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ANALYSIS THE SHRINKAGE OF DIFFERENT COTTON FABRICS IN THE DYEING PROCESS OF GARMENT

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ABSTRACT
Traditionally, garments are made from pre-dyed (piece-dyed) fabrics before the actual cutting and sewing. The advantage of this process is the economic efficiency of mass production of same clothes in identical color. The main disadvantage of this approach is the risk associated with holding large inventories of a similar style or color in today's dynamic market. The garment dyeing process provides a very short turnaround time from customers' demand to meeting market needs for cool colors and modern finishing processes.
The article analyzes the results of experiments to determine the shrinkage of cotton fabric in the process of dyeing garments in order to carry out the design of garments produced by the method of garment dyeing and to ensure its accuracy.

Keywords: cotton, plain fabric, twill, garment dyeing, shrinkage, sample.

INTRODUCTION

Today, our government is implementing complex measures aimed at organizing the production of a wide range of high-quality textile and sewing-knitting products, deepening the localization of its production, as well as increasing the export potential of local manufacturers. In this regard, the production of high-quality, competitive new types of products has great importance.
It is known that the main part of the fibers grown in our republic is cotton fiber, and in recent years, great results have been achieved in its deep processing. In this regard, many textile enterprises have been established, and cotton fabrics produced by them are offered in dozens of colors of plain, twill and satin weaving. Quality clothes made from these fabrics are directed to the domestic markets of our country and export.
However, current market demands and intense competition require quick adaptation to it. In recent decade, the market has forced sewing companies to deliver sports/leisurewear and casual clothing in very brief lead times and in the most fashionable, trandiest colours. Obviously, in the typical cycle of textile production, the process of dyeing, finishing and delivery takes a lot of time, which leads to a significant loss of sales [1-2]. The production of sewing items by garment dyeing can satisfy the needs of the market in a very short time, from the customer's demand to various colors and modern fashion trends.
Garment dyeing is the process of dyeing complete garments such as pants, pullovers, t-shirts, trousers, sweaters, shirts, tops, casual jackets, dresses skirts, socks in contrast to the conventional method of producing garments from pre-dyed fabrics [3]. That is, garments are made of grey fabric woven from

cotton or cotton blended yarn, which has not undergone dyeing and other finishing processes, and then it is dyed in colors suitable for market and fashion requirements [4]. In this case, clothes are mainly made of cotton knitwear and cotton woven fabrics.

Manufacturing apparel in this way has a number of advantages following:

- Less capital investments
- Short turnaround time
- Quick adaptation to fast changing market trends
- Low inventory
- Flexibility of batch size
- Flexibility of items to be dyed
- Washing, bleaching and dyeing processes can be performed in the same machine
- Ability to immediately react to rapidly changing market trends
- Dyeing is carried out with few equipment;
- Fancy effects
- Redyeing faded old clothes [5-6].

One of the biggest troubles encountered in the design of clothes in this way is huge shrinkage of cotton fabric in length and width during the garment dyeing process. Therefore, for producing such clothes, it is necessary to mesure in advance the exact shrinkage values of the cotton fabric and take into account during the design process.

MATERIALS AND METHODS

For this purpose, several 100 percent cotton fabrics in the highest demand, which are produced at the "Posco International Textile" LLC enterprise were selected for experimental testing. This company is one of the largest textile enterprises producing cotton fabrics in our country, with more than 300 modern weaving looms and about 40 mln. p/meter annual production volume.

Figure 1. The process of weaving cotton fabrics at "Posco International Textile"

The following table shows the description of fabric samples selected for testing, with 100% cotton content woven on a Toyota JAT 610 (Japan) loom. The yarn counts of samples 1 and 2 is 30 Ne, and sample 3 has a linear density of 20 Ne in plain weaving; sample 4 has yarn counts 30 Ne, and sample 5

has a linear density of 16 Ne in warp and 12 Ne in weft, last two are twill weave, table 1 shows detailed information about fabrics as well.

Table 1 Samples taken to determine shrinkage values

№	Fabric	Item				
		Yarn counts (Ne)	Density (1 inch)	Width (Cm)	Weave	Weight (gr/m^2)
1	Plain	CD30×CD30	68×68	170	1/1	120
2	Plain	CD30×CD30	75×75	170	1/1	133
3	Plain	CD20×CD20	60×60	170	1/1	161
4	Twill	CD20×CD20	108×56	160	3/1	216
5	Twill	CD16×CD12	108×56	160	3/1	312

The standarts GOST 30157.0 - 95, GOST 30157.1 - 95 provide sampling, test methods and devices for determining changes in the dimensions of textile materials under the influence of moisture. Also, the methods of preparing, marking and measuring samples to determine the change in linear dimensions of materials are in ISO 3759, and the methods of conducting tests in order to determine the dimensional changes of fabrics and apparel after washing are in ISO 6330 international standards, as well as the AATCC TM 135, AATCC TM 150 standards developed by the "American Association of Textile Chemists and Colorists" [7-10].

Figure 2. Tumbler garment dyeing machine, Model: K075M300

Tests were conducted under manufacturing conditions to ensure high accuracy of results. In order to accurately calculate the shrinking value and obtain direct results in percent, samples were prepared in the size of 100×100 ±0.1 cm in terms of length and width. All samples were put into a 300 kg capacity garment dyeing machine (Fig. 2) together with other dyed garments (shirts) to create a homogenous environment with the garments to be produced later. Then the dyed samples were measured at five control points in the direction of the warp and the weft.

RESULTS AND DISCUSSION

After the dyed fabric samples were completely dried at room temperature, their wrinkles were smoothed out using a steam iron. In the process of ironing, it is necessary to pay attention to the fact that the material is spread freely, not allowed to stretch or narrow. Ahter ironing the dyed samples were measured at five control points in the direction of the warp and the weft that table 2 shows values of the experiment.

Table 2 Measurements of the samples after the dyeing process

№	Control points / Samples	Values obtained after dyeing									
		1		2		3		4		5	
		warp	weft	warp	weft	warp	weft	warp	weft	warp	weft
1	Plain CD30xCD30	90,7	91,6	90,6	91,1	90,4	91,3	90,5	91,4	90,9	91,9
2	Plain CD30xCD30	92,4	90,9	91,8	91,3	91,7	91,4	91,3	91,2	92,0	91,8
3	Plain CD20xCD20	93,5	92,3	93,2	91,5	93,0	91,6	92,4	91,8	92,7	92,2
4	Twill CD20xCD20	86,7	94,4	86,2	94,3	86,0	94,7	85,8	94,9	86,1	94,3
5	Twill CD16xCD12	87,4	93,8	86,9	94,0	86,7	93,9	86,5	93,7	87,0	93,6

According to the results of the test, it was found that the fabric shrinks more in the warp direction, one of the main reasons for this is that the warp yarns are stretched in all parts of the weaving process. On the basis of the above results, the average values of the sizes of all samples and the shrinkage percentage were obtained.

Table 3 Average value of sample sizes and shrinkage percentage after dyeing

№	Samples	Average value, cm		Shrinkage, %	
		warp	weft	warp	weft
1	Plain CD30xCD30	90,6	91,5	9,4	8,5
2	Plain CD30xCD30	91,8	91,3	8,2	8,7
3	Plain CD20xCD20	93,0	91,9	7,0	8,1
4	Twill CD20xCD20	86,2	94,5	13,8	5,5
5	Twill CD16xCD12	86,9	93,8	13,1	6,2

Despite the fact that samples 1 and 2 are woven from yarns of the counts, sample 2, which has a slightly higher density of fabric, has 1.2% less shrinkage in the warp direction and 0.2% more penetration in the weft direction; It was found that sample 3 shrunk less by 2.4% and 0.4% in the warp and weft direction, respectively. Twill (samples 4 and 5) despite the fact that the surface density

is greater compared to plain, the shrinkage percentage in the direction of the warp thread is greater (3.7-6.8 %), it is smaller in the direction of the weft (3.2-1, 9 %) was found. It can be seen that shrinkage of cotton fabrics depends on the first method of weaving, then on the density of the fabric and the linear density of the yarn. Therefore, a special approach to designing clothes from fabrics of different weaves and densities is necessary in the garment dyeing.

CONCLUSION

We can see that the denser the fabric is, the smaller the amount of shrinkage is, and the fabric of the plain weave has less shrinkage in the warp and more in the weft. Based on these obtained results, input values are calculated for the design of men's shirts and summer sets, trousers and other clothes.
In course of studying the previous researches, it became clear that the method of garment dyeing has not been researched adequate, research works carried out mainly focused on the chemical aspects of the dyeing process, that is, the types of dyeing are different dyes, alkalis and properties of other reactive substances, various experiments on their application, improvement of dyeing quality, colour fastness, reduction of environmental impact of these processes. The problems and peculiarities of the design of these garments, the extent to which the sizes correspond to the original basis after the dyeing process, a special approach to fabrics of different weaves and densities, as well as the lack of research on sewing technology, are determines the importance of research.

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