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DESIGNING WELL FITTING CLOTHES

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Today the construction of well fitting clothes in small and medium companies within our clothing industry depends on manufacturer's experience. Therefore, a new way of optimisation and solutions was suggested during the work in order to reduce the time needed for production preparation using modern technological solutions and new procedures and also to increase the quality of products. Tests were carried out on fabric samples composed of 97% of cotton and 3% of lycra. The dimensional stability of jeans fabric was tested. Dimensional change of fabric, shrinkage in length 3,13% and in width 5,13% during the de-starching, stoning, softening and ironing processes were taken into the consideration within the construction of ladies' trousers cut. The way of trousers design cut adaptation to different dimensional stabilities materials by using modern technological solutions has also been analysed.

1. Introduction

In our country, small and medium companies which do their business in transition circumstances seek for the ways of optimisation and solutions related to reduction of the time which is necessary for production preparation by using new methods and modern solutions. They are also trying to improve the quality of products [1,2]. One of the main problems in the development of clothing products is variable dimensional stability of flat textile products. Flat textile products which are used for clothing manufacturing are fabrics, knitted fabrics and, in some cases, nonwoven textile materials. Well fitting of clothes can be provided by reconciling of material properties with cut construction. Thus, it is necessary to examine fabrics and their behaviour during different stages of production prior to construction of clothing products. These examinations are used for identification of dimension changing in fabrics, and those changes are build in construction of clothing products which are made according to standards in advance [3]. Companies that produce certain materials usually provide a declaration list consisting of raw material, shrinkage, washing and ironing data. Under the real production circumstances, this information is usually unsuitable for the real condition of material or we are not able to predict, on the basis of this data, the behaviour of these products during washing or chemical cleaning. Today, fashion trends, materials and models are changing rapidly. Because of that, every production process requires examination of fabrics behaviour. Building-in of elastine fibres in the

fabrics used for clothing production causes certain problems which can be seen in the unsuitable dimensional stability of fabrics. most problems in these fabrics appears during the process of technological finishing where the fabric changes its demensions, i.e. shrinks. As a result, final product dimensions doesn't fit to the usual standard of measurements.
This can be seen with the clothing made of jeans fabrics consisting of cotton and elastine during the process of washing, stoning, dying, softening and ironing. This is caused by the presence of water and high temperatures as well as the mechanical acting, especially with stone treatment. The main goal of fabrics testing is to define parameters of dimensional stability in order to designe the well fitting clothes.

2. Materials and methods

Stability of fabric dimensions is its ability to resist shrinking and stretching. Raw material structure of the fabrics has certain influence on this characteristic, but the most inportant issue is the fabric structure. One of the most important factors related to dimension stability is the level of tension which is yarn subjected to within the fabric structure. Yarn is streched during the weaving process. After removing from the loom, it is no more subjected to forces which were present during the treatment [4,5,6]. Changing of the fabric dimensions can be caused by wet treatments during which the fibres become swollen. As a result, one kind of fabric wires, for example warp wires, must pass longer circular pathway in order to encircle swollen weft threads. Warp threads must be longer or weft threads must be closer to each other. If we want to increase the length of warp threads we must engage force, so, under the circumstances when there is no tension, for example in washing mahines, the balance is obtained by closing of weft threads to each other. In most cases, this causes the shrinkage of fabrics. It is easy to conclude that the testing of fabric shrinkage should be performed under the real production conditions which the fabrics will be subjected to during the usage. This testin includes following stages: preparation of sample with marke dimensions, subjecting of samples to real conditions of technological treatment (washing, stoning, softening), drying, conditioning and re-measurement of dimensions. The probes are prepared with necessary conditioning of samples under the standard conditions. After that, the probes are marked with lines drawn with ink or marked by thread. After being dried, the sample is balanced under the standard conditions and the distances between the lines on the sample are being measured [7].The shrinkage is calculated in per cents on the basis of mean values obtained by measurement according to the following expression:

$$S = \frac{l_1 - l_0}{l_0} \cdot 100[\%]$$

Where: : S-fabric shrinkage (per cent),
l_1 – sample's length after testing
l_0 – sample's length prior to testing.

More demanding consumers impose clothing industry constant need for developing of new production methods for more quality products with constant decrease of production time [8,9,10].

3. Results discussion

In order to ensure constant good fitting of the clothes during work the relationship between the properties of the denim fabric and the design of ladies' jeans was investigated. Tests were carried out on fabric samples composed of 97% of cotton and 3% of Elastan (Lycra), with the mass of 311,85 g/m^2. The analysis of the fabric finishing was carried out on the mashines for de-starching, stoning, drying and ironing in order to define the percentage of fabric shrinkage prior to trousers' cuts production.
Fabric treatment was carried out on machines in production line of "Turkal" company. Marked fabric samples (50x50 cm) were de-starched at the temperature of 55^{0}C during the period of 20 minutes. After that, they were squeezed in the centrifugal washing mashine, and then dried in the drying mashine. Stoning process was carried out at the temperature of 55^{0}C during the period of 30 minutes. The duration of the stoning process was adopted to appropriate lightening on the fabric according to the fabric prototype. The samples were, then, squeezed and dried. The softening process was carried out at the temperature of 55^{0}C during the period of 15 minutes. After that, the ironing process was carried out. Each treatment eas followed by the changing of the samples' dimensions. 30 samples were subjected to the measurement process.

Table 1 shows the changing of fabric dimensions per length during the different treatment procedures.

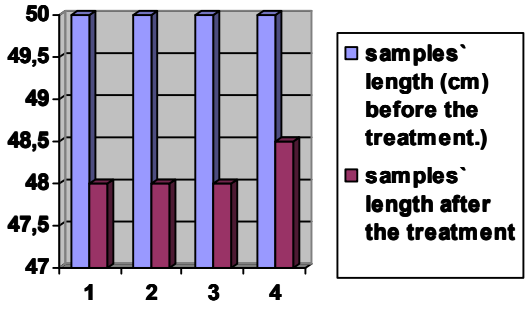


Diagram 1. Changing of fabric dimensions per length during the different treatment procedures.

Blue colour represents the values of the length and width of untreated sampled. Different treatment procedures are marked as:

1. de-starching process
2. stoning process
3. softening process

4. ironing process

Diagram 2 shows the changing of fabric dimensions per width during the different treatment procedures.

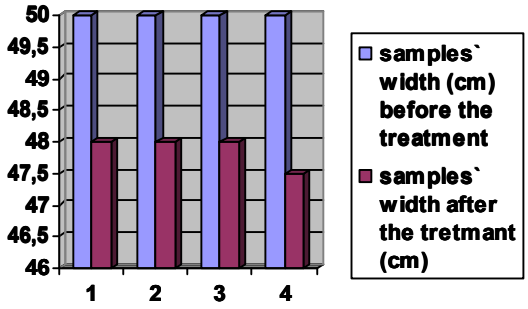
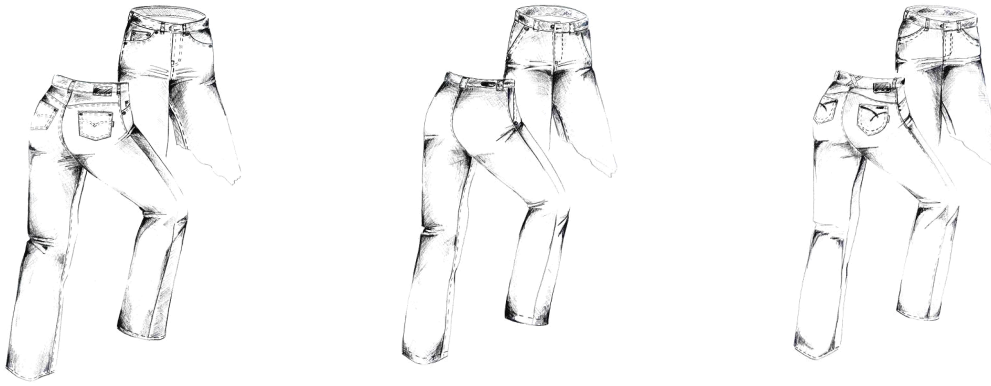


Diagram 2 Changing of fabric dimensions per width during the different treatment procedures.

After processing the data it was found that the fabric had shrunk by 3,13% per length, and 5,13% per width. This shrinking was taken into account in the designing of ladies' trousers, so that the values in the measure table for the average normal stature were adjusted by these percentages. The design of ladies' trousers was made in accordance with the rectified measures.

The analysis of the small and medium companies in our country has shown that they procure material from several producers [1,2,3]. The usage of different materials is restricted by small production series and a great number of clothing sizes. There is also the problem of adjustment of defferent dimension stability to production of well fiting clothes from different materials. Three models of ladies' jeans (size 29) were analized. These models were made from the same basal cut design by modelling procedures. Figure 1 shows the sketches of analized jeans models.



Model 1 ***Model 2*** ***Model 3***

Figure 1 The sketches of analized jeans models.

If clothing producers want to rect to the changings of materila dimensions, they must condust testings of materila shrinkage per length and width. These changings should be taken into the design of basic cut. If the producers make designs without the usage of modern technological solutions, i.e. CAD sistem for design preparation, this procedure will be time consuming. In that case, all procedures involved in basic cut design, modelling, completing and grading must be conducted separately for each fabric with different values of shrinkage per length and width. These procedures, for three given models of jeans in the figure 1, have been observed especially for the front, back and other parts of the jeans. Production time of these procedures, without the application of CAD system, has been shown in the table 1.

Table 1. Production time for jeans cut without the application of CAD system

	Production time (h)								
The part of the model	Front part			Back part			Other parts		
Model	1	2	3	1	2	3	1	2	3
Basic design	1.0	0,9	0,6	0,8	0,5	0,3	0,2	0,1	0,1
Modelling	0,8	0,7	0,5	0,6	0,5	0,4	0,1	0,1	0,1
completing	0,7	0,6	0,6	0,6	0,5	0,3	0,2	0,1	0,1
Grading	1,5	1,4	1,5	1,5	1,2	1,2	0,5	0,4	0,3
Total	4,0	3,6	3,2	3,5	2,7	2,2	1,0	0,7	0,6

If the producers make designs using the modern technological solutions, i.e. CAD system application, this procedure will not require much time. The adjustment of ladies' jeans cut on CAD system of French equipment producer Lectra within the program package Modaris was analized during the procedure. It has been shown that the procedures from designing to grading, which are shown in the table 2, take less time if we use CAD System. Experienced team of workers in design preparation who knows both ways of production with or without CAD system application have been observed. The results are:

- ❖production time for designing of basic cut with the usage of CAD system is less per 30%
- ❖modelling time with usage of CAD system is less per 20%;
- ❖completing cut parts time with usage of CAD system is less per 40%;
- ❖grading process time with usage of CAD system is less per 750%.

However, the the most important benefit of CAD application in designing well fitting clothes is the possibility of fast adjustment of materals' cuts with different dimension stability. This is caused by the fact that small and medium companies often use different parts of fabrics. Lectra's programme package, using the Shrinkage option from the menu F3, enables fast adjustment of cut parts to new fabric dimensions.

Adjustment times for analized jeans cuts, with or without the CAD application, have been shown in the table 3.

Table 3. Adjustment times for analized jeans cuts, with or without the CAD application

	Production time (min)								
The part of the model	Front part			Back part			Other parts		
Model	1	2	3	1	2	3	1	2	3
By hands	240	216	192	210	162	132	60	42	36
CAD	0,25	0,25	0,25	0,25	0,25	0,25	0,50	0,40	0,45

Times shown in the table 3 differ very much because handmade adjustment of cuts requires all procedures of designing of basic cut, modelling, completing and grading to be carried out separately for each material with different shrinkage per length and width. With CAD application, cut parts are simply adjusted to new domensions using several programme options. CAD application enables fast reaction to market demands.

4. Conclusion

Designing of well fitting clothes is a necessity in improvement of the products' quality which are disposed on world markets. Designing of well fitting clothes is influenced by machanical properties of materials, force acting, streching and dimension stability.in this paper, we have observed real production conditions in small and medium companies as well as problems they face with during the development of the product with their trade mark. We have suggested the way for testing of dimension stability which are part of the production process and using the given results in designing clothing products which are ready for market disposal.
This is only one of elements which can be used in production optimisation by small and medium companies in order to improve the quality of their products.

5. Literature

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IZVOD

KONSTRUKCIJA ODEĆE DOBRE PRISTALOSTI

Stručni rad

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U cilju obezbeđivanja konstantne pristalosti odeće u radu je ispitivana povezanost između svojstava jeans tkanine i konstrukcije kroja ženskih pantalona. Za ispitivanje je uzeta tkanina sirovinskog sastava 97% pamuk i 3% elastana (Lycra), mase 311,85gr/m^2. Tkanina je posmatrana u realnim proizvodnim uslovima pri čemu su izvršene sledeće vrste obrade: odskrobljavanje, kamenovanje, omekšavanje i peglanje.

Posle svake obrade merena je promena dimenzija uzoraka. Izvršeno je 30 merenja. Obradom rezultata merenja utvrđeno je da se tkanina skupila po dužini 3,13%, a po širini 5,13%. Ovo skupljanje uzeto je u obzir pri daljem postupku konstrukcije ženskih pantalona tako da su vrednosti u tabeli mera za srednji normalan stas korigovane ovim procentima skupljanja. Prema ovim merama urađena je konstrukcija ženskih pantalona. Zatim je posmatrano vreme izrade na svim poslovima, uključujući i poslove prilagođavanja dimenziono nestabilnih tkanina, od konstrukcije krojeva do uklapanja krojnih slika pri čemu su upoređivana dva načina: sa i bez primene CAD sistema. Posmatran je iskusan tim radnika u konstrukcijskoj pripremi koji poznaje oba načina izrade i sa CAD sistemom i poslove ručne pripreme bez CAD sistema. Utvrđeno je: da je vreme trajanja poslova u konstrukciji osnovnog kroja sa upotrebom CAD sistema manje za 30%; da je vreme trajanja poslova modelovanja sa upotrebom CAD sistema manje za 20%; da je vreme trajanja poslova kompletiranja krojnih delova sa upotrebom CAD sistema manje za 40%; da je vreme trajanja poslova gradiranja sa upotrebom CAD sistema manje za 750%.

Key words: clothes, constant good fitting, designing, denim fabric, ladies' jeans was investigated, CAD system.