrics were chosen as the research objects (Table 1).

In this article, the selected fabrics are intended for the production of both light and outerwear assortments of women's clothing, with the aim of improving shape stability in garment components. Table 1 presents a structural description of the fabrics in various assortments.

**TABLE 1.** Structural Characteristics of Fabrics from Various Assortments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| № | Samples | Fabric Code | Fabric Thickness, mm | Surface Density, g/m² | Fiber Composition, % |
| **Suiting Fabrics** | | | | | |
| 1 | Sample-1 | 18305 | 0.35 | 155.8 | 100 % Cotton |
| 2 | Sample -2 | 19716 | 0.35 | 237.8 | 50% Polyester / 50% Viscose |
| 3 | Sample -3 | 18763 | 0.30 | 132.7 | 50% Cotton / 50% Polyester |
| 4 | Sample -4 | 021 | 0.30 | 225.5 | 60% Viscose / 40% Polyester |
| 5 | Sample -5 | 8F209 | 0.30 | 224.5 | 60% Viscose / 40% Polyester |
| 6 | Sample -6 | 178 | 0.30 | 224.0 | 60% Viscose / 40% Polyester |
| Suiting Fabrics Containing Elastane | | | | | |
| 7 | Sample -7 | 038 | 0.40 | 196.9 | 70% Polyester / 30% Lycra |
| 8 | Sample -8 | 9905 | 0.60 | 283.9 | 60% Polyester / 20% Viscose / 20% Lycra |
| Dress-Suiting and Shirting Fabrics | | | | | |
| 9 | Sample -9 | 93493 | 0.25 | 88.6 | 70% Silk / 30% Viscose |
| 10 | Sample -10 | 32/957209 | 0.30 | 132.4 | **80% Polyester / 20% Viscose** |
| 11 | Sample -11 | 16899 | 0.45 | 260 | 70% Polyester / 30% Viscose |

The traditional method of imparting shape retention to garment components using fusible interlining materials through thermo-adhesive processing has several drawbacks. Notably, it increases the weight of the garment, and over time, components treated with adhesive interlinings tend to lose their original three-dimensional form during wear, gradually flattening out. These disadvantages can be effectively addressed through the use of chemical processing technologies [13].

As noted in [13], modern fabric assortments are widely used in women's clothing. Therefore, in this research, the effect of interlining materials on various types of modern suiting fabrics was analyzed. Shape stability is considered one of the key indicators in garment components. Compared to light-weight fabrics, outerwear fabrics demonstrate higher shape stability. When the fabric thickness increases, the ability to retain shape and maintain dimensional stability in outerwear components also improves [13].

To analyze the impact of textile fabrics and fabric+PVA (polyvinyl alcohol) compositions on the structural properties of the materials, 10 types of fabric samples were treated with PVA solutions in concentrations ranging from 0.5 to 60.0 g/L, and 11 fabric samples were treated with fusible interlinings (dublerin).

The experimental results showed that the fabric thickness did not change after treatment with the fabric+PVA composition (Figure 2). In contrast, for samples treated with fabric+dublerin, the thickness increased by an average of 27.7% in Group 1 (suiting fabrics), by 33.3% in Group 2 (suiting fabrics containing elastane), and by 22.5% in Group 3 (dress-suiting and shirting fabrics).

|  |  |
| --- | --- |
|  |  |
| **FIGURE 4.** Effect of gauze+PVA composition on gauze thickness | **FIGURE 5.** Comparative analysis of the surface density of textile fabrics, fabric + doubler, fabric + PVA composite |
|  |  |
| **FIGURE 6.** Analysis of the air permeability of textile fabrics after treatment with a PVA composition | **FIGURE 7.** Analysis of the wrinkle resistance of samples |

Experimental research showed that as the thickness of the fabric increased, the thickness of the fabric+doubler samples increased.

The difference between the surface density of the fabric+doubler and fabric+PVA composite samples shows that the surface density of the fabric+doubler samples was higher in group 1 suit fabric samples by 33.8-57.8%, in group 2 suit fabric samples with elastane fiber content by 26.28-30.8%, and in group 3 dress suit and dress fabric samples by 28.3-54.3% (Figure 5).

Figure 6 presents the results of the analysis of the air permeability index of textile fabrics after treatment with the PVA composition. In the diagram, since the fiber composition of fabric sample 1 consists of cotton fiber, the air permeability index was determined to be 27.7 dm³/(m²•s) in the fabric, and 26.7 dm³/(m²•s) in the sample treated with the fabric+PVA composition.

In the diagram, since the fiber composition of fabric sample 2 consists of polyester, viscose, and lycra fibers, the air permeability index was determined to be 4.78 dm³/(m²•s) in the fabric, and 6.0 dm³/(m²•s) in the sample treated with the fabric+PVA composition.

Since the fiber composition of fabric sample 9 in the diagram contains silk fiber, this indicator showed the highest result of 64.4 dm³/(m²•s) in the fabric, and 63.4 dm³/(m²•s) in the sample treated with the fabric + PVA composition.

Since the fiber composition of fabric samples 10-11 in the diagram is polyester, viscose, cotton fiber, this indicator showed the result of 5.2-10.6 dm³/(m²•s) in the fabric, and 3.2-7.9 dm³/(m²•s) in the fabric treated with the fabric + PVA composition.

The results of the experimental study showed that the air permeability index when treating textile fabrics with the PVA composition depends on the fiber composition of the fabric. If the fiber content of the fabrics contains cotton and silk fibers, the PVA composition has little effect on the air permeability index.

The analysis results showed that as the amount of PVA in the samples of suit fabrics and suit fabrics + PVA composition increased, the wrinkle resistance index of the fabric samples increased (Figure 7).

It was found that the wrinkle resistance index of the 1st group of suit fabrics after treatment with the fabric and fabric + PVA composition increased by an average of 7.1%, and the wrinkle resistance index of the 2nd group of suit fabrics containing elastane and fabric + PVA composition increased by an average of 5.6%.

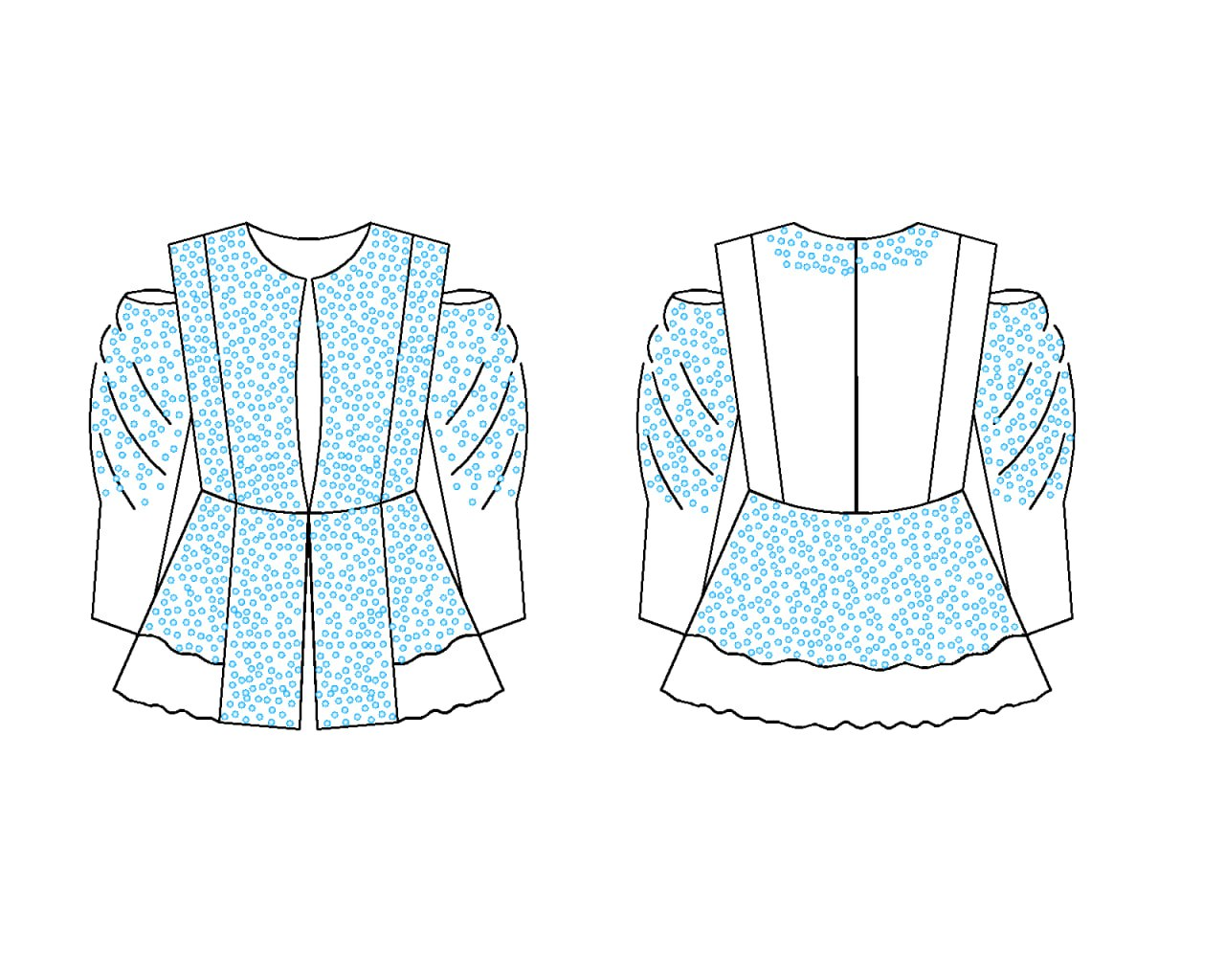
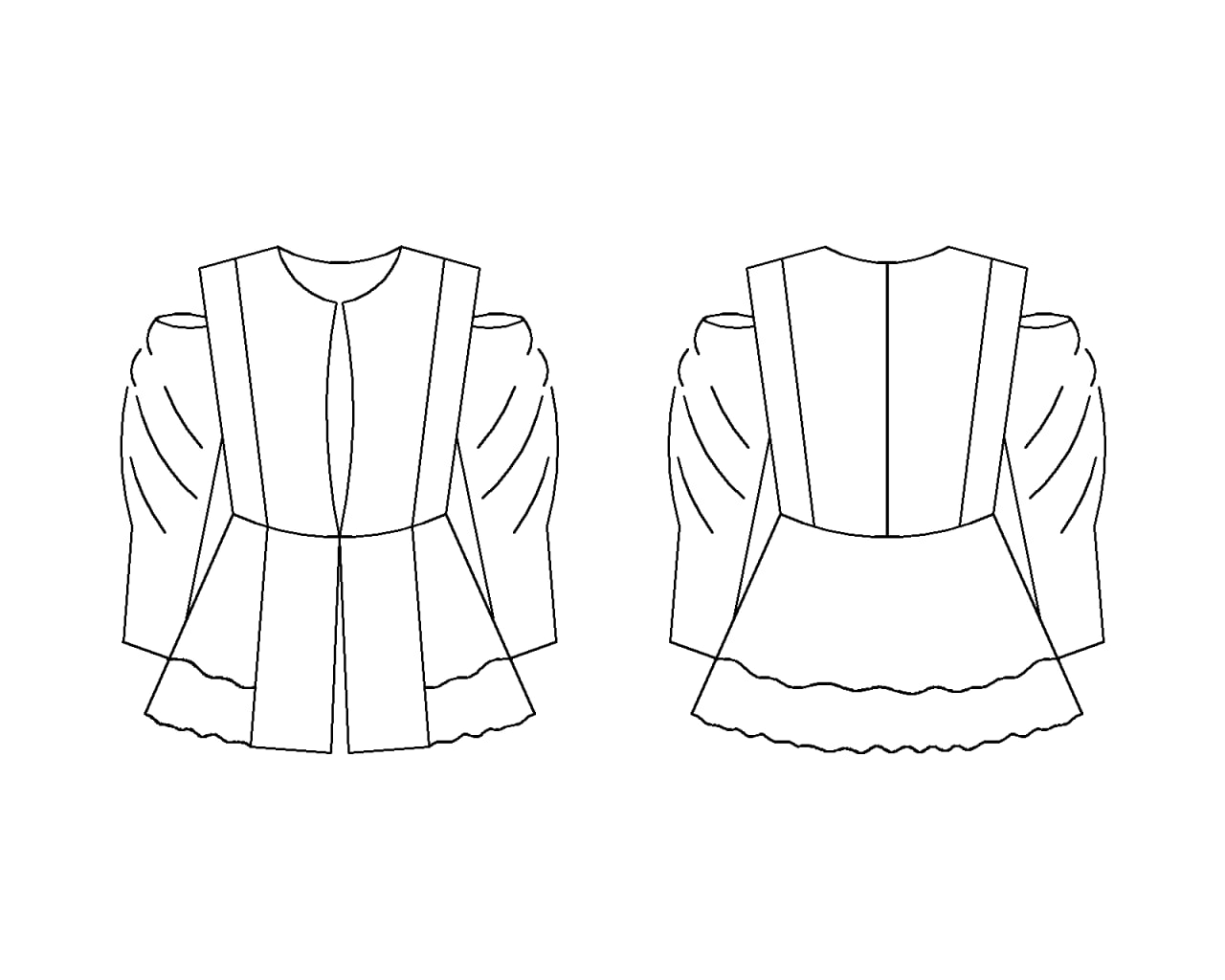
In the experiment on group 3 dress, suit and shirt fabrics, it was found that the wrinkle resistance index of the samples increased by an average of 2.3% after treatment with the fabric and fabric + PVA composition.

An increase in the wrinkle resistance index in textile fabrics also affects the shape stability of sewing products. For this reason, it was found that it is advisable to use a new processing technology for sewing products in sewing production.

Based on the results of the study, the following were recommended as the most rational options for applying the PVA composition concentration by fabric type: 50.0 g/l for group 1 suit fabrics, 50.0 g/l for group 2 suit fabrics containing elastic fibers, 20.0 g/l for samples 9 and 10 for group 3 dress and shirt fabrics, 50.0 g/l for sample 11.

The article developed a topography of the application of the PVA composition in women's clothing details (Figure 8).

It is known that during the production of clothing, depending on the fiber composition of the fabrics, when they are treated with doubler, migration of the reinforcing materials is observed before the product is ready. Therefore, by applying the PVA composition in the details of women's jackets, a number of shortcomings in the treatment of various modern fabrics with doubler were eliminated. The PVA composition solution was applied by spraying 50.0 g/l of PVA composition at 52.3% of the total surface area of these clothing details [14-15] (Table 2).



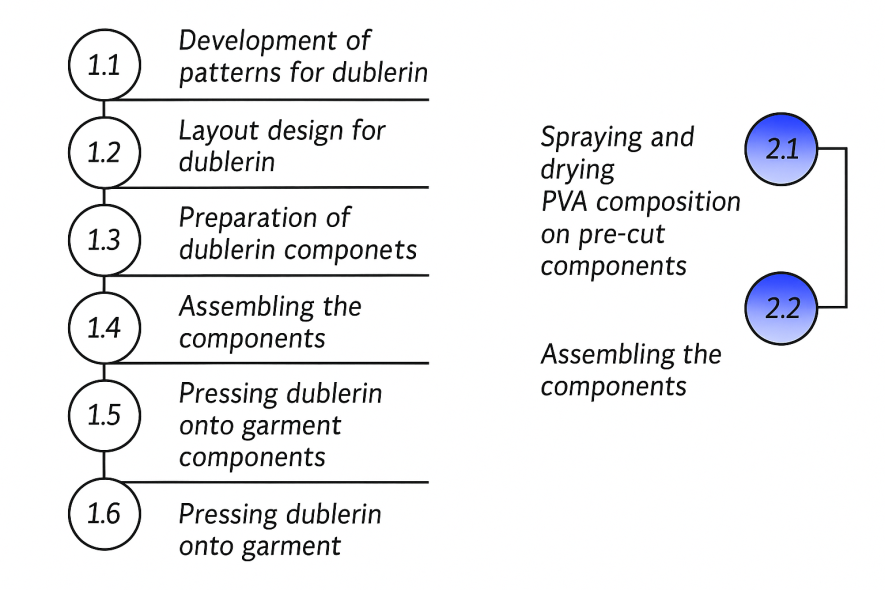
**FIGURE 8. Topography of PVA Composition Application on Women's Jacket Components**

**TABLE 2.** Determining the Amount of PVA Composition According to the Surface Area of Women's Jacket Components

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| № | Component Name | Total Surface Area, cm² | Surface Area Treated with PVA, cm² | Difference, % |
| 1 | Front Panel | 1056 | 940 | 5.2 |
| 2 | Front Side Panel | 1150 | 1035 | 5.7 |
| 3 | Side Panel | 625 | 0 | 0 |
| 4 | Back Panel | 1900 | 70 | 0.4 |
| 5 | Front Center Yoke | 622 | 590 | 3.2 |
| 6 | Yoke (I) | 3225 | 3022 | 16.6 |
| 7 | Yoke (II) | 3679.5 | 0 | 0 |
| 8 | Sleeve | 4912.5 | 3100 | 17.1 |
| 9 | Cuff | 978 | 742 | 4.1 |
|  | Total: | **18148** | **9499** | **52.3** |

The analysis results show that the technological process using dublerin involves six operations (Figure 9a). In contrast, the proposed technology includes only two operations: spraying the PVA composition onto pre-cut garment components, drying, and assembling the parts (Figure 9b).

It can thus be concluded that the use of PVA composition instead of dublerin in women's garments to improve shape stability reduces the technological process by a factor of 3.0 [14].



*a) b)***FIGURE 9.** Technological Process Flowchart

The analysis of these indicators shows that the reduction in the consumption of interlining materials, as well as the elimination of the pattern-making and cutting operations for interlining, led to an increase in the enterprise’s net profit by 243,041.63 thousand UZS.

### **CONCLUSION**

Based on the experimental results, the following conclusions can be drawn: considering the changes and diversity in modern women's clothing shapes and the specific properties of various fabric assortments, the lack of clear guidelines for ensuring shape stability in garments necessitates further research. This includes developing solutions aimed at enhancing shape stability in garment components through the use of composite materials.

The methods reviewed in this study enable a reduction in the use of costly interlining materials, facilitate the formation of required shapes in complex components, ensure high-quality shape retention, reduce the number of technological transitions, and lower labor costs.

The method of ensuring shape stability in garment components based on composite components is universal for women's garments made from various fabric assortments and opens up broad opportunities for improving product quality.

The conducted research demonstrated that the issue of enhancing shape stability in women’s garment components made from various types of fabrics, as well as improving product quality and extending service life, is a pressing one. Improving the technological process in this area holds both scientific-practical and theoretical significance.

Based on the study results, the most rational application concentrations of PVA composition were recommended for different fabric types. For suiting fabrics and suiting fabrics containing elastane, a concentration of 50.0 g/L of PVA composition was found optimal. It was determined that increasing shape stability in garment components made from different fabric assortments depends on the fabric type, fiber composition, fabric thickness, and surface density indicators. Furthermore, a topographic application map for PVA composition on women’s jacket components was developed. The findings showed that replacing dublerin with PVA composition in women's clothing improved shape stability and reduced the technological production process by a factor of 3.0.

It was also observed that as the fabric assortment changes, the garment component processing technology must also be adjusted. According to the findings, the use of PVA composition is not limited to women's garments but can also be recommended for other assortment types in the garment industry, including men's and children's clothing.

An analysis of the company's financial indicators showed that reducing the consumption of interlining materials and eliminating the pattern-making and cutting operations for interlining led to an increase in gross profit by 420,040.34 thousand UZS, operating profit by 416,041.62 thousand UZS, and net profit by 243,041.63 thousand UZS.

### **REFERENCES**

1. N. M. Artikbayeva, *Improvement of the technology for increasing the shape stability of clothing parts*, PhD dissertation, TTYSI, Tashkent (2024), 187 p.
2. N. M. Artikbayeva, N. L. Lutfullaeva, D. A. Bakhritdinova, I. G. Shin, S. Sh. Tashpulatov, and T. B. Muradov, “Investigation of formation conditions package and ensuring pillarity of pillows from composite materials,” *Eur. Sci. Rev.* **7–8**, 252–254 (2018).
3. N. M. Artikbayeva, N. L. Lutfullaeva, D. A. Bakhritdinova, I. G. Shin, S. Sh. Tashpulatov, and T. B. Muradov, “Deformability of the package of multilayer composite material of the working press organ for wet-heat treatment of sewing products,” *Eur. Sci. Rev.* **7–8**, 213–216 (2018).
4. N. L. Lutfullaeva, N. M. Artikbayeva, D. A. Bakhritdinova, I. G. Shin, and S. Sh. Tashpulatov, “Investigation of formation conditions package and ensuring pillarity of pillows from composite materials,” pp. 259–261.
5. L. N. Nutfullaeva, A. F. Plekhanov, I. G. Shin, S. Sh. Tashpulatov, I. V. Cherunova, Sh. N. Nutfullaeva, and E. A. Bogomolov, “Research of conditions of formation package and ensure the safety of the pillows from composite nonwoven fibers materials,” *Technol. Text. Ind.* **2**(380), 95–101 (2019).
6. D. A. Bakhritdinova, I. G. Shin, S. Sh. Tashpulatov, and I. V. Cherunova, “Formation of flat-bulk plots of clothes with the help of a special device for vacuuming a closed technological space,” *Technol. Text. Ind.* **6**(384), 194–202 (2019).
7. I. Cherunova, S. Tashpulatov, S. Knyazeva, P. Cherunov, and A. Subbotina, “Study the influence of the environment on heat transfer processes in sewing sheaths with heat-accumulating properties,” *E3S Web Conf.* **531**, 0100 (2024).
8. S. Sh. Tashpulatov, I. V. Cherunova, M. K. Rasulova, D. D. Inogamdjanov, M. Yu. Umarova, A. D. Daminov, U. R. Uzakova, and Sh. G. Jurayeva, “Development of the calculation method of polymer compound mass to be applied onto the textile garment pieces,” *IOP Conf. Ser.: Mater. Sci. Eng.*, 1–11.
9. I. V. Cherunova and G. R. Milyutina, “Research on development of nano-structural materials and compositions for a human’s safe life,” *Fundam. Res.* **9–10**, 2153–2156 (2014).
10. V. V. Smirnov, L. V. Larina, I. V. Cherunova, A. V. Merkulova, and E. A. Schenikova, “Methods of intensification of processes of hygro-thermal treatment with the purpose of instilling the goods of a light industry the features of shape stability,” *Contemp. Chall. Sci. Educ.* **6**, 133 (2012).
11. N. M. Artikbayeva, S. Sh. Tashpulatov, and T. M. Mavlyanov, “Determination of the stress-strain state of suit fabrics based on the shell theory,” *Textile Problems* **1**, 58–62 (2010).
12. L. N. Nutfullaeva, S. Sh. Tashpulatov, and I. V. Cherunova, “Use of polymer compositions to improve the shape stability of clothing parts,” *Mod. High Technol.*, 24–26 (2014).
13. N. M. Artikbayeva, A. J. Juraev, S. Z. Yunusov, and S. Sh. Tashpulatov, *Device for forming volumetric parts of clothing* (2013).
14. N. M. Artikbayeva and M. K. Rasulova, “Development of the technology to improve the shape stability of women’s clothing parts based on polymer compositions,” *Dev. Sci. Sci. J.* **6**, 219–224 (2024).
15. N. M. Artikbayeva, I. G. Shin, S. Sh. Tashpulatov, I. V. Cherunova, and N. Bralina, “Evaluation of the stress state during the formation of volumetric sections of clothing parts using compressed air flow,” *Technol. Text. Ind.* **5**(383), 181–186 (2019).