Textil Science and economy VI

2014.

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Techical Faculty "Mihajlo Pupin", Zrenjanin, Serbia

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INTRODUCTION

For the sixth time the department of Textile Science and Clothing Design of Technical Faculty "Mihajlo Pupin", University of Novi Sad, is organizing in collaboration with the Faculty of Mechanical Engineering, University of Maribor, *Slovenia*, the International Conference "Textile Science and Economy VI".

It has turned out that our previous meetings of scientists and entrepreneurs in the field of the textile industry had its need and justification. From these gatherings the idea of finding a model revival of the textile industry in the region has been created. Therefore, the basic theme of this conference today will be the development of this model, which is based on the promotion of the sector among the youth. Not any sector, and not any sector of the textile industry, cannot be developed without the significant work on attracting young people to enter the sector. In this regard, in the preparation of the conference TNP'2014 there has been done a lot in finding examples of good practice in the world and how to initiate a discussion on the way of making the to actively involve young people into this sector. Therefore it is necessary to talk about this matter at this conference TNP'2014. A large number of participants who announced their arrival at the conference will certainly help to develop this idea. Some of the papers that are included in the program of the conference discussed and exampled of youth involvement in primary school sector of textile crafts.

Networking and cooperation on the basis of knowledge and experience is the necessary path to sustainability and development of our textile and fashion industry. Developed countries have entered the new millennium by setting strategic objectives to achieve highly competitive and dynamic economic development based on innovation and technological development. Therefore, this conference TNP'2014 wants to contribute to directing the development strategy of the Serbian textile and fashion industry in the direction of dynamic cooperation of science and industry. In this direction at this event this will be promoted by the establishment of innovative clusters in the fashion industry in several regions of Serbia. In these clusters there is a significant role envisaged for the activities that will involve students of the Technical Faculty "Mihajlo Pupin".

The conference of TNP'2014 aims to foster regional co-operation with scientists, experts, businessmen from neighboring states and from other countries, which confirms the international importance of TNP'2014 and its scientific and professional level.

The considerable attention at the conference TNP'2014 attracts the participation of the scientists from countries that are the today's leaders of the development of modern textile and clothing industry, such as China and Turkey. Also, our invitation was accepted by a large number of scientists and businessmen from the region. The papers of our colleagues were published in the Proceedings of the meeting. Because this conference has an economic focus, in the Proceedings there is a place for professional papers of entrepreneurs and our graduates that are employed in many companies.

In the part of the invited lectures, we tried to bring together the leading scientists and experts from the academic institutions and the industry so their work can contribute to the Strategy of Scientific and Technological Development of the Republic of Serbia.

The Chairman of the Organizing Committee:

Vasilije Petrovic, PhD, Professor

FLAGS OF PARTICIPATING COUNTRIES

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China

Ukraine

Croatia

Romania

Macedonia

Italy

Hungary

Turkey

Sweden

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Germany

Bosnia and Herzegovina

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CONTENTS

RESEARCH ON CHINA'S TEXTILE INDUSTRY'SFEATURES AND ITS IMPACT ON ECONOMIC GROWTH

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Donghua University, Shanghai, China

ABSTRACT: Textile industry in China is a high degree labor-intensive and externally dependent industry.China’s textile industry has seen a tremendous growth since 2000.Between 1998 and 2011, the annual average growth rateof textile production was 16.72%.In terms of exports, textile and apparel industryis China's third largest export industry. Based on the survey content,we summarize five main features of China's textile industry: great number of outputsof the textileproducts, well developed its sub-branches, numerousregional industry clusters, colorful traditional textile industry base and sound textile science and machinery manufacture.

Key words: China textile industry,economic growth, textile cluster

INTRODUCTION

Textile industry in China is a high degree labor-intensive and externally dependentindustry. China is the world's largest producer and exporter of textiles and clothing, textile and garment exports continued to grow steadily to ensure China's foreign exchange reserves, balance of payments, exchange rate stability, and solve critical social employment and sustainable development of the textile industry.Textile industry profits and taxes paid also account for the country’s exports, accumulate funds for construction, create jobs, prosperity and develop urban and rural markets, and promote the development of agriculture and other related industries to meet the needs of industrial development of textiles and improve the people's living standards, playingan irreplaceable role.

LITERATURE REVIEW

According tothe particular market and social situation in China after the liberation, YuBinbinstudied the textile industry in China, the development stages of China's textile and garment industry,and divided it into four distinct phases: 1) the early phase, 2) the rapid development stage, 3) the stage of industrial restructuring, and 4) the liberalization of trade stage.(Bin-binYu, 2010) After China joined WTO, Y.Li noted that if we want enhance the sustainable competitiveness of the textile industry, there are some points can be improve : internal business environment, strengthening resource factors, competitiveness and other aspects of its core competitiveness (Y. Li, Hua Zhu, 2003).FangjunZhang empirically studied the factors that affected economic growth in China's textile industry, but failed to thoroughly research the textile industry’s overall contribution to the national economy (Fanjun Zhang, 2011).

METHODS

In order to collect more data to dig textile industry contributions to the national economy, China Statistical Yearbook, Wind database, UN Comtrade database are searched.

As China’s economic construction are carried out by five-year plan, so relevant data of three recent “five-year plan” (9^{th}, 10^{th} and 11^{th}) are collected and compared. Basic statistics about textile industrypercentage with secondary industries as well as with Total national GDP are analyzed.

FNDINGS

Since the Reform and Opening Up, the textile industry as a pillar industry in the second industry, made tremendous contributions to the development of China's economy. From the 9^{th}five-year period to 11^{th} five-yearperiod, economic value added by textile industry and its contribution to socioeconomic is summarizedin the Table 1 below.

Table 1:Economic value added by textile industry and its contribution to socio-economic development

Period	9th five-year period	10th five-year period	11th five-year period
Year	1996-2000	2001-2005	2006-2010
GDP （hundred million CNY）	423443.5	710626.4	1538586
Secondary industry （hundred million CNY）	172282.5	288398.3	628068.2
Textile industry （hundred million CNY）	16370.76	44044.32	106921.2
Textile industry accountingin the proportion of secondary industry （%）	9.50%	15.27%	17.02%
Textile industry accountingin the proportion of GDP （%）	3.87%	6.20%	6.95%

The data collect form Wind database

From the table above, we may observe that the Chinese textile industry has seen a rapid growth after the year 2000. From the specific data, China's textile industrial output value was 437.627 billion CNY in 1998. Accounting for 12.86% of the secondary industrial output value of the year, the contribution to GDP for the same year was 5.19%.The latest data show that in 2011, China's textile industrial output value was 3.265299 trillion CNY, accounting for 17.33 percent of the secondary industrial output value of the year, the contribution to GDP was 6.9% in the same year.We can observe textile industry’s contribution to the economic growth in the period of 1998-2011in Figure1 below.

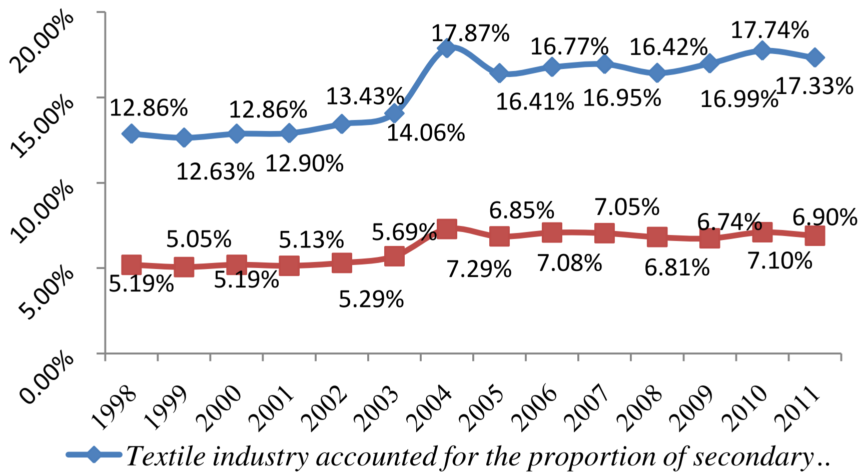

Figure 1: Textile industry contribution to economic growth in the 1998 -2011period

The data collect form Wind database.

During 1998-2011, the annual average growth rateof textile production was 16.72%, higher than the same period of the annual average growth rate of secondary industrial output value (14.08%), also higher than the same period average annual growth rate of GDP (14.18%).

In terms of exports, data released by the China Customs shows that in 2013 China's textile and garments trade export volume was about 284.07 billion USD, accounting for 12.9% of the country's trade in goods, as China's third largest export industry.Since 1994, China has been global leader intextile and apparel exports for 18 consecutive years, the share rose from 12.5% to 2012's 36%.2010-2012, the export value of textile and garments is shown belowon Figure 2. Textile and apparel industry exports belong mainly two types, one is the amount of exports of clothing, and other is the export of textile yarn and fabric products.

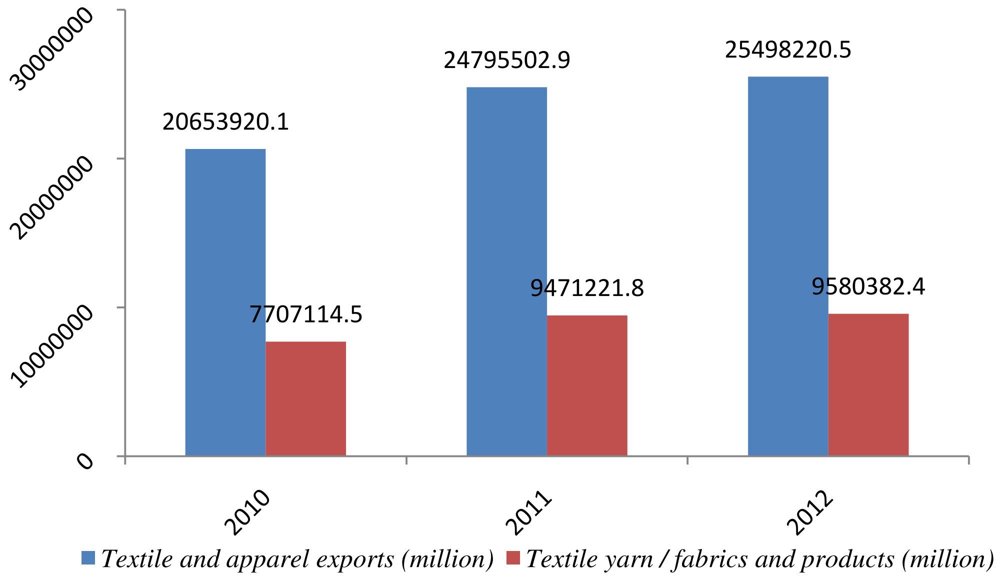

Figure 2: Export in 2010-2012

The data collect form Wind database and UN Comtrade.

From the trade point of view, vast majority of textile and garment export products are now used in general trade, while processing trade decreased significantly.According to Chinese Customs statistics, in 1995 the textile and garment exports accounted for 56.6% of general trade, processing trade accounted for 43.3%; and in 2013 the proportion of general trade was up to 75.4%,whiletheprocessing trade was only 14.7%.

Textile industry investment in fixed assets amounted to 397.15 billion CNY in 2012. However, in 1998, it was only 2.313 billion CNY. The average annual growth rate was 44.42%. The rapid growth of fixed asset investments also contributed to the rapid development of China's textile industry(see also Figure 3).

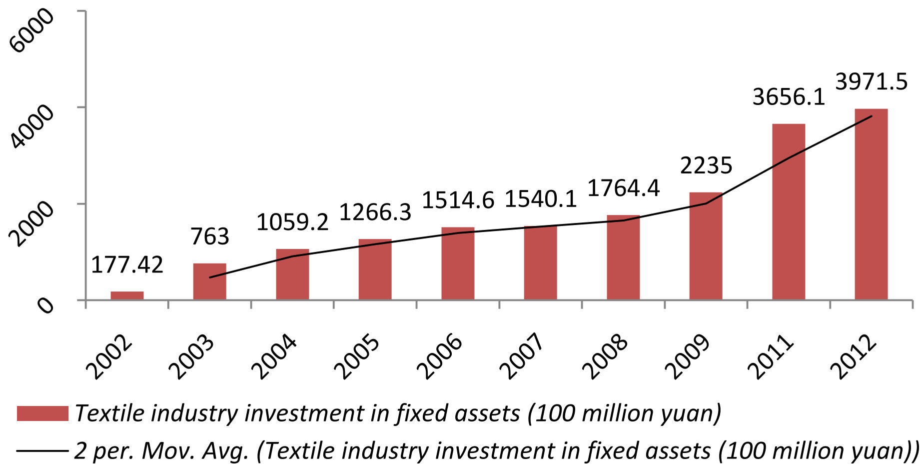

Figure 3: Textile industry investments in fixed assets

The data collect form China Statistical Yearbook.

DISCUSSION

Based on the above presented information, we summarize five main features of China's textile industry: 1) Output textile: textile production capacity accounted as number one in the world;2) Well developed in every textile branch;3)Typical regional industry cluster;4) Colorful traditional textile industry base;5) Sound textile science and manufacture.

Output textile: textile production capacity accounted as number one in the world

The development of China's textile industry is more mature, it has been ranked as the world's largest producer of textiles and textile production capacity accounted for number one in the world. From the raw material point of view, Chinese textile raw materials are also at the level of world's leader, it is the world's largest cotton producer. As early as 2011, China's cotton production reached 7.18 million tons, which accounted for nearly 30% of the world's total. (God Site, 2012) Our veil, cotton, textile production are all the first in the world, as of 2011, the number of ring spinning, rotor spinning and loom reached 120 million, 2.32 million and 1.26 million units, capacity of spinning production is more than 50% of global total output. (Global textile net, 2012) In addition, China is the world's largest producer of silk, where silk production accounts for over 70% of the world's.(Chinese Report net, 2007) In comparison with the global textile major net exporters, the Chinese exports accounted for half of the eight former net exporting countries' total exports. Indian export scale, which was the closest to Chinese in total net exports, only accounting for less than 30 percent of China.(China Industry Insight, 2013)

Well developed in every textile branch

There are textile, printing and dyeing, finished products and a series of complete industrial chains in China. The raw materials of textile are mainly cotton, cashmere, wool, silk cocoons, chemical fiber, feather, etc. Downstream industries are mainly textile and garment, home textiles, industrial textiles, etc.

Typical regional industry cluster

Industrial cluster is in the form of industrial and economic development organizations and plays an important role in enhancing regional competitiveness and regional economic development. Since the year 2002, Shaoxing City in Zhejiang Province, along with 38 other cities (counties, districts) was awarded the title "Textile Industry Base" and "Town with Special Features". By the end of 2012, a total of 191 cities (counties, districts) had become textile industry cluster pilot areas. (YuanyuanBao, 2012)

Due to limited space, we will only sort out some textile clusters of the industrial areas and their characteristic products (see Table 2 for reference). Please note that all those clusters are mainly located in coast areas, whereas western parts of China are still lack of textile and apparel industries.

Table 2: A part of the industry cluster areas and their characteristic products

Area	Characteristic Product	Area	Characteristic Product
Zhili Town	children garment	Xiaoshan District	chemical fiber
Haining City	leather	Haimen City	embroidery
Shengzhou City	ties	Shaxi Town	sportswear
Chongfu Town	fur	Shantou City	underwear
Wenzhou City	garment	Pinghu City	export clothing
Datang Town	hosiery	Shengze Town	silk
Changzhou City	cotton spinning	Nantong City	home textiles
Yuhang District	home textile & fabrics	Xiqiao Town	Fabrics and decorative cloth
Jiaxing City	cocoon silk	Chaozhou City	Wedding and evening dresses

Colorful history of textiles industry in China

China has developed its modern textile industries since 1900s, Shanghai, Qingdao and Tianjin, are most famous China's textile bases as "Shang-Qing-Tian". China also developed its national older famous brands, such as Hengyuangxiang, Longfeng, Three Guns, Hongxiang, and so on, these traditional companies leaded great number of private investors since the Reform (1978). As an example, Hengyuanxiangwas appointed as Beijing 2008 Olympic Games general sponsor, which is the first time inOlympic Games history that a textile and garment enterprise to become such player.

Also after liberation, China invested greatly in Shijiazhuang and Zhengzhou, and those areas became new textile bases in China. Zhejiang, Jiangsu and Guangdong provinces are new model provinces in China's textile industry, for most categories of textile and apparel, those three provinces accounted for almost half of total those productions in China.

Sound textile science, education and machinery manufacturing

China sets up several national textile research institutes in Shanghai and Beijing, which greatly upgrade the Chinese textile science level. Also Chinese textile and apparel firms invested a lot in textile and apparel technologies, which are main forces for promoting R&D. Also China sets up about 100 professional and vocational colleges for textile and clothing and about 110,000 students involved in textile major and those graduates become professional leaders or corporate middle management staff in the industries.(Yuzhou Du, 2011)

Concerning the factors to improve Chinese textile industry, China's whole aspects development of textile and apparel machinery industry takes big role for improving China's textile quality and efficiency, which also reduced the investment costs for most textile and apparel firms in China, because China now can produce high quality textile machines, so sky price of foreign machinery in China has been down greatly.

CONCLUSIONS AND IMPLICATIONS

Textile industry has made a great contributionfor China's economic growth. Especially in exports,itwas China's third largest export industry, and China has been global leader intextile and apparel exports for 18 consecutive years.But from the trade point of view, vast majority of textile and garment export products are now used in general trade, while high value added trade in textile and apparel sectors are still in lower position. China now is a nation with great quantity productions in every textile branch, which still has a long march to go ahead for being a strong nation of textile and apparel.

Chinese textile and apparel geographic clusters are now mainly located in coast areas, if those kinds of clusters could be moved into more inner lands, that is to say, to further develop Chinese western parts, China's textile and apparel industries will have more space for further development.

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PIGMENT PRINTING OF WOOL AND SOYBEAN FABRICS WITH BLACK CARROT (*Daucus Carota L.*) AND RED CABBAGE (*Brassica oleracea var. capitata f. rubra*)

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ABSTRACT: Natural colorants are not only important for sustainable environment but also known as non-toxic, eco-friendly and renewable. The pigment printing is one of the most commonly coloration methods for some fibres due to its application and costwise advantages. The goal of this study was to gather the advantages of natural dyes and pigment printing together. In this study, soybean and wool fibers are pigment-printed with %10 black carrot (Daucus carota L.) and red cabbage (*Brassica oleracea var. capitata f.*) extracts which are not usually utilized as a common natural textile dyestuff source for textile fibers. Black carrot and red cabbage extracts were applied to the selected fibers via simultaneous mordanting or without mordanting by pigment printing method. The color and fastness properties, such as rub, water and wash fastness of printed samples were examined. The highest color yield value was observed on wool fiber printed with red cabbage in company with the mordant. Both printed samples exhibited excellent wash fastness and good water and dry rub fastness and low to good wet rub fastness properties.

Key words: Black carrot, *Daucus carota L.,* red cabbage, *Brassica oleracea var. capitata f. rubra*, pigment printing, wool, soybean

INTRODUCTION

Natural dyes were discovered by our ancestor's centuries ago and they can be obtained from insects, minerals and various parts of plants (Kumbasar, 2011; Betchold and Mussak, 2009). In natural textile colorization, various recognized plant extracts can be used to colorize textile fibers. Black (purple) carrots (*Daucus Carota L.*), originated from middle and Far East as well as Turkey, are in bluish-purple colors and contain great amount of anthocyanin pigments, (Montilla et al., 2011; Turkyilmaz et al., 2012; Khandare et al., 2011) (see also Figure 1). Red or purple cabbage (*Brassica oleracea var. capitata f. rubra*) containing greatly anthocyanins is a member of Cruciferae family (Yen et al., 2012; Sevgisunar 2013). Anthocyanins are responsible for the blue, red and purple colors on the flowers, fruits and vegetables (Khandare et al., 2011; Lazcano et al., 2001). The main anthocyanins of black carrot and red cabbage display remarkable stability to pH changes and heat treatment (Studies, 2013; Barzak, 2005; Montilla et al., 2011). Black carrot and red cabbage are known as a food and textile colorants (Studies, 2013; Barzak, 2005; Mortensen, 2006; Natural dyes, 2010, Yildirim et al., 2013; Sevgisunar et al., 2013). The chemical structures of red cabbage and black carrot are shown on Figure 1.

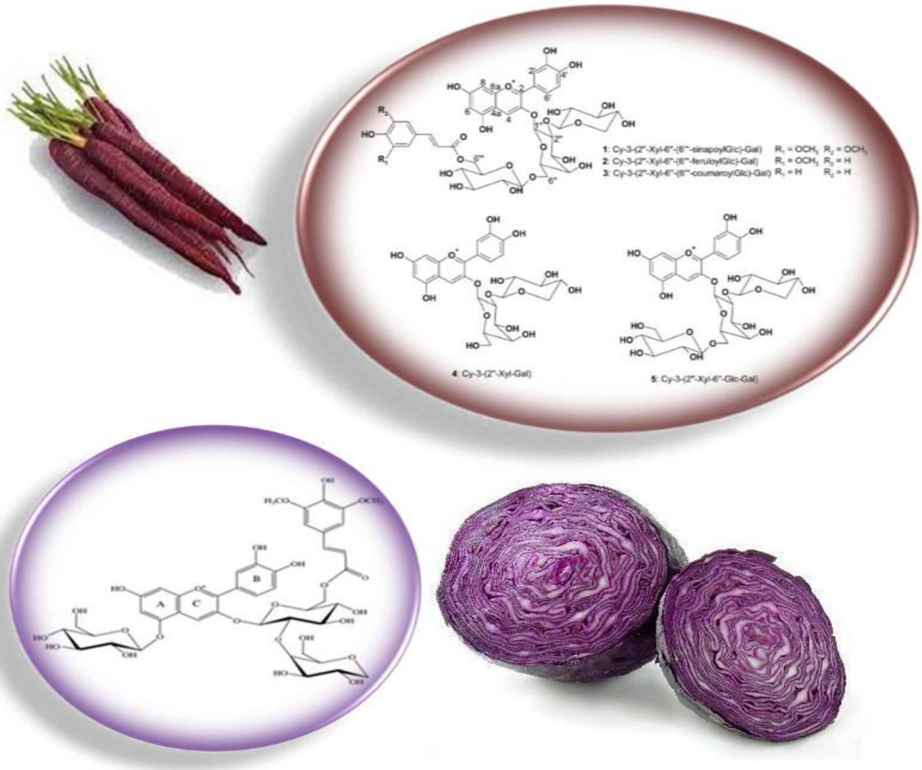


Figure 1: Black Carrots (Daucus carota L.) and its main anthocyanins structures (Cy; cynadin, Xyl; β-D-galactopyranose; Glc; β-D-glucopyranose) (Black carrot image, 2013; Montilla et al., 2011; Schwarz et al., 2004). Red cabbage and its main anthocyanins structures (Cyanidin-3-(sinapoyl)giglucoside-5-glucoside) (Red cabbage image, 2014; Mcdougall et al., 2007)

Mordants are generally required for natural dye fixation for fibers since the natural dyes can exhibit limited substantivity to the textile fibers (Prabhu and Bhute, 2012). To illustrate this, the complex formation of the wool fabric and anthocyanins with alum mordant is given in Figure 2.

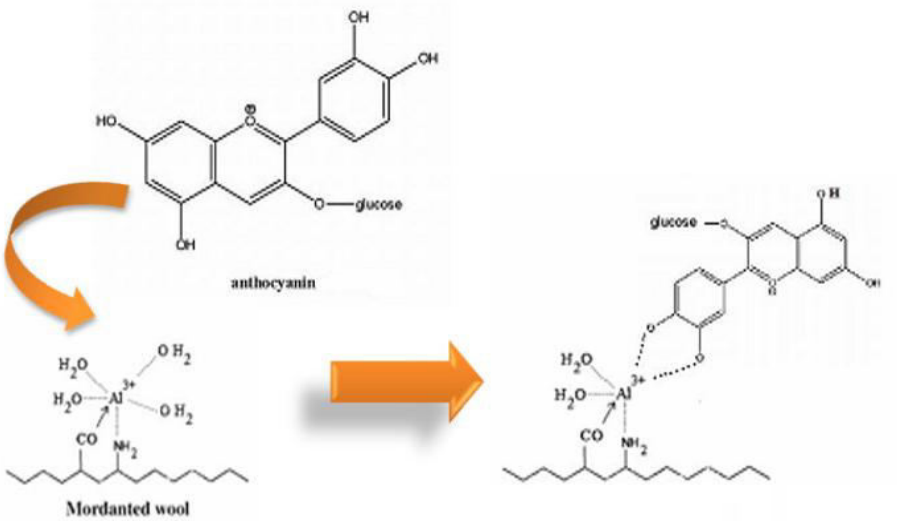


Figure 2: The complex formation structure of anthocyanin, aluminium and wool fibres (Parvinzadeh and Kiumasi, 2008)

Today, pigment printing is one of the most commonly applied technique for some fibers. Pigment printing method has several advantages; one of the most economical printing methods, applicable to all natural and synthetic fibers, provides brilliant print quality, easy application with simple technical process without wet after-treatment process and moreover possible mistakes can be recognized quickly (Pigment printing, 2014). There are some studies concerning the application of some natural dyes via pigment printing; however there are no researches concerning the application of red cabbage and black carrot extracts on any fabrics (Bahtiyari et al., 2013; Rekaby et al., 2009; Nakpathom et al., 2011).

In this study, woven wool fabrics and knitted soybean fabrics were pigment-printed with an eco-friendly and renewable black carrot and red cabbage extracts via simultaneous mordanting. The color and fastness properties of all samples were analyzed and compared.

EXPERIMENTAL

100% wool woven fabrics and 100% soybean fiber knitted fabrics were used in this study. Diluted black carrot concentrate and red cabbage extracts were used as a dyestuff.

Dyestuff Preparation and Pigment Printing process

In the extraction process of red cabbage, the juice of red cabbage wastes was extracted with automatic Arzum fruit reamer. Black carrot concentrate was diluted with water to achieve 10% black carrot extract. Simultaneous mordanting method with potassium dichromate was applied for eco-pigment printing. The Potassium dichromate mordant was added to the pigment printing paste for better color fastness and bonding properties.

The pigment printing of these fabrics was carried out with using diluted black carrot concentrate and red cabbage juice extract. Additionally, Tubivis VP681 was used as a thickener and Tubivis Binder 450 was used as a binding agent. Pigment printing process with red cabbage juice and 10% black carrot extract was carried out using the flat screen printing method in Atac printing machine (RGK-40). The paste recipe is shown in Table 1.

Table 1: Printing paste recipes

Printing paste without mordant		Printing paste with mordant	
Tubivis VP681	4 g	Tubivis VP681	4 g
Tubivis Binder 450.	15 g	Tubivis Binder 450.	15 g
Extract (Red cabbage/ black carrot)	81 g	Potassium dichromate (2%)	2 g
		Extract (Red cabbage/ black carrot)	79 g
	100 g		100 g

Wool and Soy bean fibre fabric samples were printed with a 10 mm doctor blade in diameter with a printing pressure at 4 and a printing speed of 2.2 m/min. The doctor blade was used twice for wool and soybean fabrics during pigment printing. Printed fabrics were dried with using ATAC drying machine (FT 200 model) at 100 °C for 3'. The fixation was applied at 150 °C for 5 minutes with using ATAC drying machine (FT 200 model). After fixation process printed samples were divided into two pieces. First fabric pieces were washed with warm water at 40°C for 5' then washed with cold water for 5' to remove any possible surface unfixed dyes. Finally, washed samples were air-dried. Second pieces of fabrics did not receive any washing. Afterwards, color fastness and color properties of both printed fabrics were evaluated.

Colorimetric and Fastness Measurements

The CIE Lab values (L^*, a^*, b^*, C^*, and h^o) were measured from the reflectance values with using a Data Color Spectra Flash 600 (Datacolor International, Lawrenceville, NJ, USA), spectrophotometer under illuminant D65, using 10º Standard observer for each printed samples. The colour strength value K/S is calculated by using the Kubelka-Munk equation. The equation of *K/S,* Eq. (1) is given at below:

$$K/S = (1-R^2)/2R \qquad (1)$$

Both dry and wet rub fastness testing were performed with the ISO 105: X12 protocol in James Heal Model 670 Hand Driven Crock master. Wash-fastness test was carried out in a M228 Rotawash machine (SDLATLAS, UK) according to ISO 105:C06 A2S test. Color fastness to water testing was performed with ISO 105: E01 protocol. Overall fastness properties were evaluated by using ISO grey scales in the light box.

RESULTS AND DISCUSSION

Color Properties

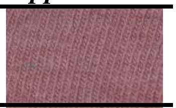
It is important to state that pigment-printed fabric samples (wool and soybean) do not have the same yarn count and the same fabric structure. Therefore; one to one even comparison for color properties of printed wool and soybean fabrics is not appropriate. Owing to this reason, wool and soybean fibre fabrics were compared individually according to their applied natural dye type and with or without mordant usage. The colorimetric data of pigment printed fabric samples are shown on Table 2 and Table 3.

Table 2: Colorimetric properties of pigment printed wool fabrics with using black carrot and red cabbage extracts before and after washing

	Fabric type, dyestuff type, mordant accompany	*L**	*a**	*b**	*C**	*h^o*	*K/S*	*Appearance*
Before Washing	**Wool,** *printed with black carrot extract*, **without mordant**	39,3	12,3	8,3	14,8	33,8	6,3	
	Wool, *printed with black carrot extract*, **with mordant**	41,5	6,7	20,8	21,9	72,1	11,7	
	Wool, *printed with red cabbage extract*, **without mordant**	37,0	13,2	19,0	23,1	55,3	12	
	Wool, *printed with red cabbage extract*, **with mordant**	43,9	5,6	23,5	24,2	76,7	13	
After Washing	**Wool,** *printed with black carrot extract*, **without mordant**	57,3	6,9	11,8	13,7	59,6	2,6	
	Wool, *printed with black carrot extract*, **with mordant**	44,7	7,1	19,4	20,7	70	9,2	
	Wool, *printed with red cabbage extract*, **without mordant**	51,2	10,3	21,4	23,7	64,3	5,3	
	Wool, *printed with red cabbage extract*, **with mordant**	51,3	3	21,7	21,9	82,2	8,9	

Color strength values of wool fabrics are varied from 2.6 to 13 K/S. The highest color yield value was obtained on mordanted wool fabric before any washing. Washing led to color strength decrease which indicated that the unfixed surface dyes were removed during washing. After washing, color strength values of printed wool fabrics without mordant usage were decreased much more than that of printed fabrics with the mordant company.

Table 3: Colorimetric properties of pigment printed soybean fabrics with using black carrot and red cabbage extracts before and after washing

	Fabric type, dyestuff type, mordant accompany	*L**	*a**	*b**	*C**	*h°*	*K/S*	*Appearance*
Before Washing	**Soybean,** *printed with black carrot extract,* **without mordant**	43,5	10,3	1,7	10,5	9,4	3,5	
	Soybean, *printed with black carrot extract,* **with mordant**	48,9	3,5	17,4	17,8	78,6	6,3	
	Soybean, *printed with red cabbage extract,* **without mordant**	58,9	10,8	23,3	25,7	65,0	3,9	
	Soybean, *printed with red cabbage extract,* **with mordant**	54,2	1,8	20,3	20,4	84,8	5,7	
After Washing	**Soybean,** *printed with black carrot extract,* **without mordant**	54,3	5	1,5	5,2	17	1,9	
	Soybean, *printed with black carrot extract,* **with mordant**	52,2	4	16,5	17	76,3	4,8	
	Soybean, *printed with red cabbage extract,* **without mordant**	67,1	7,4	22,6	23,8	71,9	2,3	
	Soybean, *printed with red cabbage extract,* **with mordant**	56,8	0,7	16,4	16,4	87,6	4,2	

Color strength values of printed soybean fabrics are ranged between 1.9 and 6.3. As seen on Table 3, the highest hue angle values (h^o) (*84,8 and 87,6*) were observed on soybean fibers printed with red cabbage in company with mordant whether washed or not. Similar to printed wool fabrics, unwashed printed soybean samples displayed higher color strength values, but not a great extent, than washed samples.

Colorimetric properties of the pigment printed wool and soybean fabric samples were given on Figures 3-5. The colors of printed samples without mordant usage led to different shades of purple, pink and brown. Additionally, mordant usage resulted in brownish shades for both fabrics leading to color properties changes. Lightness (*L**) values of printed soybean fabrics were higher than those of printed wool fabrics whether washed or not.

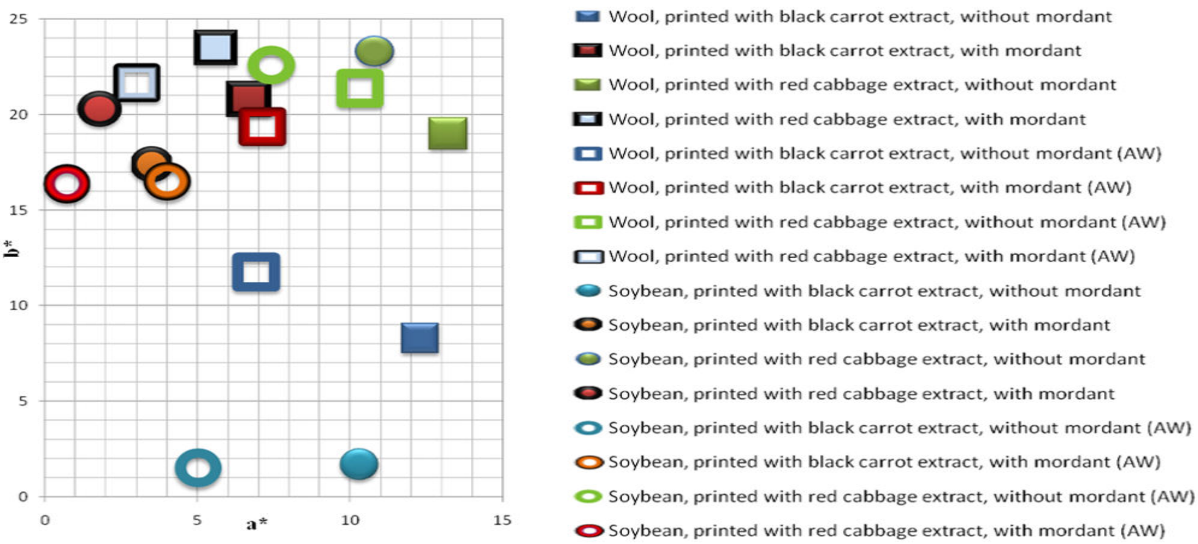


Figure 3: a-b* values of washed and unwashed printed samples* (AW; after washing samples)

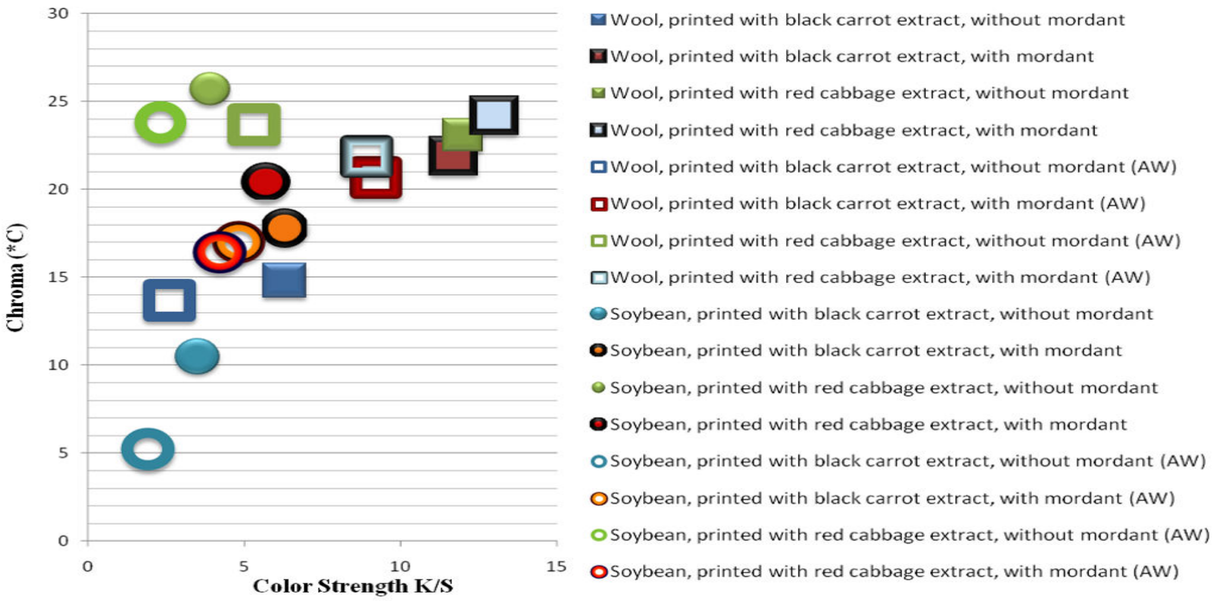


Figure 4: Chroma- color strength diagram of printed samples (AW; after washing samples)

Wool fabrics generally displayed higher chroma, higher color strength values, leading to deeper appearance, than soybean samples with few exceptions. One of these exceptions was observed on Soybean fabric *printed with red cabbage extract*, without any mordant usage which exhibited the highest chroma (*C**) value in this study.

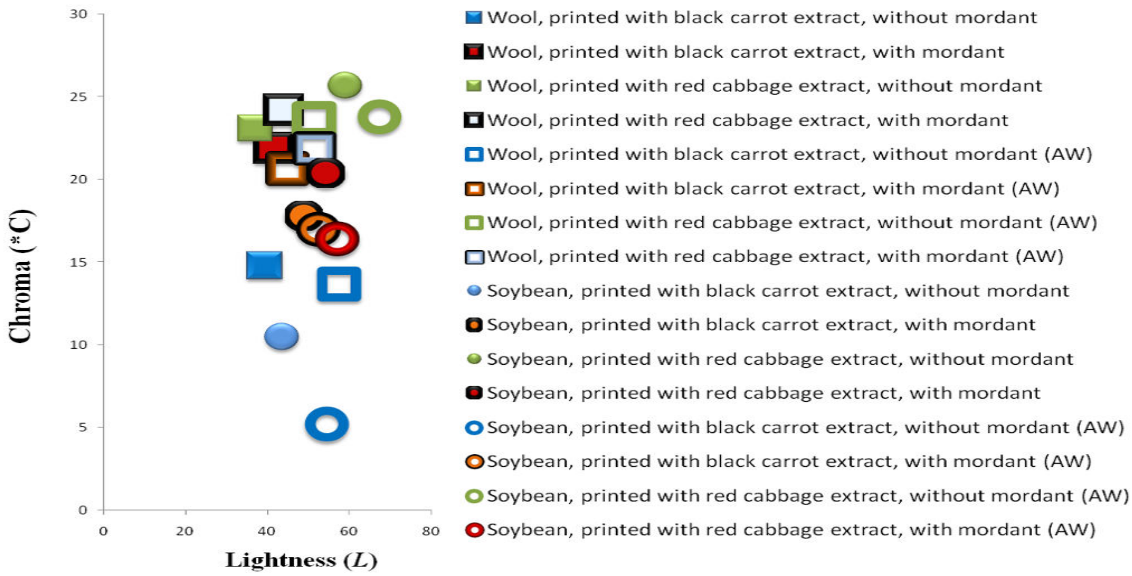


Figure 5: Lightness and chroma values of printed samples (AW; after washing samples)

According to L^* and C^* values (Figure 5), soybean fabric printed with red gabbage, without any mordant accompany, displayed the highest lightness (L^*) value. Moreover, washed - printed soybean fabric using red cabbage without mordant exhibited the highest chroma (C^*) value. That is why the brightest colors were observed on these two aforementioned soybean fabric samples.

Fastness Properties

Rub Fastness Properties

Wet and dry rubbing fastness values were given on Table 4. All printed samples exhibited very high dry rub fastness values and low to good wet rub fastness properties according to 5 grey scale ratings for staining.

Table 4: Wet and dry rubbing fastness values of all printed samples using black carrot and red cabbage extracts with and without mordanting

Fabric type, dyestuff type, mordant accompany		***Rub Fastness (Cotton staining)***	
		Wet	***Dry***
Before Washing	**Wool,** *printed with black carrot extract*, **without mordant**	1-2	4-5
	Wool, *printed with black carrot extract*, **with mordant**	3	4-5
	Wool, *printed with red cabbage extract*, **without mordant**	2	4-5
	Wool, *printed with red cabbage extract*, **with mordant**	3	5
After Washing	**Wool,** *printed with black carrot extract*, **without mordant**	3-4	5
	Wool, *printed with black carrot extract*, **with mordant**	4-5	5
	Wool, *printed with red cabbage extract*, **without mordant**	3	5
	Wool, *printed with red cabbage extract*, **with mordant**	4-5	5
Before Washing	**Soybean,** *printed with black carrot extract*, **without mordant**	3	5
	Soybean, *printed with black carrot extract*, **with mordant**	3-4	5
	Soybean, *printed with red cabbage extract*, **without mordant**	3-4	5
	Soybean, *printed with red cabbage extract*, **with mordant**	4-5	4-5
After Washing	**Soybean,** *printed with black carrot extract*, **without mordant**	4-5	5
	Soybean, *printed with black carrot extract*, **with mordant**	3-4	5
	Soybean, *printed with red cabbage extract*, **without mordant**	4-5	5
	Soybean, *printed with red cabbage extract*, **with mordant**	4-5	5

Dry and wet rubbing fastness values of unwashed wool and soybean fabrics were lower than those of washed samples. This again validates our earlier comment about the surface unfixed dye removal which then can cause lowering effect on fastness properties.

Wash and Water Fastness Properties

Overall, wash fastness values of printed samples were excellent with 5 grey scale rating for staining. The water fastness values of all printed samples were given on Table 5. Generally, all printed samples exhibited good water fastness values with very few individual exceptions.

Table 5: Water fastness properties of all printed samples

	Fabrics	*WO*	*PC*	*PES*	*N6.6*	*CO*	*AC*
Before Washing	**Wool,** *printed with black carrot extract*, **without mordant**	4-5	4-5	4-5	4-5	3-4	4-5
	Wool, *printed with black carrot extract*, **with mordant**	4-5	4-5	4-5	4-5	4-5	4-5
	Wool, *printed with red cabbage extract*, **without mordant**	3-4	3-4	4	4	4	3-4
	Wool, *printed with red cabbage extract*, **with mordant**	4-5	4-5	4-5	4-5	4-5	4-5
After Washing	**Wool,** *printed with black carrot extract*, **without mordant**	4-5	4-5	4-5	4-5	4-5	4-5
	Wool, *printed with black carrot extract*, **with mordant**	4-5	4-5	4-5	4-5	4-5	4-5
	Wool, *printed with red cabbage extract*, **without mordant**	4-5	4-5	4-5	4-5	4-5	4-5
	Wool, *printed with red cabbage extract*, **with mordant**	4-5	4-5	4-5	4-5	4-5	4-5
Before Washing	**Soybean,** *printed with black carrot extract*, **without mordant**	4-5	4-5	4-5	4-5	3-4	4-5
	Soybean, *printed with black carrot extract*, **with mordant**	4-5	4-5	4-5	4-5	4-5	4-5
	Soybean, *printed with red cabbage extract*, **without mordant**	4	4	4	4	4	4
	Soybean, *printed with red cabbage extract*, **with mordant**	4	4	4	4	4	4
After Washing	**Soybean,** *printed with black carrot extract*, **without mordant**	5	5	5	5	4	5
	Soybean, *printed with black carrot extract*, **with mordant**	5	5	5	5	5	5
	Soybean, *printed with red cabbage extract*, **without mordant**	4-5	4-5	4-5	4-5	4	4
	Soybean, *printed with red cabbage extract*, **with mordant**	4-5	4-5	4-5	4-5	4-5	4-5

As seen on the Table 5, after washing, the water fastness properties of printed samples were improved which is in line with the earlier discussed rub fastness properties.

CONCLUSION

Many different extracts from plants and many different techniques can be used for natural textile printing. However, pigment printing with natural dyestuffs and moreover the usage of natural dyes extracted from black carrot and red cabbage are not commonly encountered for textile products. In this study, pigment printing of wool and soybean fabrics with natural dyestuffs (black carrot and red cabbage) with and without mordant usage was studied. The colors of printed wool and soybean fabric samples without mordant were purplish color shades. Moreover, mordant resulted in brownish shades for both fabric types leading to color properties changes. Generally, wool fabrics displayed higher chroma and deeper appearance than their soybean counterparts. Washing led to fastness properties improvement. All wool and soybean printed samples exhibited excellent wash fastness and good water and dry rub fastness and low to good wet rub fastness properties.

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ANALYSIS OF CHINA'S TEXTILE POTENTIAL CROSS-BORDER TRANSITIONS CAUSED BY TPP: A COMPARISON OF CHINA-VIETNAM TEXTILE AND APPAREL

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ABSTRACT: The US-led 12-nation talks "Trans-Pacific Strategic Economic Partnership Agreement" TPP will be the largest free trade area in the world, and due to the "zero tariff" high standards, China' s textile and apparel exports will be affected. By calculating the textile and apparel exports similarity index ESI between China and Vietnam, we found that the textile and apparel competition between the two countries focuses on five major categories of clothing and Vietnam depends too much on the U.S. market. Despite the fierce competition, TPP will not have a devastating impact on the China's textile and apparel exports because of the huge difference in the trade volume, China's fragmentation of target market and diversification of export structure. In contrast TPP will promote China's international industrial transfer and upgrading to a certain extent.

Key words: TPP, textile and apparel, export similarity index(ESI)

INTRODUCTION

China is the world's biggest exporter of T&A[1]. In 2013 the export of China's T&A is more than 284.01 billion U.S. dollars, an increase of 699% compared to $35.548 billion in 1994. During 20 years, the ratio of China's T&A trade volume to world has rose from 12.6% in 1994 to more than 37% in 2013. To be specific, in 2013 China's textile exported $ 106.58 billion, accounting for 38% of the total; Chinese apparel exported $ 177.435 billion, accounting for 62% of the total[2].

EU, U.S., Japan are the top three traditional trading partners of China, China's T&A accounted for approximately 40%,39% and 70% of their market share separately, and emerged a slight decline in recent years. Meanwhile China maintains rapid growth of exports to emerging markets of ASEAN, Russia, Brazil and India, in which the average annual growth rate of the exports to ASEAN maintained at 33.5% from 2009-2013 and ASEAN has become China's third largest T&A l trade partner in 2013. China's T&A trade structure was further optimized in 2013, in which general trade was further increased to 75.63% while processing trade was further reduced to 14.83%, border trade and other trade accounted for 7.51% in total[3]. Private enterprises are still the main force of China's T&A export. The trade volume of private enterprises reached 184.1 billion U.S. dollars in 2013, of which exports $ 177.34 billion, accounting for 62.4% of total exports, for the first time over 60%[4].

By the end of 2013, China has a population of 1.36 billion, of which 770 million is working population[5]. China's T&A directly employed population is over 22 million (2010)[6], accounting for 2.86% of the population employed, nearly 10 times over the textile employment in the EU 28.

LITERATURE REVIEW

Regional economic integration has experienced a booming development since World War II. From a helicopter view, the United States is participating in global affairs by means of military, political and economic policies, the Asia-Pacific region is the powerhouse of its future strategy and TPP is an important tool, which has become the latest academic research hotspot.

[1] T&A in the paper is short for "Textile and Apparel"
[2] Data source: UNcomtrade database
[3] Data source: China Chamber of Commerce For Import and Export of Textiles(CCCT)
[4] Data source: ChinaIRN.com [2014-10-4] http://www.chinairn.com/print/3512569.html
[5] Data source: National Bureau of Statistics of China (NBS)
[6] Data source: China National Textile And Apparel Council (CNTAC)

The US-led, 12-nation talks TPP (short for “Trans-Pacific Strategic Economic Partnership Agreement”) was founded by 4 small developed countries: Singapore, Brunei, New Zealand and Chile in 2006 and stepped into the spotlight after USA announced to join it in 2010, Vietnam joined the TPP negotiations in 2010. If the TPP is fully reached, the GDP of the covered area would increase to 24.91 trillion US dollars, accounting for approximately 40% of the world, which is 1.5 times the size of the EU economy (Fengyang Wang, 2012).TPP would become the world's largest free trade area.

Textile and apparel sector is an important component of TPP negotiations. According to WTO statistics, in 2011 TPP12 countries’ total T&A imports were up $ 61.66 billion and $ 147.48 billion, accounting for 19.8% and 34.2%[7] of the global T&A import share.

China and Vietnam are the world's largest and fourth largest exporters of T&A, the largest export destinations are both the United States (on individual countries). Since most of the T&A are manufactured in the middle of the smiling curve, China and Vietnam are powerful competitors. Due to the TPP “zero tariffs” of all goods among member states, as a major exporter of cotton and textiles, the United States will open a blank Vietnamese textile market. With its low labor cost, Vietnam will get the advantage of raw material costs and the zero tariffs into American market, which will greatly enhance the competitiveness of Vietnam's T&A exports to compete for market share against China.
The signing of free trade agreements will have effect on countries both inside and outside the FTA. According to the customs union theory created by the American economist Jacob •Viner(1950), benefits obtained from the formation of the customs union are summarized as “trade creation”, “trade diversion”, “trade expansion” and other static effects, as well as stimulating competition between member states and obtaining economies of scale and other dynamic effects. J • E • Meade (1955) believed that the biggest difference between customs union and free trade area (FTA) lies in: FTA may has “trade deflection effect”: to meet the explosive growth in demand, FTA member state might export its products to member states while import products from non-member countries to meet its domestic demand, that’s the reason why rule of origin is needed but hard to avoid this phenomenon. And Kindleberger(1966) put forward the "investment creation effect", namely multi-national corporation replace the commodity exports by FDI or through the establishment of branches in the region to avoid the tariff barrier.

At present, many scholars at home and abroad have started quantitative assessment of TPP, most of these studies are from the macro-level, focused on the effect of TPP on the relevant country's overall economic welfare situations or trade balance. Among which, Sheng Lu (2013) was the few who researched the shuffle and flow changes in the global T&A through GTAP model and found TPP trade diversion effect will reduce American apparel imports from NAFTA, CAFTA and China. Meanwhile, TPP will expand textile exports to Asia TPP members (especially Vietnam) from China and East Asian.

Against the fact above and the enhanced attention on Vietnamese garment exports, this paper aims to further research the influence of Vietnam's accession to the TPP on China’s textile and garment exports, by going deep into the industry from the whole to specific categories.

CHINA AND VIETNAM T&A ESI ESTIMATES AND COMPARISON

China’s and Vietnam's T&A exports to the United States

China is the world's largest exporter of T&A, but the export market is relatively fragmented. The United States is China's largest export market, from 2008 to 2013, China's exports of textiles and apparel to the United States accounted for an average 15.1% of its exports to the world market.

[7] Data source: World Trade Organization. Time series on International Trade. WTO website[2013-7-28], http://stat.wto.org/StatisticalProgram/

In 2013 China's T&A exports to U.S. market reached $ 41.564 billion, in which apparel accounted for up to 75%, while textiles accounted for 25%. Compared with 2008, the overall has increased 64.1%, of which apparel export has grown $ 12.422 billion.

Vietnam is the world's fourth largest exporters of T&A and the U.S. market is its largest export market, accounted for 46.8% of its textile and garment exports during 2008 to 2012 on average. (see alsoTable 1), indicating that Vietnam's export markets are over-centralized. In 2012, Vietnam's textile and garment exports to U.S market reached $ 7.939 billion, including apparel exports $ 7.551 billion, up to 95% of its total[8].

Table1. China and Vietnam's T&A exports to U.S. market comparison (by Million Dollar Value)

		2008	2009	2010	2011	2012
China	Textile	6763.7	6409.5	8472.6	9445.5	9821.5
	Apparel	18566.4	19940.9	25207.7	28174.8	29029.1
	Total amount	25330.1	26350.4	33680.3	37620.3	38850.7
	Apparel %	73.3%	75.7%	74.8%	74.9%	74.7%
	U.S. Market%	13.6%	15.8%	16.3%	15.2%	15.2%
Vietnam	Textile	103.6	163.8	259.9	358.0	387.7
	Apparel	5145.1	5022.7	6135.9	6884.4	7551.5
	Total amount	5248.7	5186.4	6395.8	7242.4	7939.1
	Apparel %	98.0%	96.8%	95.9%	95.1%	95.1%
	U.S. Market%	51.0%	49.2%	47.6%	42.8%	43.3%

Data source: UNcomtrade

China's top 5 T&A categories exported to America were 845(25%), 658(16%), 842(16%), 844(10%), 841(8%) in 2013, accounting for over 75% of the total. The women's (842&844), knitted or crocheted sweaters (845), mainly home textiles (658), men's (841) are the main categories, same with its main products in the world. However, America is a strong textile exporter with its raw materials advantages, thus in 2013, 8 categories of textiles exported from China to America were all below 2% except 658.

In 2012, over 90% of the T&A exported from Vietnam to America were concentrated in 5 categories of clothing, which were 845 (32%), 842 (19%), 844 (18%), 841 (14%), 843 (9%), in which women's (842 and 844) accounted for 37%, men's (841 and 843) accounted for 23%(see also Table 2).

In summary, Vietnam's T&A export is basically composed of 5 apparel categories and Vietnam has excessive dependence on the U.S. market.

ESI (export similarity index) calculation and data source

Since the U.S. market is the largest T&A export market of both China and Vietnam, and the most representative market within the TPP frame, taking U.S. as a representative target market to study the competition between China and Vietnam's T&A industry, is convincible. Apart from the data above, to find out the intensity of competition in this industry, we need to calculate a precise scientific research indicator: ESI. The advantage of Finger-Kreinin ESI (export similarity index) lies in: the degree of competition between the two countries on a third market becomes increasingly fierce if the index rose over time. Moreover, if this convergence occurs between developed and developing countries, then the index could rise to reflect the rapid economic growth in developing countries.

$$\mathrm{ESI}(\mathrm{ij},\mathrm{k}) = \left\{\sum \mathrm{Minimum}\left[\frac{X_{ik}^{1}}{X_{ik}},\ \frac{X_{jk}^{1}}{X_{jk}}\right]\right\} \times 100 \qquad (1)$$

[8] Due to the Vietnam data in UNcomtrade database is only updated to 2012, thus all the comparison between China and Vietnam in this paper is up to 2012

Where

—$\mathrm{ESI}(ij,k)$ denotes the ESI for T&A products from country i and country j to market k. In this study, country i and country j, respectively, stand for China and Vietnam.

—X stands for export. X_{ik}^{1} stands for the dollar value of the No.1 category T&A exports of China to the U.S.; X_{ik} stands for the dollar value of the T&A exports of China to the U.S. in product groupings.

—$\frac{X_{ik}^{1}}{X_{ik}}$ and $\frac{X_{jk}^{1}}{X_{jk}}$ stand for the proportion of the No.1 category of China and Vietnam, respectively.

The value of $\mathrm{ESI}(ij,k)$ ranges is from 0 to 100. The larger the value of ESI, the more similar is the product structure and the more fierce competition is between the countries. If the T&A exports of China and Vietnam to the United States are in identical product categories, then $\mathrm{ESI}(ij,k)=100$, but if the product categories of such exports of these countries do not overlap at all, then $\mathrm{ESI}(ij,k)=0$.

Data used to calculate ESI values are from the UNcomtrade database in SITC Rev.4. The data provide dollar values of China and Vietnam T&A exports annually to U.S. market in each T&A product group analyzed in this study (i.e., total T&A, 6th sector 65 categories "Textile yarn, fabrics, made-up articles, n.e.s., and related products", and 8th sector 84 categories "Articles of apparel and clothing accessories" as well as further subdivided categories).

RESULTS AND ANALYSIS

The results show that at the aggregate level, China and Vietnam's T&A ESI index has increased gradually from 63.91 in 2008 to 69.17 in 2012, while textile ESI index has decreased to 63.29 in 2012 from 79.08 in 2008 and reached the bottom of 54.28 during 2010-2011. China and Vietnam's apparel ESI index has rose to 84.13 in 2012 and has been stable at an average of 84.57 for 5 years.

China and Vietnam's T&A ESI index in the overall never less than 50, nearly 70(see also Table 2), showing a competitive nature. Textile ESI index all the way down, indicating that textile development of two countries are moving towards different directions. And apparel ESI index stay in a high level of over 84, showing the two products in the U.S. market are highly competitive.

Table2. China and Vietnam's T&A ESI index (overall)

	2008	2009	2010	2011	2012	Changes in the magnitude of 5 years
Textile	79.08	64.73	54.05	54.51	63.29	-20.0%
Apparel	83.81	84.42	85.04	85.43	84.13	0.4%
T&A	63.91	68.78	69.24	69.42	69.17	8.2%

Data source: UNcomtrade

In further comparison, statistics found that between 2008 and 2012, drastic fluctuations exist in ESI index of 9 categories in textile industry (651-659) Compared with 2008, 655 significantly rose 116.6% to 91.81 in 2012 while 657 significantly decreased 77.7% to 11.01, ranking the top and bottom respectively in the ESI index of 9 textile categories, indicating that 655 and 657 were the most competitive and the most complementary textiles in the U.S. market (see also Table 3).

Table3. China and Vietnam's T&A ESI index (specific categories)

	2008	2009	2010	2011	2012	Changes in the magnitude of 5 years
651	30.00	36.04	19.85	31.93	35.33	17.8%
652	48.07	54.68	51.62	19.49	52.52	9.2%
653	26.08	48.82	43.76	44.75	51.48	97.4%
654	44.35	52.80	46.56	37.09	36.15	-18.5%
655	42.38	74.53	82.94	88.69	91.81	116.6%
656	80.53	55.38	55.09	43.19	43.60	-45.9%
657	49.39	18.01	10.99	8.61	11.01	-77.7%
658	62.71	62.08	65.97	55.70	47.59	-24.1%
659	23.03	41.35	50.10	31.82	20.05	-12.9%
841	78.10	83.24	85.28	84.22	87.23	11.7%
842	80.07	84.23	89.40	89.38	87.95	9.8%
843	63.07	74.86	78.17	73.85	71.67	13.6%
844	80.48	82.83	83.92	85.01	86.07	6.9%
845	63.73	68.87	70.39	74.96	73.82	15.8%
846	72.21	70.56	63.11	60.96	57.84	-19.9%
848	41.41	47.40	52.71	53.73	51.48	24.3%

Data source: UNcomtrade

In the apparel industry, ESI index of 7 categories of products 841-848 fluctuate gently, but are in the high level of 50-90. During the 5 years, ESI index 6 categories are raising except 846.

It's a zero-sum game between China and Vietnam' T&A in the U.S. market. If the demand of U.S. market will not experienced an explosive growth in the short term, with such a high competitive relationship from a purely ESI index level, Vietnam will have a giant impact on China once the TPP agreement comes into force. However, if we focus on trade volume, during the 5 years, Vietnam's T&A exports in the world market, even less than 10% of China's, even apparel accounted for only 9.0% in 2012 (see also Figure 1).

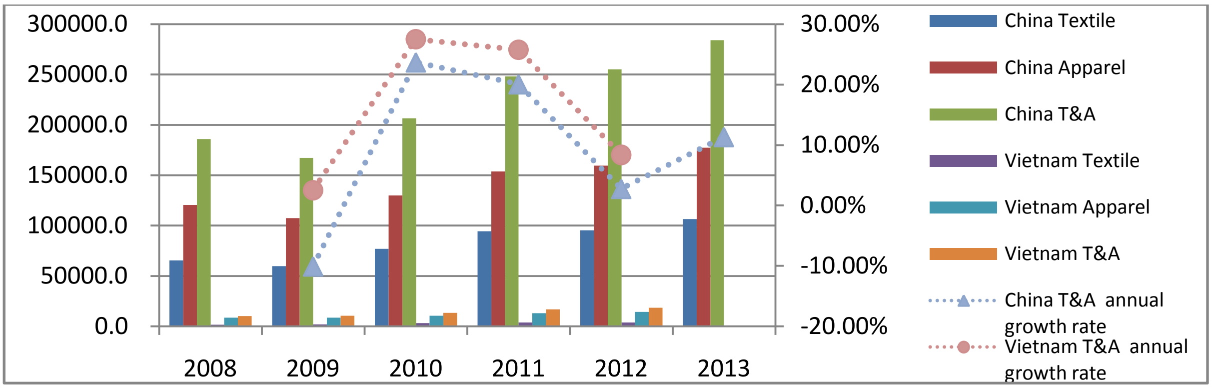

Figure1. Trade volume and growth rate of China and Vietnam's T&A exports to the world (by $MM)

Data source: UNcomtrade

If we focus on the U.S. market, the situation is relatively optimistic. Because of Vietnam's structure of export market and commodities are rather simple, more than 50% exports focus on U.S. market and 95% of its products focus on apparel, while only 15% of China's T&A exports focus on U.S. market, thus in U.S. market, Vietnam's apparel accounted for an average 25.5% of China's apparel in the last 5 years. Nevertheless, in the comparison of the absolute amount, in 2012 the apparel exported from

Vietnam were $ 21.478 billion less than China's, the gap is even more than the total trade volume that Vietnam exported to the world that year (see also Figure 3).

Therefore, we can see that the defect in this index. It can measure the similarity of the products that 2 countries competing in the same market, which shows the competition and complementary trend, but doesn't take into account the difference of the absolute amount, thus it's difficult to measure the degree of real threat caused by the competition and complementarities when an agreement comes into force.

CONCLUSIONS AND DISCUSSION

By calculating the T&A exports similarity index ESI between China and Vietnam, both whole department and specific categories, Major findings are discussed below.

First, on the whole, research found that the exports of China and Vietnam's T&A are remarkably similar, with ESI index close to 70, of which textile exports between the two countries are developing towards different directions, with ESI index all the way down, while apparel products are highly competitive, with ESI index above 84 on average in the last five years.

Second, deep into specific categories, study found that the T&A competition between these two countries focused on women's (842 and 844), men's (841 and 843), knitted or crocheted sweaters (845) five major categories of apparel[9], in which the competition of non-knitted or crocheted women's and men's (842 and 841) was the most intense and 845 maintained a strong momentum of growth in the past five years. However, despite the ESI index of the most competitive five categories were on average up to 81.35, there is a huge difference in the absolute amount.

Third, in U.S. market, Vietnam's apparel exports accounted for only 25.5% of China's apparel exports, with $ 21.478 billion less than China's absolute amount, the difference is even more than the total T&A trade volume that Vietnam exported to the world. In addition, China's target markets are relatively fragmental and export structure is diversified, with only 15% of its T&A exports focus on U.S. market and 75% of its products focus on the top 5 categories, while more than 50% of Vietnam's T&A exports focus on U.S. market and over 90% of its products focus on the top 5 categories, showing Vietnam's excessive dependence on U.S. market, which explains why Vietnam wish to join the TPP actively.

Therefore, based on the research results above, we discuss the impact of TPP as follows:
First, the implementation of TPP will bring on trade diversion effect

China's apparel exports market share of the United States will be transferred to Vietnam.
If TPP comes into effect, American apparel tariffs will be cut to zero, the most competitive five apparel categories will be most affected. Based on the trade diversion effect, part of China's apparel market share in the U.S. market will be taken away by Vietnam.

China's textile exports market share of Vietnam will be transferred to the United States.
In 2013 American textile exports $ 14.004 billion, which accounted for only 14.8% of China's textile exports, but the ESI index of these two countries were up to 84.35, of which 657 "Special yarns, special textile fabrics " accounted for 33%, 651 "Textile yarn" accounted for 24%.

Calculated results show that the textile exported to Vietnam from America accounted for only 0.23% of its total textile exports during 2009-2013, this market is almost blank due to the price, tariffs, transportation costs and other reasons. TPP would greatly open American textile exports market in Vietnam, on one hand helping Vietnam to cut down the cost of textile to compete with China, on the

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[9] 655 is removed because of its difference of absolute amount reaches 77.7 times although it ranks the top of ESI

other hand will be conducive to the development of American textile industry. Based on trade diversion effect, the share of Chinese textile exports to Vietnam will be transferred to the United States.

Second, TPP will not have a fatal impact on China in the short term

China's T&A export market share will be chased by the United States and Vietnam respectively if China cannot join TPP in the short term. However, TPP won't have a fatal impact on China based on 2 reasons:

First, despite the intense competition between China and Vietnam in apparel and China and America in textile, the huge differences in the trade volume limited the impact.Second, China's T&A exports market is relatively fragmented and export structure is diversified, thus spread the risk to some extent.

Third, TPP will promote China's industrial transfer and industrial upgrading in the long term

First, Vietnam's textile and garment industry will flourish due to the trade creation effect of TPP. To comply with and take advantage of a strict "yarn forward" rule of origin in TPP, China's T&A enterprises will be encouraged to build joint-venture plants in Vietnam or invest in Vietnam's enterprises, which is a potential trade diversion.

Second, due to the rapid expansion of demand for capacity and technology, Vietnam will expand imports of China's T&A machinery and technology, which will further promote the development of China's T&A's industrial restructuring and upgrading. This is consistent with the basic rules of international industrial transfer and industrial upgrading and is a favorable factor TPP brought to China.

In summary, Vietnam's getting more attention and competing with China in many fields is because it has developed into a major country that carrying on the international industrial transfer of low-end industries. Although the situation is tense, but will not change the fact that more and more low-end industrial chain will be undertaken by Vietnam in the long run, while the United States will not leave its key commercial and strategic site of the future and Asia-Pacific regional economic integration has become a trend. China's rising labor costs and competition from Vietnam has promoted China's industrial transfer and industrial upgrading.

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ORGANIZATION SETTINGS, KNOWLEDGE MANAGEMENT AND MAPICC 3D PROJECT

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ABSTRACT: The paper investigates organizing ideas and factors affecting the level of success of knowledge management with special reference to the European project FP7 MAPICC 3D. Five key factors affecting knowledge management are pointed out. The special field of knowledge management is monitored in such a way that business is continuously reviewed. Holders or managers of knowledge management from member countries of the project MAPICC 3D are strategic leaders who combine teams and in practice they follow the defined knowledge management infrastructure. A potentially developed computer system called "garment cutting plan" that makes the demanding process of knowledge management easier and faster and keeps business more profitable is presented at the end of the paper.

Key words: knowledge management, FP7 MAPICC 3D project, organizational culture, knowledge management measurement

ORGANIZING IDEAS AND KNOWLEDGE MANAGEMENT

Knowledge and expertise in contemporary business conditions occupies a key position as an extremely important resource that can provide competitive advantage to an institution or business entities. Furthermore, organization and knowledge management have become one of the basic techniques of modern management that ensure the optimal use of this resource to institutions and enterprises.
In the modern world knowledge is considered to be a key strategic resource and it is the topic of discussion both in science and within the European projects that often combine experts from science and industry, creating new products (on the principle of FP7-MAPICC 3D project), but also within business entities. Knowledge management can be defined as a series of interconnected activities, organizations and management focused on the strategy and tactics of human capital or the development of knowledge, skills and competencies of employees in general, through education and training, gain work and professional experience, etc. (Chakravarthy B., McEvily S., Doz Y., Rau D. 2005., Ponzi, L. J.: Knowledge Management: Birth of a Discipline 2004).

Area of Knowledge Management (KM) began to be systematically developed after the publication of the book The Knowledge - Creating Company (the company that creates knowledge) written by Nonaka and Takenchi 1991, based on their years of researching practices of Japanese companies (Chakravarthy B., McEvily S., Doz Y., Rau D. 2005., Vidović M. 2008.). The complete definition of knowledge management includes the component of knowledge and real owners of knowledge - scientists, experts (human resources), as well as all the factors that affect the ability of the institution. The company or project uses different knowledge to achieve success in business, the development of new products, including organizational structure, upgrading system, leadership towards the adoption and application of knowledge, and especially information technology which aims to connect professionals and at the same time to facilitate the implementation of knowledge.

The concept of the European FP7 MAPICC 3D project unites experts from different fields of knowledge, scientific committees and leaders from several countries in order to create new products, especially in the automotive sector. Knowledge is presented in joint meetings as well as through publishing scientific and technical papers available in the conference proceedings, monographs (Monograph of the Faculty of Textile Technology, AUTEX Conference 2012, Zadar, Croatia) (http://www.autex2012.hr)
.
Many authors believe and in their studies point out that the key factors affecting knowledge management are:

- Infrastructure of scientific and professional knowledge management

- Knowledge management holders
- Organizing ideas and information technology
- Measuring the benefits of knowledge management

The infrastructure of knowledge management can be seen as the first step in the implementation of knowledge management. It involves setting up appropriate mechanisms that are focused on the transfer of knowledge and best practices within an institution, compound technological projects, companies, or the way of using technology and defining work processes. In particular, within the European project FP7 MAPICC 3D it involves the precise tasks of the project members from individual countries, but also mutually shared scientific and infrastructural knowledge management.
Furthermore, within the project FP7 MAPICC 3D infrastructural knowledge management includes an adequate organization and scientific structure, and defining the role of scientists and technical staff to ensure flawless conditions for the transfer of knowledge.

Holders or managers of knowledge management among the member countries within the project FP7 MAPICC 3D practically build on the defined knowledge management infrastructure. The factor that makes the whole process of knowledge management easier and faster is information technology. The information system for knowledge management applies to the system that is based on computers and is used to facilitate certain activities of knowledge management, such as the activities of collecting, structuring, storing and distribution of knowledge.

The field of knowledge management measurement is an important factor in the success of knowledge management and the trend that is being more and more scientifically researched and defined. The importance of measuring benefits is reflected in the continuous review and validation of the role that knowledge management plays in an institution or a compound technological project (FP7 project MAPICC 3D) or an organization and the justification of the funds invested in this business philosophy.
Holders of knowledge management are factors that, in practice, build on the defined knowledge management infrastructure. In its domain FP7 MAPICC 3D is a large-scale integrating four-year collaborative project with a number of member countries, divided into teams, headed by national managers, scientists and professional staff.

The project FP7 MAPICC 3D is focused on the development of industrial process for the on line automated production of up graded composites based on 3D textile structures manufacturing, with innovative textile and composites technologies based on thermoplastic materials. The development of industrial equipment is performed by teams of project members and is practically carried out by means of innovative modeling. The project FP7 MAPICC 3D is focused on new high performance flexible materials technologies able to produce light weight high performance composites with significant improvement of mechanical properties and impact behavior with functions integration. The field of knowledge application includes manufacturing composite panels and stiffeners for transportation systems (automotive and railways applications), building and energy applications. The Scientific Council and the Consortium continuously study the relationship between yarns, processing conditions, microstructures of the 3D performs and final properties of composite parts.

MAPICC 3D coordinator is ENSAIT, Roubaix (France), project partners come from different countries, including the Faculty of Textile Technology of the University of Zagreb.

Infrastructural knowledge management involves setting up adequate mechanisms which in this case are focused on the collection and transfer of knowledge to all members of the project, the use of technology, the definition of success. At the end of this section we can say that knowledge management is a relatively young discipline, and in a successful company it takes a special place.

INFORMATION TECHNOLOGIES AND KNOWLEDGE MANAGEMENT

Although information technologies for the purpose of knowledge management in many institutions and companies are a significant factor, it should said that it has not been fully developed. In fact, many of these organizations are using classic software for the management and implementation of knowledge, in other words, only a small number of entities have invested additional resources to develop their own innovative software. For this reason the computer program based on knowledge will be briefly described; it is also used for compound technological projects such as FP7 MAPICC 3D, with upgrading knowledge in certain segments of the information adjustment program. Today, modern CAD / CAM systems can offer a comprehensive scientific and technical assistance based on original knowledge that contributes to saving and financial operations in the textile and clothing production. Such computer information technologies become a decisive factor in the success and development of a company. The procedure of garment cutting includes finding out the best combination of placing a set of sewing patterns over the cloth to be cut.

Knowledge management in the original example makes a significant contribution to the development of an application program. Using the method of automatic planning with computer optimization of material consumption, it is possible to achieve extremely high material utilization. In this part of the project from concept to implementation scientists and production experts must integrate their knowledge - from forming ideas, development, computer programs, computer programmers, testing and implementation. The point is that this program can function effectively in the production of textiles and clothing, in the construction preparation commonly referred to as cutting plan.

The idea for this scientific computer program is based on the concept that the cutting plan is finalized on the basis of collecting the necessary data, such as the data on the groups of garment sizes, data on the raw material warehouse and data on materials, the storage of raw data on the card material, followed by data on material consumption, work order and finally on the development of garment sizes. Computer support for this procedure allows direct access to information on the stocks which significantly speeds up and simplifies the process. By selecting the required material an overview of materials in bundles is obtained. By selecting a cutting pattern from the cutting plan the program automatically calculates how many cutting layers can be cut from a specific bundle and shows material consumption (http://www.dkm.hr, Ujević D., Rogale D., Hrastinski M.2010.)

After selecting the amount of material, the program will automatically deduct the required amount from the current bundle length and shows the new state. If there is dissatisfaction with part of material management, it is possible to cancel the data about the undesired selection. The procedure is repeated until the satisfactory result has been achieved. The subtraction from the amount determined for a cutting pattern is automatically renewed which gives us insight into the number of pieces to be arranged in a cutting pattern. The program is scientifically and technically acceptable to other process industries based on knowledge.

CONCLUSION

Today, knowledge management as a relatively new scientific discipline takes an important position in successful institutions and organizations in the world. Important principles of knowledge management have been incorporated into their business processes, establishing the basis of their success. The strategic action of the integration collaborative project FP7 MAPICC 3D is precisely in this direction directed by the project coordinator through partner institutions with the innovative goal of knowledge collection, knowledge management and knowledge implementation. In the final analysis, it should be noted that knowledge management has become a practice in the business policy of institutions and various businesses.

At the beginning of the 21st century knowledge is considered a strategically valuable resource, and effective knowledge management is an activity that contributes significantly to the success and reconcilability of the collective as a whole.

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THE IMPACT OF THE INTERLACEMENT AND DENSITY OF WEFT WIRES ON THE BREACKING FORCES OF WOVEN FABRICS

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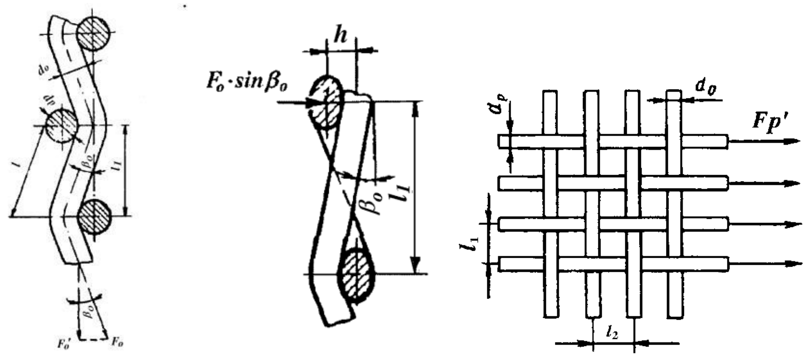
ABSTRACT: Fabric tensile properties are dependent on their structural and constructional solutions. The stability of the fabric structure at the effect of different forces depends on their mechanical properties, which are determined by the characteristics of the structural elements of lower rank (warp and weft yarns, fibers) involved in their construction, and the parameters of the structure and construction of the very fabric (applied interlacement, density of the warp and weft wires, woof et seq.)

INTRODUCTION

The fabrics are produced for different purposes, and therefore require appropriate properties that are tailored for their application in future.

Each type of fabric has a certain specificity that determines, or conditions, its characteristic properties, such as length, width, density, surface mass, thickness, breaking force, elasticity, thermal characteristics, color, touch, appearance, etc..[1, 2, 3, 4, 7].

Studying the breaking force of fabric starts from the geometric patterns of its connective structure (Figure 1), which takes into account the uneven tension of wires when stretching the fabric [4].



а)б) *c)*

Fig. 1. Scheme of force application [2] on the warp and weft wires while stretching the fabric

a) and b) –in the direction of the warp, c) in the direction of the weft wires

While straining the fabric, the fabric stretches then breaks. Stretching the fabrics can be seen as a process, which disrupts the internal balance of the fabric elements, resulting in a shift of the system to a new equilibrium state. Then, in the direction of the stretching force, initially straightening system of wire formed, causing changes in the position of contact points between the warp and weft wires and thus changing the structure of the fabric.

MATERIALS AND METHODS

The experimental material comprises of two hundred and one fabric, various in structural and constructive solutions. Fabrics are created on modern looms, and the optimal tension of the warp and weft wire is applied in the weaving process. Fabric samples differ in density wire, the longitudinal mass of warp and weft, weave and fiber composition of the applied yarn (Table 1).

Table 1.Characteristics of the studied raw fabric

Fabric	Raw fabric width [cm]	Longitudial yarn weaight[tex]		Yarn ingrediients(%)		Stated density- cm^{-1}		Weave (interlcement)
		warp	weft	warp	weft	warp	weft	
1, 4,6, 8,10	147	30x2	50	ПАМ. 100%	ПАМ. 100%	19,5	15,17,19,20,22	Canvas
2,3,5, 7,9	147	30x2	30x2	ПАМ. 100%	ПАМ. 100%	19,5	15,17,19,20,22	
11,13,15,17,19	148	16.7x2	50	ПАМ. 100%	ПАМ. 100%	22,5	15,17,19,20,22	
12,14,16,18,20	148	16.7x2	30x2	ПАМ. 100%	ПАМ. 100%	22,5	15,17,19,20,22	
21÷24	159	16,67x2	16,67x2	ПАМ/ PES; 67/33	ПАМ; 100%	27	20÷26	
25 ÷ 28	159	16,7x2	33,33	ПАМ/ПЕС 67/33	ПАМ. 100%	27	20 ÷ 26	
29÷34	159	20x2	16,67x2	ПАМ / PES; 33/67	ПАМ / PES; 67/33	32,3	14÷24	
35÷40	159	20x2	20x2	ПАМ /ПЕС; 33/67	ПАМ / ПЕС; 33/67	32,3	12÷22	
41 ÷48	159	20x2	20x2	ПАМ/ПЕС 50/50	ПАМ/ПЕС 50/50	32,5	12÷26	Twill 2/1 Z
49÷54	159	20x2	15,6x2	ПАМ/ПЕС 50/50	ПАМ/ПЕС 50/50	32,5	18÷28	
55÷ 60	159	20x2	25x2	ПАМ/ПЕС 50/50	ПАМ/ПЕС 50/50	32,5	14÷24	
61÷68	159	20x2	29,4	ПАМ/ПЕС 50/50	ПАМ/ПЕС 50/50	32,5	14÷ 26	
69÷78	159	16,7x2	16,7x2	ПАМ/ПЕС 67/33	ПАМ 100	27	20 ÷ 38	Twill2/2 Z
79÷86	159	16,7x2	33,33	ПАМ/ПЕС 67/33	ПАМ 100	27	20 ÷ 34	
87÷94	159	16,7x2	16,7x2	ПАМ/ПЕС 67/33	ПАМ/ПЕС 67/33 ч.	27	20 ÷ 34	
95÷100	159	20x2	20x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	32,3	16 ÷ 26	
101÷109	159	16,7x2	16,7x2	ПАМ/ПЕС 67/33	ПАМ 100	27	20 ÷ 36	Twill 3/1
110÷115	159	16,7x2	20x2	ПАМ/ПЕС 67/33	ПАМ/ПЕС 67/33	27	18 ÷ 28	
116÷125	159	16,7x2	16,7x2	ПАМ/ПЕС 67/33	ПАМ/ПЕС 67/33 ч.	27	18 ÷ 36	
126÷134	159	20x2	20x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	32,3	14 ÷ 30	
135÷143	168	16,7x2	25x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	12÷28	Twill4/1
144÷147	168	16,7x2	10x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	18, 30, 34÷36	
148÷156	168	16,7x2	20x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	14,16, 20÷32	
157÷168	168	16,7x2	29,4	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	14÷36	
169÷177	168	16,7x2	14,29x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	18, 22÷36	Atlas (Satin) 4/1 (3)
178÷184	168	16,7x2	20x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	16÷22 28÷32	
185÷192	168	16,7x2	25x2	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	16÷30	
193÷201	168	16,7x2	29,4	ПАМ/ПЕС 33/67	ПАМ/ПЕС 33/67	40	14,16, 22÷34	

With the application of standardized methods, necessary investigation of applied yarn, warp density and weft wires in the fabric were carried out. The breaking force and breaking elongation of fabrics were measured by the dynamometer ZWIK (method of strips- ИСО 13934-1:1999),

RESULTS AND DISCUSSION

To objectively observe the influence of changes in the density of the end strength of the samples, all other structural and structural parameters must be identical (raw material composition, longitudinal mass of warp and weft, weave). Therefore, for the analysis only some samples were taken and grouped according to the above criteria. Based on the study, results have been formed in histograms, which show the influence of density of weft wires on fabric tensile forces in both directions observed in linen fabric interlacing (сл.2, 3 и 4).

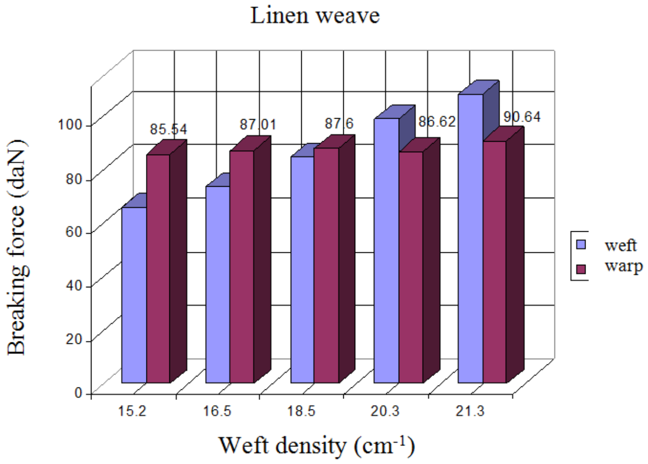


Fig. 2. The influence of the change of weft density on the breaking force of the fabric 2,3,5,7,9

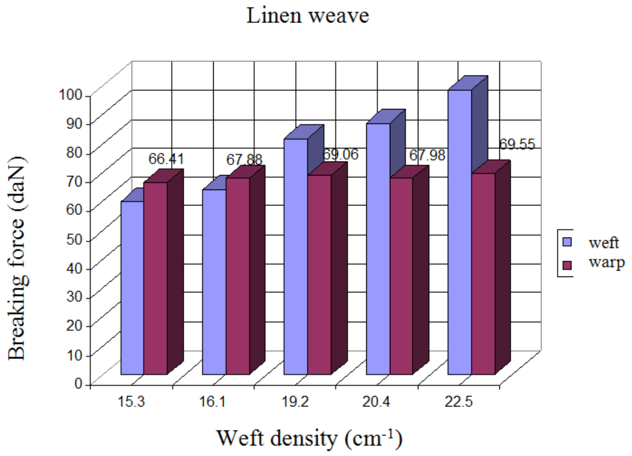


Fig. 3. The influence of the change of weft density on the breaking force of the fabric 11,13,15, 17,19

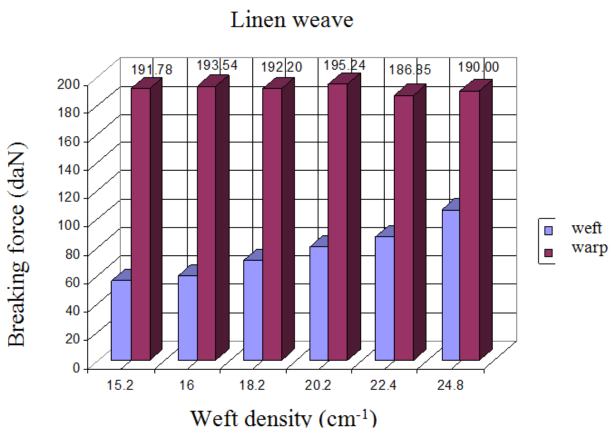


Fig. 4. The influence of the change of weft density on the breaking force of the fabric29÷34

As the histograms clearly show- with increasing density of weft wire the breaking force of fabric in the weft direction increases, as expected.

The breaking strength of the fabric in the weft direction in a given interval of increasing density of weft wire slightly increases (the biggest increase among border density values of 6% with fabric 2,3,5,7,9), except for the fabric 29 ÷ 34 where, observing the end point of the interval density, shows a slight decrease of the measured values of breaking force.

This is due to the fact that within a group, among all fabrics warp wires occupy compulsive positions and have a relative density of warp wires higher than a unit basis [5,6,8].

THE INFLUENCE OF THE DENSITY CHANGE ON THE BREAKING FORCE OF THE TWILL AND ATLAS (STAIN) FABRIC

As with fabric with applied canvas weaves here are fabrics grouped by the same composition and the same longitudinal yarn weight in both structural directions. At that selected groups we examined the effect of changes in the density of the weft of the fabric breaking force in the direction of the warp and weft, and these changes are shown histograms (Figure 5 ÷ 11).

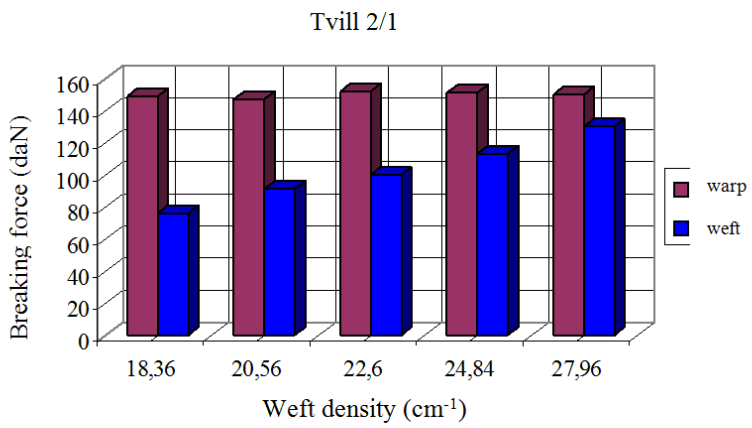


Fig. 5: The influence of the change in density of weft breaking point in fabric 44 ÷ 48

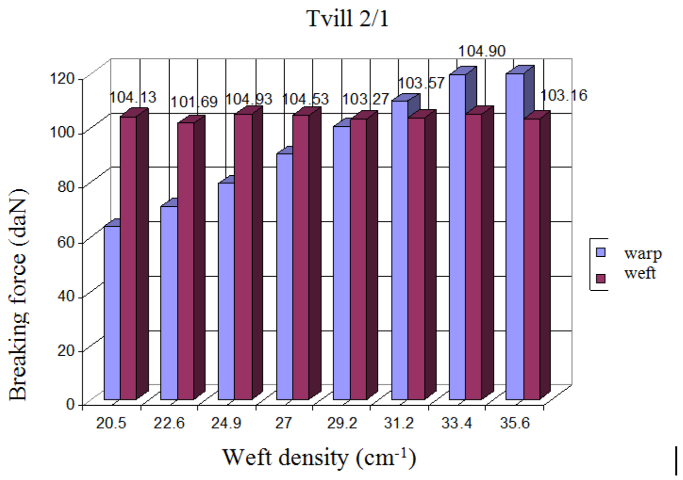


Fig. 6: The influence of the change in density of weft breaking point in fabric 87÷94

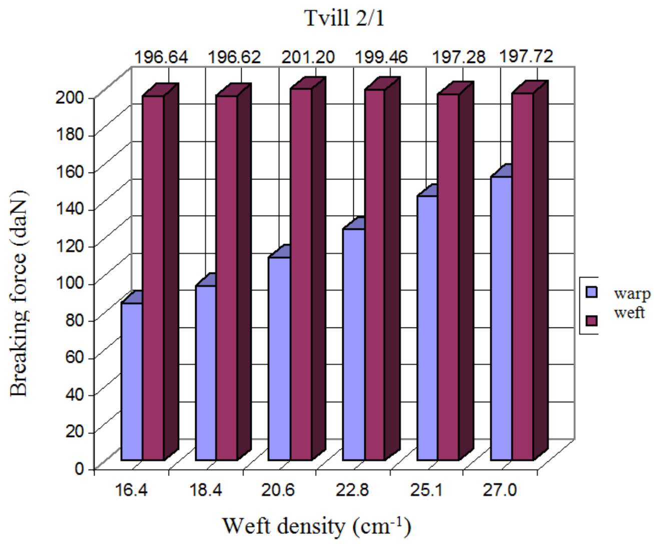


Fig. 7: The influence of the change in density of weft breaking point in fabric 95÷100

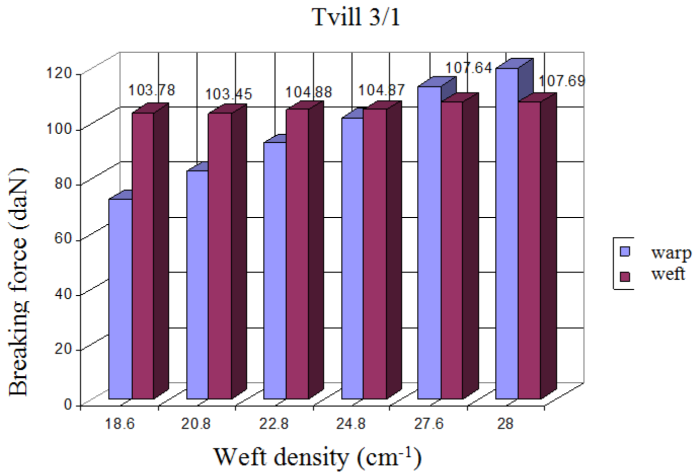


Fig. 8: The influence of the change in density of weft breaking point in fabric 110÷115

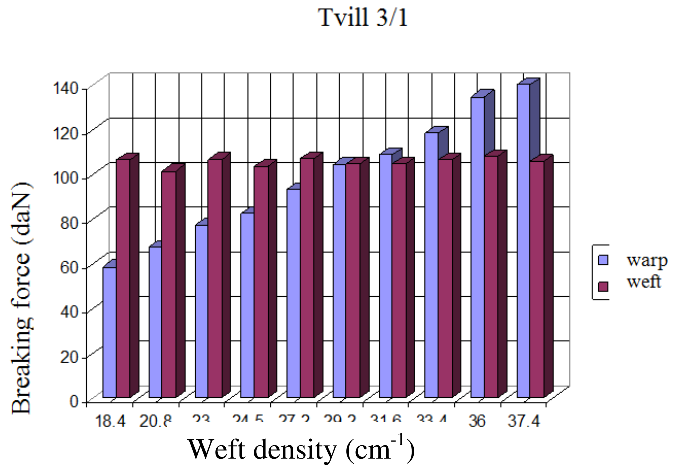


Fig. 9: The influence of the change in density of weft breaking point in fabric 116÷125

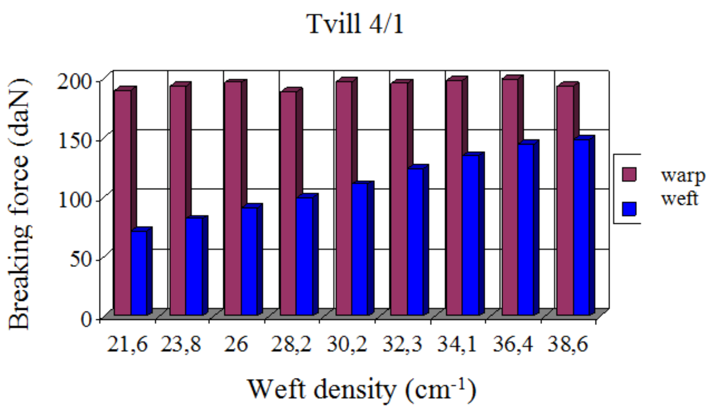


Fig. 10: The influence of the change in density of weft breaking point in fabric 160÷168

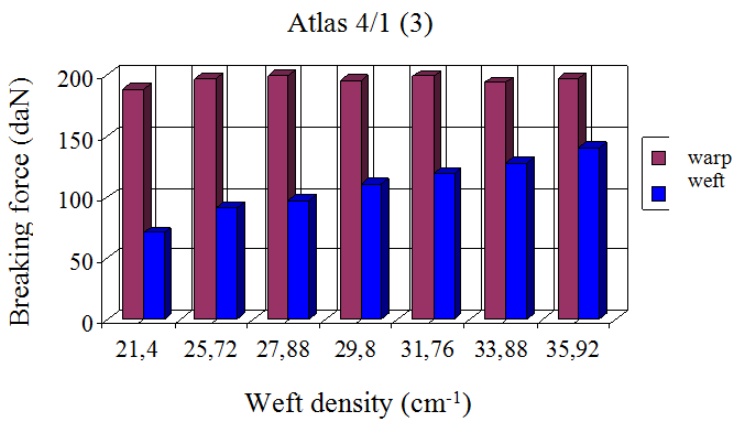


Fig. 11: The influence of the change in density of weft breaking point in fabric 195÷201

Given that among all seven groups of fabric no significant differences in the longitudinal mass of used yarn, the difference in the breaking strength is crucially influenced by raw material composition and consequently the largest nominal value of breaking force in the weft direction was measured in the third group of fabric (Figure 7). With the increasing density of the weft, the breaking point in the weft direction is slightly changed (up 3.8% in the fourth group of fabrics, Figure 8). But it does not show a continuous decline in its value, because the twill weave and atlas fabric in most cases do not have warp wires that occupy compulsory positions or wires that are very close to this position.

With increasing density of weft wires increases the breaking force of fabric in the weft direction, which is an expected result because the observed fabrics have a relative density of less than one weft. Further increasing the density of the weft (especially fabric 87 ÷ 94, 160 ÷ 168), it is clear that there was a decrease of breaking force.

THE INFLUENCE OF INTERLACEMENT CHANGE ON THE BREAKING FORCE OF THE FABRIC

In order to analyze the influence of interlacements on the value of breaking force of fabric in the direction of the warp and weft a selection of clustered fabric was formed on the same warp, the same applied yarn, same density, same composition and different weaves (interlacements). In order to acquire more comprehensive insight into the impact of changes the changes were observed with increase in density of the weft wires.

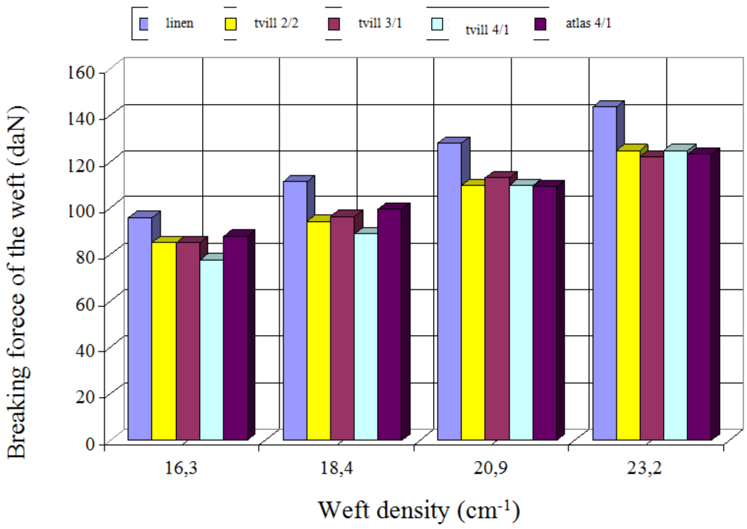


Fig. 12. The effect of interlacement on the breaking force in the weft direction on the fabrics37÷40, 95÷98,127÷130, 148÷151, 178÷181

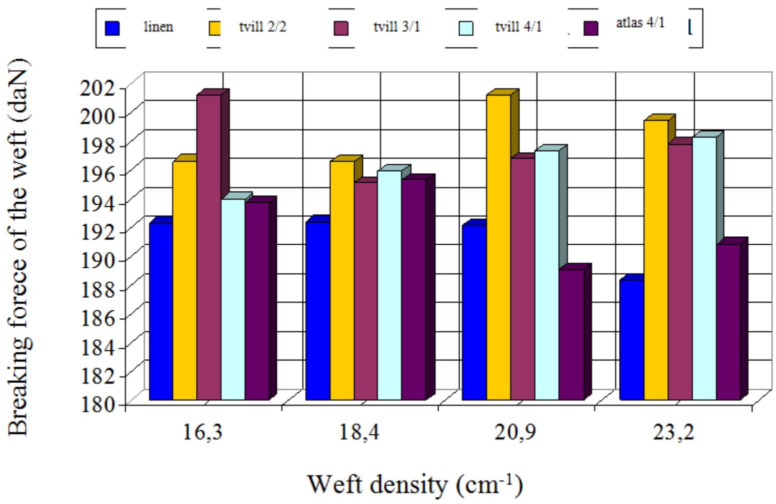


Fig. 12. The effect of interlacement on the breaking force in the warp direction on the fabrics37÷40, 95÷98,127÷130, 148÷151, 178÷181

When we look at all five types of interlacements, it can be concluded that the number of changes in the effects of the wire in relation to the report is the highest in the fabric with applied fabric weave.On that note, it is expected that the maximum breaking force in both observed structural directions are in fabrics that are woven in the fabric of canvas interlacing (in the case of other equal parameters).Confirmation of this expectation when it comes to cross-wire system can be seen in Figure 12. Fabrics with applied fabric canvas weave have an average of 16% increase in strength compared to other fabrics.

However, when it comes to warp direction (Figure 13) the least value of breaking force (except for groups with an average density of 20.9 cm-1) were measured within the canvas weave fabric.
This is largely a consequence of higher stress on warp wires (they are in comprehensive positions). Or in the case of the fabric (37 ÷ 40) relative density of the base is greater than one.

Relative density above units may contribute to a higher percentage contribution of plastic deformation in the total deformation, which has a negative impact on the final quality of the fabric.

CONCLUSION

Tensile properties (breaking points) of fabrics depend on their structural and constructive solutions, as well as the technological requirements of making fabric in the weaving process. In fact, the most important role is fiber composition, structural and physical-mechanical properties applied yarn, warp and weft density and applied weave of fabric.

Knowledge of the connections of structural and mechanical characteristics of the fabric provides the possibility of proper planning in the future, depending on the purpose.
Based on the experimental results, it can be concluded that the breaking force increases with the density of wires in a given structural direction, but this increase may not be up to the limit of the specific technical characteristics of the loom, but to increase the density above the critical level has a reverse effect and leads to a deterioration of mechanical properties.
Under the same other conditions (density, longitudinal weight yarn, raw material composition) the maximum breaking force (when the a certain boundary of density isn't crossed) havethe fabrics that are woven into intertwining with the largest number of effects of changes in relation to the report. This can not be ignored when designing...

In this way we can achieve a certain saving of energy and raw materials in the process of weaving.

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ECO-FRIENDLY PIGMENT PRINTING WITH RED BEET (*Beta Vulgaris L.*) JUICE AND RED ONION PEEL (*Allium Cepa L.*)

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ABSTRACT: Pigment printing can be easily applicable to all textile fibers as well as it is an economic cost-saving coloration technique. Eco-friendly, non-toxic and renewable natural colorants can be used to colorize textile materials. In this study, soybean and wool fibers are pigment-printed with red beet juice (*Beta Vulgaris L.*) and red onion (*allium cepa L)* peel extracts with or without mordant accompany. The color properties and rub, water, perspiration and wash fastness properties of printed samples were investigated and compared. The highest color yield value was observed on wool fabrics printed with red beet juice extract in company with mordant presence. The observed color shades of printed wool and soybean fiber fabrics were different shades of pink and brown. Overall, printed wool and soybean fabric samples exhibited very good to excellent color fastness (wash, acidic and alkaline perspiration, wet and dry rub, water fastness) properties.

Keywords: Red beet, *Beta Vulgaris L.* , red onion, *Allium cepa L.,* pigment printing, wool, soybean

INTRODUCTION

Pigment printing is not only the one of the most commonly applied technique for some fibers but also is an economical printing method (Bahtiyari et al., 2013; Pigment printing, 2014). The advantages of pigment printing are well known due to their processing advantages which led to popularity increase recently in textile printing industry (Pigment printing, 2014). In pigment printing process, insoluble pigments, which have no affinity to the textile fiber, are fixed onto the textile materials with binding agents (Bahtiyari et al., 2013). Although there are some studies about natural dyes in pigment printing, there are no research study concerning the application of red beet juice and red onion peel extracts on textile fabrics (Bahtiyari et al., 2013; Rekaby et al., 2009; Nakpathom et al., 2011).

Sustainable and renewable natural dyes are extracted from insects, minerals and various parts of plants (Kumbasar, 2011; Betchold and Mussak, 2009) and then those can be used for textile colorization. Red beet extract, which is obtained from red beet (*Beta Vulgaris L.*) wastes, are commonly used for food, textile and leather coloration as well as in pharmaceutical applications (Betchold et al., 2006; Velmurugan et al., 2010; Henry, 1996; Siyakumar et al., 2009; Crinela et al., 2007; Atodiresei, 2011; Chen and Li, 2006; Frick, 2003, Yildirim et al, 2013; Wybraniec, 2005). The beet root (*Beta Vulgaris L.),* known as red beet, garden beet or beet, is one of the cultivated varieties of beets (*Beta vulgaris*) and can be found in Central America, North America and Britain (Wiki, 2013) (see also Figure 1). Nitrogenous pigments, betanin, isobetanin and minor yellow betaxanthins are main components of the Red beet (*Beta* V*ulgaris* L.) (see also Figure 1). Betalains, which are the main constituent in the red beet, are known to be very sensitive to low pH conditions or elevated temperatures. (Wybraniec, 2005).

The onion (*Allium cepa L.*) is one of the mostly cultivated species of the genus *Allium* and used date back to 5000 B.C. (Wiki 2, 2014). Numerous varieties of onions were developed with different colors (red, yellow, white), sizes etc. (Red Onion, 2014). Red onions are known as purple onions and they have purplish red skin. The red color of the red onions comes from its anthocyanins (*such as cyanidin*) content (Wiki 3, 2014) (see also Figure 1). Onions are commonly used as foodstuff. Moreover, onions are used as a moth repellent, for therapeutic purposes and to produce a yellow-brown dye and used for textile colorization (Wiki 2, 2014; Coman et al., 2014; Hussein and Elhaasaneen, 2013). The chemical structure of red onion and red beet can be seen on Figure 1. It should be emphasized that red onion peels are total waste and have no specific usage area.

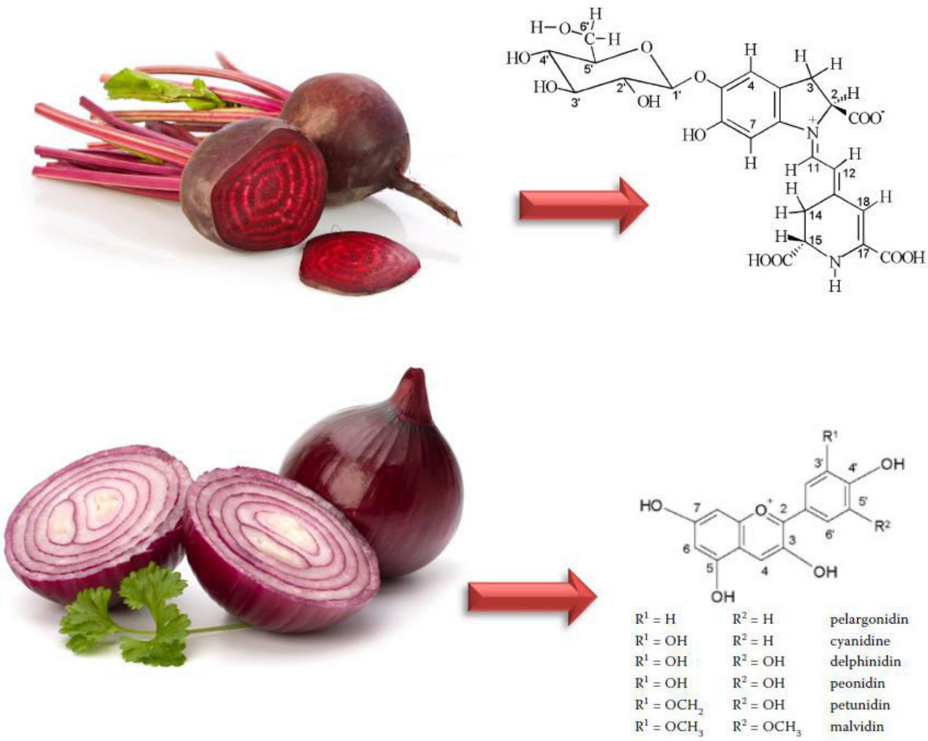


Figure 1: Red beet (Beta Vulgaris L.) and chemical structure of betanin (Red beet image, 2014; Wybraniec, 2005). Red onion image and its main anthocyanidin structures (Red onion image, 2014; Oancea and Draghici, 2013)

In this study, eco-friendly and renewable red beet juice and red onion peel extracts were applied to the woven wool fabrics and knitted soybean fabrics using pigment printing method via simultaneous mordanting technique. The colorimetric and color fastness properties of naturally printed fabric samples were examined and evaluated.

EXPERIMENTAL

Materials

100% soybean fiber knitted and 100% wool woven fabrics were used in this study. The red onion peels, which are the waste of red onion, were boiled with purified water for one hour for its extraction process. On the other hand, in the extraction process of red beet, the juice of red beet wastes was extracted with automatic Arzum fruit reamer. Simultaneous mordanting method with potassium dichromate was applied to both fabrics. Some fabrics were pigment-printed without a mordant as a control for comparison. Potassium dichromate was used as a mordant to achieve better color fastness properties due to possible better bonding opportunity. The red onion peel and red beet juice extracts were applied via pigment printing method (screen flat) using Atac printing machine (RGK-40). In the pigment printing process, Tubivis Binder 450 was used as a binding agent and Tubivis VP681 was used as a thickener. The paste recipe is shown in Table 1.

Table 1: Printing paste recipes

Printing paste without mordant		Printing paste with mordant	
Tubivis VP681	4 g	Tubivis VP681	4 g
Tubivis Binder 450.	15 g	Tubivis Binder 450.	15 g
Extract (Red onion/red beet)	81 g	Potassium dichromate (2%)	2 g
		Extract (Red onion/red beet)	79 g
	100 g		100 g

The pigment printing process for wool and soybean fabric samples with red beet and red onion extracts were carried out with a 10 mm doctor blade in diameter with a printing speed of 2.2 m/min and a printing pressure at 4. The doctor blade was used twice for wool and soybean fabrics for all pigment printings. Printed fabrics were dried at 100 °C for 3' and then the fixation was carried out at 150 °C for 5' with using ATAC drying machine (FT 200 model). All samples were washed at 40°C for 5' then washed with cold water for 5'. Lastly, washed samples were flat-air-dried. The color fastness and color properties of the printed fabrics were evaluated.

Colorometric and Color Fastness Measurements

The colorometric values of printed samples were measured with using a Data Color Spectra Flash 600 (Datacolor International, Lawrenceville, NJ, USA), spectrophotometer under illuminant D65, using 10º Standard observer. The colour strength values (K/S) of each sample is calculated by using the Kubelka-Munk equation. Eq. (1) is given at below:

$$K/S = (1-R^2)/2R \qquad (1)$$

Acidic and alkaline perspiration fastness properties were performed with ISO 105: E04 protocol. Dry and wet rub fastness properties were tested according to the ISO 105: X12 protocol using James Heal Model 670 Hand Driven Crock master. Finally, wash-fastness test was carried out in a M228 Rotawash machine (SDLATLAS, UK) according to ISO 105:C06 A2S test. Overall fastness properties were evaluated by using ISO grey scales in the light box.

RESULTS AND DISCUSSION

Color Properties

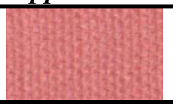
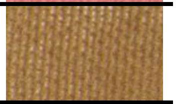
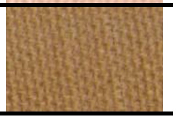
One to one even comparison for the color properties of wool and soybean fabrics could be improper due to their different yarn and fabric structures. Thus, soybean fabrics were compared within their own kind and similar approach was applied to wool fabrics. The CIE Lab values of the pigment printed samples are shown on Tables 2-3.

Table 2: CIE Lab values and appearance of pigment printed soybean fabrics with using red beet juice and red onion peel extracts

Fabrics	*L**	*a**	*b**	*C**	*h^o*	*K/S*	*Appearance*
Soybean, *printed with red beet extract*, **without mordant**	73,5	5,3	17,3	18,1	72,9	1,3	
Soybean, *printed with red beet extract*, **with mordant**	56,2	1,5	18,6	18,7	85,6	4,6	
Soybean, *printed with red onion extract*, **without mordant**	76,8	4,0	18,3	18,8	77,8	1,5	
Soybean, *printed with red onion extract*, **with mordant**	58,0	3,1	20,3	20,5	81,3	4,3	

Color yield of soybean fabrics are ranged from 1.3 to 4.6 K/S. The highest color yield (K/S) value was observed on pigment printed soybean fabric using red beet juice extract with mordant company. Generally, mordanted samples displayed higher color yield values than those of without mordanted samples.

Table 3: Colorimetric properties of pigment printed wool fabrics with using red beet juice and red onion peel extracts

Fabrics	*L**	*a**	*b**	*C**	*h°*	*K/S*	*Appearance*
Wool, *printed with red beet extract*, **without mordant**	70,8	6,5	16,4	17,6	68,4	1,4	
Wool, *printed with red beet extract*, **with mordant**	51,1	3,3	23,7	23,9	82,1	9,9	
Wool, *printed with red onion extract*, **without mordant**	72,6	5,5	16,7	17,6	71,9	1,8	
Wool, *printed with red onion extract*, **with mordant**	50,8	5,1	24,2	24,7	78,0	8,9	

The highest color yield value was observed on mordanted wool fabric printed with red beet juice extract. Overall samples displayed different shades of pink and brown. Moreover, mordant resulted in brownish shades for both fabrics which also can be observed from *a** and *b** values from Table 3 and Figure 2. The colorimetric properties of printed samples are exhibited on Figure 2.

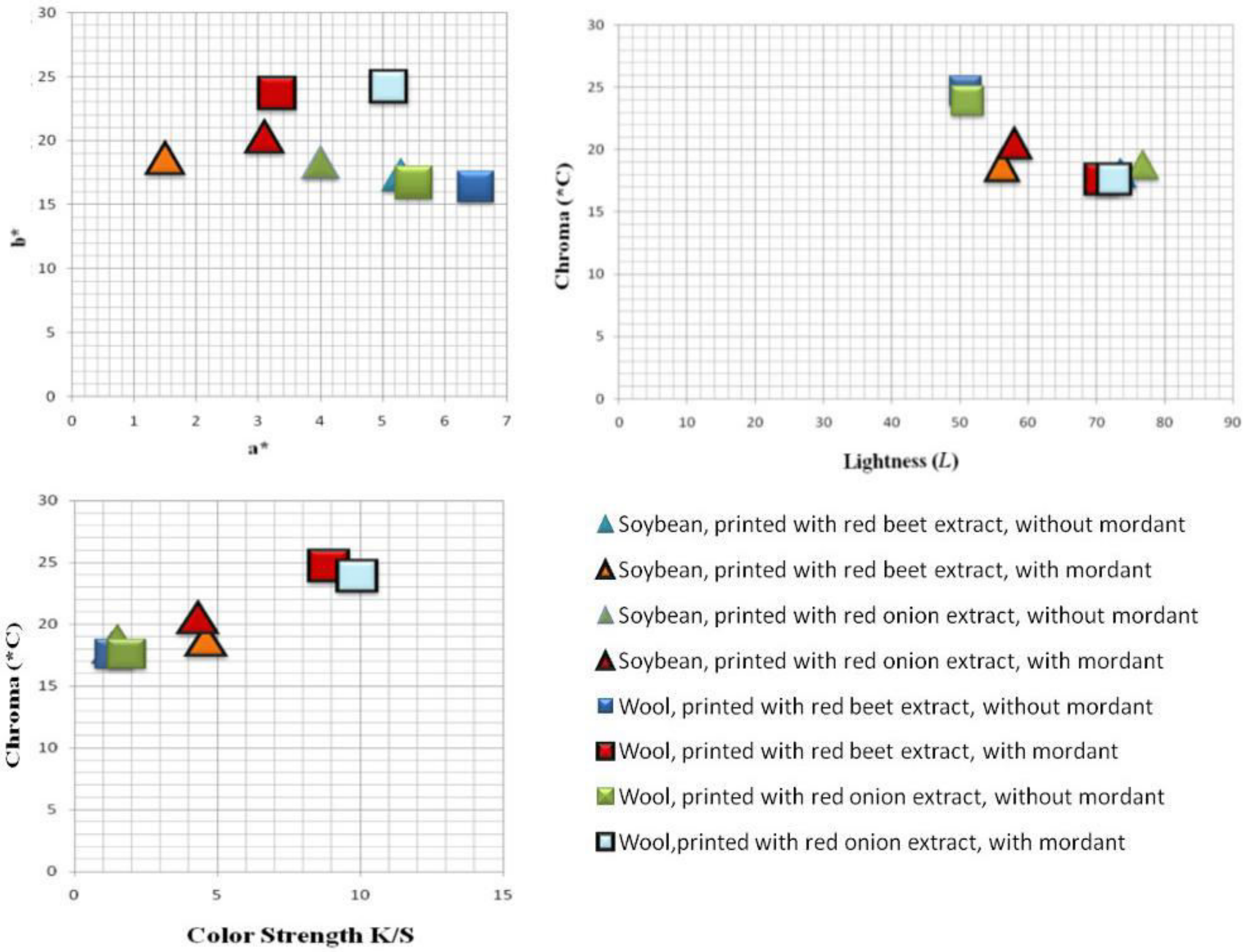


Figure 2: a-b*, lightness - chroma and chroma- color strength values of printed samples*

Generally, soybean fiber fabrics exhibited similar chroma (C^*) values. According to L^* and C^* values (Figure 2), printed soybean fabric using red onion peel extract without mordant exhibited the highest lightness (L^*) value leading to lower color yield. Wool printed with both extracts in accompany with mordant exhibited deepest color properties in this study due to the highest color yield and the highest chroma values (Figure 2).

Rub, Washing, Water and Perspiration Fastness Properties

The perspiration fastness values of all printed samples are given on Table 4.

Table 4: Perspiration fastness properties of all printed samples

Samples	*WO*	*PC*	*PES*	*N6.6*	*CO*	*AC*
Perspiration fastness						
Acidic Perspiration Fastness						
Soybean, *printed with red beet extract*, **without mordant**	5	5	5	5	5	5
Soybean, *printed with red beet extract*, **with mordant**	5	5	5	5	5	5
Soybean, *printed with red onion extract*, **without mordant**	5	5	5	5	5	5
Soybean, *printed with red onion extract*, **with mordant**	5	5	5	5	5	5
Wool, *printed with red beet extract*, **without mordant**	5	5	5	5	5	5
Wool, *printed with red beet extract*, **with mordant**	4-5	5	5	5	5	5
Wool, *printed with red onion extract*, **without mordant**	5	5	5	5	5	5
Wool, *printed with red onion extract*, **with mordant**	4-5	5	5	4-5	5	5
Alkaline Perspiration Fastness						
Soybean, *printed with red beet extract*, **without mordant**	5	5	5	5	5	4-5
Soybean, *printed with red beet extract*, **with mordant**	4-5	4-5	5	5	4-5	4-5
Soybean, *printed with red onion extract*, **without mordant**	5	5	5	5	5	5
Soybean, *printed with red onion extract*, **with mordant**	5	5	5	5	5	5
Wool, *printed with red beet extract*, **without mordant**	5	5	5	5	5	5
Wool, *printed with red beet extract*, **with mordant**	4-5	5	5	5	4-5	4-5
Wool, *printed with red onion extract*, **without mordant**	5	5	5	5	5	4-5
Wool, *printed with red onion extract*, **with mordant**	4-5	5	5	5	5	5

Generally, all printed soybean and wool fiber fabric samples exhibited good to excellent acidic and alkaline fastness properties. Wet and dry rub fastness values of all samples were given on Table 5.

Table 5: Wet and dry rub fastness values of all pigment printed samples

Samples	***Rub Fastness (Cotton staining)***	
	Wet	***Dry***
Soybean, *printed with red beet extract*, **without mordant**	4-5	5
Soybean, *printed with red beet extract*, **with mordant**	4-5	5
Soybean, *printed with red onion extract*, **without mordant**	5	5
Soybean, *printed with red onion extract*, **with mordant**	5	5
Wool, *printed with red beet extract*, **without mordant**	4-5	5
Wool, *printed with red beet extract*, **with mordant**	4-5	5
Wool, *printed with red onion extract*, **without mordant**	4-5	5
Wool, *printed with red onion extract*, **with mordant**	4-5	5

Similar to perspiration fastness performance, all printed samples exhibited excellent dry rub fastness by 5 grey scale rating for staining and quite good wet rub fastness properties by grey scale rating for staining over 4-5 for each case. Pigment printed samples using red onion extract exhibited very slightly better fastness properties than printed samples using red beet extract up to a quarter points. Washing fastness values of all printed samples were excellent with 5 grey scale rating for staining. What is more, water fastness values of all printed samples were given on Table 6. Generally, all printed samples exhibited very good to excellent water fastness values, in the range of 4-5 and 5 gray scale rating.

Table 6: Water fastness properties of all printed samples

Samples	***WO***	***PC***	***PES***	***N6.6***	***CO***	***AC***
Soybean, *printed with red beet extract*, **without mordant**	5	5	5	5	5	5
Soybean, *printed with red beet extract*, **with mordant**	4-5	5	5	5	4-5	5
Soybean, *printed with red onion extract*, **without mordant**	5	5	5	5	5	5
Soybean, *printed with red onion extract*, **with mordant**	4-5	5	5	5	5	5
Wool, *printed with red beet extract*, **without mordant**	5	5	5	5	5	5
Wool, *printed with red beet extract*, **with mordant**	4	5	5	4-5	5	4-5
Wool, *printed with red onion extract*, **without mordant**	5	5	5	5	5	5
Wool, *printed with red onion extract*, **with mordant**	4-5	5	5	4-5	5	5

CONCLUSION

The colors of printed wool and soybean fabric samples without mordant have pinky color shades. However, mordant usage led to brownish shades for both fabric types. The highest color yield value was observed on wool fabric printed with red beet juice extract with mordant accompany. Generally, overall printed wool and soybean fiber fabric samples exhibited very good to excellent color fastness (wash, acidic and alkaline perspiration, wet and dry rub, water fastness) performance.

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ASSESSMENT OF INFRARED RADIATION HEAT GAIN FOR SELECTED FABRIC MATERIALS

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ABSTRACT: Thermal manikin heating in response to a controlled Infrared radiation exposure was evaluated for fabric materials including wool, polyester, cotton, and polyurethane. The influence of separation spacers that were placed underneath the fabric was also studied. The results showed that all of the materials tested exhibited similar heating characteristics with no measurable attenuation of the infrared radiation. Overall, the fabric materials increased the manikin heat loading by an average of 22%. The data also revealed that the fabric materials contributed to additional heat loading by creating additional insulation. It was seen that the separation spacers did not improve the overall heat dissipation characteristics of the clothing materials. The results of this study identified key principles that should be considered when developing new clothing systems designed to protect persons against heat radiation.

Key words: *protective clothing, infrared radiation, inflatable thermal mannequin, garment spacers, heat gain.*

INTRODUCTION AND BACKGROUND

Exposure to high levels of Infrared radiation (IR) can lead to excessive body heating resulting in serious health and safety problems. Body heat gain occurs when infrared radiation penetrates through the clothing material and when it is absorbed by the garments and transferred to the skin by conduction. Use of appropriate clothing material and innovative garment design features such as separation spacers has been shown to reduce heat gain [1, 2]. To achieve such improvements requires an understanding of the infrared radiation penetration characteristics associated with individual garment materials. The purpose of this study was to evaluate the performance of selected fabric materials during exposure to infrared radiation. Heat gain was measured using a thermal manikin exposed to controlled laboratory conditions.

Physiologically, the human body is a metabolic heat generating system which must maintain a balance between heat loss and heat gain within a narrow range of body temperature. Environmental parameters such as air temperature, air velocity, radiant heat, and humidity can affect this balance. [3,4,5]

Clothing material and garment design influence the heat balance by promoting or reducing heat exchange through sweat evaporation, convection, conduction, and heat radiation. The performance of fabric materials under such conditions is usually related to the chemical and physical structure of the material such as thickness, weight, and chemical composition.

Factors that contribute to the heat transfer through clothing systems include garment design, tightness of fit, layering, body areas covered by the garment, etc. However, human reaction to heat or cold will depend on the individual who is being exposed to the environmental conditions, the specific clothing worn by the individual and the nature of the work being performed.

METHODS AND PROCEDURES

An inflatable thermal manikin technology described elsewhere [6] was used for measuring body heat gain in response to controlled infrared heat radiation exposure levels of 400W. The heat source was placed 55 cm away from the manikin torso. The system provided real-time data capture for system input air temperature and system output air temperature. While the system input air was held constant, the system output air temperature increased in response to clothing and the infrared heat radiation exposure. The input air temperature (T_{in}°C) was held at 42 ± 0,1°C. The output air temperature (T_{out}°C) increased in response to heat radiation penetration and garment insulation. The manikin thermal equilibrium time was 10 minutes. A "semi-nude" manikin configuration was used as a "control". As previously described in similar studies [2], the infrared radiation was applied to the upper torso only, approximately 30x50 cm in area, whereas the rest of the body was shielded by an aluminum barrier as illustrated in Figure 1. The test configuration assured that the change in the manikin thermal equilibrium temperature was always the result of the infrared radiation exposure and the clothing.

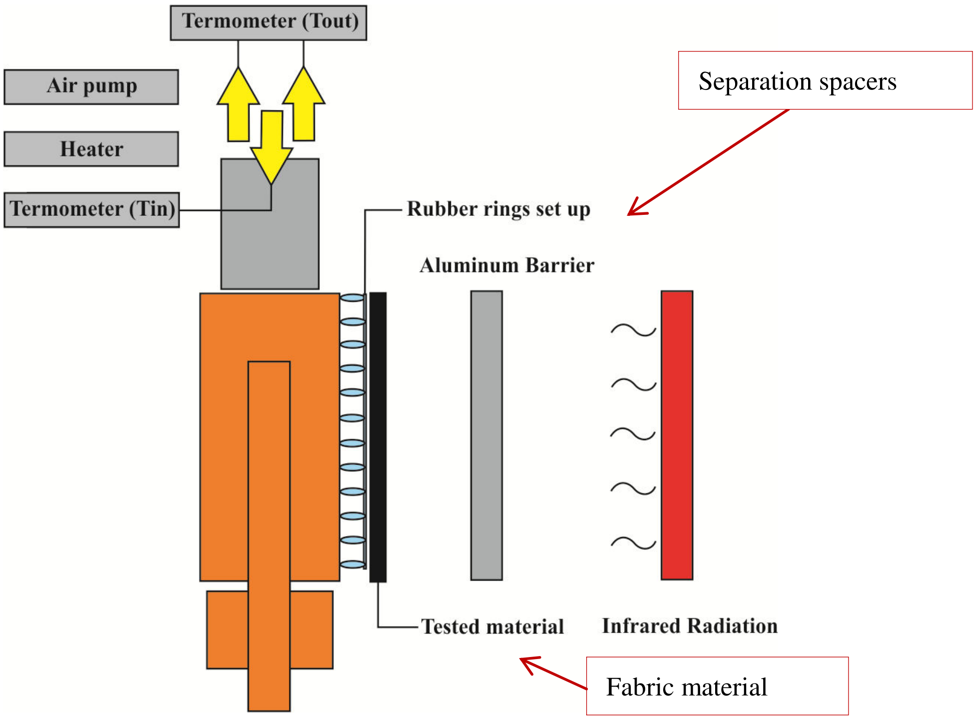

Figure. 1: *Experimental set-up of the thermal manikin system with placement of separation spacers on the manikin chest, location of aluminum barrier, and location of the infrared heat source*

The study included six commercially available garment materials that were placed on the thermal manikin's chest. The heat gain observed during the infrared heat radiation exposure was evaluated with and without garment spacers. These spacers provided a 2.5 cm gap between the thermal manikin and the clothing material. The placement of the spacers on the manikin chest is illustrated in Figure 2.

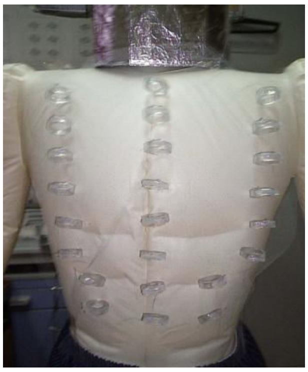

Figure. 2: *Illustration of separation spacer placement on the chest of the thermal manikin*

The fabric materials evaluated are listed in Table 1. They include Wool I (weave), Wool II (weave), Polyester (knit), Polyester (weave), Mercerized cotton, and Electro-spun polyurethane.

Table 1: Fabric materials evaluated for infrared radiation (IR) heating

Reference	Textile Material
T1	Wool I (weave)
T2	Wool II (weave)
T3	Polyester (knit)
T4	Polyester (weave)
T5	Mercerized Cotton (weave)
T6	Electro-spun Polyurethane

The manikin heat gain Q (Watts) for all experimental conditions was calculated using Eq. 1, where: ρ is the air density (1.18 kg/m^3), V is the air flow volume (0.012 m^3/sec) and Cp is the specific heat of air (1.005 KJ/(kg-K).

$$Q = \rho \ V \ Cp \ (T_{out} - T_{in}) \ 1000$$

RESULTS

Each fabric material, T1 through T6, was evaluated with and without garment spacers. The results without garment spacers are summarized in Table 2. The results with garment spacers are summarized in Table 3. It can be seen that, in comparison to the "control" output temperature of 42.0^{0}C, the average system output temperature with garments increased to 32.5^{0}C for the configuration without garment spacers and increased to 32.7^{0}C for the configuration with garment spacers. The heat loss for each configuration was computed using Equation 1.

The "control" condition exhibited a heat loss of 169.9 Watts while all of the garment configurations reduced this heat loss and subsequently contributed to a "heat gain". As seen in column 5 of Table 2 and Table 3, The average heat gain for the configuration without separation spacers was 36.6 Watts and the average heat gain for the configuration with separation spacers was 35.2 Watts. Using the "control" value of 169.9 Watts as a reference, each garment heat retention value could be calculated. As an example, the T! fabric material heat retention was calculated by subtracting the T1 thermal manikin heat exchange value of 127.4 Watts from the "control" configuration heat exchange value of 169.0 Watts. This results in a heat retention value of 42.5 Watts for T1. These calculations were carried out for all six (T1-T6) fabric materials and the results summarized in column 5 of Table 2 and Table 3.

Table 2: *Data summary of textile materials evaluated for infrared radiation (IR) heating*

Material	System Input Temp. (^{0}C)	System Output Temp.(^{0}C)	Manikin Heat Exchange (Watts)	Garment Heat Retention (Watts)
1	2	3	4	5
Manikin nude (Control)	42.0	30.0	-169.9	0
T1	42.0	33.0	-127.4	+42.5
T2	42.0	32.9	-128.8	+41.1
T3	42.0	32.2	-138.7	+31.2
T4	42.0	33.3	-123.1	+46.8
T5	42.0	31.1	-154.3	+15.6
T6	42.0	33.0	-127.4	+42.5
Average	42.0 ^{0}C	32.5 ^{0}C	-133.2 Watts	+36.6 Watts

Table 3: *Data summary of textile materials evaluated for infrared radiation (IR) heating using separation spacers*

Material	System Input Temp. (^{0}C)	System Output Temp.(^{0}C)	Manikin Heat Exchange (Watts)	Garment Heat Retention (Watts)
1	2	3	4	5
Manikin Nude (Control)	42.0	30.0	-169.9	0
T1 + Spacers	42.0	32.7	-131.6	+38.3
T2 + Spacers	42.0	32.4	-135.9	+34.0
T3 + Spacers	42.0	37.6	-133.1	+36.8
T4 + Spacers	42.0	32.8	-130.2	+39.7
T5 + Spacers	42.0	35.1	-126.0	+43.9
T6 + Spacers	42.0	32.6	-133.1	+36.8
Average	42.0 ^{0}C	32.7 ^{0}C	-131.6 Watts	+38.2 Watts

Table 4 provides a comparison of the six garment materials tested with and without separation spacers. Garment materials T1, T2, T4, and T6 including the separation spacers exhibited slightly lower heat retention values than the same materials without the separation spacers. However, viewing all six garment materials together, the average heat retention was lower when garment spacers were not used. The average heat retention value for the configuration without separation spacers was 36.6 Watts. The average heat retention value using garment spacers was 38.2 Watts. Table 5 summarizes the same information in terms of % heat gain relative the "control" conditions.

Table 4: *Manikin heat gain during IR exposure with and without separation spacers*

Material	Garment Heat Retention without Spacers (Watts)	Garment Heat Retention with Spacers (Watts)
1	2	3
T1	+42.5	+38.3
T2	+41.1	+34.0
T3	+31.2	+36.8
T4	+46.8	+39.7
T5	+15.6	+43.9
T6	+42.5	+36.8
Average	+36.6 Watts	+38.2 Watts

Table 5: *Added manikin heat gain with and without separation spacers during exposure to IR radiation*

Fabric Material	Manikin Heat Gain without Spacers (%)	Manikin Heat Gain with Spacers (%)
1	2	3
T1	25%	23%
T2	24%	20%
T3	18%	22%
T4	28%	23%
T5	9%	26%
T6	25%	22%
Average	22%	22%

DISCUSSION

Manikin heating in response to infrared radiation exposure exhibited minor differences in the heat retention properties among the fabric materials tested. The differences measured appear to be due to two factors – direct penetration of the infrared radiation through the fabric material and heating of the fabric material due to the absorption of infrared radiation. The penetration of the infrared radiation through the fabric heats the manikin "skin" directly while the infrared radiation that is absorbed by the fabric conducts the heat into the airspace between the manikin and the fabric material. The overall data suggest that the separation spacers used in this study did not provide an advantage in reducing heat radiation effects as reported in literature for other experiments [2]. This difference can be explained by considering the fact that previous studies did not evaluated textile materials but evaluated materials only that are "opaque" to the IR radiation. Such materials offer "shielding" against infrared radiation and allow the separation spacers placed between the garment and the skin to transport body heat away through convection.

CONCLUSION

The garment materials tested consisted of woven fabrics that allowed infrared radiation to easily penetrate the fabric while at the same time creating a thermal insulation barrier. This contributed to additional heating of the thermal manikin. The separation spacers were, therefore, not effective in enhancing convective heat exchange by channeling air out of the garment. It will be necessary to incorporate such principles in the future design of garments that are intended to protect persons from exposures to heat radiation.

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BRANDING ISSUES AND CREATIVE PRODUCT DEVELOPMENT IN THE DENIM INDUSTRY

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ABSTRACT: Despite the fact of global crisis on the saturated fashion market denim is a constantly growing industry. It is a specific field of fashion design and textile industry. It is almost independent part of the market where constant grooving is evident, and where design and technology are always ready to create fresh and new achievements. Denim industry employs a huge number of workers and professionals. It was always an interesting field for designers, producers and retailers as well. Nevertheless, it has to be underlined that producing of marketable products in one hand depends on rapid and perpetual development of the product range. But in the other hand, due enormous costs of product development it is necessary to resolve the process of sampling, as well as some issues of branding, product range development and management. There are great opportunities for companies which are able to produce high quality denim in a way that is relevant to the contemporary model of sustainable, transparent garment supply chain. This paper attempts to solve some of these issues by offering a model of company, and product development organization in this specific field of industry fashion industry, that is also interested in Serbia.

Key words: product development, denim industry, management

INTRODUCTION

Denim is a rapidly growing part of the fashion market, and fashion is imperfect without it today. It's hard to believe that former workwear has developed to a huge segment of the market. Fashion consumers are ready to buy themselves few pairs of new jeans each season, so the market welcomes their shopping intention by offering endless varieties of denim looks – i.e. styles, details, washes, fabric qualities and so on – in a million shades of blue-hue and by-familiar color scale each season. But our formerly *blue love baby* isn't a naïve one anymore! Success of jeans is due in part to the versatility of the product itself. It became a consumer product able to survive fashion changes and economic challenges.

There is a huge industry, working all day and night behind the scenes highlighting endless varieties of new styles. *Denim* – the most democratic fabric and garment ever invented in the fashion history – jet allows great possibilities for the saturated fashion market, and together with it for the industry, for the economy and for designers as well.

Due to technological advancements denim became *more than a fashion symbol*. (Ambavale et al., 2013) Denim is an independent sector of the fashion industry; a Goliath – *a basking shark* – that offers great work and trade opportunities within the fashion industry, but is also able to induce a failure of a region (Antoshak, 2014) as we have seen for example in Hungary[10]. Even that excess capacity can be registered around the globe at the moment; some will reduce their production, and some countries will actually step up construction of new mills. Global denim business faces with the pressure caused by the global recession. The global financial crisis that hit the denim segment too, has left a lasting impact on consumer spending… In terms of trends *a continuing decline in aggregate denim capacity* is foreseen over the next few years. Inefficient mills in Europe, North America and Asia will be dismantled, *while at the same time new capacity comes online in China, Vietnam, India, Turkey and Brazil* (Antoshak, 2014) even the labor costs continue to rise worldwide.

It is important to focus on these aspects for the reason of an absolutely unique industry that exists in Novi Pazar, located in the Raška-Sandžak region in south Serbia. I's time to pay over more attention

[10] In mill of Mustang Marcali Rt. in Marcali (HU): 400 people left without job and in factory of Levi Strauss Hungary in Kiskunhalas (HU): 550 people left without job.

on facts and figures associated with the economy and industry of this region, which were assumed in a great survey that had made on this topic in 2007 (Development Alternatives, Inc., 2007).

DENIM BRANDING ISSUES

Jeans became an important piece of the wardrobe and denim products remain to be a significant part of each seasonal collection. Denim product range – as any other – has to cover different needs of the consumers. Although both women and men wear them mostly for casual wear women's jeans records the most significant improvement; while women will choose less exclusive jeans (they will rather spend on two-three less costly pieces) until then men will rather spend on a single piece of well suiting jeans even it is more expensive. For this reason denim has to be well adopted within the product range of certain capsule of the each seasonal collection. (Csanák, 2014)

Trends in central and eastern European denim market – 2014

We have to consider that long-ago adored jeans have given way to smartphones, and compared with the denim's *popularity of low-cost knitted athletic wear has gained considerable market share*. It is not the time to credit-driven spending, but for tight budgets! *Expensive is out; ship is in.* Another fact is, that while *the extreme high end of the jeans market remains robust,* until then *the mass market for denim around the world has stalled* and *global denim prices are relatively weak.* (Antoshak, 2014).

According to some public data of a market research agency (Euromonitor International, 2014) can be concluded that good annual growth of the denim market, which was registered before 2010, turned up into slow recession. The process begun in 2011, and after reaching its low point in 2012, in 2013 a better performance was registered. These positive tendencies lasts these days too. Referring to the same source the sales of jeans declined by 2% in the Czech Republic. In the Netherlands denim is very popular; the average consumer owns 5.1 of jeans; declining denim market. In Turkey jeans is expected to continue its value growth with approx. 5% because of domestic brands that are very popular among young people. In Portugal national premium denim brand Salsa Jeans were able to maintain the lead in jeans from 2005; continuous investment in new fits increased its popularity. Austria total jeans performance increased by 3% in 2013. [11]

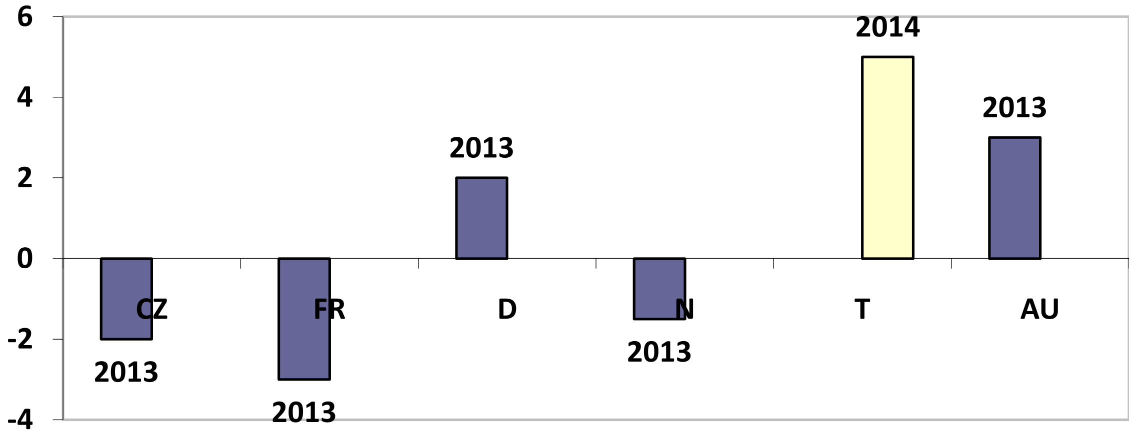

Figure 1.: Diagram of popularity of denim jeans in Europe in 2013/2014

ISSUES OF CREATIVE PRODUCT DEVELOPMENT

[11] **In Czech Republic:** C&A Moda - was also the leading player in jeans as a whole, holding a 6%, second ranked was the private label producer Tesco Stores, holding a 4%. **In Italy:** performance of premium and super premiumcategory was better in 2013; economy jeans declined by 3% VF Corp (Wrangler and Lee) was the leading jeans ompany in 2013 with 9%. **In Germany:** total jeanes sales increasing by 2%: C&A continued to lead jeans in Germany in 2013 with a value share of 8%, H&M 7%. **In The Neatherlands:** plus size jeans collections seam to be bestsellers.

There is a wide range of opportunities according to the fitting, detailing and finishing of each style. There's no limit in variety of available styles and looks that is possible to create, and together with it no other field of design offers such variations that can result in plenty of different styles! Product development in this field of design means specifying of diverse properties.

The fitting process

Proper fit is almost the supreme feature of the garment! Since denim goods are mainly washed products, getting of a nice fit depends on a well-adjusted pattern that is adapted on a specific *shrinkage* of certain denim fabric. This will vary from one fabric to another, according to the material composition and weight (eg. 8-14 Oz) as well as the weaving characteristics of the fabric. Even the similar fabric will vary from a supplier to another. To get a proper fit we've to make at first a so called *fit sample* that will typify the style. The fit has to meet requirements of certain measurement[12]; even the international sizing does not cover unambiguous sizes. After its developing we have to adjust certain pattern onto a specific *fabric properties* and *style requirements*. Details are adopted on certainly fit.

Figure 2.: 15 popular design features of denim design

The core of jeans anatomy

When we talk about the design, there are no less than 15 features that characterize design and styling. They are the following:

1. *The fabric:* denim, traditional fabric of jeans, may vary in its woven, weight, color and composition. All these features result, endless variations according to the touch, look and finish. Due to the growth of cotton prices since 2011 mills and apparel companies have scrambled to find more economically priced fibers for use in their denim. Many manufacturers have replaced cotton with polyester or other synthetic fibers, as well as stretch fibers have a great part and force in the global textile market and in denim for many years.

2. *The cut:* 4 basic *cuts* (shapes of leg – *regular, comfort, loose* and *slim fit*) may vary according to the fashion trends, and may result much more shapes (i.e. cuts) such as the *boot cut* or the *bell bottoms*, etc. The shape of the leg is a very fashion-sensitive part of the design.

3. *The rise:* similar to the cut the rise is also a sensitive part of the design. It changes every 2-3 year. The cut of the seat determines how the jeans fit. This feature regards to the *length of the fly*

[12] It also may vary; international sizing of women's as men's denim regularly uses measures from 25 to so on, according to the type of the range, and it may be subdivided into 3 lengths.

and the shape (curve) of the rise as well. Dealing with fitting term “anti-fit” may also be in use. (denimhunters.com, 2012) and it has nothing to do with the size of trousers.[13]

4. *The back yoke:* this is the V-shaped section at the back of jeans, also known as the *riser*; one of the most typical part of tailoring. It was originally made in a sartorial manner of fabric saving reasons. It’s shaping is a fashion influenced feature that determines the curve of the seat and pretty look of the garment. [14]

5. *The 5 pockets*: the curve of the front pockets, the shape of the back pockets, as well the design of the small *coin pocket* are typical features. Term “five-pocket” is commonly used in the fashion jargon as a synonym of denim jeans. The “classic version” 5 pocket design had been developed in the early historic period (before 1901), when the fifth left back pocket was added; it is often confused with the coin pocket (or watch pocket), that was actually part of the original design from 1873. The *five pocket denim jeans* were developed after the post historic period (1901-1930), and they doesn’t change much until the ‘80s when designer jeans was born. *The coin pocket* is the most typical design detail of the denim jeans. The small, almost 5-6 cm wide details shape, position (traditionally it is located near to the right front pocket) the way of its stitching and/or riveting, etc. can be varied endlessly! (Csanák, 2009)

6. *The belt loops:* meant for holding up the trousers, belt loops were first added to the waistband of the Levi’s 501 jean in the 1902[15]. Classic ones are 1 cm wide, and are made/applied (sewed on) by automatic equipment. There are commonly 5 belt loops, however the design of the loop (width, length, way of folding the fabric) or adding further belt loops for extra comfort, as well as their construction (for instance a smaller loop underneath the larger visible loop) take a part in the design.

7. *The shape of the fly:* basically denim jeans have longer (18-20 cm) flown. Commonly stitching is „J” shaped, and the classic version is 4 cm wide. This is a wide range of opportunities how to re-design the “official” shape of this small, functional detail, adding a new look to the trousers. There is also an opportunity to choose a button or zipped fly.[16]

8. *Rivets:* The inventor of the use of rivets was *Jacob Davis,* business associate of Levi Strauss. The first riveted ones were famous *Levi’s XX*, which are a kind of “pre-501”. Riveting[17] has made a huge difference in commodity and quality of the work wear developed upon the needs of the hard labor workers in the late 19th century. They became very popular as “waist dungarees”. Others are part of the jeans-story…

9. *Metal accessory:* Use of metal *jeans-buttons* and other metal accessory, like suspender buttons, metal loops, metal buckles on the *back cinch* is also common.

10. *Branding patch:* also known as belt label or *jackron*, is a commonly placed at the back, along the waistband, above the right pocket. It’s usually made of leather or ‘leather-like’ fabric.[18]

11. *(Red) Tab and other labeling:* are a small label that was originally used to identify Levi’s 501 jeans, but now it is in common use. Its original place is

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[13] This cut is the result of Levi’s experimenting to maximize fabric consumption in the late 1890s and early 1900s. The cut of the trousers is in a straight line (it is not curved) what gives the jean its recognizable top block; they don’t follow the shape of the body.

[14] The cut of the yoke can range from a deep ‘V’, shallow ‘V’, straight yoke to no yoke at all. The deeper the ‘V’ results greater curve. The classic cut is 4cm high on the side and 7 cm high the back.

[15] When customers began preferring wearing belts rather than suspenders.

16 The first pair with zip-fly were made by Lee in 1926.

[17] Patent invention submitted 1872.

[18] Levi’s was the first one who used that kind of branding (1886) which main purpose was to inform customers of the strength of the product and to help identify the brand.

12. *The "arcuate*[19]*" and other decorative stitching on the back pockets:* Levi's patented their *seagull-arcuate* in 1943. After that Wrangler introduced the *typical (western wear) "W*" and Lee their *lazy "S"*. The stitching on the back pocket – in most cases – is a way of indicating a trademark or remains part of a trademark, *a protected intellectual property.* This condition is often forgotten and may cause long lasting lawsuits.

13. *Bartack:* These closely spaced stitches that form a band or a bar is used mostly on the parts and points that are exposed to stress usually around zippers, button flies, pocket openings, end of the belt loops, and crotch joins of inseams.

14. *Stitching* is also a emblematic part of design that can be customized on very different ways depending on the thread thickness, the length of the stitch, and numbers of stitch/unit (given in inch or in cm). The color of the thread has a wide range of shadows from the typical ochre/yellow/gray/khaki tones to some fancy colors that may vary according to the tradition or the fashion trends.

The 15th feature: The finishing

Denim is a rough twill fabric which is not nice when it is raw. That's why the ready garment has to be adjusted by applying different technologies that are not cost effective because they need lots of handwork and use lot of water and electricity. All these processes have advantages associated with them as well as some limitations and environmental polluting aspects[20].

15. *Washes and finishes:* a lot of work invested is worthless if we do not have a well-equipped laundry! From the mid of the nineties finishing has evolved into an independent industry, which is at least equal rivalry as other areas of this segment. There based on the latest information world-famous laboratories[21] are continually developing new techniques in their workshops, and their agencies offer a wide range of chemicals that developed and presented in context of a seasonal collection.

But jeans sometimes does not look like new! In order to get *used-* and *vintage-look* there are many hands adjusting processes applied onto the ready garment that are usually very polluting. But if we know that this phase of the manufacturing process gives the job to a lot of people, then it becomes clear why it is so important to mention it. Basically the denim washes are of two types:

Table 1.: Table of denim finishes

Mechanical washes	*Chemical washes*
Stone wash	Bleaching
Micro-sanding or sand blasting	Enzyme wash
Other Mechanical treatments that are used	Acid wash
Whiskering	Rinse wash
Water jet fading	Overdye
Laser technology finish	Crash wash or crinkle look (*thermofusing)*
	Wrinkled effect
	Cellulose wash
	Ozone fading

[19] Together with the Red Tab is specific only to Levi's. They don't know the origin of the design due to the 1906 San Francisco earthquake, which destroyed the headquarters and factories of Levi Strauss & Co.
[20] Learn more in: Edit Csanák, *Sustainable Concepts and Eco-Friendly Technologies in the Denim Industry*
[21] For instance: Interwashing Group (Eletti) (IT), Okinawa (IT), etc.

THEORY OF OPPORTUNITIES

I foresee great opportunities in manufacturing of limited series customized products and developing a high quality product range.[22] At the reason of high costs of development and the limited time that is available to develop certain product, aim of this survey is to put emphasis on design by managing above mentioned aspects of product development. By offering a qualitative solution on some issues related to the work quality and quality of the ready product we can maintain continuous workflow.

Convinced that ***good design can provide a comprehensive solution for all the interests in the sustainable fashion retail chain*** and dividing the idea that ***goal of future fashion industry has to be created producible products born upon existing consumer demands*** try to focus here on design aspects of the denim and it's multiple product development process, that have to be managed somehow in the up-to-date familiar denim industrial environment.

The key issue is: *How to provide appropriate technical documentation for manufacturing of the prototypes, which will result samples in appropriate of the ideas?* In order to solve the problem, it is necessary to develop technical documentation that is informative, but equally comprehensible due to the very special manufacturing conditions that characterize this genre of fashion. While manufacturing of regular casual trousers can be finished by using for almost 2-3 types of machines (that – basically – may be carried out, whether a single person) than in case of denim, every product – along with this the prototype – will met completely different technology during the various stages of the sampling/production process.

Due these facts of the market denim industry are interested in continuously improving of new design and esthetics, in parallel with this development of new fabrics, washes and finishes, technical improvements, etc. Having the latest equipment became primary factor, as well applying of qualified workers and design professionals.

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[22] If collection is developed in 3-4 deliveries and each delivery is divided into 2-3 themes (capsules) of each delivery than it means not less than 8-15 denim styles per season/customer. Multiply it!

INTEGRATED SYSTEMS OF MONITORING AND CONTROLLING WASTEWATER QUALITY

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ABSTRACT: For the last 20 years, due to globalization and trade liberalization, the European textile sector has undergone changes such as the modernization of production processes refocused towards an increase of productivity, of product quality in line with the market and environmental protection requirements. These concerns are also the concerns of the Romania-Bulgaria cross border area, through the Cross-Border Cooperation Programme, project ENVICONTEH. The project objectives are: to establish a cross border specific joint strategy on short, medium and long term for environmental protection; to develop joint systems for environmental protection monitoring and control; to develop joint information and promotion materials referring to the cross border environmental protection.

In the cross border area Giurgiu – Ruse, within the ENVICONTEH project we have studied the correlations between the pollutants generated by the technological phases and their influences on quality indicators of wastewater and treatment methods in treatment plants, in order to comply with the national and European norms.

Keywords: wastewater, pollutants, wastewater treatment, monitoring

INTRODUCTION

The textile materials processing uses a broad variety of chemical substances (detergents, alkali, acids, dyes, surfactants, surfactants etc) that *contribute to the significant pollution of the environment*. Wastewater from textile finishing raise serious problems related to the quantity of sediments, pH, temperature, colour (group of dyes), content of organic substances (fibre particles, fibre materials, surfactants, phosphates, auxiliary chemical products, albumin, carbohydrates etc.), content in inorganic substances (salts, acids, alkali, chlorine, metals etc.). Due to the diversity of the production structure, the quality of wastewater varies not only from one company to another, but also within the same company.

The effluents resulted from the textile finishing generate the following pollution problems for the environment:

- concentration of pollutants in the discharged wastewater that leads to an increase of the main wastewater quality indicators provided NTPA 002/2005 and NTPA 001/2005: pH, matters in suspension, COD, BOD, chloride, sulphide, detergents, nitrogen;
- pollution of groundwater by a concentration of polluting minerals;
- pollution of soil in the area where textile and leather companies operate;
- pollution of natural receptors (in our cross border region RO-BG the main receptor is Danube) and the compelling of riverside industries to search for other clean water sources;
- persistence of dyes that are difficult to degrade in the natural receptors;
- impact on aquatic flora and fauna;
- decrease in photosynthesis due to water coloration;
- pollution of ground waters with dissolved solid substances, increase of alkalinity and of the content of mineral, organic substances and of soluble substances.

SOURCES OF POLLUTANTS IN TEXTILE FINISHING

Textile finishing can be defined as the multitude of operations (mechanical, chemical, biochemical) that ensure the improvement of textile properties, that is their aspect, comfort, durability and functionality. Most of the textile finishing operations can be effected over the entire technological flow on: fibre, sliver, yarn, fabric, knit and garment; however, finishing applied to fabrics or knits is predominant.

In a simplified form, a textile finishing technological flow is represented in Figure 1.

Raw textile → **Preliminary preparation** → **Dyeing/ print** → **Higher finishing** → **Finished textile**

Figure 1: A textile finishing technological flow

In Giurgiu - Ruse Cross-Bborder region the correlation between the main pollutants generated by technological phases was studied (from companies on the Giurgiu Nord Technological and Industrial Park - PTIGN platform and from companies in Bulgaria: Fashco - Byala and Freshtex – Popovo) with influences over quality indicators of wastewater and the treatment methods in wastewater treatment plants in conformity with National and European Norms.

The correlations between technology stages of textile processing, polluting factors, their influences on quality wastewater indicators is presented in Table 1((Pricop F. et al., 2013).

Table 1: Polluting factors and methods for pollutant removal

Technology stages generating polluting factors	Polluting factors and their effect on wastewater	Influences on quality indicators of wastewater	Methods to remove pollutants
WARPING	Dust, fly	Suspended matter	-
SIZING	Sizing products Starch, Polysaccharides, CMC, APV Polyacrilates	COD, BOD, TSS	-physical-chemical treatment, ozonation, - biological treatment, filters, membranes
WEAVING	Dust and fly, various waxes, oils and paraffin	It does not directly influences the water indicators in this stage	
PRELIMINARY PREPARATION (Desizing, alkaline boiling)	surfactants, complexing agents, oils, sizing products, fibres, various waxes, mineral or vegetal impurities, enzyme products	COD, BOD, TSS, pH	-physical-chemical treatment, ozonation, biological treatment, filters, -membranes
BLEACHING	Chlorine or oxygen-based oxidizing agents (chlorite, hydrosulphite, thiosulphite, surfactants and complexing agents)	COD, BOD, TSS, pH, sulphites, sulphates, chlorine	- physical-chemical treatment, ozonation, biological treatment, filters, -membranes
DYEING	Wastes of sulfur dyes Wastes of indigosol dyes Chemical auxiliaries, surfactants, complexing agents, heavy metals (for dyeing with metal complex dyes), dispersing agents, mordants	pH, color, TSS, metals, salts, temperature, COD, BOD, metals (Cu, Cr, Co, Cd, Fe, Ni), sulphates, sulphites, accelerating substances, fixed residue	-physical-chemical treatment, ozonation -biological treatment, filters, membranes -photocatalysis, advanced treatment

CROSS DYEING	Wastes of sulphur dyes Wastes of indigosol dyes Chemical auxiliaries, surfactants, complexing agents, heavy metals (for dyeing with metal complex dyes)	pH, TSS, metals, salts, temperature, water volume COD, BOD, fixed residue	-physical-chemical treatment, ozonation -biological treatment, filters, membranes - photocatalysis, advanced treatment
WASHING / RINSING	Wastes of sulphur dyes Wastes of indigosol dyes Chemical auxiliaries	Influence in lower %, COD, BOD, water volume, fixed residue	- physical-chemical treatment, ozonation -biological treatment, filters, membranes - photocatalysis, advanced treatment
STARCHING	Starching products (natural and synthetic polymers)	BOD (biochemical oxygen consumption), COD, TSS	physical-chemical treatment, -ozonation, -biological treatment, -filters, membranes - photocatalysis - advanced treatment

PROPOSALS FOR THE UPGRADING OF WASTEWATER TREATMENT PLANTS IN THE TEXTILE COMPANIES

To increase the pre-treatment efficiency the following upgrades are necessary:
- in the grill and sieve room the existing used grills and sieves will be replaced with stainless steel grills and sieves with a greater capacity of retaining the impurities (holes smaller than 10 mm);
- mechanized scraping devices for impurities will be produced;
- automated systems for reading and adjusting the pH and turbidity will be mounted;
- new basins for performing coagulation-flocculation processes several stages will be built;
- introduction of aeration systems in the 2nd treatment stage;
- settling basins and additional pumping plants for sludge will be installed;
- a sludge dewatering and pressing plant will be built.

The efficiency of upgraded pre-treatment plants will be higher than those of the old pre-treatment plants by 20÷50%. To increase the treatment efficiency it is necessary to introduce a filtering module of pre-treated water which will also contribute to water recirculation in industrial processes (Pricop F. et al., 2013) .

In the PTIGN upgraded aeration basin (see Figure 2), wastewater, mixed with activated recirculated sludge, is oxygenated by a pneumatic aeration process (see Figure 3). Treated water, in a percentage of 94-97%, is separated from the flakes of activated sludge in the secondary settler.

Figure 2: PTIGN upgraded aeration basin

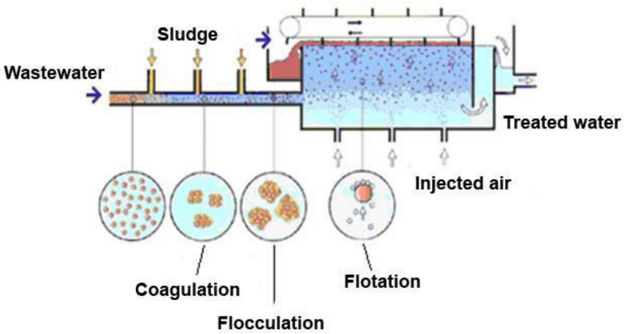

Figure 3: A pneumatic aeration process

The advantages of introducing the aeration system into the process flow are the following:

- improving the treatment degree by 10-26% of wastewater expressed by reducing the value of chemical oxygen consumption (COD), biochemical oxygen consumption (BOD), NH4, total P, SO4, detergents, degree of discoloration, reducing the amount of sludge that results from the wastewater treatment;
- reducing the amount of chemicals used for the treatment operations (coagulation, flocculation, pH correction, discoloration);
- reducing treatment time.

In order to point out as eloquent as possible the evolution of the wastewater parameters on the wastewater treatment station modules from PTIGN, were plotted both parameters compared with accepted values contained in the normatives and the values of the ecological efficiency for the wastewater main parameters (see Figure 4 - Figure 9).

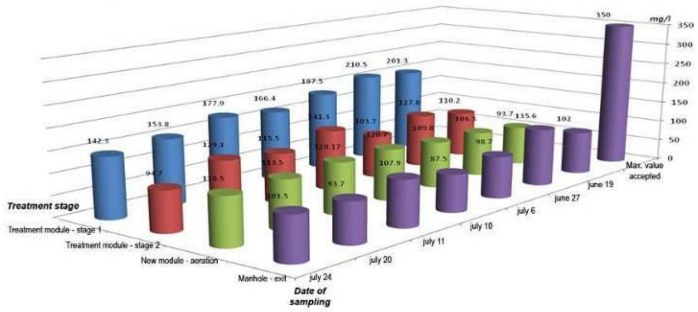

Figure 4: The evolution of the parameter "suspended matter" during the analysis

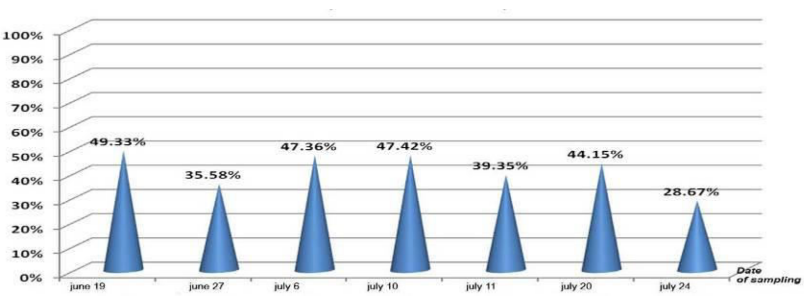

Figure 5: The evolution of the ecological efficiency of the parameter "suspended matter"

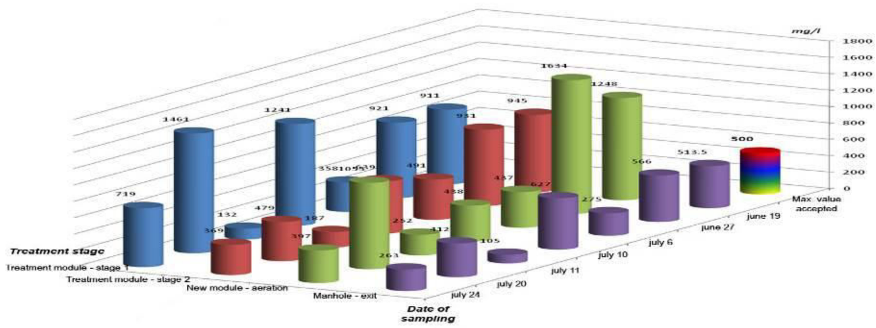

Figure 6: The evolution of the parameter "COD" during the analysis

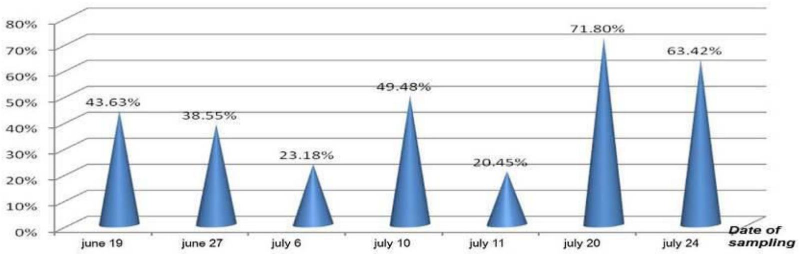

Figure 7: The evolution of the ecological efficiency of the parameter "COD"

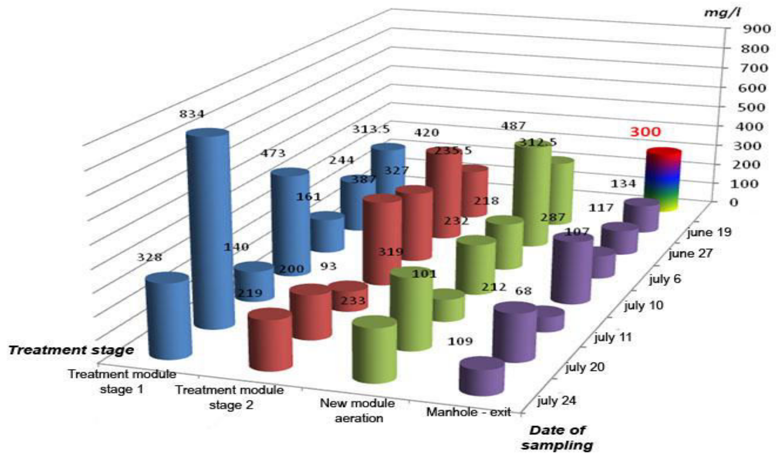

Figure 8: The evolution of the parameter "BOD" during the analysis

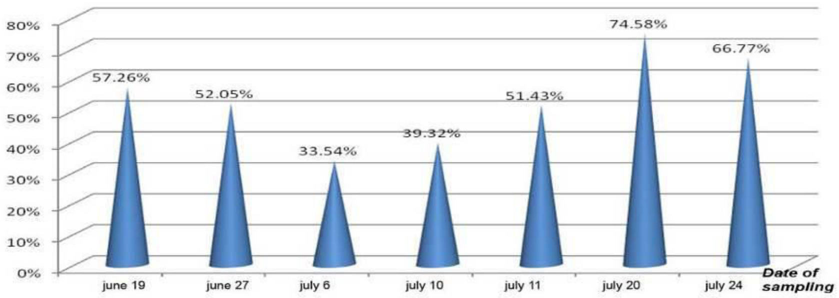

Figure 9: The evolution of the ecological efficiency of the parameter "BOD"

TECHNOLOGY SOLUTIONS FOR WASTEWATER TREATMENT BY COMBINED PROCESSES

The use of combined treatment processes of wastewater from textile companies lead to treatment efficiency and reuse in a percentage of 50-70% of water treated in industrial technology processes. In figure 10 is presented an example of combined treatment diagram:

Wastewater treatment plant characteristics:

- 100% water recirculation;
- recovery of chemicals in wastewater;
- reduction of total expenses by 0.6÷0.8 €/m^3 water;
- compliance with the European standards.

Another possibility to treat the wastewater generated by the textile industry is presented in Figure 10 and 11 and represents a scheme for aerobic/anaerobic/tricling filter combined process (Pricop F. et al., 2013).

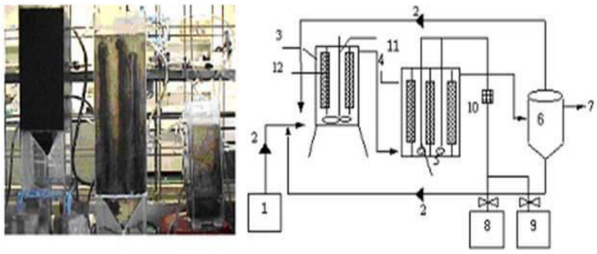

Figure 10: Plant scheme for aerobic/ anaerobic/ trickling filter combined processes treatment

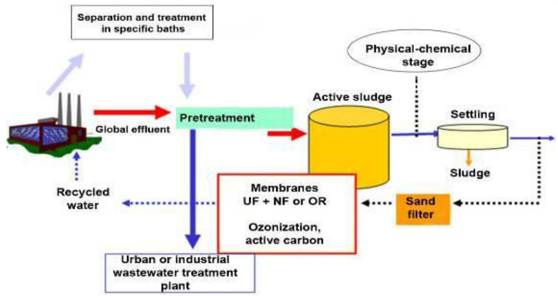

Figure 11: Combined scheme for aerobic/ anaerobic/ trickling filter treatment of collected water from specific technological processes

Wastewater treatment plant characteristics for 1.000 m^3/day capacity:

- obtaining of maximum treatment efficiency assuring the reciculation possibility of treated water;
- total expenses/ year: 0,6÷0,8 €/m^3;
- consumption reduction of water and energy.

The advantages of the solutions for treatment of collected water on specific technological processes are:

- reducing the use of chemicals for treatment;
- reducing the amount of sludge;
- reducing the amount of COD, BOD by 50÷60%;
- recirculation of treated water.

COMPARATIVE EFFECTS AND EFFICIENCY OF TREATMENT SOLUTIONS PROPOSED TO BE USED IN THE TEXTILE INDUSTRY

The identification of many treatment technologies (see Table 2) for wastewater from the textile companies is a major concern for the specialists in order to comply with EU regulations.

Table 2: Treatment processes and their efficiencies

Dyeing process	Treatment process	Treatment efficiency	Color fading
Dyeing with reactive dyes	Catalytic oxidation	30÷50% (depending on the amount of dye remaining in the bath)	10÷90% (depending on duration, 30 ÷ 120 min)
	Ozonation	30÷48%	100%
	UV/ozone radiation	85÷90%	100%
Dyeing with direct dyes	Electrochemical	84÷90%	99÷100
	Biological treatment	90÷95%	99%

ECONOMIC ASPECTS OF WASTEWATER TREATMENT

Water consumption and water price represent a factor that plays an essential role in all economic decisions aimed at choosing manufacturing processes and effluent treatment plants.

In the calculation of water cost, in addition to the water supply cost, the effluent treatment costs are also included.

An European study showed that there are different levels of water cost by country as follows [Wendland A., 2008]:

- in Germany, costs range from 2.77 to 4.3 €/m^3;
- in the UK, the current cost is between 0.6 -1.4 €/m^3;
- in France, Italy, Spain, costs range from 3 to 5.2 €/m^3;
- in Romania, the cost ranges from 3.5 to 5.5 €/m^3.

Costs for highly polluting effluent treatment are much higher sometimes exceeding 15.4 €/m^3. In these circumstances it is advisable to reuse a portion of the effluent. It should be noted that in countries where the cost is higher or where areas are affected by water shortages, lowest water consumption are registred.

Application of an increasingly tougher law in EU will lead to water price increasing and therefore, the measures must be taken for pollution prevention and for wastewater treatment.

Wastewater treatment involves substantial costs, both for investment and for operation (see Table 3) (Pricop F. et al., 2013).

Table 3: Economic aspects of wastewater treatment

Method of treatment	Performances	Costs [€/m^3]	Observations
Coagulation-floculation	Inefficient for λ=400nm	0.2 - 0.29	Primary treatment
Oxidation with active chlorine	Partially efective	4.06	AOX formation
Oxidation with H_2O_2/catalysts	Efficient	3.34 - 145	For the treatment of concentrates
Biological process	Partially efective	0,11	Further ozonization is nedeed
Ozonization	Efficient Efficient	0.22 - 0.44	Final treatment
Adsorbtion	Efficient	0.11 - 0.58	Requires regeneration - recycling adsorbent mass
Membrane	Very efficient	0,73 - 29	Final treatment for recycling
Electrolysis	Efficient	0.44 - 0.58	-

CONCLUSIONS

Through the monitoring and control of wastewater quality parameters throughout the technological process of wastewater treatment and by creating databases we will contribute to the reduction of the negative impact upon the natural ecosystems and the implementation of prevention strategies for pollution.

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EXPLORATION OF ONLINE SUPPLY OF WEB TAILORING MEN's DRESS SHIRTS

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ABSTRACT: Based on the discussions of Chinese shirts consumption demand escalation, this article has made the explorations of online supply of web tailoring men's dress shirts in China. Supply model of eleven such kinds of Chinese suppliers from Tmall.com, the China's largest retailing platform, are analyzed. Some comparisons with US, UK, and India's similar shirts web tailoring suppliers have explained with hints seeking discussion. For better developing such new supply model, a cost structure of this model is offered based on interviews of the shirts industry in Shanghai region.

Keywords: online supply, man's dress shirts, web tailoring, flexible apparel production

INTRODUCTION

As living standard in a community increases, consumers have increasing interests to have some of their apparel be tailor making for more fitting. There are several reasons for this including the fact that tailor made dress shirts really allow them to express their true identity and wear something that fits their body perfectly. Usually bridegrooms go to tailor making shops for their wedding suits, also there have been increased numbers of customers having intentions to tailor making their suits to attend formal events. According to recent report, some experts estimate that tailor making apparel requirements in China are approximately RMB 300-500 billion in which shirts segments are about RMB 60-100 billion yearly (Das, 2013; Wu et al., 2012).

RESEARCH METHOD

Firstly, Chinese shirts web suppliers are collected to make analysis of price range, delivery time, ordering processes including web ordering self-service, web real time customer service, and face to face service to make orders, as well as body measuring guidance tool availability.
Secondly, US, UK and Indian shirts web tailoring suppliers are surveyed, price and features of those suppliers are compared, and hint for developing such model are discussed.
Thirdly, cost structure of web tailoring shirts supply is developed according to the results of the interview with a manager of a shirts company.

FINDINGS (1): THE GROWTH OF MEN's SHIRTS WEB TAILORING SUPPLIERS ONLINE IN CHINA

Stimulated by customers' demand, there have been great increase numbers of dresses' web tailoring shops. And shirts tailor making is a newly emerged segment in apparel industry, which has developed with suit tailor making, and greatly become as independent supplier, because of shirts' styles are relatively easy to be standardization. In China, Shanghai and other main city people are still having the memory of PPG's efforts in shirts web retailing, which had some venture capital support and once was regarded as number one largest shirts supplier in 2006 (Li et al., 2008; Li et al., 2003). After PPG's story, there has been booming in web retailing for apparel. Main web platforms to sell shirts are as shown (see also Table 1).

Table 1: The main web platform to sell shirts in China

Taobao	***Tmall***	***Jingdong***	***Weipinhui***	***Yihaodian***	***Maikaolin***	***Vancl***
taobao.com	*tmall.com*	*jd.com*	*vip.com*	*yhd.com*	*m18.com*	*vancl.com*

All the e-commerce sites above sell shirts, but shirts tailoring suppliers are mostly concentrated on Tmall.com, the Chinese largest web retailing platform, and the main suppliers and their characteristics of customized shirts are shown in Table 2.

Table 2: The main suppliers and their characteristics of customized shirts in Tmall.com

Sr. No.	***Supplier***	***Price (RMB/ USD)***	***Delivery time (day)***	***Ordering process***			***With detailed body measurement guidance***
				Self-service	***Online Real time service***	***Face to face service***	
1	IWODE	198-998 /32-163	14		Available		Available
2	I.D.S	158-398 /26-65	7-10		Available		Available
3	MONO FORMAL	219-299 /36-49	7	Available			Available
4	LONQN	298-788 /48-128	15		Available		Available
5	Baaler	295-336 /48-55	7-10		Available		Available
6	Ushan Bespoke	598-2698 /97-440	10-14		Available		Available
7	Jieshimai	99-149 /16-24	7		Available		
8	Longqing xiang	588-6688 /96-1091			Available		
9	Yuanxiang	200-278 /32-45	14			Available	Available
10	Saint Angelo	1580-2280 /258-372	14			Available	
11	Collectrouge	349 /57	7			Available	

Four points can be analyzed from Table 2.

i) ***Price analysis****:* The price of Jieshimai is the lowest, from 99 to 149 RMB (16-24 USD) per piece. As we can see, it clearly targets the low-end market segment. On the other hand, the highest price is in Longqingxiang, as high as 6,688 RMB (1091 USD) per piece.

ii) ***Delivery time analysis***: We can see from Table 2 that the shortest time is 7 days, and the longest is 15 days. There are 7 suppliers whose delivery time is over 10 days. The logistic time in China is usually about 2 or 3 days to send goods to customer, so we know that the time spent on the production process is 7 or 8 days in China markets.

iii) ***Analysis of customization process service***: There is only one supplier, MONO FORMAL, that can totally let customers complete the ordering process by themselves with no need of any supplier's help on the web. And 7 of them guide customers to measure and order by real time customer service, and the remaining 3 suppliers offer the higher form of service, that is, sending staff to customers' place or invite them to the local store to measure the size, which costs more and requests more in hardware (e.g. store arrangement).

iv) ***Analysis of online measurement guidance service:*** what MONO FORMAL offers is the most user-friendly among all of the suppliers. What's more, it can reduce human resource input, and it indicates the direction of future development, especially this web ordering plays on the situation of cross-region (country).

FINDINGS (2): THE HINTS FROM OTHER INTERNATIONAL SHIRTS WEB TAILORING SUPPLIERS

Next is the comparison of some international brands which are successfully offering online custom tailored dress shirts from last few years. Table 3 describes the world's top seven custom tailoring shirt's companies and their important features. The companies offer their services in a number of innovative ways, and provide their services globally all around the world.

Table 3: World's top 7 custom tailoring shirt's companies and their important features

Sr. No.	***Company name***	***Price range (USD)***	***Special features***			
			Available Language s	*Making & shipping duration (weeks)*	*Orderin g process*	*Measurement guide*
1	ALTON LANE (USA based)	89-385	English	4-6 weeks	Online	Available, also can post your sample
2	HARRY SUITS (India based)	79-345	English	2-3 weeks	Online	Available
3	Modern Tailor - The art of tailoring (USA based)	20-170	English French Chinese	2 weeks	Online	Available
4	Blank Label (USA based)	95-95	English	2 weeks	Online	Available
5	Black Lapel (USA based)	99-129	English	5 weeks	Online	Available
6	STUDIO SUIT (USA based)S	34-68	English	2-3 weeks	Online	Available
7	Tailor4Less (UK based)	55-77	English French Spanish Dutch Italian, Russian	2 weeks	Online	Available

The service analysis of these world's top seven companies is summarized in following points.

i) In terms of prices, some companies offer a wide range while some are restricted to one price. The company "Modern Tailor -The art of tailoring" provides a wide range of prices (20-170 USD) depending upon the type and color of fabrics, which covers a wide range of customers.

ii) Second most important point is the delivery time. Every company needs at least two week, but some even need more time. The company "The blank label" provides the quickest delivery service with additional charges. But the price range for their shirts is too limited (just one price of USD 95).

iii) Other features like measurement guides, few companies gave customer appointment and all of them have user friendly online measurement guide. Customer can provide additional information as well as post the sample shirts and pictures.

SOME DISCUSSIONS TO PUSH FORWARD THIS KIND OF MODEL

1) Pay more attention to value proposition

A value proposition is a promise of value to be delivered and acknowledged and a belief from the customer that value will be appealed and experienced. A value proposition can apply to an entire organization, or parts thereof, or customer accounts, or products or services. Concerning the shirts web tailoring supply model, main value is the fitting of shirts, meanwhile costs should be controlled within reasonable scope.

2) Price Decision

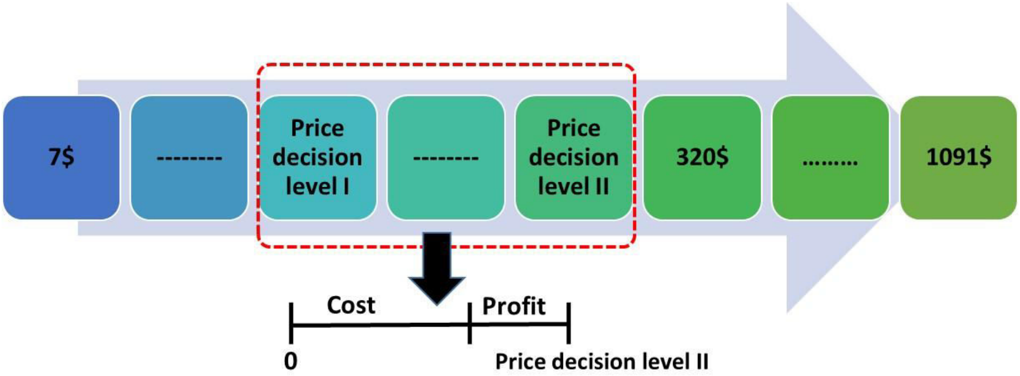

Figure 1: Price Discussion of Ongoing Suppliers in world scope

As the Figure 1 indicates the situation of prices appeared in the web globally, some suppliers position high price spectrum, even some price is extremely high, like 1091 USD, whereas some suppliers offered to lower price spectrum as only 7 USD. We believe that the offered prices are mostly related with their marketing strategies. From all the information we got for this paper, two price decision points (levels) could be discussed as following according to authors understanding of Chinese markets:

Decision point (level) one: It is the lowest price that suppliers can afford to offer. This point should be not less than USD 30 for normal business situation in Chinese markets. The prices lower than this could be a Low price trap both for the company as well as for the customer. The decision level one should stand higher than suitable cost line, which is the key issue for web ordering shirts suppliers.

Decision point (level) two: this point (level) is flexible to increase or decrease according to different market situations and product offering. Based on Table 2 and Table 3, the price of a web tailoring shirt above USD 100 in Chinese markets would have few customer responses. In short, such shirts web tailoring supply in the scope of USD 30 to USD 100, would have good potential in future.

3) Cost Structure

As price is determined by markets, especially inference by competitors, if shirts web tailoring suppliers want to survive and develop well, the cost control is their main concern. Based on our research, a shirts web tailoring supply cost structure is provided as follows in Figure 2.

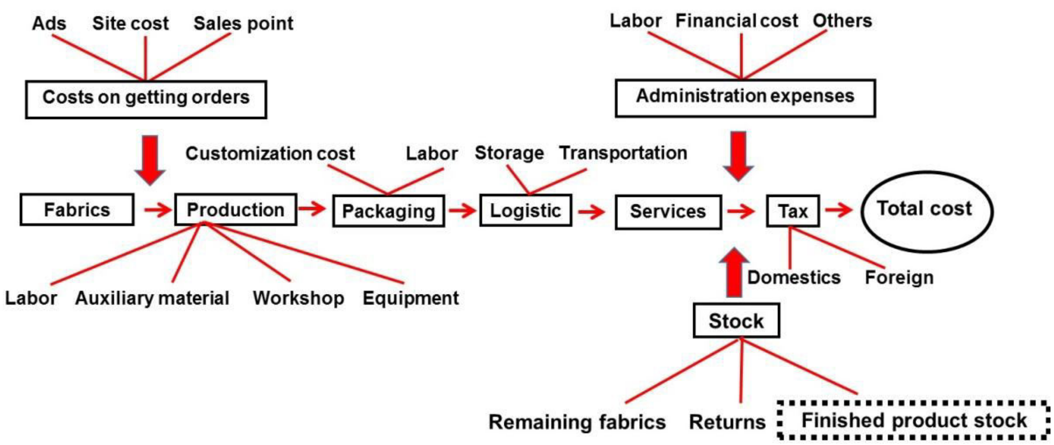

Figure 2: Cost structure of shirt web tailoring supply model

Among all factors of the cost structure of Figure 2, fabrics, getting orders and production are the main costs. Whereas stock costs are also important for such model's success, which is a typical advantage for new model for manufacturing suppliers in Chinese apparel industry, especially there is very few finished product stocks in this tailoring model.

Table 4: production cost for one customized shirts of 100 counts

Item	***Fabric***	***Lining***	***Interlining***	***Button***	***Packing***	***Labor***	***Total***
Price(RMB)	51.2	0.14	1.6	1.1	2	35	91.04

Source: Winful industrial development Co., LTD, Shanghai

From Table 4, we know that major cost of shirts is fabric, which is equal to 56% of the total production cost, whereas labor is about 38% of this cost. The labor cost of one shirts making in China is far less than that in Europe and US.

4) Unique Advantage in stock issue

Stock issue is one of the key factors which cause failures in most Chinese apparel suppliers in traditional model. Whereas tailor ordering supply model is that ordering is the first and production is the second, it could greatly reduce the inference of stock issues, which is a unique advantage for this model. To develop a quick response fabric supply system in small quantity therefore to increase purchasing quantity of fabrics become new concerns for such suppliers. Meanwhile up and downstream cooperation in textile and apparel production is greatly encouraged to face this new customer trend.

5) International cooperation and future prediction

As China has developed quite good fabric manufacturing capacities, for such kind of shirts or suits web tailoring suppliers' development, there is a need of international cooperation between China and other nations, especially in European region. Local nation's geographic location and good customer demand understanding of partners have obvious advantages to develop such international cooperation. Also local company's customer services are also the advantage for supporting online ordering for such tailor making.

Concerning future prediction of such model, people may think about the cases of Alibaba's taobao, which is the largest web retailing provider in China, as well as other Chinese largest OTA provider Ctrip.com. Those two successful cases indicate the great power of internet, so we may expect shirts web tailoring supply could also have great development in the future.

SUMMARY AND IMPLICATIONS

This article points out that shirts web tailoring supply is a new segment of apparel web tailoring industry, which has been stimulated by customers demand escalation. Shirts web tailoring suppliers from China, US, as well as other countries have shown the common attentions to body measuring technology in web, meanwhile off line customer service support and on line customer services are seen as the trend, especially from Chinese market. The key to the success of this model is to propose right value proposition, whereas suppliers' main efforts in cost reduction are to choose the proper fabrics supply, reduce the costs of getting orders, and to invest flexible production line. International cooperation in production and marketing for shirts web tailoring supply is also a meaningful topic for China and Europe firms as well as for both parties' textile scholars and experts.

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THE INVESTIGATION OF WARP KNITTED FABRIC FOR SPECIAL PURPOSES

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ABSTRACT: The research in the sphere of development medical devices, health care and prophylactic articles is incessantly, that can significantly extend the market potential of new product. Overwhelming majority of this market is still medical textiles, particularly for traditional products such as wipes and swabs, wound dressings and orthopaedic bandages. Research into innovative medical textiles is now concentrated in the areas of highly intelligent medical products and implantable devices. The properties of medical knitted bandages intended for compression therapy for the treatment of venous leg ulcers is discusses in article.
For the research were selected five samples of elastic bandages knitted fabric with elastomeric yarn. Elastomeric yarn is laid in a walewise direction and is feeding with the extension to ensure the elastic properties of knitted fabrics. The chain with closed loop is used as the basic interlooping with different drawing of guide-bar. Wales of chain loop are connected into the fabric by weft yarns, which are laid at the different sides of fabric in order to full cover the elastomeric yarn. The linear density of weft yarn is exceeding the linear density of ground yarn for chain in order to create a dense lay which prevents the output of the elastomeric yarns on the surface of the fabric. In-layed yarn and weft yarns are positioned between the underlap and overlap of chain loop, which is dense wrapped around them and holds them in the structure.
The research of the structure parameters and properties of fabrics were carried out according to standard methods. The influence of elastomeric thread on physical and mechanical properties has been established.

Key words: warp knitted fabric, structure parameter, chain, elastomeric thread, bandage, physical and mechanical properties

INTRODUCTION

The modern people, who is accustomed to the comfort, can hardly imagine life without such a polyfunctional and comfortable material as knitwear. Given the great interest of the consumer in this material, knitting industry fairly rapidly gaining prestige in various fields, develops more and more areas of application jersey, while providing a good appearance of their products, creating everything in order to not fall into question the claimed function and properties of a product.

Knitwear medical devices, or as it is sometimes called, medical hosiery has a very wide area. In jersey medical purpose, including different compression products are popular as weft and warp knitted fabrics [1]. The diversity and purpose of elastic medical fixing and compression products large enough. By construction, these products are divided into some groups: elastic bandages, bandages for fixation of joints, compression garments, hosiery productsof highly compression. However, despite this diversity, practical interest are elastic bandages that are no worse, and some times the best treatment medical tool with much lower price than other compression tools. The tension of the bandage and the degree of compression is created yourself, so the product is beneficial in various of injury, prevention and treatment of diseases of veins of different stages. Elastic bandage is indispensable in sports where often occur minor injuries [2].

Bandages are tubular and flat. Flat elastic bandage are divided into low, medium and high tensility, which differ in percentage of elongation and according indications to their use. By appointment products is divided into preventive, medicinal and fixing. The degree of compression products are divided into five classes, depending on the pressure that it creates on the human body.

THEORY

The need for compression products continuously increases, it is always creating new and improving existing methods for their production. When developing elastic materials for bandages should take into account certain requirements such as: manufacturing technology should provide the necessary performance and quality product, to withstand reusable washing without changing the functional, physical and mechanical properties, to ensure even distribution of pressure, stretch well to provide physiological muscle massage, without compromising normal level of plasticity of movement, should not change their size while in service. Providing these properties is due to the the raw composition of fabric and interlacing it.

The manufacturing of compression fabrics with special properties may be due to the use of elastomeric yarn, which are increasingly used in the production of the jersey and give it the necessary properties. The use an elastomeric yarn, which is capable after unloading to recover its original size, has led to the development of new types of textile fabrics, which feature is extensibility, elasticity, compressive ability when used in a stretched state. Fabrics containing elastomeric yarn are very stretchable and these properties are preserved during exploitation. Given the impact of elastomeric yarns for fabrics structure is a very important study its properties [3].

The properties of fabrics is defined not only the properties of the yarns used, but their relative positioning in the structure of the knitwear. The choosing of a fixing method of the elastomeric yarn is depend on requirements that apply to the preventive goods: the stable fixing, the structures uniformity and the fabric elasticity. Besides, the elastomeric yarn should be positioned inside of the knit structure, in order to avoid its contact with the human body.

The using of elastomeric yarn as in-lay lets create a fabric with a lower consumption of materials compared to other ways of its fixing, making maximum use of their elastic properties. Furthermore, this method of introducing the elastomeric yarn in knitted structure allows used don’t braided yarns as they are not in contact with the needles. This allows the widest range regulate elongation and compression properties of products [4]. The use warp knit structure as a basic interlooping provides reliable wrapping an elastic thread by loops. The necessary flexibility and extensibility of knitted fabrics are caused by the pre-stretching of elastomeric yarns and their relaxation after the removal of the draw-off force.

METHODS

The purpose of this work is to investigate the influence of elastomeric yarn on the structures parameters and properties of warp fabrics. To achieve this purpose warp knit fabric with various variants of elastomeric yarn in-laying were produced; the structure parameters and the physico-mechanical properties of warp knitted fabrics have been investigated.

The standard tests methods were used for experimental research of the properties of elastic warp knit fabrics [5, 6].

RESULTS AND DISCUSSION

Warp knitted fabrics, which are used for the manufacture of medical bandages, have been produced with using to four guide-bar. There were investigated five variants warp knitted interloping. In all samples, the chain with closed loop is used as the basic interloping with full drawing of guide-bar for first variant. In the second, third, fourth variants – drawing of guide-bar through one needle, for the fifth – through two. Elastomeric yarn is laid in a walewise direction and is feeding with the extension to ensure the elastic properties of knitted fabrics, drawing of guide-bar a similar. Wales of chain loop are connected into the fabric by weft yarns, which are laid on the entire width of the fabric at the different sides of fabric in order to full cover the elastomeric yarn. In the first variants on the one side are laid weft yarn on two needles with the full drawing of guide-bar, on the other side is laid on the entire width fabric. The linear density of weft yarn is exceeding the linear density of ground yarn for chain in order to create a dense lay which prevents the output of the elastomeric yarns on the surface of the fabric. Therefore, for all the variants fabrics were used for weft thread a linear density of 31 tex (cotton); chain - 18.8 tex and elastomeric tread - diameter of 0.6 mm (table 1). In-layed yarn and weft yarns are positioned between the underlap and overlap of chain loop, which is dense wrapped around them and holds them in the structure. Such warp knit structure has high dimensional stability and provides comfort, because elastomeric yarn is located inside of the knitted fabric and has not negative influence on human skin.

Table 1: Producing data

Fabric	Linear density, tex			Diameter of in-lay elastomeric thread, mm	Length of yarn per unit, мм			
	Chain	Weft yarn 1	Weft yarn 2		Chain loop	Weft 1 per wale	Weft 2 per wale	In-lay per course
1	18 Nylon	31 X 2 cotton	31 X 2 cotton	0,6	5,7	1,6	1,6	0,54
2	18 Nylon	31 X 6 cotton	31 X 6 cotton	0,6	5	1,6	1,6	0,76
3	18 Nylon	31 X 2 cotton	31 X 2 cotton	0,6	4,2	2,9	2,9	0,53
4	18 Nylon	31 X 3 cotton	31 X 3 cotton	0,6	3,3	3,2	3,2	0,51
5	18 Nylon	31 X 3 cotton	31 X 3 cotton	0,6	4	4,8	4,8	0,72

The research parameters knitted structure showed that in all variants the elastomeric yarn to be knitted in a stretched state, and with the decrease of the length of the weft elastomeric yarn to form a loop height course is reduced. When restoring its original size in the structure of knitted fabrics, elastic thread is tilts chain loops to the loop course. The greatest thickness of the fabrics has the variant 2, which uses weft yarns maximum folded yarns. This leads to the location of the weft yarn in a plane perpendicular to the structure of fabrics. Uniform thickness is determined in samples 4 and 5, when of length in the loop of the chain yarn is different. This is explained by the fact that the structure of the variant 4 elastomeric yarn are less regains transverse dimensions, has a smaller diameter. The most basic weight a variant 2, with the highest linear density of weft yarns, smallest basic weight has the variant 5 (table 2).

Table 2: The structure and strength parameters of knitted fabrics

Fabric	Thickness, mm	Loop step, mm	Course height, mm	Basic weight, g/m^2	Breaking load, P_P, кгс	Breaking elongation, l_P, мм
1	1,38	1,6	0,55	432	27	181
2	1,55	1,6	0,78	601	15	129
3	1,2	2,9	0,54	392	20	99
4	1,1	3,2	0,55	406	15	51
5	1,1	4,8	0,73	343	20	94

The investigation of deformation properties of particular importance for compression products. In uniaxial tension the material to break down the characteristics of strength and deformation of materials. Analyzing the data, we concluded that the breaking load which can withstand the sample, depends on the strength and tread and orientation of the material elements looped structure. Elastomeric yarn is laid in the structure of knitted fabrics with advanced traction, after unloading restores the original sizes at it changes the slope of the chain loops nearer to the line of course.

Because of this, more straightened loop chain with greater number of looped up, maintain less frangible load than those inclined. Because of this, a straight chain loop with greater height course, withstand lower breaking load than those are tilted. Also necessary to consider drawing of guide-bar chaser because of decrease in the number drawing threads increases load on the one wales. So variant two and four withstand the slightest load. Variant five, which the maximum height of the wales, withstand more load, because have full drawing threads. All investigating samples meet the standard.

Feature of the use of such warp knit fabrics is the need to support tensile loads. The processes with an alternation of loading, unloading and rest affect the structure of fabric, which is being deformed and changes the original shape and size. Therefore of considerable interest is to study the mechanical characteristics of the fabrics to breaking fabric. The results of this research are presented at table 3.

Table 3: Deformation properties of knitted fabrics

Fabric	Full stretch	Parts of full stretch, %			Parts' quota		
		elastic	plastic	residual	elastic	plastic	residual
	ε, %	ε_1, %	ε_2, %	ε_3, %	$\varepsilon_1/\varepsilon$	$\varepsilon_2/\varepsilon$	$\varepsilon_3/\varepsilon$
1	229,5	223,5	4,3	1,6	0,97	0,02	0,006
2	98	95,2	2,6	0,16	0,97	0,03	0,001
3	149	145	3	1	0,97	0,02	0,007
4	106	102	3	1	0,96	0,03	0,009
5	50	49	1	0	0,98	0,02	0

The full stretch of warp knitted fabrics is 229,5 – 50 %, while the elastic part of it is constitute 96-98%. This means that almost all samples at 2-5 seconds restore its original size and shape. Residual part of full stretch is less than 2%, that is important for this type of product. This makes it possible iteratively apply bandages, as they have a large elastic and the ability to quickly to recover size.

The greatest elongation has variant one, in which the maximum length of the thread in the loop of the chain and the minimum height of the loop wales. The lower elongation has five variant in which the height of wales of much more. That is the stretch of such fabrics depends on the low-stretch interloping chain, which in this case is oriented (tilted) along the course.

CONCLUSION

The use of elastic warp knitted fabrics for the manufacture of bandage products is promising way. Investigations of warp knitted fabric with elastomeric thread showed that the stretching of an elastomeric yarn during the knitting greatly affects the structure parameters and properties of knit fabric. Besides, the orientation of the chain loops in the fabrics is changes. The increase linear density of the thread to the increased basic weight and the thickness of the knitted fabric. On the deformation properties of knitwear affects pre stretching the elastomeric yarn and have a linear density of the yarn. As a result of the research established standards compliance variants 1-4.

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TEACHING IN THE FIELD OF TEXTILE IN PRIMARY SCHOOLS ON EXAMPLES OF GOOD PRACTICE IN SWEDEN

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Abstract: This paper presents the teching subject in the Swedish primary schools, that comprises the field of textile. Historical development of the case and a description of the goal of this course today, is presented in this paper. Based on the many years of work in teaching this subject in Swedish schools, the first two authors have presented the most important benefit from this course in education. The paper further emphasizes that this case may be a good basis for students from our elementary schools primarily as a subject that will promote the textile area among young people. Therefore, the authors recommend certain activities in initiating the process of recomendatition, to the appropriate government authorities, of including this type of teaching subject into the curriculum.

Key words: primary education in Sweden, the textile area, the promotion of the textile sector.

INTRODUCTION

The fact that the success of any enterprise is crucial managerial, technological and technical knowledge and experience of experts in the company doesn't have to be argued.

However, the textile and clothing industry in Serbia has suffered a drastic decline in production. The problems that this industry faces today are largely specific and related to the longer period of unfavorable economic conditions. One of the main problems that the sector faces today is certainly a lack of adequate personnel. This is due to the lack of interest of young people in entering this sector.

Despite such adverse conditions the textile and clothing industry in Serbia has survived and today employs more than 25,000 workers. New investment and oppening of the new job possitions are mostly slowed due to the lack of workers with adequate skills from sewers to engineers and production managers. Therefore, this paper gives some suggestions for the promotion of the sector, among young people. The proposals are based on the best practices of the educational system in Sweden, which has included Crafts in primary school teaching subjects. This item also includes the acquisition of knowledge and skills in the field of textile.

This paper presents the data that was acquired in the direct work and implementation of this subject in the Swedish primary schools by the first two authors and also based on the experience of other authors who work in our educational system. The paper used information from literature sources [1 and 2] as well as from other literature sources referred to in the text.

HISTORICAL DEVELOPMENT OF TEACHING SUBJECT THAT INCLUDES THE AREA OF TEXTILE IN SCHOOLS IN SWEDEN

The term (Slöjd), hand-made household objects, first appeared in Swedish language, in legislation, back in the year of 1300, and has been used, more or less, in private practice of education in the Swedish national schools. [Myndigheten för skolutveckling, 2007: 18].
When the law was enacted on compulsory education in Sweden in 1842, the teaching subject handmade textile, wood and metal products, was not on the list of compulsory subjects. Only a few years later in national schools this subject is added as practical teachings, especially for boys (wood and metal) and girls (manufacture of textile). [Hartman, 2003: 104]

Skilled women taught the girls how to spin, weave and sew, while skilled men taught the boys how to handle and produce items of wood and metal.

It has been introduced to the public schools as a separate subject already in 1878, 35 years after the enaction of the law on compulsory education, but only in 1955 became a compulsory subject in all forms of the Swedish school SITEMA. And even today there is a great need for teachers, in Sweden, who teach this subject and have relevant pedagogical education degree.

In the 19th century, Otto Salomon and Hulda Lundin had a major impact on development and shaping the content of this course. Otto Salomon founded the school in Nees for teachers who will train the boys to produce objects made of wood and metal, while Hulda Lundin had a similar school for teachers who will train the girls in the field of textile arts in Stockholm.

With the new curriculum from the year 1919, Swedish school system has received three new courses: drawing, physical education and production of textile, wood and metal. While drawing was a common subject for both girls and boys, physical education and production of textile, wood and metal were separated for boys and girls. [Berge, 1992].

"Textile section had a collection of artifacts that belonged to their mothers as an inspiration, and wood and metal section took inspiration from the works of their fathers that were made in their workshops." [Trotzig 1997: 117].

With the curriculum from the year of 1955, this subject became compulsory in all schools in Sweden – national as well as state. But the subject was still divided into two cases in order to give the opportunity for boys and girls to try, in a short period of time, that other kind of handcraft – boys to try crafts of producing textile and girls of producing wood and metal. This posibility to try was limited to 20 lessons in the period from the fourth to the sixth grade.

"All the boys should master the basic techniques of wood and metal and to get familiar with the tools needed to process them. All girls should master the basics of textile crafts and maintenance of textiles in the house. Girls should not be unaware of wood and metal processing, and boys should also know something about textile materials, cooking and caring for children. [Samtliga flickor bör f lära sig grunderna and syslöjd och hemmets skötsel. "- Berge, 1992: 57].

The new curriculum from 1962, gives the possibility that both boys and girls can change the craft program in a short period of time ... "and that in a short period of time can be involved in both craft orientation," but in practice it has been used only in some schools. [Med den nya läroplanen från år 1962 fick Elever möjlighet att byta slöjdart och under "-Johansson 2002: 10].

In 1969, the new curriculum comes into force, that states that... "all craft programs are mandatory for boys and girls from grades 3-6." [Johansson, 2002: 10]. So that the curriculum of 1980, students are given the opportunity to ... "from7-9 grade can choose in which group they want to master crafts" [Johansson, 2002: 10].
Curriculum in 1994, the division of the wood-metal crafts and textile crafts was made, with the desire for it to be a common subject of craft techniques that will contain the two groups mentioned. [Johansson, 2002: 10].
Latest syllabus from 2011, LGR11 implies that craft techniques are one unified teaching subject.

Lectures, in the craft technique subject, starts from the premise that students develop and master the various craft techniques with various tools and stated abilities of working with different materials and different forms. Students are given the opportunity to develop and improve in the process of where their thinking, feeling and practical work come to the full expression. [Skolverket, 2011a: 213].

DESCRIPTION OF THE CRAFTS TEACHING SUBJECT

According to the data from the sources of the given literature [2], this case can be described in the following manner: Producing objects and processing material with the help of tools is one way for people to think and express themselves. Working with crafts is a type of creativity involving creating concrete solutions within the tradition of handicrafts and design based on needs in different situations. Crafts involve a combination of manual and intellectual work, which together develop creativity, and strengthen belief in the ability to manage tasks in daily life. These abilities are important, both for the individual and the development of society.

AIM

Teaching in crafts should aim at helping the pupils to develop knowledge of different handicrafts and the ability to work with different materials and forms of expression. Pupils should be given opportunities to develop their skills in a process where thinking, sensory experiences and action work together.

Teaching should give pupils the opportunities to develop ideas, consider different solutions, produce and evaluate the results. In this way, teaching should contribute to stimulating the pupils' curiosity to explore and experiment with different materials, and take on challenges in a creative way.

Through teaching, pupils are given opportunities to develop knowledge of colour, form, function and design, and about how this knowledge can be combined through making conscious choices of materials and techniques. Moreover, the teaching should contribute to pupils developing familiarity with concepts describing working processes, tools and the aesthetic expressions of craft productions. Pupils should also be given opportunities to develop knowledge of the working environment and safety issues, and how to choose and handle materials in order to promote sustainable development.

Teaching should contribute to pupils developing an awareness of aesthetic traditions and expressions, as well as an understanding of crafts, handicrafts and design from different cultures and periods.

Teaching in crafts should essentially give pupils the opportunities to develop their ability to:

- design and produce objects from different materials using appropriate equipment, tools and handicraft techniques,
- choose and give reasons for their approach in handicrafts based on the aim of the work, and on quality and environmental aspects,
- analyse and evaluate work processes and results using terms specific to the crafts, and
- interpret aesthetic and cultural expressions of craft objects.

CONCLUSION

After 1955, the teaching subject of craft techniques isin the constant development from the elective subject, divided between genders (male - female) to the subjects who gives importance where the plans are implemented in actual products, where the thought and action are in a constant and indivisible process. Period when students did not have the opportunity to choose which technique will they master, until now when they have a free choice in choosing the technique in the final years of primary school. Also, the situation involving the teachers has changed significantly from the detailed curriculum for each craft techniques to curriculum and program from 1994, where the teachers and students have been given the possibility of free choice in the order of mastering techniques during the education. In the latest curriculum from 2011, LGR11, there are given clear guidelines what to do and has limited the possibility for students to work with only one technique. This means that if students want to get better grades they have to master the majority of craft techniques.

Based on the given facts, it can be concluded that this course can be a good foundation for the students of our elementary schools, primarily as a subject that will promote the textile area among young people. Therefore, It would be necessary to start the procedure of recommendation, to the appropriate government authorities, to include such a subject in the curriculum of elementary schools.

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THE EFFECT OF DYEING TEMPERATURE ON COLOUR YIELD, STRENGTH AND ELASTICITY PROPERTIES OF ELASTIC POYLESTERS

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ABSTRACT: Polyesters (PES) are the most important polymer class which widely used in textile industry. Poly(trimethylene terephthalate) (PTT) and poly(butylene terephthalat) (PBT) fibers are new important aromatic polyesters that display nice elasticity and easy dyeing properties and these fibers are known as elastic polyesters. In this study, PTT and PBT fiber knitted fabrics were dyed with disperse dyes (C.I. Disperse Red 167:1 and C.I. Disperse Red 65) at pH 5 with various dyeing temperatures (100^{o}C, 110^{o}C, 120^{o}C and 130^{o}C) for 30 minutes. The color yield, colorimetric properties, elasticity and strength performances of dyed elastic polyesters are investigated and compared for each dyeing temperatures. Dyeing processes at all dyeing temperatures studied (100^{o}C, 110^{o}C, 120^{o}C and 130^{o}C) did not led to any adverse and/or detrimental effect on strength and elasticity properties of PTT and PBT fiber fabrics. On the contrary, dyeing at all four studied dyeing temperatures led to stronger and more elastic fabrics for both PTT and PBT fibers in comparison to their greige fabric counterparts. However, these strength and elasticity increases are due to fabric shrinkage and ultimately tightening. Overall, all dyeing temperatures studied (100^{o}C, 110^{o}C, 120^{o}C and 130^{o}C) led to similar colorimetric, strength and elasticity properties for both PTT and PBT fibers. Therefore, 100^{o}C can be selected as optimum dyeing temperature for both PTT and PBT fibers due to its lower operational cost.

Key words: Poly(trimethylene terephthalate) fibre, poly(butylene terephthalat) fiber, PTT, PBT, elastic polyesters, dyeing temperature, strength, elasticity

INTRODUCTION

Throughout the world, 2010 global polyester staple fiber production was estimated as 13,3 million tons leading to leader of the world textile fiber production [3]. Therefore, polyesters (PES), a polycondensation polymer, are known as the most important fiber polymers for textile industry [1, 2]. Poly(trimethylene terephthalate) (PTT) and poly(butylene terephthalat) (PBT) fibers fibers are known as elastic polyesters due to their good elasticity properties [5]. Researchers reported that PTT has an elastic unit cell having a zigzag structure and giving a tightly wound helical structure to the polymer chains [1, 2, 4]. These chains can be acted like a coil spring during elongation [2]. PTT can be produced by polycondensation reaction with PDO (1,3-Propanediol) and DMT (dimethyl terephthalate) or TPA (terephthalic acid). On the other hand, PBT is produced by again polycondensation reaction with BDO (1,4-butanediol) and DMT or TPA (Figure 1) [1, 4]. These polyesters, which are used for many different textile applications, can be easily dyed at low temperatures with disperse dyes [6, 7]. PTT and PBT fibers can be used in ready-to-wear, intimate, active and sportwear apparels, carpets, swimwear, automotive and home upholstery applications (Figure 1) [1, 4, 6]. PBT and PTT fibers were presented to the textiles markets as trademarks of ‘Cleanex’ (PBT) and Sorona (PTT) and Corterra (PTT), respectively [1].

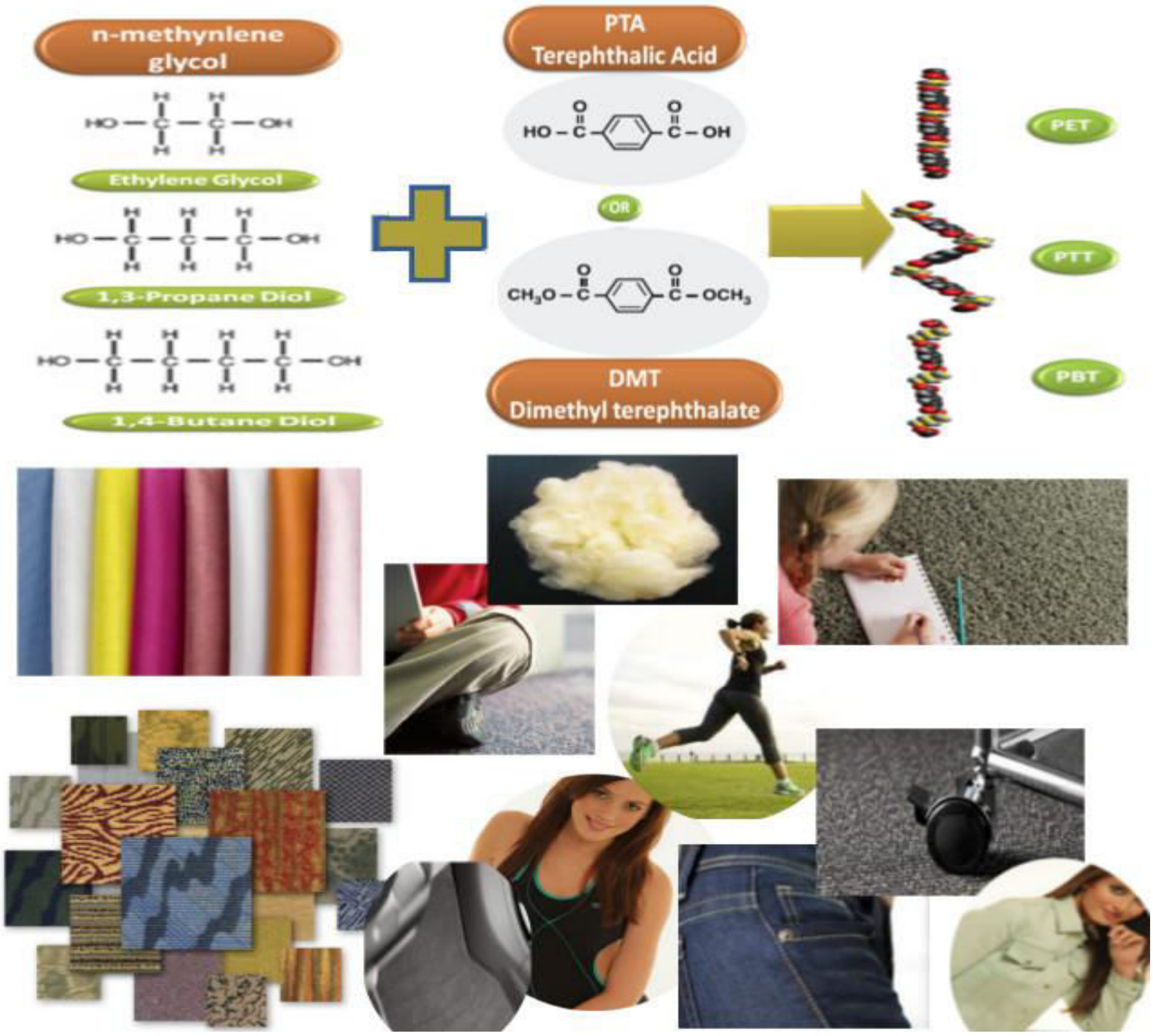


Figure 1: *Raw materials and textile application areas of PTT and PBT [4, 6, 13-15, 17-21]*

In the last decades, many researchers have been studied about dyeing conditions of PTT and PBT fibers. In recent studies, PTT fibres were dyed at 60 °C [31], 70 °C [31], 80 °C [31], 90 °C [31], 95-100 °C [29, 30], 110 [32], 120 °C [32], 130 °C [32] for 30-60 min [29] or 20-40 min [30] with disperse dyes [29, 30, 31, 32]. pH values of dyeings were in the range of 4-9 [29], 5 [31] or 7 [31]. In these research studies, exhaustion, colour strength or kinetic properties of dyeings [29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40] of PTT fibres were investigated. Similar to PTT fiber, PBT fibers were dyed at 80 °C [22], 95 °C [22], 98 °C [22], 100 °C [23, 25] and 130 °C [22] with disperse dyes for 30, 40, 45 [22] and 60 [25] minutes. The pH values of these dyeing were generally adjusted to pH 5. Again color strength, color fastness and/or exhaustion properties [22, 23, 24, 25, 26, 27, 28] of PBT fibres were investigated during dyeing.

The main striking property of these elastic polyester fibers (PTT and PBT) is their valuable elasticity property. We think comprehension about the effect of dyeing temperature on the elasticity and strength properties of PTT and PBT fibers is vital for textile industry. In this study, therefore; the effects of dyeing temperatures on not only elasticity and strength properties but also color yield and colorimetric properties of PTT and PBT fiber knitted fabrics were investigated and discussed.

EXPERIMENTAL

Materials
100% PTT fiber and 100% PBT fiber single jersey knitted fabrics were used for dyeing studies. All fabric samples were scoured and then rinsed before dyeing experiments to remove any possible impurities.

Dyeing

The dyeing processes were carried out using two commercially available disperse dyes, C.I. Number Disperse Red 65 and Disperse Red 167:1. Dyeing processes of PTT and PBT fiber fabrics with these two disperse dyes were carried out according to exhaustion method at 2% dye concentration in company with 1 g/l dispersing agent in an Atac Lab-Dye HT machine at a liqour ratio of 30:1. Various dyeing temperatures (100^{o}C, 110^{o}C, 120^{o}C and 130^{o}C) were applied in order to investigate the effect of dyeing temperatures on the elasticity and strength properties of PTT and PBT fiber fabrics. As a result of literature review, optimum dyeing pH and dyeing time for dyeing experiments were chosen and applied as pH 5 and 30 minutes, respectively. For each different dyeing temperature disperse dyeing, dyeing pH is adjusted via acetic acid/sodium acetate to reach pH 5. The PTT and PBT fiber fabric samples were rinsed with warm water (40 ^{o}C) for 5 minutes and then further rinsed with tap water for 5 minutes. Afterwards, all dyed fabric samples were reduction-cleared with 3 g/l sodium hydroxide and 3 g/l sodium dithionite at 50 ^{o}C for PTT fiber and 40^{o}C for PBT fiber, due to their low glass transition temperature points, in an Atac Lab-Dye HT machine to remove unfixed surface dyes. Afterwards, the samples were washed with warm water (40^{o}C) for 5 minutes and tap water for 5 minutes to clear any remaining unfixed dyes and clearing chemicals on the fabric surfaces and left in the air for flat-air-drying. These air-dried samples were used for colorimetric measurements, strength and elasticity determination.

Colorometric Measurements

The CIE Lab *L*, a*, b*, C*,* and h^o values were measured with using a DataColor SpectraFlash 600 (Datacolor International, Lawrenceville, NJ, USA), spectrophotometer under illuminant D65, using 10º Standard observer for each dyed samples. The colour strength value K/S is calculated by using the Kubelka-Munk equation. The equation of *K/S, Eq. (1)* is given at below:

$$K/S = (1-R^2)/2R \tag{1}$$

Dimensional Stability

It is known that fabric shrinkage may occur during hot-wet processing. Therefore, dimensional stability of both fabrics after dyeing processes was investigated. Both PTT and PBT fiber fabrics have been left in relaxed situation in standard atmospheric conditions for two days and have been marked with reference points sized 0,1m*0,1m squares. The squares have been placed on wale and course directions. Then, fabrics were dyed according to aforementioned various conditions and again left in relaxed situation in standard atmospheric conditions for two days. The dyed samples reference points were measured in both course and wale directions for fabric shrinkage calculations [41].

Strength and Elasticity Measurements

Elasticity and strength measurements of dyed PTT and PET fiber fabric samples were carried out using Titan 3 machine in accordance with BS 4952 elastic fabrics test protocol and ASTM 5034 (Grab Method) test, respectively.

RESULTS AND DISCUSSION

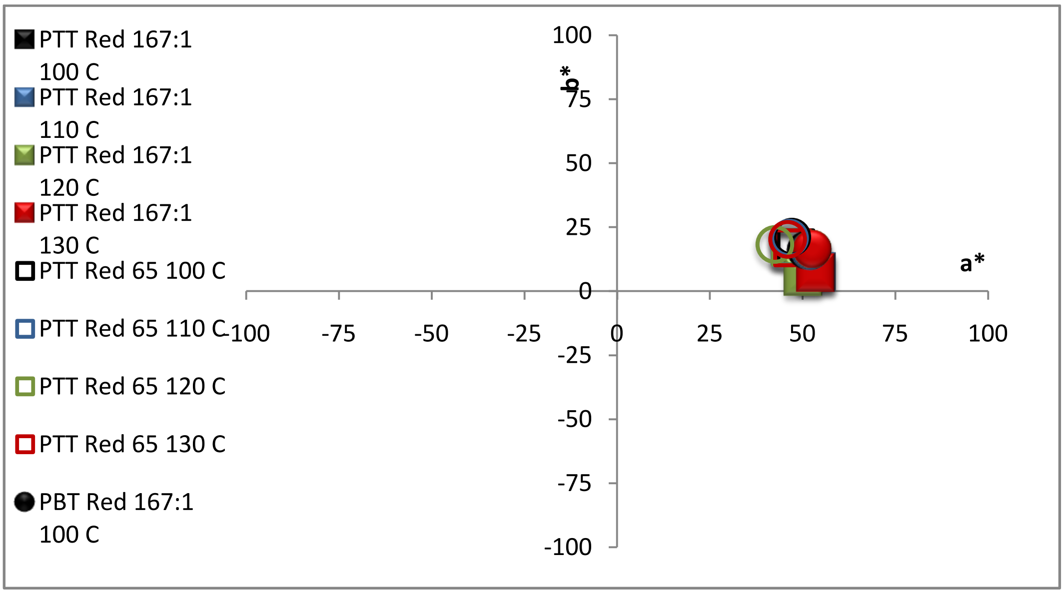
Color Properties of dyed PTT and PBT fiber fabrics

The colorimetric data of the dyed PTT and PBT fiber fabric samples are shown on Table 1 and Figure 2a-c.

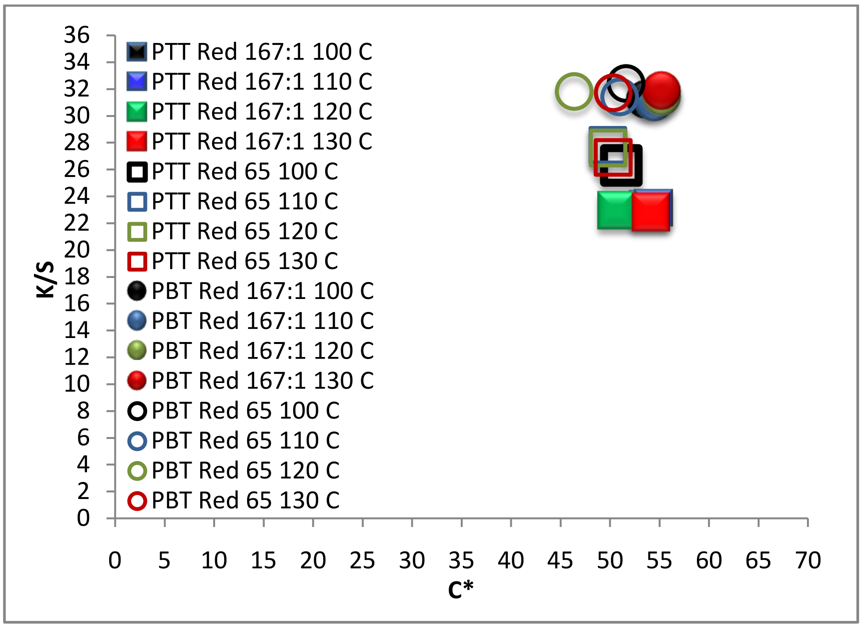
Table 1. *Colorimetric properties of PTT and PBT fabrics dyed at pH 5 for 30 minutes*

Fiber Type	*Disperse dye (C.I. Index Number)*	*Dyeing Temperature (°C)*	*L**	*a**	*b**	*C**	*h°*	*K/S*
PTT	**Red 167:1**	**100**	35,3	53,3	7,5	53,9	8,1	23,0
		110	35,5	54,0	7,6	54,48	8,0	23,1
		120	34,1	50,3	5,7	50,7	6,5	22,9
		130	35,5	53,7	7,0	54,2	7,4	22,8
	Red 65	**100**	32,4	48,2	17,0	51,15	19,4	26,3
		110	31,1	46,7	17,3	49,8	20,4	27,8
		120	31,0	46,8	17,2	49,83	20,2	27,6
		130	31,8	47,4	17,0	50,34	19,7	26,9
PBT	**Red 167:1**	**100**	31,2	51,2	15,8	53,6	17,1	31,2
		110	31,8	52,2	15,7	54,5	16,7	31,0
		120	31,8	52,8	16,4	55,3	17,3	31,4
		130	31,6	52,8	16,5	55,26	17,3	31,8
	Red 65	**100**	29,0	47,1	21,1	51,65	24,2	32,4
		110	28,8	46,6	20,8	50,99	24,0	31,4
		120	27,1	42,6	18,3	46,4	23,2	31,8
		130	28,5	46,1	20,3	50,36	23,8	31,7

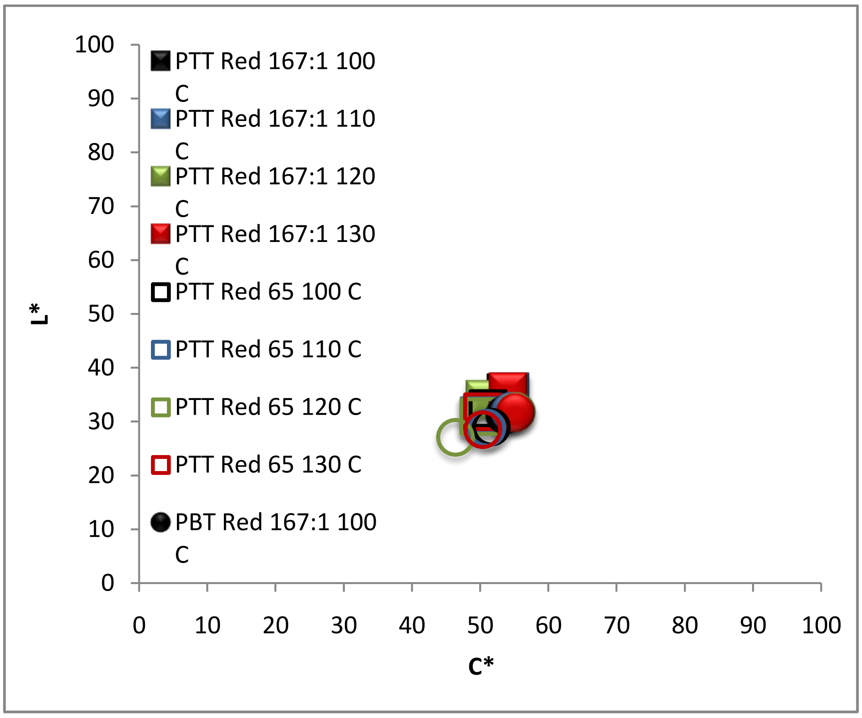
Overall, PBT fibers exhibited higher color strength values than PTT fibers (Table 1 and Figure 2b). Various dyeing temperatures resulted in similar comparable colorimetric properties and color yield (K/S) for both fibers (Table 1 and Figure 2a-c). So, 130°C dyeing has no advantage over 100°C dyeing or any other dyeing temperature studied in respect of colorimetric properties for both PTT and PBT fibers (Table 1 and Figure 2). Measured hue angle values (h°) were below 90° (yellow-red axis zone) for all dyed PTT and PBT fibers leading to red shades as expected (Table 1 and Figure 2a). Lightness and chroma values of dyed samples were similar (Table 1 and Figure 2c).



(a)



(b)



(c)

***Figure 2.** Color properties of dyed samples; (a): a*-b*, (b): K/S-C* (c): L*-C* plots,*

Therefore, 100°C can be selected as optimum dyeing temperature for both PTT and PBT fibers from the colorimetric point of view. This is actually in line with earlier studies [7, 16, 22]. However, it is important to clarify whether this conclusion could be justified by also elasticity and strength measurements. This curiosity is enlightened below section.

Strength and Elasticity Properties of dyed PTT and PBT fiber fabrics

Tensile strength, reported as load at break, values of PTT and PBT fiber fabrics after dyeing with various dyeing temperatures are shown in Tables 2 and 3, respectively. Dyeing at four different dyeing temperatures (100°C, 110°C, 120°C and 130°C) resulted in slightly higher tensile strength results in comparison to greige fabric counterparts for both PTT and PBT fibers (Table 2). This means that dyeing at all four studied dyeing temperatures led to stronger fabrics for both fibers. These tensile strength increases could be explained by the fabric shrinkage leading to tightening. Therefore, in order to understand these tensile increases, shrinkage of each fabric was calculated after respective dyeing processes and shown on Tables 2 and 3. The shrinkage values of the dyed fabrics were 2%; 2%; 3%; 4.1% and 11.8%; 11.9%; 12%; 12% at 100°C, 110°C, 120°C, 130°C and 140°C for PTT and PBT fibers, respectively.

Table 2. *Tensile strength values of dyed PTT fabrics dyed at pH 5 for 30 minutes*

Fabric sample			**Breaking Load (N)**	**Fabric Shrinkage %**	**Relative Breaking Load (N)***
PTT greige fabric			99,56	Reference	99,56
Dyeing Temperature (°C)	**Dyeing Time (min)**	**Dyeing pH**	**Breaking Load (N)**	**Fabric Shrinkage %**	**Relative Breaking Load (N)***
100	30	5	102,20	2,00	100,156
110	30	5	102,18	1,99	100,136
120	30	5	102,16	3,00	99,095
130	30	5	103,88	4,05	99,673

*Relative breaking load is calculated using original breaking load and fabric shrinkage values

Table 3. *Tensile strength values of dyed PBT fabrics dyed at pH 5 for 30 minutes*

Fabric sample			**Breaking Load (N)**	**Fabric Shrinkage %**	**Relative Breaking Load (N)***
PBT greige fabric			70	Reference	70
Dyeing Temperature (°C)	**Dyeing Time (min)**	**Dyeing pH**	**Breaking Load (N)**	**Fabric Shrinkage %**	**Relative Breaking Load (N)***
100	30	5	80,38	11,80	70,895
110	30	5	81,25	11,90	71,589
120	30	5	80,70	12,00	71,016
130	30	5	79,52	12,00	69,978

*Relative breaking load is calculated using original breaking load and fabric shrinkage values

PBT fiber fabrics exhibited higher shrinkage in comparison to PTT fiber fabrics. Higher dyeing temperature seems to cause slightly higher shrinkage especially for PTT fiber (Tables 2 and 3). So in comparison to PTT and PBT greige fabrics, all PTT and PBT fabrics dyed at different dyeing temperatures tightened due to fabric shrinkage. It is clear that this tightening caused an increase in the total number of threads in cm^2 fabric. Due to the fact that total number of threads in cm^2 was much more compared to the greige fabric, tensile strength was higher. PTT and PBT fiber fabrics dyed at different dyeing temperatures looks stronger with higher tensile strength than greige fabric, since more threads (in cm^2) are needed to be broken in tensile strength test measurement. Therefore relative tensile strength values are calculated for more even comparison. Relative breaking load is calculated using original breaking load values and fabric shrinkage values (Tables 2 and 3). For both PTT and PBT fibers, greige fabric and dyed fabrics at various dyeing temperatures (100°C, 110°C, 120°C and 130°C) exhibit similar relative tensile strength values after taking the shrinkage values of the fabric into consideration (Tables 2 and 3). It is clearly visible from Tables 2 and 3 that dyeing processes at all dyeing temperatures studied (100°C, 110°C, 120°C and 130°C) did not led to any adverse and/or detrimental effect on tensile strength properties of PTT and PBT fiber fabrics. Elasticity properties, reported as extension at force of PTT and PBT fiber fabrics after dyeing with various dyeing temperatures are shown in Tables 4 and 5, respectively.

Dyeing at four different dyeing temperatures (100°C, 110°C, 120°C and 130°C) resulted in slightly higher extension at force results in comparison to greige fabric counterparts for both PTT and PBT fibers (Table 2). This means that dyeing at all four studied dyeing temperatures led to more elastic fabrics for both fibers. These elasticity increases could be explained by the fabric shrinkage leading to tightening. Shrinkage values for both fibers were discussed earlier in tensile strength section. Dyeing process caused higher elasticity change, over greige fabric, on PBT in comparison to PTT due to substantially higher shrinkage property in the case of PBT fiber (Tables 4 and 5).

Table 4. *Elasticity properties of dyed PTT fabrics dyed at pH 5 for 30 min*

Fabric sample			**Fabric Shrinkage %**	**Extension at Force (%)**	**Relative Extension at Force (%)***
PTT Greige fabric			Reference	56,88	56,88
Dyeing Temperature (°C)	**Dyeing Time (min)**	**Dyeing pH**	**Fabric Shrinkage %**	**Extension at Force (%)**	**Relative Extension at Force (%)***
100	30	5	2,00	58,77	57,595
110	30	5	1,99	57,37	56,228
120	30	5	3,00	58,58	56,823
130	30	5	4,05	60,82	58,357

*Relative extension at force is calculated using original extension at force and fabric shrinkage values

Table 5. *Elasticity properties of dyed PBT fabrics dyed at pH 5 for 30 min*

Fabric sample			**Fabric Shrinkage %**	**Extension at Force (%)**	**Relative Extension at Force (%)***
PBT Greige fabric			Reference	75	75
Dyeing Temperature (°C)	**Dyeing Time (min)**	**Dyeing pH**	**Fabric Shrinkage %**	**Extension at Force (%)**	**Relative Extension at Force (%)***
100	30	5	11,80	87,28	76,981
110	30	5	11,90	86,26	76,004
120	30	5	12,00	86,68	76,278
130	30	5	12,00	86,79	76,375

*Relative extension at force is calculated using original extension at force and fabric shrinkage values

So in comparison to PTT and PBT greige fabrics, all PTT and PBT fabrics dyed at different dyeing temperatures tightened due to fabric shrinkage. It is clear that this tightening caused an increase in the total number of threads in cm^2 fabric. Due to the fact that total number of threads in cm^2 was much more compared to the greige fabric, extension at force was higher. PTT and PBT fiber fabrics dyed at different dyeing temperatures looks more elastic with higher extension at force than greige fabric, since more threads (in cm^2) are available to be extended in elasticity measurement leading to more elastic behaviour. Hence relative extension at force values are calculated for more even comparison. Relative extension at force is calculated using original extension at force and fabric shrinkage values (Tables 4 and 5). For both PTT and PBT fibers, greige fabric and dyed fabrics at various dyeing temperatures (100°C, 110°C, 120°C and 130°C) exhibit similar extension at force values after taking the shrinkage values of the fabric into consideration leading to similar elasticity performance (Tables 4 and 5). In other words, therefore; elasticity of dyed fabrics seems to be increased due to shrinkage. It is clearly visible from Tables 4 and 5 that dyeing processes at all dyeing temperatures studied (100°C, 110°C, 120°C and 130°C) did not led to any adverse and/or detrimental effect on elasticity properties of PTT and PBT fiber fabrics. Moreover, there were no significant difference whatsoever between different dyeing temperatures (100°C, 110°C, 120°C and 130°C) regarding their effects on tensile strength and elasticity performances of both PTT and PBT fabrics.

CONCLUSIONS

Poly(trimethylene terephthalate) (PTT) and poly(butylene terephthalat) (PBT) fibers, known as elastic polyesters, are important new aromatic polyesters that exhibit good elasticity and easy dyeing properties. In this study, PTT and PBT knitted fabrics were dyed with selected disperse dyes (Red 167:1 and Red 65) at pH 5 and various dyeing temperatures (100°C, 110°C, 120°C and 130°C) for 30 minutes.

Various dyeing temperatures (100°C, 110°C, 120°C and 130°C) resulted in similar comparable colorimetric properties and color yield (K/S) for both PTT and PBT fibers. Dyeing at four different dyeing temperatures (100°C, 110°C, 120°C and 130°C) resulted in slightly higher tensile strength and extension at force results in comparison to greige fabric counterparts for both PTT and PBT fibers. This means that dyeing at all four studied dyeing temperatures led to stronger and more elastic fabrics for both fibers. These strength and elasticity increases could be explained by the fabric shrinkage leading to tightening. PBT fiber fabrics exhibited higher shrinkage in comparison to PTT fiber fabrics. Higher dyeing temperature seems to cause slightly higher shrinkage especially in the case of PTT fiber. It is clear that this tightening caused an increase in the total number of threads in cm^2 fabric. Due to the fact that total number of threads in cm^2 was much more compared to the greige fabric, strength and elasticity were higher leading to stronger and more elastic fabrics. For both PTT and PBT fibers, greige fabric and dyed fabrics at various dyeing temperatures (100°C, 110°C, 120°C and 130°C) exhibit similar relative tensile strength and similar relative extension at force values after taking the shrinkage values of the fabric into consideration. It is clear that dyeing processes at all dyeing temperatures studied (100°C, 110°C, 120°C and 130°C) did not led to any adverse and/or detrimental effect on strength and elasticity properties of PTT and PBT fiber fabrics.

Overall, all dyeing temperatures studied (100°C, 110°C, 120°C and 130°C) resulted in similar colorimetric properties, similar color yield, similar strength values and finally similar elasticity properties for both PTT and PBT fibers. So, dyeing at 130°C has no advantage over dyeing at 100°C or any other dyeing temperature studied in respect of colorimetric, strength and elasticity properties for both PTT and PBT fibers. Therefore, 100°C can be selected as optimum dyeing temperature for both PTT and PBT fibers due to its lower operational cost.

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THE EFFECT OF WASHING CYCLES ON THE HANDLE AND PHYSICAL PROPERTIES OF WOVEN FABRICS

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ABSTRACT: Fabrics are subjected to washing many times in usage conditions. While purchasing of a fabric, the consumers generally assess the quality of a fabric by the reaction obtained from the sense of touch. However, as the garments are used, the handle and other physical properties change. This study reveals the effect of machine laundering on the handle and other physical properties of cotton woven fabric. The fabric was washed at 40°C during one hour with the water having hardness of the 20°F. 1, 5 and 10 washing cycles were used. Handle evaluation was done subjectively by 10 textile experts. Fabric mass per unit area, thickness, surface friction coefficient, air permeability, tensile strength and circular bending rigidity values of each fabric were measured. The effect of washing cycle was evaluated in terms of each physical property. Due to the shrinkage of the fabric, there were found obvious changes in all properties after each wash.

Key words: washing, handle, physical properties, woven fabric

INTRODUCTION

The consumer always tries to select the garment on the basis of personalized choice based on his own method of assessment for a particular end use. This kind of assessment is called 'subjective evaluation of fabric'. The result of this kind of assessment is not same for an unused fabric and the same fabric after a certain use i.e. the fabric becomes inferior as it goes through a certain number of wash cycles. Machine laundering leaves fabrics with an uncomfortable hand as a result of the removal of the fatty finish and lubricating waxes on the fabric when the synthetic detergents remove dirt and oil (Agarval et al.,2011).

It is well known that the properties of worn materials are often quite different from fresh ones. During the wearing cycle, the fabrics are subjected to combined action of abrasion, washing and ironing (Militky and Baljik, 1997) Laundering plays a significant role on the physical, mechanical, and aesthetic properties of a fabric. Research has concluded that laundering changes the appearance as well as the performance properties of fabrics (Orzada et al., 2009). Hand is not a static property of the fabric and it changes even after the wash and wear cycles (Vassiliadis, 2005).

The comfort sensation of a fabric has multi-dimensional attributes and is impossible to quantify through a single physical property. In order to find a method for the comfort evaluation of textiles, the concept of "fabric hand" is commonly used to assess fabrics (Makinen M, Meinander H., 2005).

Subjective assessment treats fabric hand as a psychological reaction obtained from the sense of touch. Apparently it is a valuable method that has traditionally been used by textile technologists and researchers. Objective assessment attempts to find the relationships between fabric hand and some physical or mechanical properties of a fabric objectively. It quantitatively describes fabric hand by using translation result from some measured values of relevant attributes of a fabric. For objective hand evaluation, special instruments are used in order to measure the properties of fabrics corresponding to hand (Backar, 2004).

There have been several studies on the effect of washing on fabric properties. Busilien et al. investigated the effect of materials fibre composition and washing conditions upon the changes of hand properties of knitted materials. Surface density and thickness of investigated materials differed insignificantly, from 206 g/m^2 up to 222 g/m^2 and from 0.56 mm up to 0.79 mm, respectively. Analysis of obtained results showed that, during washing, textile materials shrink and become more dense and rough, and their rigidity increases as well.

Halleb et al. investigated the effect of four different washes such as rinse, stone wash and stone bleach on the denim fabric tactile properties using a sensory analysis. It was found that the change of washed denim fabric handle depends on the washing intensity.

Mezarcıöz and Toksöz examined the effect of different washing processes on various performance and surface properties of denim fabrics. For this purpose, 3 different types of fabrics (1/1 plain, 2/2 twill and 3/1 twill constructions) were produced from 100% cotton yarn, and 4 different types of washing processes (rinse, enzyme, stone and stone+bleach) were applied. The effect of woven structure and washing processes on denim fabrics performance properties like dimensional stability, breaking strength, tearing strength, bending rigidity, surface views examination and colorimetric evaluation were investigated statistically.

Orzada et. al, investigated the effect of laundering on the drape, shear, and bending properties of bottom weight fabrics. According to the results, laundry cycle did not have a significant effect on fabric drape, shear or bending properties. However, drape values increased overall, while shear and bending modulus and hysteresis decreased, resulting in a more drapeable, pliable fabric after five laundry cycles.

In a study conducted by Juiene et al., the denim in twill 1/2 weave were processed by different industrial washing techniques, namely simple and silicone softening, washing with chlorine solution, enzyme and double enzyme washing. In order to evaluate influence of different washing on fabric properties, the structural characteristics, shrinkage, air permeability, bending rigidity, extensibility on load 98.1 N/m, breaking force and elongation, shear rigidity were determined. It was concluded that the silicone softening made the greatest influence on the denim properties, whereas the simple softening caused the least.

In this study, the effect of machine laundering on the handle and other physical properties of plain woven fabric such as fabric mass per unit area, thickness, surface friction coefficient, air permeability, tensile strength and circular bending rigidity values was investigated.

MATERIALS AND METHODS

In this study 1/1 plain woven fabric produced 100% cotton yarns was used. The weft and warp yarn linear densities was Ne 40/1. The density of the warp yarns was 51 ends/cm whereas the density of weft yarns was 26 picks/cm. In order to determine the effect of the washing cycles on the physical and handle properties of the fabric, 1, 5 and 10 washings were carried out at the temperature of 40ºC during one hour with the water having hardness of the 20° F.

Fabric mass per unit area was determined according to TS 251 standard. Fabric thickness was measured by Digital Thickness Gauge M034A with the measuring area of 20 cm2 and under the pressure of 200 g according to EN ISO 5084 standard.

Air permeability test was carried out by using Textest FX 3300 air permeability tester with the 20 cm2 measuring field and 100 kPa air pressure according to EN ISO 9237 standard. For each product, the average of the air permeability values (l/m2/sec) was calculated. Tensile strength of the fabrics was determined by Zwick Z010 Universal tensile tester according to EN ISO 13934-1 standard.

Friction coefficient test was carried out by using Frictorq instrument developed by Minho University-Portugal. The lower the kinetic friction coefficient (µkinetic) means the smoother and more even product. Circular bending rigidity of the fabrics was determined according to ASTM D 4032 standard. Subjective handle evaluation was carried out by 10 panelists with a scale from 1 to 4, from smooth to rough.

RESULTS AND DISCUSSION

The mass per unit area and thickness values of the unwashed and washed fabrics are given in Table 1. With the increasing washing cycles, as the fabric gets denser due to the shrinkage, fabric mass per unit area and thickness values increase.

Table 1:Mass per unit area (g/m^2) and thickness values of the fabrics

	Unwashed fabric	1 washing cycle	5 washing cycles	10 washing cycles
Mass per unit area (g/m^2)	123	128	130	132
Thickness (mm)	0.208	0.258	0.280	0.280

Figure1 indicates the air permeability values of the fabrics. As expected, with the increasing washing cycles, the yarns in fabric structure becomes closer and fabric density increase as a result of that the air permeability values decreases. The decrement is obvious especially after the first washing. Between 5^{th} and 10^{th} washing cycles, air permeability values are nearly stable, as similar with the mass per unit are and thickness values.

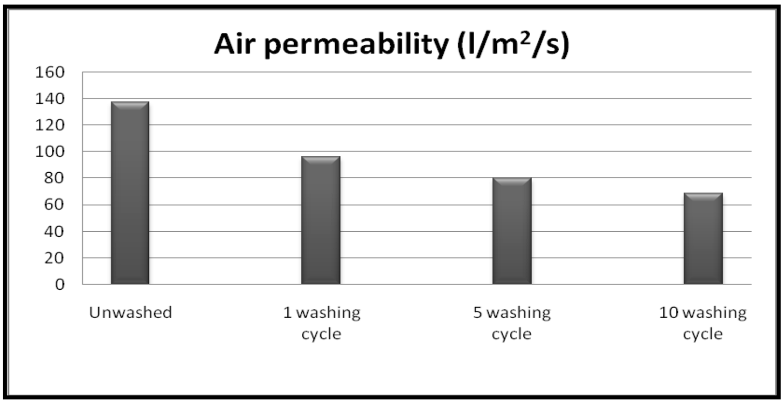

Figure 1: Air permeability values of the fabrics

In order to determine whether the washing causes damage on the fabrics or not, tensile strength values of the fabrics in weft and warp direction were measured (Figure 2). As can be seen, in weft direction the shrinkage of the fabric was more than the warp direction and this result caused increment in the tensile strength values by the increased washing cycles. On the contrary, due to the mechanical damages during washing, the tensile strength values decrease in warp direction of the fabrics.

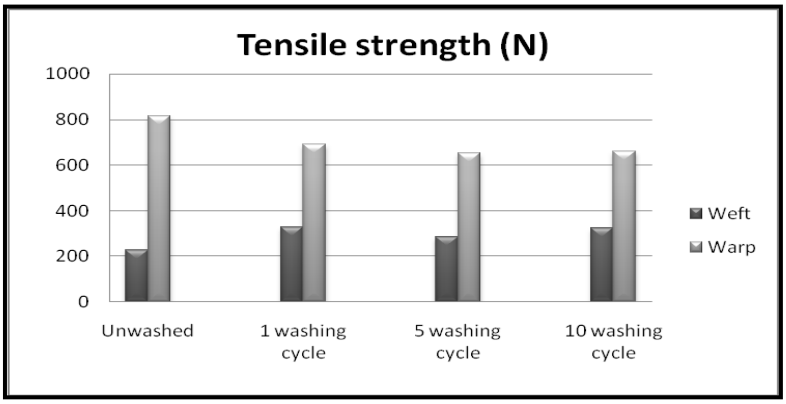

Figure 2: Tensile strength values of the fabrics

In order to determine the effect of washing on the handle characteristics of the fabrics, circular bending rigidity and surface friction coefficient values of the fabrics were measured, as given in Figure 3 and 4 respectively. The apparent increase in the bending rigidity feature was occurred in the 10th washing cycle, which is an indication of the increment in the fabric stiffness. As for the surface friction, it can be seen that the coefficient of friction values increases continuously with the repeated washes. Due to the shrinkage of the fabric, the gaps between the weft and warp yarns decrease and the crimp increases, therefore the surface becomes rougher as compared with the unwashed fabric.

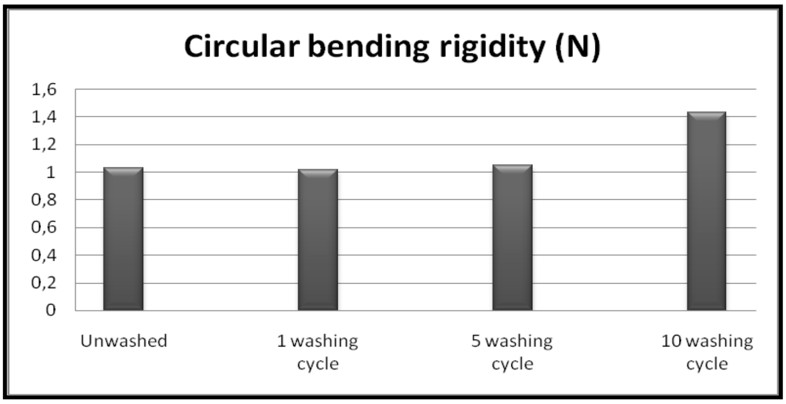

Figure 3: Circular bending rigidity values of the fabrics

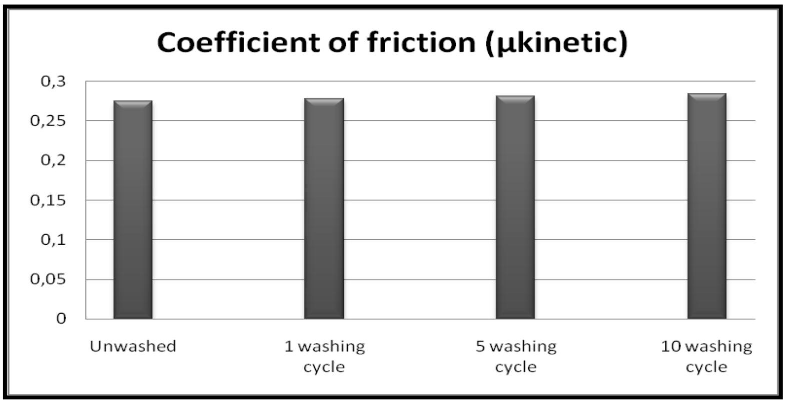

Figure 4: Coefficient of friction values of the fabrics

In addition to the objective handle related properties measurements, subjective evaluation was carried out by 10 textile experts. Grade 1 defines the softest fabric and grade 4 means the stiffest fabric. According to the average values of the evaluations, unwashed fabric has grade 2, and one cycled washed, 5 cycled washed and 10 cycled washed fabrics have grade 2.4, grade 2.2 and grade 3.4 respectively, which are similar to the results of objective handle related properties.

CONCLUSION

The main factors affecting consumers when selecting garments are aesthetic, appearance and fashion, but overall the handle of the fabric has a big influence on consumer preferences. However, with the usage of the garment, the handle and other physical properties change. In this study, it was aimed to determine the effect of washing on the basic physical features and handle characteristics of the woven fabrics.

According to the results, it was found that, as the washing cycles increase, all the investigated parameters changed negatively. Due to the shrinkage of the fabric, whereas the mass per unit area, thickness, coefficient of friction and circular bending rigidity values increase, air permeability and tensile strength values decrease. Subjective handle evaluation verified the objective handle related measurements and indicated that high number of washing cycles causes stiffer sensory feeling.

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FIT AND WEAR COMFORT OF A MAN'S SPORTS SHIRT

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ABSTRACT: Increasing attention, both from aesthetic and functional standpoints, is given today to clothing for people who are taking an active part in different sports. Sportswear, actively influencing the physiological function of body heat regulation, must maintain a thermal barrier between the user's clothing and the environment in different climatic conditions and thus allow normal activities in different environmental conditions. Suitable wear comfort when using sportswear depends on many factors and can only be achieved by proper selection of technologically sophisticated textile fabrics, an appropriate design and construction of clothing patterns.
The paper presents the study of the influence of knitwear's properties and clothing pattern construction on the fit and wearing comfort of men's sports shirts. The influence of clothing pattern construction and knitwear's mechanical properties on the fit of a man's sports shirt was analyzed using 3D simulation of garments on a virtual parametrical body model with tension areas in certain parts of the body and along the seams that are highly loaded in sports activities. The analysis of the virtual and real appearance of a man's shirt prototype was also performed for this purpose. Furthermore, in terms of wearing comfort, analysis of the subjective evaluation of wearing comfort of real prototypes of a man's sports shirt was performed in real wearing conditions with the help of test subjects.

Key words: sportswear, 3D simulation, virtual prototyping, knitwear, wearing comfort

INTRODUCTION

Fit and wear comfort are one of the key properties of clothing for people who are taking an active part in different sports. It depends on many factors and can only be achieved by proper selection of textiles, an appropriate design and construction of clothing patterns. Nowadays the new product development process can be done using the conventional procedure using a real clothing prototype, or virtually, using modern CAD technologies that enable virtual prototyping and simulation of behaviour of garments in a virtual environment. The purpose of the introduction of computer design and 3D prototyping is to replace the conventional way of developing real products with virtual clothing prototypes that allow insight into the appearance and performance of the product. In virtual prototyping, we develop a garment from start to finished product with the help of suitable and up-to-date computer hardware and software. This allows a significant reduction of garment re-modification, which provides savings in time, energy and material at the same time. The process also offers more opportunities for creativity when designing new clothing products. Advantages of virtual prototyping of new garments are not only in a great responsiveness and lower costs, but also in the more efficient use of planning time required for a new clothing product and a realistic presentation of 3D-shape of garments, including the texture of textile fabrics and their mechanical and physical characteristics (Geršak J., 2013; Rudolf A. et al., 2008; Jevšnik S. et al., 2012; Stjepanović Z. et al., 2012; Celcar, D. et al., 2013).

In this study, we have tried to replace the conventional process of developing garment's patterns and prototypes made from knitted fabrics with virtual prototyping, which allows realistic simulation of virtual clothing. Therefore, we developed appropriate 2D patterns of a man's sports shirt with different ease allowance and used modern 3D prototyping technology, in order to evaluate the fit of the developed wide and narrow man's sports shirt. Moreover, in terms of wearing comfort, we developed real prototypes of men's shirts, which were then tested in real wearing conditions with the help of test subjects. Furthermore, the differences between the appearance and fit of the real and virtual prototypes of man's sports shirts were analysed.

MATERIAL AND METHODS

Taking into account the purpose of the research, low-stress mechanical fabric characteristics including tensile, shear, bending, and compression properties, were measured by using the FAST measuring system, as well as the surface mass and density in wale and course direction of knitted fabrics were determined, Table 1. Mechanical properties of the knitwear were converted by using the Fabric Converter programme of the OptiTex CAD system for the purposes of virtual prototyping.

Table 1. Mechanical and construction parameters of the knitted fabrics

Mechanical and construction parameter		Knitwear code	
		P1 (ACG-C)	P2 (ACG-S)
Material and structure of a knitwear		21 % PES, 73 % CO, 6 % EL Single-jersey inlaid knitted fabric	72 % PES, 24 % CO, 4 % EL Single-jersey inlaid knitted fabric
Surface mass / W [g/m^2]		260 g/m^2	236 g/m^2
Density	wale / course direction	20 / 16	20 / 13
Shear rigidity / G [Nm^{-1}]		224	194
Bending rigidity / B [μNm]		560	470
Surface thickness / ST [mm]		0.0310	0.0311

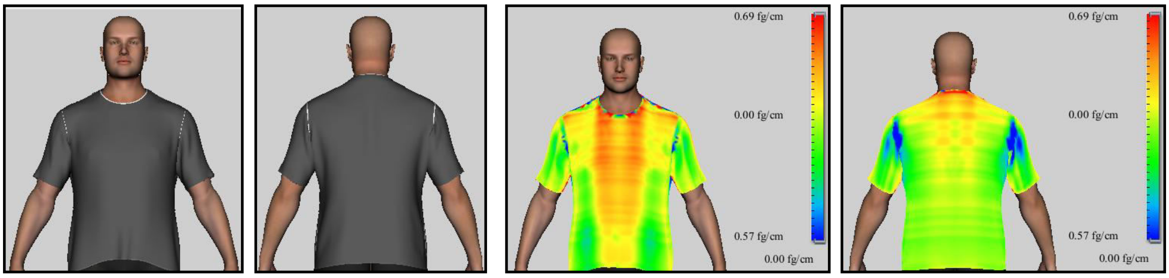
On the basis of the developed 2D shirt patterns with different ease allowance, and selection of knitted fabrics with measured mechanical properties, 3D simulations of man's shirts were performed by using the OptiTex PDS/3D module. Once the material properties and patterns' seams were set and synchronized, the obtained planar patterns were placed around the virtual human body model with primary body measurements of the real test person: body high = 188 cm, bust circumference = 114 cm, waist circumference = 107 cm, hip circumference = 115 cm. Furthermore, sewing and draping was performed in order to simulate the fitting of a man's shirts on a 3D model of a human body. The analysis of tension areas in certain parts of the body and along the seams was made in order to evaluate the fit of designed wide and narrow man's sports shirt.

Furthermore, we developed real shirt prototypes for a test person, which were then compared with virtual prototypes and tested in real wearing conditions with the help of test subject, in order to evaluate wearing comfort of developed man's sports shirt. Subjective assessment of wearing comfort was obtained during the experiment in the wear trial test according to a questionnaire and an assessment scale defined by ISO 10551:2004 with male person age of 37 years. He was 188 cm tall and had a body mass of 100 kg. The test person answered at predetermined time of experiment using questionnaire that comprised personal and environmental questions. Those related to the personal thermal state may be perceptual – How do you assess your current feeling of the heat (e.g. hot, warm, neutral, cool, cold) – affective – How do you assess your current thermal comfort (e.g. comfortable, uncomfortable) – and preference – How would you prefer to be the thermal environment? (e.g. warmer, cooler). Those related to the environment fall into two types: acceptance – Is the thermal environment acceptable? and tolerance – Is the current thermal environment tolerable? (ISO 10551:2004). When determining the subject's thermal perception, the test subject assessed the perceptual judgements of personal thermal state according to a scale from +4, which means that he felt very hot, up to a scale -4, which means that he felt very cold. The test subject assessed the "affective" thermal comfort according to a scale from 0, which means that he felt thermally comfortable, up to a scale +4, which means that he felt extremely uncomfortable. In determining the desired thermal state, the test subject have provided evaluation of the desired thermal state according to a preference scale, where scale +3 means that people desire much warmer thermal state, while scale -3 means that people desire much cooler thermal state. When assessing the acceptability of the current thermal conditions, the test subject evaluated the current thermal environment as more acceptable (degree 0) and more unacceptable (degree 1). By judging the personal tolerance of the thermal environment, the test subject determined whether he excellent tolerate the current thermal situation (degree 0), or he can't stand it any longer (degree 4) (ISO 10551:2004). Tests with wear trial were performed in real environment at an ambient temperature of 20 °C. During the wear trial the test person walked 45 minutes at a speed of 5 kmh^{-1}. Assessments of the thermal comfort were performed at the end of wear trial test.

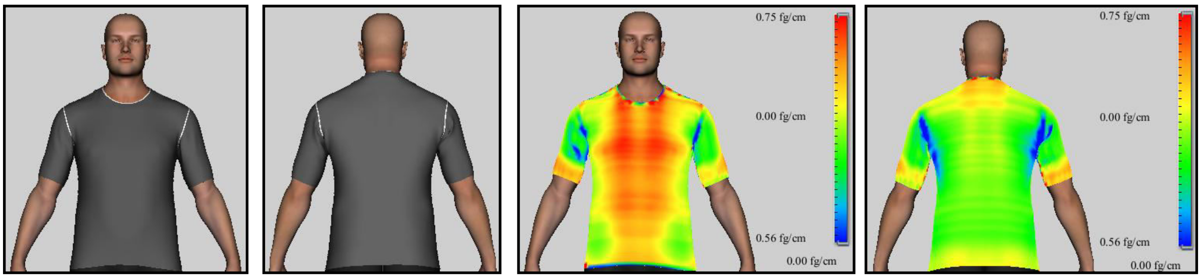
Moreover, an analysis of condensed and accumulated sweat was made during the experiment with wear trials, as well as thermal and sorption properties of knitwear were measured and discussed in previous research (Grujić, D. et al., 2013).

RESULTS AND DISCUSSION

The influence of clothing pattern construction and knitwear's mechanical properties on the fit of a man's sports shirt was analysed using 3D simulation of garments on a virtual parametrical body model with tension areas in certain parts of the body. Figures 1 and 2 show the results of virtual prototypes and tension areas of wide and narrow man's sports shirts developed applying the measured mechanical properties of knitwear P1 and P2.



a) wide shirt

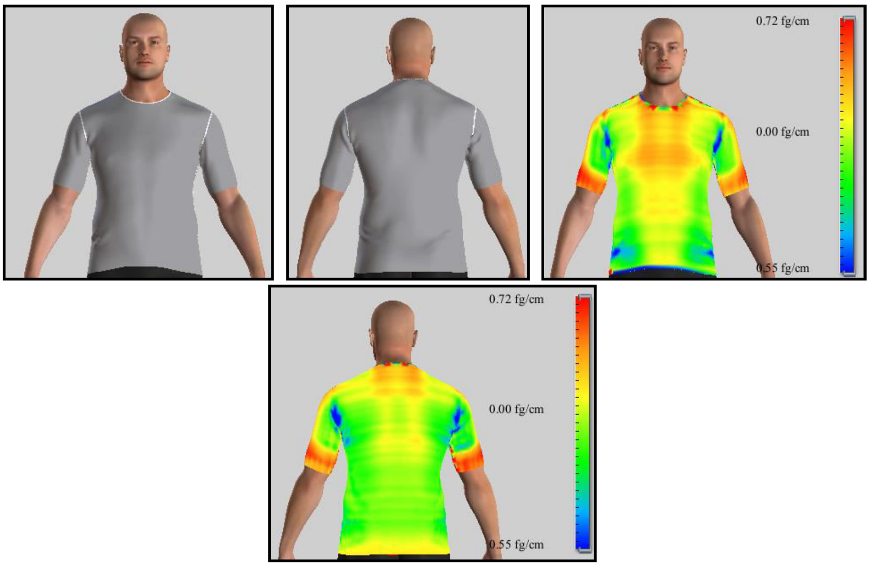


b) narrow shirt

Figure 1: 3D virtual prototypes and tension areas of narrow and wide man's shirt applying the properties of knitwear P1

When observing the virtual prototypes of man's shirts developed using different knitted fabrics and construction ease allowance it is evident that different shirt's fit to the 3D body model were achieved, Figures 1 and 2. Both narrow shirts, simulated applying the properties of knitwear P1 and P2, show better fit to the 3D body model in the area of trunk and arms. Therefore, the higher tensions of these shirts were achieved especially on the front part and on the edge of the sleeves when compared with the wide shirts. Some excess of the material is visible only in the sleeves in the armhole and armpit areas, which shows also low tensions in these areas. An influence of the greater construction ease allowance for wide shirt reflects also virtual prototypes, where some folds on the front and back part from bust to the hip area are visible, and consequently wider sleeves. Therefore, the tensions around the bust and on the edge of the sleeves are lower, Figures 1 and 2.

a) wide shirt



b) narrow shirt

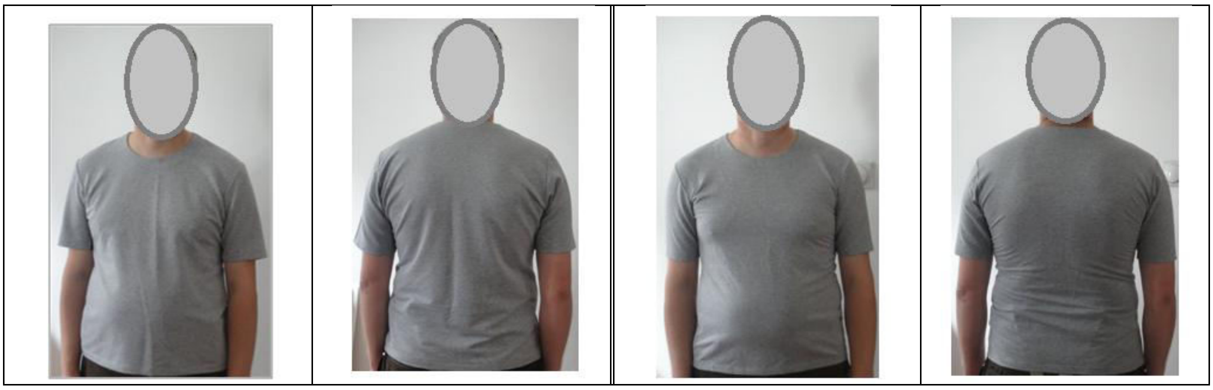
Figure 2: 3D virtual prototypes and tension areas of narrow and wide man’s shirt applying the properties of knitwear P2

The influence of knitwear’s mechanical properties reflects the fit and appearance of virtual shirts prototypes, Figures 1 and 2. We used two knitted fabrics (P1 and P2, Table 1) with different mixture proportion of cotton, polyester and elastane fibers for developing virtual and furthermore real shirt prototypes. Knitwear P1 contains a higher proportion of cotton and elastane fibers, compared with the knitwear P2 which contains a higher proportion of polyester fibers. Both knitted fabrics marked P1 and P2 have beside different fiber composition, surface mass and density in the wale and course direction, also different mechanical properties, Table 1, which reflects the fit and appearance of virtual shirts prototypes. Virtual shirt prototype developed applying the properties of knitwear P2 shows greater number of folds visible in the middle of the back part and on the sleeves compared with virtual shirt prototype developed applying the properties of knitwear P1, Figures 1 and 2. We suppose that this is due to measured lower shear rigidity, bending rigidity and surface mass of knitwear P2 compared with the knitwear P1. On the other hand the observed greater tensions in the bust area on the wide and narrow virtual shirt prototype developed applying the properties of knitwear P1, could be attributed to a higher percentage of the elastane fibers compared to the knitwear P2.

Figure 3 shows real prototypes of narrow and wide man’s shirt developed from knitwear P1 and P2 and 2D shirt patterns with different ease allowance. The analysis of the virtual and real appearance of man’s shirt prototypes and the subjective evaluation of wearing comfort of a man’s shirts was performed in order to evaluate the fit and wear comfort of developed clothes.

By analyzing the results of the virtual and real prototypes of narrow and wide man’s shirt we could state that there are some similarities between real and virtual prototypes and appearance and fit to the body models, respectively, Figures 1-3. However, the exact comparison of these prototypes is not possible, because the 3D body model was adopted only on measures of the body height, bust, waist, hips, neck and biceps circumferences, shoulder length and cross shoulder width in a standard pose of the 3D body model. In addition, for the need of virtual prototyping arms were raised up, while the arms of the real model are hanging relaxed close to the body.

a) wide and narrow shirt made from knitwear P1



b) wide and narrow shirt made from knitwear P2

Figure 3: Real prototypes of man's shirt developed from knitwear P1 and P2

The analysis of the subjective evaluation of the perception of the personal thermal state show that when the test subject was wearing wide shirt made of knitwear P1, with lower content of polyester, he felt neutral (degree 0), while when wearing wide shirt made of knitwear P2, with higher content of polyester, he felt hot (degree +3). By comparing subjective evaluation of narrow shirts the test subject felt warm (degree +2) when wearing narrow shirt made of knitwear P1 and he felt hot (degree +3) when wearing narrow shirt made of knitwear P2 with higher content of polyester. The analysis of the subjective evaluation of the feeling (affective assessment) of thermal comfort show that test subject felt slightly uncomfortable (degree 1) when wearing wide shirts made of knitwear P1 and P2, while when wearing narrow shirt with lower content of polyester (knitwear P1) he felt uncomfortable (degree 2) and when wearing narrow shirt with higher content of polyester (knitwear P2) he felt very uncomfortable (degree 3). By comparing the results of the thermal preference of the test subject it is evident that when wearing the wide shirt made of knitwear P1 he doesn't want changes in the thermal environment (degree 0), while when the test person wearing all other three shirts he prefer to be cooler (degree -2). The test person stated that during the wear trial test the thermal environment was acceptable. When wearing both shirts made of knitwear P1 and narrow shirt made of knitwear P2 he also stated that the thermal conditions were slightly lower tolerated (degree 1), while wearing wide shirt made of knitwear P2, he stated that the thermal conditions were very difficult tolerated (degree 3). During wear trials it was also noted that the test person's skin was sweating while wearing any of the tested shirts (degree 2).

CONCLUSSIONS

Based on the analysis of the subjective assessments of the wearing comfort during wear trials it can be concluded, that better thermal comfort was achieved when wearing shirts made of the knitwear P1, with higher content of cotton and elastane fibers, while the better wearing comfort was perceived in a wide shirt also made of the knitwear P1. On the basis of results of 3D virtual prototyping of man's shirts with different construction ease allowance and mechanical properties of knitted fabrics it can be concluded that virtual 3D prototyping has a significant potential for pattern development of knitted sportswear. At the same time, we realised that virtual 3D prototyping in combination with wear trial tests in real wearing conditions give us appropriate information for developing sports shirt and other sports garments.

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CHANGES IN THERMOPHYSIOLOGICAl PROPERTIES OF THE WOVEN FABRICS AFTER WRINKLE RECOVERY TREATMENT

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ABSTRACT: Wrinkle recovery of cotton fabrics has attracted much attention recently. There are various finishing methods applied for this purpose. Although the treatments improve crease resistance, they have also effects on thermophysiological properties after the treatment. In this study, two different shirt fabrics woven in plain and sateen structures were used. The woven fabrics were produced by using yarns in Ne 50/1 yarn count and in αe= 4 twist coefficient. Crease resistance finishing was applied to the fabrics. Thermal resistance, water vapour resistance and air permeability of the fabrics were tested. The results were evaluated by using independent samples t-test. Consequently, it was concluded that, after crease resistance finishing fabric thermal and water vapor resistance increase, whereas air permeability value decreases.

Key words: Wrinkle recovery, shirt fabric, thermal resistance, water vapor resistance, air permeability.

INTRODUCTION

The fast and difficult lifestyle of the century has forced producing and developing a product which is easier to use and keep which does not require ironing, can be easily washed and dried and also have wash proof cease/s for which all properties are found in the anti-crease finishing operations (Köstem A. M., 2005). Garments made from 100% cotton fibers are comfortable because they absorb perspiration and cotton is most commonly used for shirt fabrics as well because of its texture, durability, softness and nice feelings against the skin. Unfortunately, garments made from cotton become badly wrinkled during wear; they don't retain the nice smooth "just ironed" look. After they have been washed and dried, they must be ironed otherwise they will look very rumpled.

The wrinkle recovery is one of the fundamental properties of fabrics which affects product performance and refers to the ability of the fabric to return to its original shape after removing the folding deformations.

Wrinkle recovery performance of untreated cotton fabric is poor because creases can be stabilized by intermolecular hydrogen bonds that easily break and reform in a creased configuration within the fiber during wetting/drying of the fabric (Hauser P., 2007). Therefore, cotton fabrics could be treated with chemicals to reduce wrinkling and this applied crease resistant finish to cotton fabrics improves comfort, ease of maintenance, dimensional stability (Can Y. et.al., 2009). Wrinkle (or crease) resistance is imparted to cellulosic fibers by restricting the slippage of molecular chains through crosslinking (Lu, 2010). Formulation of the finish is significant to yield the desirable balance of physical properties.

There are some researches related with the effect of finishing treatments to the properties of the fabrics. Yürük investigated crease resistance and the chemical substance used in fabrics, defined the relationship between the structural properties of fabrics and crease resistance, abrasion resistance, creasing angle. A connection was built between the structural properties of fabrics and the change of breaking strength, abrasion resistance, crease angle by using artificial neural network (Yürük N., 2006).

Can et al., investigated the performance of 100 % cotton plain fabrics after crease resistant finish. It was concluded that, the wrinkle recovery angle increases approximately 50% after the crease resistant finishing (Can Y.et.al., 2009).

Another study was aimed to predict the crease recovery performance and tear strength of cotton fabric using modified N-methyloldihydroxyethylene urea, polyethylene softener, catalyst, curing time and curing temperature as the predictor variables. The crease recovery and tear strength properties of cotton fabric are modelled through a validated regression model. The model has a strong prediction capability indicated by a high, positive correlation between the predicted and observed crease recovery angle and tear strength values (Hussain T. et al.,2010).

Although the wrinkle resistances of cotton fabrics were investigated by various researchers, there are a few studies on the thermophysiological properties of the wrinkle recovery treated fabrics. In a work conducted by Hassan, two different techniques were used for the finishing of cotton fabrics with DMDHEU; thermal curing at 160 °C for 3 min and gamma irradiation at different doses. The color properties, crease recovery, mechanical properties, thermal properties and surface morphology after treatments were studied. It was found that the finishing of cotton fabrics with gamma irradiation affords better crease recovery values at low doses without affecting the color intensity and the physical properties than the finishing by thermal curing. However, the finishing with higher doses of gamma radiation affects the mechanical properties of cotton fabrics. On the other hand, it was found that the thermal properties were improved with increasing dose (Hassan M.S., 2009).

In this study it was aimed to find the effect of the wrinkle finishing treatment on the thermophysiological properties of the shirt fabrics.

MATERIALS AND METHODS

Yarns in Ne 50/1 yarn count and in αe= 4 twist coefficient were used in this experiment. They were woven in the same density (56 ends/cm and 31 picks/cm) in plain and sateen weave constructions. After pretreatment processes including the burning, disizing, rinsing, bleaching, mercerizing and drying, crease resistance finishing process was applied to the fabrics by using the following a certain recipe: 60 g/L dimethylol dihydroxy ethylene urea (DMDHEU) resin, 40 g/L dimethylol urea (DMU) resin, 60 g/L polyethylene, 30 g/L polyuretan and 10 g/L Mgcl2 catalyst, 135 ˚C, 4 m/min. Afterwards, they were washed and dried. After finishing, the fabrics were conditioned under standard atmosphere conditions (20 °C±2 °C temperature, 65% ± 4% RH) and tested for their thermophyscological properties.

Thermal and water vapour resistance of the fabrics were tested by using Hotplate instrument and air permeability was measured by Textest FX 3300 instrument. The SDL Atlas M259B Sweating Guarded Hotplate conforms to ISO 11092, this standard specifies methods for the measurement of the thermal resistance and water vapor resistance, under steady state conditions. The Sweating Guarded Hotplate (often referred to as the “skin Model”) is intended to simulate the heat and mass transfer processes which occur next to the surface of the skin.

Thermal resistance, Rct, temperature difference between the two faces of a material divided by the resultant heat flux per unit area in the direction of the gradient. The dry heat flux may consist of one or more conductive, convective and radiant components. Rct expressed in square meters kelvin per watt, is a quantity specific to textile materials or composites which determines the dry heat flux across a given area in response to a steady applied temperature gradient.

Water-vapor resistance, Ret, water-vapor pressure difference between the two faces of a material divided by the resultant evaporative heat flux per unit area in the direction of the gradient. The evaporative heat flux may consist of both diffusive and convective components. Ret expressed in square meters Pascal per watt, is a quantity specific to textile materials that determines the “latent” evaporative heat flux across a given area in response to a steady applied water vapour pressure gradient.

RESULTS AND DISCUSSION

Test results were evaluated statistically by using independent samples t-test with the significance level of α= 0.05 to determine whether the treatment and fabric construction have significant effect on tested fabric parameters. The related p values are given in Table 1.

Table 1: Statistical analysis of the test results (Independent Samples T-Test)

Physical property	Effect of Treatment			Effect of Construction		
	Fabric construction	**Direction**	**Sig. (p)**	**Treatment Status**	**Direction**	**Sig. (p)**
Water Vapor Resistance	Plain Fabric	Before Tre.	*0.000**	Before Tre.	Plain	*0.000**
		After Tre.			Sateen	
	Sateen Fabric	Before Tre.	*0.000**	After Tre.	Plain	*0.000**
		After Tre.			Sateen	
Thermal Resistance	Plain Fabric	Before Tre.	*0.017**	Before Tre.	Plain	*0.001**
		After Tre.			Sateen	
	Sateen Fabric	Before Tre.	*0,050**	After Tre.	Plain	*0.032**
		After Tre.			Sateen	
Air Permeability	Plain Fabric	Before Tre.	*0.001**	Before Tre.	Plain	*0.000**
		After Tre.			Sateen	
	Sateen Fabric	Before Tre.	*0.000**	After Tre.	Plain	*0.000**
		After Tre.			Sateen	

* Statistically significant according to α=0.05

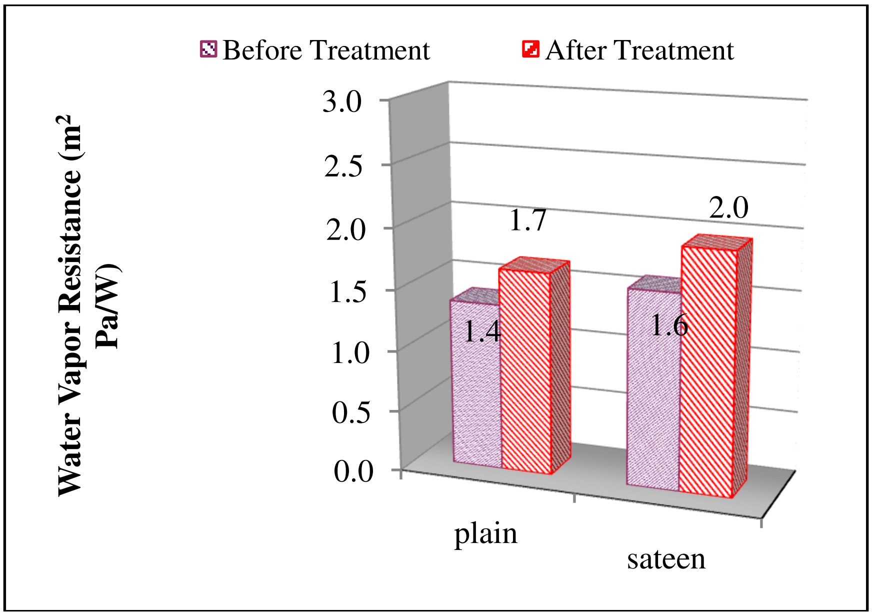

Figure1: Water vapor resistance values of the fabrics

Water vapor resistance test results were given in Figure 1. As the test results and statistical evaluation results were analyzed, it can be stated that, water vapor resistance increases after crease resistance finishing both for plain and sateen fabrics. It is related with the increased fabric thickness and lower porosity after treatment. In case of fabric construction, it was found that, water vapor resistance of the sateen fabrics were found higher than the resistance of plain fabrics. The difference between the values of plain and sateen fabrics were found statistically significant.

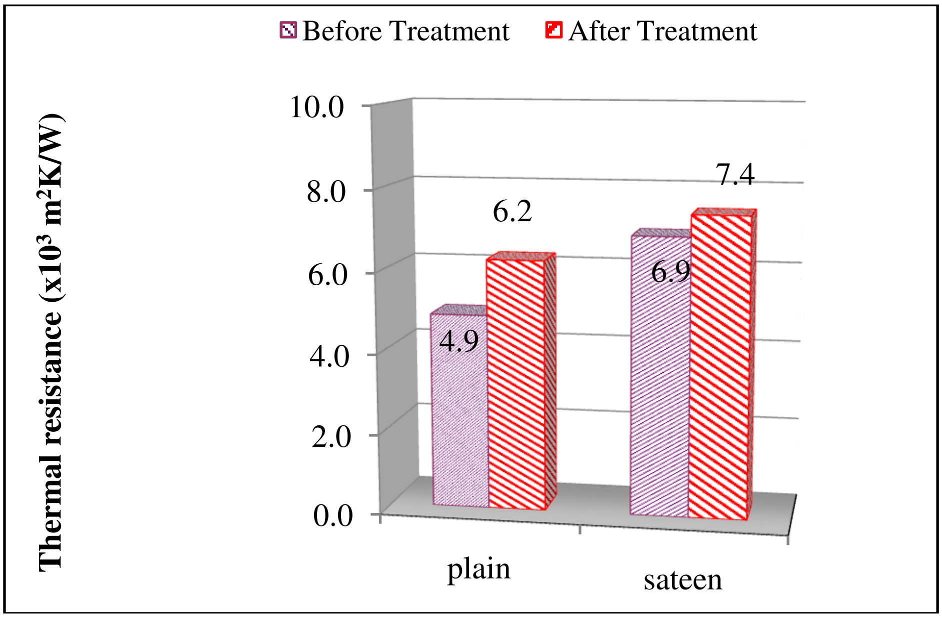

Figure2: Thermal resistance values of the fabrics

Similar test results were obtained for thermal resistance test results. According to the thermal resistance test results (Figure2) and statistical evaluation results, it can be depicted that, crease resistance finishing causes an increase in thermal resistance of the fabrics. The increase found statistically significant. Thermal resistance of sateen fabrics were found higher than plain structured fabrics.

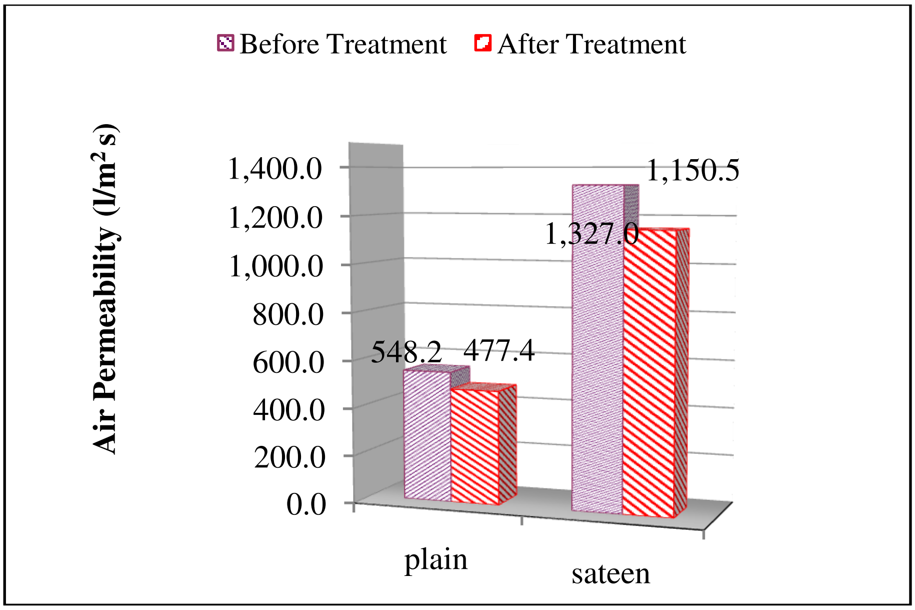

Figure3: Air permeability values of the fabrics

The effect of the crease resistance finishing on air permeability of the fabrics was given in Figure 3. As it can be seen from the results, it can be revealed that air permeability value decreases after crease resistance finishing. This is associated with the decrease in the porosity of the fabrics, which is a result of fabric shrinkage. The variance between the values was found statistically significant. Air permeability of sateen fabrics were found higher than the plain fabrics.

CONCLUSION

Due to the structural properties of fibers, cotton fabric has natural tendency to wrinkle. In order to avoid and improve this property, several methods were developed in the case of wrinkle resistance finishing.

In this study 100% cotton yarns (Ne 50/1, αe= 4) were woven in plain weave and sateen constructions in the same tightness values. After the pretreatment processes, crease resistance finishing process was applied to determine the effect of finishing on thermophysiological properties. According to the results of treated and untreated samples, following conclusions were pointed out.

Wrinkle resistant treated fabrics showed higher thickness and lower porosity, as a result of that water vapour resistance and thermal resistance values found higher than untreated fabrics. However, the treatment caused decrease in air permeability values. Sateen fabrics have higher resistance and air permeability values than plain fabrics in all cases.

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FOREIGN TRADE OF TURKEY'S TEXTILE AND APPAREL INDUSTRY

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ABSTRACT: Textile and apparel industry is one of the most important branches of industry in the world particularly in developing countries. It has an important place in the economic development process due to the value added activities created in the production process and high share of export revenues. While the share of textile and clothing industry in the manufacturing industry has declined steadily in developed countries, this sector's share in manufacturing production has increased in developing countries. The most important reason of this situation is labor cost. Strong companies carry out some studies such as design and organization within the company, on the other side they have moved their production other regions and countries where labor cost is much cheaper to increase their competitive advantage. Textile and clothing industry has the ability to be an important employment opportunity in countries like our country with a young population. Since the 1980s, it has continued to be one of the leading sectors. The values in the import- export process have showed increase positively.
In this research, foreign trade in Turkey textile and clothing industry has been investigated especially in recent years. Therefore, with the help of foreign trade data investigation of changes in our country's from past to present and making comments about the future are the purpose of the study.

Key words: export, import, textile and apparel industry, Turkey's trade

INTRODUCTION

Textile sector is one of the oldest industry branches of our country. Textile sector has gone to mechanization process as a result of increasing population and demand for diversity of wear of people as well as technological progression. Consequently it is observed that human labor has decreased. However production at clothing sector still has not been saved from manual labor dependency. Textile trade of our country has been started together with settlement of Turks to Anatolia. They blended weaving tradition brought from Middle Asia with local hosiery culture of Anatolia. Anatolia has developed textile sector by synthesizing the advancement of East and West with each other. After the birth of Republic of Turkey, industrial investments are incentivitized under intense industrialization efforts. For example Sümerbank is established as manufacturing factories during that period giving importance to textile weighted production.
(http://texen.s5.com/Tekstil_Sektorunun_Tarihi.htm/a%C4%9Fustos2014).

Especially after seventies, textile and ready-made clothing production and trade was shifted from developed countries to developing countries. In these countries it has become driving force of the economy and basic source of employment (Arslan K. 2008). Textile sector in Turkey has shown continuous increase from eighties to nineties, but entered to weakening period because of the high inflation lived. This disadvantage was tried to overcome by ready wear. At the beginning of eighties exported textile products like thread, fiber, fabric etc. but in nineties ready wear had more weight in export. During these years garment and ready wear industry has increased its share to more than 20 % with respect to general export of Turkey by its high export performance. Thus, ready wear has become the "locomotive sector" of Turkey. Since 1993, weight of import is increased, Turkey has become in net importer state. Asia crisis occurred in 1997 has affected Turkish textile sector negatively; it caused especially formation of throwaway prices. Sector also influenced by Russian crisis in 1998, continued its sustainability in exportation although these events. At the same time it became the most highly rated employment source after agriculture (Baran M. 2008). It is important that sector development is connected with being a country which produces its own raw materials. Besides; low manpower cost supported the development of the sector defined as labor intensive sector and sector in nineties, sector has provided notable important acceleration (Baran M. 2008). After 2000 years textile sector has an attack for the export. One of the biggest reasons is loss of TL value against foreign currency and increase of the export. Ready wear keeping the sector supported nearly provided an increase every period with respect to previous period (Özgür İ. 2006). Ready wear sector defined as "labor intensive" industry branch because of reasons like production stages, variability of the machinery used and low production rate now has changed to "capital intensive" industry branch as a consequence of structural changes in industry for recent years (Arslan K. 2008). Level of textile and ready wear sector in Turkey is one of the leading socio-economic activity areas with respect to economic effectivity and social interaction. With effect of changing world conditions and fashion movements, it protects being an investment area conforming to enlargement (Arslan K. 2008). This study has the aim of examining the change of foreign trade of Turkish textile and ready wear sector from past to today and analysis of future expectation.

TEXTILE AND READY WEAR PRODUCTION FROM PAST TO TODAY

Textile and ready wear Sector has lived golden age since eighties. Many investors realized investments directed to this area. Many textile companies realized productions with local raw materials since they have share in cotton production. For ready wear, ordinary basic products in large quantities and resembling each other are produced. Many factories opened by more than necessary persons who cannot dominate work could not follow a sustainable production policy. At the present time, factories which were opened during that period and remained at top are plants which succeeded in keeping up with time. As applicable to each area, establishments keeping up with changes in consumer trends can find marketing chances. These establishments become always open to innovations with experienced staff.

Nowadays together with developing automation and educated production- administration staff, Turkey has been one of the addresses where products with high value added are produced. Many companies take important steps towards branding road. Companies not working on order but marketing their own products enter to markets. These companies gained important ground on research and development with well-trained staff. Going beyond competition make using different technical material a current issue besides production. Consequently technical textile issue also became well-heard in our country. Although research and development expenditure in world has been increased three times more, unfortunately share of Textile and ready wear sector from total research and development expenditure in Turkey has very low percentage. In this case it seems research and development studies on technical textiles are insufficient. In order to reach the aims related with sector, it is required to give great importance to research and development studies for developing innovative, smart, competitive, with high value added technical textile products (Marmarali A. 2013).

Major production and consumption of world textile are realized in North America, West Europe and Japan. In these nations, production of technical textile has important share in textile and ready wear industry. Parallel to developments in world markets, technical textile production and product diversity gradually increases in Turkey. According to available world conjuncture, Turkish textile industry aims to produce high value added, special and qualified products and to sell these products with competitive prices (Marmarali A. 2013).

GENERAL EXPORT AND IMPORT FIGURES

As stated data given by Turkish Exporters Assembly, during 2014 January-June period, ready wear and textile worth of 9.4 billion dollar export is realized in Turkey. Compared with 2013 January-June period, 12.1 % increase is observed in dollar basis. Ready wear and textile sector has state of being in second rank in export after automotive sector with 11.1 % increase in 2014 January-June period. (İTKİB, 2014). Following figure shows textile and ready wear foreign trade data during 2002-2013 period.

Figure 1. Foreign trade figures of Turkish textile by years (Yazıcı M. 2014).

With respect to annual Turkish textile export figures, it is observed a sudden decrease after 2008 and then increasing trend is followed. Import values decreased after 2007 and reached the minimum value of seven years in 2009. After 2009, a rapid increase is observed and it took maximum value in 2011.

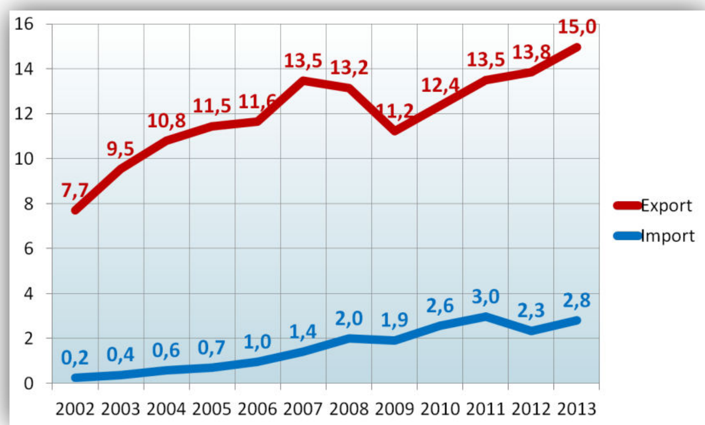

Figure 2. Foreign trade figures of Turkish ready wear by years (Yazıcı M. 2014).

As shown in Figure 2, from data of Turkish ready wear foreign trade, export values show a sudden decrease after 2008, and then it is observed an increasing trend. When considering the import values, it is determined that there is an increasing trend for 12 years except 2009 and 2012 years.

In the figure 3 below, it can be seen the values of import and export data of 2013 in sectoral basis, balance of foreign trade and share in the export.

Product Group (1000 $)	Export	Import	Balance of foreign trade	Share in export
Ready Wear	**14.973.727**	**2.804.139**	**12.169.588**	**10%**
Agricultural Products	21.596.435	17.729.669	3.866.766	14%
Textile	**12.754.985**	**9.653.315**	**3.101.669**	**8%**
Extractive Products	5.046.380	6.050.459	- 1.004.080	3%
Automotive Industry	21.369.237	23.753.473	- 2.384.237	14%
Iron and nonferrous metals	6.746.828	10.097.695	- 3.350.868	4%
Steel	13.795.068	20.229.669	- 6.434.601	9%
Jewel	6.980.281	16.276.084	- 9.295.803	5%
Machinery and equipment	5.861.449	16.980.483	- 11.119.034	4%
Electric-electronic	11.840.455	24.452.574	- 12.612.119	8%
Chemicals and chemical products	18.950.382	87.860.323	- 68.909.940	12%
Other	11.953.325	15.762.677	- 3.809.352	8%
Total	151.868.551	251.650.560	- 99.782.010	100%

Figure 3. Foreign trade values on sectoral basis of the year of 2013 (Yazıcı M. (2014).

When looked at share values in the export, it is observed that ready wear is in the 4th place after agricultural products, automotive industry and chemicals with 10 % and textile has also 8 % value.

FOREIGN TRADE FIGURES ON COUNTRY BASIS

During 2014 January-June term, ready wear and textile export from Turkey to Middle East countries, Africa countries, America countries and Asia and Oceania countries showed an increase at different rates changing between 4.9% to 27.3%.

EU nations as the biggest market of sectorial export is increased 13.9%; to Middle East countries 27.3 % and to Africa Countries 19.2 % increases and it is observed some decreases at some other regions; however Turkey carried its ready wear export to 9.4 billion dollars with 12.1% increase (İTKİB. 2014). When looked at year of 2013 highest textile export values belongs to Russia with 1 billion dollars. During this term it is observed that export to Russia decreased as 10.3% . Again in the same period, highest increase among 10 highly exported nations was Ukraine with 307.8 million dollar with 50 % increase (Hedef 240. 2014). In Figure 4 below data related with country share of textile export in 2013 are shown.

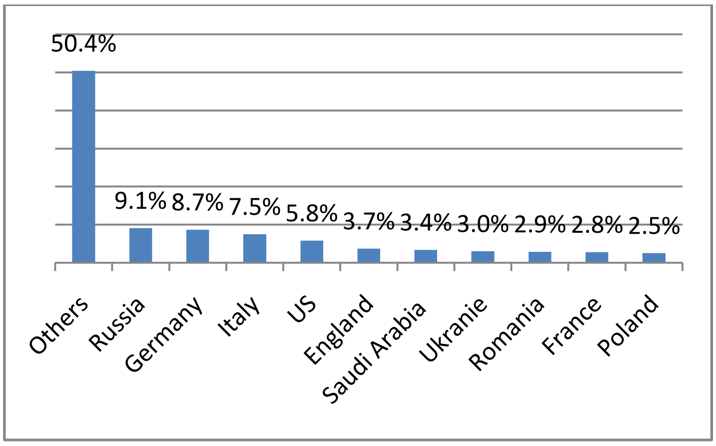

Figure 4. Country shares of textile exports in 2013 (Yazıcı M. 2014).

When ready wear export data in 2013 (figure 5.) is examined, ready wear export worth of 17,4 billion dollars was exported as 76,2 % or three fourths to 28 European Unity countries. This year Spain, Germany, England was biggest and most important markets of Turkey.
The country that ready wear export has the highest share was Iraq with 579.6 million dollars export comprising 39.3% increase. France was the second with 8 % increase worth of 1.1 billion dollars export figure. Russia Federation was the third country in increase rate with 8.5% increase worth of 411.7 million dollars (Hedef 240. 2014).

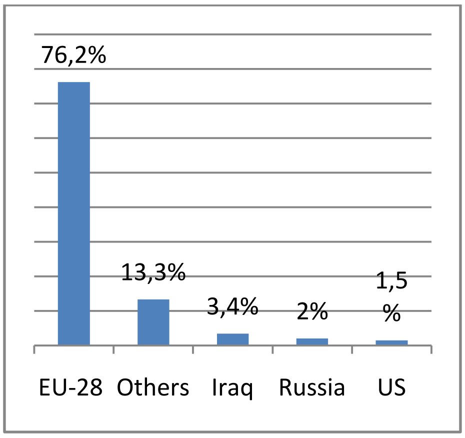

Figure 5. Country shares of ready-made clothing exports in 2013 (Yazıcı M. 2014).

CONCLUSION

The most important factors of rapid development of Turkish textile sector are cheap labor, production of raw material and closeness to European Union Countries. Textile and ready wear sector using this advantages successfully has fully grown and carve out a niche for itself (Özgür İ. 2006). At the same time it has potential to become popular in future global trade by its product quality, designs owing power to determine fashion and trends and high technology. Although instability lived in neighbouring countries, economic nuisance lived in European Union Countries during past year of 2013, Turkey has shown great performance. Increasing export assumed as basis of economic development is determined as important element for reaching the goals. It is highly important to provide modernization of available investment, protection of available and additional investment and increase of productivity for the sustainability of production and employment with 2023 perspective. Research and development and product development are among the subjects required to be given importance. Consequently, it is aimed to increase research and development expenditures and to make double the staff working at research and development. Generalizing of technical textile production, design focused production, high value added studies will appear important factors in 2023 vision. Serious transformation on production technology and product qualities in world textile sector, smart and technological textiles field rapidly developed and appeared as new competition area. Becoming leader in this area is one of the targets of Turkish textile sector for the next years. Turkey has to develop and use alternative technologies for not being affected by the limitations brought to products produced by methods harmful to environment at world markets. Having safe work environment of work places determined for production conforming to certain rules, not working of child worker, using energy economically, supporting recycling; in brief developing sustainable production strategies increases competition power of the plants. One of the important superiorities of Turkish ready wear and textile sector in world market is advantages brought by rapid and qualified service and its geographical position. Especially in metropolitan cities there are units doing organization of establishments. Production of basic products is at countries with cheap labor or southeast cities. Consequently industrialization and development of southeast region are provided. For sustainability of these conditions, fortification of Turkey image and global branding must be aimed. Since the products resemble each other, competition among companies is realized through images. Receiving much larger share of Turkey from world textile and ready wear markets depends on necessity of creating a positive “Turkey image”. It is required that such important sector for Turkey must do appreciation of the situation again, determine how to protect the opportunity, how to escape from risks by revealing its opportunities and risks. It is necessary to catch the era, to present new technological products in order to survive in world markets having changed consumer demands, and limitless product diversity. Government must take care of textile and ready wear sector and must provide certain advantages. Turkey having a very good position in the area of textile and ready wear area must not lose its position.

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INFLUENCE OF UNSTANDARDIZED WORKSTATIONS ON OPERATOR PERFORMANCE

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ABSTRACT: Apparel manufacturing in nature is more complicated than many other industries. Many factors such as the properties of fabrics and human skills will affect the performance of operatives that ultimately will cause variance on the task time. The aim of this paper is to see how lack of standardization of the work stations influences the performance of experienced and inexperienced operators. Actual sewing room conditions were used to film operators, while motion data was extracted from the footage. Analysis of variance was used to determine time deviations between the operators. Workplace standardization influences the motions of obtaining garment pieces, which accounted for roughly 13% of operation time. The time of obtaining garment pieces depended on two factors – position of pieces on the working area and method of work. Experienced operators achieved shorter production times by placing garment pieces closer, which allowed them to obtain the pieces using fewer motions. The results show the importance of standardizing the workplace and providing training in order to increase operator's skills and achieving sewing room efficiency.

Key words: Optimization techniques, Motion study, Apparel industry

INTRODUCTION

Apparel manufacturing is in nature more complicated than many other industries. It involves a number of machines arranged in assembly and sub-assembly lines in order to process simultaneously bundles for producing different styles. The production process involves a set of work stations in each of which a specific task in a restricted sequence is carried out. More importantly, it remains an industry heavily dependent on human labor. Fabric properties make clothing a product that requires much human handling, hence relatively complicated for its price. In fact, sewing and assembly continue to account for 80 percent of all labor costs in clothing manufacture (Dicken 1998). Therefore it is not surprising that apparel production is outsourced to less developed countries to achieve labor-cost advantages. Human skills will affect the performance of operatives that ultimately will cause variance in the task time. As a result, the study of human motion and improvement of operator skills through training remains a necessity for conducting efficient operations in the apparel industry.

THEORY

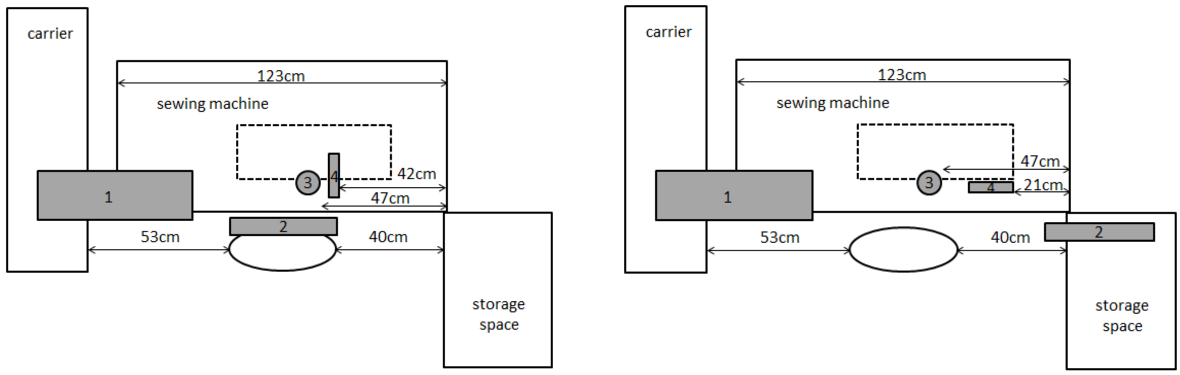
The introduction of scientific management in the 1900's led to particular attention to the way work is conducted. In their pioneering work *Motion Study* the Gilbreths argued that a truly systematic shop brings motion, tools, equipment, work surroundings, and worker characteristics into optimal alignment (Krenn, 2011). They were the first to conduct studies into micromotions with motion picture cameras and chronocyclegraphs to identify the one best way to do work. Since then work and time study have been recognized as important contributors to any industry involving manual labour.

Work study is used in the development and control of work situations. Work study encompasses all those procedures concerned with work measurement and motion study. Motion study is qualitative analysis of a work situation leading to the design or improvement of an operation. Work measurement techniques such as time study and work sampling are used in measuring or forecasting the rate of output of an existing or newly designed operation, as well as in determining how much time is consumed for various productive and non-productive activities of a process or operation. Also involved is the determination of standard times which represent the allowable time for the performance of work (Chuter, 1990; Jenkins and Orth, 2004). Time study is used to determine a standard time for an operation by direct time measurement. Work Sampling Technique can be used to determine the required data necessary for the application of a percentage allowance of personal needs, fatigue and unavoidable delays (Pape, 1991).

Work and time study are fundamentally linked with production processes, which in the case of apparel manufacturing are usually outsourced to developing countries. Sadly, rather than being used as industrial engineering tools their role in apparel manufacturing is being reduced to a tool for estimating labor costs, and often replaced with historical rather than actual data (Miler, 2010). For instance, recent research into the application of time study in Macedonia has shown that manufacturers who employ time study techniques are few and far between (Nedanovska and Demboski, 2014). Still, as buyers continue to drive the market and their purchasing practices are based on target margins improving (Lamming et al., 2005), the increasing the efficiency of production is a viable option for manufacturers to combat ever decreasing buying prices. Investing in work study operator training improves the overall shop floor performance (Tomovska and Kortoseva, 2014). With this in mind, the aim of this paper is to see how lack of standardization of the work stations influences the performance of experienced and inexperienced operators.

METHODS

The study was carried out in the sewing room of a garment manufacturing company. For the purpose of the research the time of attaching a waistband to the leg of a men's trouser was measured. The operation was selected as it includes parts of various sizes – ranging from rather large pieces such as trouser legs to small pieces such as belt loops. The time study was conducted on two operators, of whom the first was an experienced operator, while the second an inexperienced operator. In order to reflect actual working conditions the working unit was not previously standardized. This provided the operators with the opportunity to place the garment pieces on the working area in their habitual manner. The schematic representation of garment pieces on the working area is shown on Figure. 1. All garment pieces are delivered to the workstations in small bundles of 10 to 15 pieces. The bundles used in this research included 11 and13 pieces. To deliver the trouser legs to the working station a manually handled overhead carrier is implemented. The smaller pieces (waistband, belt loops, labels) are placed on a storage space on the right of the work surface and redistributed by the operators.



Operator 1 **Operator 2**

Figure 1: Working stations of operators 1 and 2 with garment pieces (1-legs, 2- waistbands, 3 – belt loops, 4 labels)

Footage with 29fps of the working motions of both operators was taken using a Canon PC 1585 digital camera mounted on the right hand side of the working stations. The footage provided clear view of the motions for obtaining garment pieces. The length of footage for the first operator was 22min27s for a batch with 13 pieces; however one piece was not included in the research due to incomplete footage. For the second operator a 23min31s footage was made for a batch of 11 pieces. To conduct the time study Adobe Speed Grade CS6 was used in order to analyze motions frame by frame. The obtained results were analyzed using analysis of variance.

FINDINGS

The average time for completing the studied operation for the first operator was 3274,17 TMU, whereas for the second operator 3900,60TMU. The placement of garment pieces influences motions of obtaining. Motions of obtaining a garment piece are those needed to get the piece and put it on the working surface. They can broadly be divided into motions which involve one hand and motions which involve both hands. The former is typically applied with small pieces, in the studied case belt loops, whereas the latter occur when obtaining larger pieces, such as legs or waistbands. For both operators the time in obtaining garment pieces is about 13% of the total time (Operator 1 13,48%, Operator 2 13,54%). Statistically significant differences in times needed to obtain pieces existed between the operators (Table 1).

Table 1: Time of obtaining garment pieces in compassion to total time

Motions	T_{O1} *(TMU)*	T_{O2} *(TMU)*	F	p
Total	3274,17±219,79	3900,60±389,59	23,088	0,000
Obtaining garment pieces	397,0±81,01	475,61±85,14	5,714	0,031

To further analyze the problem an analysis of the motions for obtaining each part was conducted (Table 2). Significant differences were found in obtaining the small parts (belt loops and labels) and the waistband.

Table 2:Times of obtaining different garment pieces

Motion	*Operator 1*		*Operator 2*		*F*	*p*
	n	*t±SD(TMU)*	*n*	*t±SD(TMU)*		
Obtain part with two hands						
Leg (first)	12	75,74±36,96	11	66,67±27,29	0,44	0,514
Leg (second)	12	52,22±6,80	11	50,00±17,77	0,16	0,691
Waistband (first)	12	72,97±36,51	11	70,81±17,71	0,03	0,861
Waistband (second)	12	26,48±9,91	11	55,26±11,07	43,26	**0,000**
Label	12	28,89±12,34	11	18,69±3,68	6,92	**0,016**
Obtain part with one hands						
Belt loops (x8)	96	20,57±8,99	88	29,84±15,07	26,23	**0,000**
Label	12	20,83±8,41	11	28,28±5,48	6,20	**0,021**

DISCUSSION

Lack of internal standardizations of the workstations allows a study of the difference in positioning parts between experienced and inexperienced operators. The first set of obtaining motions involves obtaining relatively large pieces – a trouser leg and a waistband. As the trouser legs are delivered in a standardized manner by an overhead carrier the time of obtaining them did not significantly differ. Differences in the operating procedure can be seen at two key points – firstly the order of selection of pieces to be obtained from the bundle, and secondly the positioning of the waistband. The waistbands arrive at the workplace at a planned order – the position in the bundles is left piece followed by a right piece. To match this order the second, inexperienced, operator always looks for the left leg of a trouser first. On the other hand, the first operator takes a leg piece randomly and then looks for the adequate waistband in the batch. The high standard deviation time for the first waistband shows that this operator often has problems to locate the correct piece. As a consequence of not following the planned order, the experienced operator is slowed down and there is no statistically significant difference between operators.

On figure 1 it is noticeable that the inexperienced operator 2 leaves the waistbands at the storage space, whereas the experienced operator 1 places them in her lap. Subsequently the second operator needs to conduct the obtaining in two motions. In contrast the first operator easily conducts the task in one motion. As a result the time for obtaining the piece is cut in half, as can be seen in Table 2 for obtaining the second waistband.

Similarly, the second operator uses two motions for obtaining the belt loops. While the first operator gets the belt loops one by one, the second operator gets an arbitrary number of belt loops with one hand, followed by getting the part with the other hand in order to position it close to the needle. Consequently the total time for obtaining the belt loops is increased (Table 2). Although the time of this motion is short, the motion is repeated eight times, therefore it contributes significantly to the total time of the overall operation. In addition, holding belt loops in one hand while sewing limits the freedom of movement of the operator, thus has an adverse influences on the overall time.

Obtaining the label is also conducted in two motions by both operators. The first motion is necessary to get the label from the working surface with one hand, and the second conducted with both hands to fold it and put it close to the needle (Table 2). The placement of the label influences the time of getting this piece. As the first operator has placed the labels closer, the time for obtaining them is shorter. On the other hand, the rotation of the labels in the direction in which they are placed on the waistband, as seen with the second operator, leads to shorter time of the second motion.

CONCLUSIONS AND IMPLICATIONS

The study investigated how standardization of the workplace influences the performance of experienced and inexperienced operators by analyzing the motions of obtaining garment pieces from unstandardized work stations. The time of obtaining garment pieces depended on two factors – position of pieces on the working area and method of work. The experienced operator achieved shorter production times by placing garment pieces closer, which allows obtaining the pieces using fewer motions. Never the less, when the experienced operator was faced with the task of obtaining pieces in a planned manner, ignoring the procedure leaded to longer operation time. This indicates that training operators, irrelevant of their experience, will improve their performance, The results show the importance of standardizing the workplace and providing training in order to increase operator's skills and achieving sewing room efficiency.

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CHINESE TRADITIONAL WOMEN'S DRESS: A CASE STUDY OF "LONGFENG QIPAO" SHANGHAINESE TIME HONORED BRAND

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ABSTRACT: Traditional dress has through history been regarded as a mark of tribal, ethnic, or religious affiliation throughout the world. At the end of the Middle Ages in Europe, trade routes between the Far East, most notably China, and the Western civilization emerged, with one of the primary commodities that was traded being silk, as both raw material and garment. This article describes a recognizable style in women's silk dress introduced in Qing dynasty - the "qipao", whose revival and coming into fashion we have witnessed in 20th century on several occasions, and which many Chinese and foreign women today wear in special occasions, and even daily. In addition to the textile industry overview, a case study of "Longfeng Qipao", an old Shanghainese brand is presented in this article, with special focus on its brand, and the brands' relationship with its place of origin – the city of Shanghai.

Key words: textile industry, China, Shanghai, qipao, brand management, branding, place of origin

INTRODUCTION

Traditionally, textile industry has been one of the most important ones for the development of the national economy, since the Imperial Times, after the liberation of 1949, and well into the Reform and Opening Up era of 1980s and 1990s. Currently, China is the world's largest producer and exporter of textiles and clothing, textile and garment exports continuing to grow steadily to ensure China's foreign exchange reserves, balance of payments, exchange rate stability, and solving socially critical employment levels and macro economically sustainable development. Textile industry profits and taxes paid accumulate funds and the national budget helping other industries and areas such as construction, creates jobs, prosperity, and promotes development of urban and rural markets, and the development of agriculture and other related industries to meet the needs of industrial development of textiles and improve the people's living standards, generally playing an irreplaceable role.

Overview of the Development of China's Textile Industry

Since the reform and opening up, the textile industry is a pillar industry in the secondary industry, with tremendous contributions to the development of China's economy. From the 7th five-year plan period period to 11th five-year plan period, the economic value added by textile industry and its contribution to socio-economic development is summarized in the following table.

Table 1: Overview of the Development of China's Textile Industry

Period	7th five-year period	8th five-year period	9th five-year period	10th five-year period	11th five-year period
Years	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010
GDP （hundred million CNY)	72550.1	187773.1	423443.5	710626.4	1538586
Secondary industry（hundred million CNY)	31326.9	87775.5	172282.5	288398.3	628068.2
Textile industry（hundred million CNY)	903.6	1053.9	16370.76	44044.32	106921.2
Textile industry accounted for the proportion of secondary industry（%）	2.88%	1.20%	9.50%	15.27%	17.02%
Textile industry accounted for the proportion of GDP（%）	1.25%	0.56%	3.87%	6.20%	6.95%

Source: Wang Xin and Wang Yu's Research Report of China's Textile Industry's Contribution

(2014 in Donghua University)

However, even though China produces a huge quantity of shirts and export heavily to international markets, the economic benefits of such production and exports are not as high as China's leadership would hope. As one Chinese commerce department leader stated, China exports 800 million of shirts, but the value of its exports are only worth a single Airbus A380, while from each of the exported shirts, the Chinese manufacturing firm can on average only get USD 0.35 (equivalent to CNY 2.89 in 2005).(Xinhua News, 2005) With that in mind, China should focus on manufacturing more added-value clothing, one of the possible solutions being high quality traditional style clothes.

TRADITIONAL CLOTHING AS A POTENTIAL SOLUTION FOR INCREASING EXPORTS NET VALUE

With the development in the apparel industry, traditional clothing is easily being lost, less and less people wearing it in every day occasions. National traditional costume is related to the historical and cultural heritage, being one of the critical expressions of ethnic culture. Therefore, we believe a nation should not give up on its traditional clothing, but should rather strongly cherish it, and where possible develop it and seek for economical benefits consumption of such clothing can bring.
In Europe, there is a lot of experience in the development of national costumes (see Pictures 1 and 2), and China has also started exploring this clothing category. Longfeng Qipao company in Shanghai is one of the leaders in this area, that has been cherishing traditional culture and promoting it even further, and we will present their opinion on this fashion, and the link of their brand to the city brand of Shanghai.

Picture 1: English men's suit (cca. 1750)

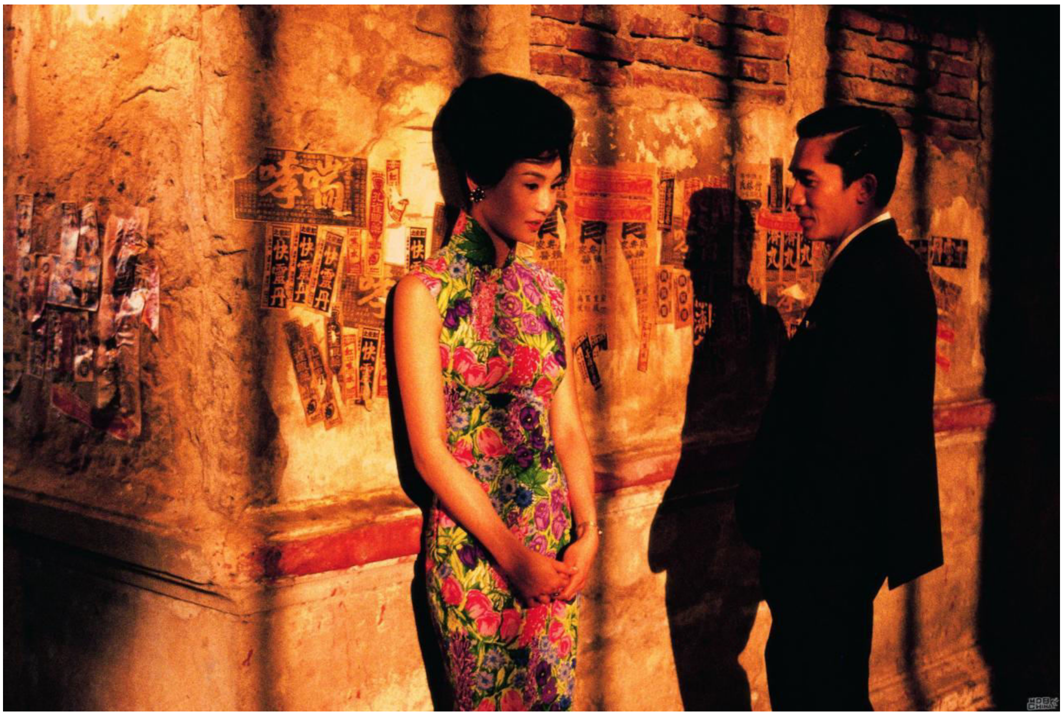
Picture 2: French women's dress (cca. 1800)

QIPAO: QING DYNASTY INTRODUCTION TO CHINA

Qipao, or otherwise known as "cheongsam" or "Mandarin gown" in English, was first introduced in China in the 17th century, by the Qing tribes that conquered the nation. The stylish and often tight-fitting qipao that is best known today was created in the 1920s in Shanghai and made fashionable by socialites and upper class women (Bao, Ma, 1998). When the Manchu ruled China during the Qing Dynasty, certain social strata emerged, among which were the *Banners* (*qí*). At first, mostly Manchu people, who as a group were called *Banner People* (旗人 pinyin: *qí rén*), where adorning the dress, and the Manchu women typically wore a one-piece dress that retrospectively came to be known as the *qípáo* (旗袍, Manchu: *sijigiyan* or *banner gown*).

Subsequently, in the early 20th century, people eagerly sought a more modernized style of dress and transformed the old *qipao* to suit their tastes. Slender and form fitting with a high cut, it had great differences from the traditional *qipao*. It was high-class courtesans and celebrities in the city that would make these redesigned tight fitting *qipao* popular at that time (Clark, 2000). In Shanghai it was first known as *zansae* or "long dress" (長衫—Mandarin Chinese: chángshān; Shanghainese: *zansae*; Cantonese: *chèuhngsāam*), and it is this name that survives in English as the "cheongsam".

In the 1950s, women in the workforce in Hong Kong started to wear more functional cheongsam made of wool, twill, and other materials. Most were tailor fitted and often came with a matching jacket. The dresses were a fusion of Chinese tradition with modern styles. Cheongsam were commonly replaced by more comfortable clothing such as sweaters, jeans, business suits and skirts. Due to its restrictive nature, it is now mainly worn as formal wear for important occasions. They are sometimes worn by politicians and film artists in Taiwan and Hong Kong. They are shown in some Chinese movies such as in the 1960s film, *The World of Suzie Wong*, where actress Nancy Kwan made the cheongsam briefly fashionable in western culture. However, they are sometimes used as Halloween costumes in some western countries. They are also commonly seen in beauty contests, along with swim suits. Today, cheongsam are only commonly worn day-to-day for some people—restaurant hostesses and serving staff at luxury hotels, for instance—as uniform.



Picture 3: Hong Kong movie star Maggie Cheung wearing a qipao in "In the Mood for Love", cinematic classic by the acclaimed director Wong Kar-wai

Picture 4: Mainland China actress Tang Wei in Ang Li's "Lust, Caution", set in 1930s Shanghai, wearing an elegant qipao

"LONGFENG QIPAO" TIME HONORED BRAND FROM SHANGHAI

In our research of old Shanghainese brands, and their interconnection with the city brand of Shanghai, we have chosen to interview representatives of an old time honored brand, Shanghai Longfeng Chinese Style Garment Company. The company with a long history in making the finest qipaos in the world, Longfeng, was certainly a good choice of a subject for research. We have had the pleasure to visit their store in bustling commercial Jing'an district, on the corner of North Shaanxi Road and West Nanjing Road, a very busy spot in a business and commercial area in Shanghai, and meet with Ms. Chen Yueqin the company's general manager, and Mr. Tao Yaokang, the marketing manager and the manager of their flagship boutique store.

Mr. Tao explained us that Longfeng was established in 1840, at the time when Shanghai was just opening to the outside world. It was the time when Chinese culture and foreign cultures met and interacted extensively for the first time. At that time, there were plenty of workshops that were making Chinese style clothes, with artisans falling in two different design styles, one being the Cantonese style, the other the Suzhou style. One of the busiest and most recognizable workshops called "Suguang", which means "Suzhou factory", named so because they were making clothes in the Suzhou style, was also established in that time. It was operating under that name until the liberation of 1949, when the company changed its name to the one that is in use until today, Shanghai Longfeng Chinese Style Garment Company. All of the clothes made by Suguang, later Longfeng, were tailor made to perfectly fit a woman's body, and since they had different levels of customers, the brand differentiated the products into 3 groups, for high, medium and low income level customers.

Ms. Chen told us that when Shanghai opened its shores for foreign business in the early 20th century, Shanghai girls wanted to explore their beauty, and started showing their figure though traditional clothing, the qipao. However, because of a variety of reasons of social nature, after the liberation of 1949, people began to pay less and less attention to Chinese traditional clothing. Just as every Japanese man and woman have a kimono, and wear them after work, on weddings and at casual times, their Prime Minister frequently wearing it to go to visit the shrines and temples, Ms. Chen thinks China's leadership should also sometimes wear qipaos or traditional shirts and trousers to visit a foreign country in casual occasion. Wife of the new president of China Xi Jinping, started this fashion recently on her overseas travels.

Discussing about the very manufacturing itself, we learned from Mr. Tao that the workshop was before combined with the retail shop, when it used to be behind the shop. Because it is a prime location now, it is not economically sound to continue to have a workshop at the same location, however, because it is still advanced and heavily customized products they manufacture, the workshop is a kilometer down the North Shaanxi Road. If there are some smaller problems, they can be quickly resolved through the "workshop next to the shop model". Mr. Tao explained us that the costumers can have a cup of tea or a little chat, while their clothes are being corrected, and it is a reasonable operation model that will be kept for the future as well.

When asked how much does their brand rely on the image of the city, and will their company emphasize the culture of Shanghai as a strong selling points, Mr. Tao said that he believes the development of Chinese clothing is closely linked to the culture of Shanghai. Shanghainese local culture is very distinct, and it supports the brand image of old brands such as Longfeng. This city is one of the reasons that so many people are still interested in Chinese traditional clothing. "Shanghai is highly, deeply and widely interacting with foreign countries and cultures, and people have the idea that it is an honor to own a product made in Shanghai.", Mr. Tao told us with strong assurance. "When it comes to fashion and clothing, Shanghai is a place for trend setting. Our brand was, is, and always will be influenced by Shanghai, we use its images in ads, in every marketing means. Even though qipao originates from Northeast China and is a kind of Manchu clothing promoted in the Qing dynasty period, not until it was adorned by the ladies in Shanghai, did it attract wider national and global attention. The Manchu qipao changed in Shanghai, because the city is a place of creativity. France has Paris, Italy has Milano, the USA has New York, and we have Shanghai, it is our capital of fashion. Our brand is greatly influenced by the image of Shanghai and we must utilize this great point. In addition to this, our success in sales, of course, heavily depends on the position of the company, which is the very heart of this city.", Mr. Tao goes on to explain the relationship with the image of the city.

In discussing the relationship between Longfeng and the image of the city of Shanghai, Mr. Tao said: "Our company does not only advertise itself, but the whole culture of Shanghai, we improve the city brand for sure, and when people know about our brand, they will know more about the culture of Shanghai. Qipao can help them express themselves without words, simply through the figure of their body."

"The image of Shanghai certainly brings loyalty among our customers. This is the charming part of our company. By advertising Shanghai through our brand, consumers from all parts of China and abroad will come to Shanghai for our products. Why will these people take a plane or train to come to Shanghai and buy a qipao? They think qipaos made in Shanghai are of better quality, qipaos made in Shanghai are more fashionable than those made in their cities. And finally, they believe the companies from Shanghai have integrity so that they have nothing to worry about. Therefore, such a long trip to Shanghai to buy a piece of qipao makes perfect sense, it is an utmost pleasure for the consumer."

CONCLUSION

We have seen a re-emergence of traditional dressing style in modern day China, and can conclude that this particular type of dress, the qipao, is strongly connected to the city brand of Shanghai. As such, it can serve to promote Shanghai's particular culture domestically and abroad, and increase the city brand, having an umbrella effect on other industries, who can utilize the positive city brand to increase their own brand equities.

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EFFECT OF OIL REPPELENT AND WATER REPPELENT FINISHING ON GARMENT COMFORT PROPERTIES

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ABSTRACT: The paper investigates the effect of water repellent and oil repellent finishing treatment on water resistance on functional and comfort properties of woven fabrics. Blended woven fabrics of same fibre composition in plain and twill weave, were treated with water and oil repellent finishing. The influence of finishing on water repellency, air permeability and water vapor permeability was investigated. Greater effect of finishing on water repellency was found for twill fabric. Decreasing of air permeability as result of finishing was higher on twill fabric, while decreasing of vapor water permeability was more prominent on plain fabric.

Key words: waterproof and oilproof finishing, water resistance, air permeability, water vapor permeability, comfort

INTRODUCTION

Clothing comfort is an attractive topic of clothing science. Today, it is well known that clothing comfort have a good relation with the several factors, such as thermal, tactile and physical properties of fibers and fabrics. Good moisture absorption and release can be found in fibers with greater specific surface area. Rapid transportation of moisture or diffusion of sweat in the form of steam from the body towards the outside enables good moisture absorption and release, thus maintaining dryness and comfort during garment wearing. Fibers such as cotton and viscose are hydrophilic, meaning that their surface has bonding sites for water molecules. Therefore, water tends to be retained in the hydrophilic fibers, which have poor moisture transportation and release. On the other hand, synthetic fibers such as polyester are hydrophobic, meaning that their surface has few bonding sites for water molecules. Hence, they tend not to get wet and have good moisture transportation and release. Neither natural nor synthetic fibers can perform well in both moisture absorption and release at the same time. To achieve such performance would require moisture absorption and release finishing through which the structural design and quality of fibers are modified so that the textile products thus manufactured can have good performance in absorbing, transporting, and dissipating moisture. Fabrics with good moisture absorption and release that have been developed include profiled polyester fibers and hollowed and micro porous fibers. They are usually of multilayer structure with two or three alternating layers of hydrophilic fiber and hydrophobic fiber (Su C. I., et al., 2007). Recently, with rising living standards, people’s needs and expectations of clothing and textile products have also become different (Buhler M.., Iyer C., 1988, Loy W., 1990, Chen T. W., et al., 2005). Clothing comfort can be induced by thermal, pressure related, and tactile properties, etc. Among these factors affecting clothing comfort, the thermal factor is the most decisive one affecting the comfort level. Many researchers have examined the effects of the fiber type and the fabric composition on thermal comfort. The fiber composition and the fabric structure or the presence of layers was revealed to affect the heat and moisture transfer properties of textiles (Jun Y., et al., 2009). In a study conducted by Su et al., composite yarns were spun using profiled polyester fibers and cotton fibers at different blend ratios. Experiment results revealed that the diffusion rate and drying rate become better with decreasing cotton content [7]. Wang et al. Analysed moisture absorption and quick dry fabrics from profiled PES fibre (Wang F., et al, 2009). Ozdil et al. investigated the effect of the yarn count and yarn twist coefficient of cotton yarns on the moisture properties of knitted fabrics. They noted that a higher twist coefficient value creates a compact structure, a maximum absorption rate, spreading speed and a decrease in the maximum wetted radius, whereas the wetting time of the fabrics increases (Ozdil N., et al., 2009). Liquid sorption in two-layer packets of knitted materials was investigated by Bartkowiak and Szucht. They noted that viscose fibres are the most favorable of the traditional materials for sorptive layers. For diffusive layers, the best are non-hygroscopic fibres, especially textured polyester fibre (Bartkowiak G., Szucht E., 2002). Static water absorption decreases with an increase in the area density and thickness of the samples; therefore these parameters and water absorption have a good correlation for different kinds of bamboo and soy fibre (Abramavičiūtė J., et al., 2011). The moisture

transmitting property of fabric is a key factor that both affect textile and clothing comfort decides handling quality of clothing. According to previous researches, raw material type, yarn properties such as; number and twist and fabric properties mainly affect the moisture management properties of fabrics (Öner E., et al., 2013). Material that is permeable to air is also in general, likely to be permeable to water in either the vapor or liquid phase. Thus, the moisture-vapor permeability and liquid-moisture transmission are normaly closely related to air permeability. Fabric with different surface textures on either side can have a different air permeability depending upon the direction of air flow (Li Y., Wong A.S.W., 2006). Also, a lot of discussion has been done regarding the characteristics of the pores and the relationship between fabric permeability and porosity (Kullman, M.H.R, et al., 1981, Hsieh Y.L., 1995). For the woven fabrics, it has been confirmed that beside fabric structure and set, the effects of: yarn structure, yarn twist, yarn crimp, and filament wrapping are also important factors affecting the air permeability (McCullough E.A., et al., 2003).
In this context, the paper investigates the influence of water repellent and oil repellent finishing, on water resistance and on water vapor permeability and air permeability of fabric.

EXPERIMENTAL

The fabrics investigated are woven blended fabric treated with water and oil repellent finishing. The fabrics have same fiber composition, the same yarn count, but different weave and thread density.
The fabrics are treated with oil proof finishing. The fabrics in plain weave are designated MPU and MPF. MPU has standard clear cut finishing while MPF has waterproof and oilproof finishing. Similarly, the fabrics in twill weave are designated MTU and MTF for clear cut and waterproof and oilproof finishing respectively.
Waterproof and oilproof finishing of fabrics consist of Teflon impregnation process on the padder, with a 80% - degree of leakage, 25 g/l Tubiguarda 66, 3 g/l Tubiguard fix and 5 g/l Kollosala FD, after which follows thermo fixation at a temperature of 130-150°C.
The samples are investigated on water resistance according to AATCC 42-2000 [15], air permeability [16] and water vapor permeability [17].
The particulars of fabric structure parameters are shown in Table 1.

Table 1: Investigated fabric particulars

Fabric	**MPU**	**MPF**	**MTU**	**MTF**
Weave	Plain		2x2 Twill	
Fiber composition	44%wool/54% PES/2% Lycra			
Warp yarn count, tex	18x2			
Weft yarn count, tex	18x2			
Warp density, cm^{-1}	29	29	35.4	35.4
Weft density, cm^{-1}	20	20	24.4	24.4
Fabric thickness, mm	0.39	0.39	0.45	0.45
Fabric weight, g/m^2	200		250	
Finishing	Standard	Oilproof and waterproof	Standard	Oilproof and waterproof

RESULTS AND DISCUSSION

The results of water resistance properties of investigated fabrics are presented in Table 2.

Table 2: Water resistance of tested fabrics

Fabrics	MPU	MPF	MTU	MTF
W [%]	53.09	8.76	50.66	0.26
SD [%]	0.80	0.18	1.59	0.01
CV[%]	1.51	2.1	3.14	3.85

The results show large increasing of the water resistance percentage, for the samples treated with special finishing (MPF and MTF). Fabrics having waterproof and oilproof finishing show significant drop in the percentage of water absorption: from 53.09% to 8.76%, for the plain weave fabric, and from 50.66% to 0.26% twill fabric (Table 2). Greater effect of the finishing on water resistance was found for the twill fabric, where the water resistance drops for 50.40%. Compared to plain fabric, twill fabric has higher cover factor and fabric tightness, which in this case can be the reason for increasing the effect of water repellent finishing.

The results of testing fabric for air permeability are presented in Table 3.

Table 3: Air permeability of tested fabrics

Fabrics	MPU	MPF	MTU	MTF
R [$dm^3/min \cdot cm^2$]	89.79	88.09	63.38	58.75
SD [$dm^3/min \cdot cm^2$]	3.44	3.47	3.77	1.33
CV [%]	3.83	3.90	5.94	2.27

The fabric MPU which has only standard finishing has air permeability 89.79 l/m^2s, while sample MPF, which has waterproof and oilproof finishing has slightly decreased permeability 88.09 l/m^2s. The difference in permeability is 1.9%. The result obtained for the second pair of fabrics (MTU and MTF), confirms the previous finding. Due to waterproof and oilproof finishing, the air permeability decreases from 63.38 l/m^2s to 58.75 l/m^2s (7.3%). The effect of finishing on decreasing air permeability is more evident at twill fabric. The reason could be the different structure of the fabric, particularly the weave and fabric cover factor. In this case, twill fabric has higher cover factor, which contribute to better spreading of the finishing film, thus decreasing air permeability. Although the waterproof and oilproof finishing creates tiny protective film on the fabric (2%), this slightly affects air permeability. It is preferable that finishing treatment does not reduce initial properties of materials. In this case, it is provided, since both fabrics, show small decrease of air permeability after waterproof and oilproof finishing.

Test results of water vapor permeability of fabrics, "WVPt" and water vapor permeability index, "I", are shown in Table 4.

Table 4: Water vapor permeability "WVPt" and water vapor permeability index "I" of tested fabrics

Fabrics	MPU	MPF	MTU	MTF
WVP_t, $g/m^2/24h$	97.41	89.37	90.58	89.25
SD, $g/m^2/24h$	1.06	2.91	1.28	2.93
CV, %	1.09	3.25	1.41	3.28
I, %	91.69	84.13	85.26	84.01
SD, %	0.58	5.56	1.15	2.64
CV, %	0.63	6	1.35	3.14

The water and oil repellent finishing, variously affects water vapor permeability, (expressed through WVP_t and I values) depending on the type of weave. For the plain fabric we see much greater decreasing of water vapor permeability, from unfinished to finished fabric: fabric having water repellent and oil repellent finishing (MPF) has 8.3% less water vapor permeability compared to its pair

with standard finishing (MPU). Water and oil repellent finishing decreases water vapor permeability of fabric, as a result of forming the film on the surface of the fabric, which adversely affects of water vapor permeability. The twill fabric has considerably smaller effect of decreasing water vapor permeability compared to sample in plain weave, and the difference is only 1.5%. Although, the two fabrics have the same fiber composition and the same warp and weft yarn count, differences in weave, cover factor and fabric weight induce various effect of finishing on water vapor permeability.
Generally, finishing treatment has effect of decreasing water vapor and air permeability of the fabrics, thus decreasing garment comfort.

CONCLUSION

The influence of water repellent and oil repellent finishing on water resistance, air permeability and water vapor for a wool blended fabrics has been investigated.As a result of finishing, the percentage of water absorption decreases from 53.09% to 8.76% for the plain weave fabric and from 50.66% to 0.26% for the twill fabric. The application of waterproof and oilproof finishing has negative affect on woven fabric air permeability and water vapor permeability. The effect varies depending on the type of weave. The waterproof and oilproof finishing reduces the water vapor permeability for by 8.3% and 1.5% for the plain fabric and twill fabric respectively.

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STUDY OF THE NEEDLE THREAD CONSUMPTION IN A LOCKSTITCH SEWING MACHINE

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ABSTRACT; A range of woven fabrics for men's tailored clothing, of various thicknesses, were sewn applying two sewing speeds. The seams were produced in warp and weft directions. For the purpose of investigation, the experimental unit, consisting of lockstitch industrial sewing machine, encoder for monitoring the sewing thread consumption and special unit for collecting and storing data on a PC was developed. High linear correlation was found between fabric thickness and needle thread consumption in both principal directions and for both machine speeds. It was shown that the increase of the sewing speed results in the increase of the needle thread consumption.

Key words: needle thread consumption, sewing machine monithoring, lockstitch machine, seam

INTRODUCTION

The apparel industry demands faster changes in setting up machines for range of new materials having various properties. The time consumed in this task has acquiring more and more importance, because it must be frequently, properly and quickly, due to market demands of shorter in quantities and higher level of quality. The introduction of high technologies in the sewing machines is a reality that matters all machine manufacturers. Their main objective is to reduce machine setting times, in order to obtain good quality seams. Moreover, machine producers "tailor" sewing machine features according garment companies production line features.

A study of sewing dynamics, considering thread tension and thread consumption as two very important parameters to achieve good quality seams, considering different machine set-up (sewing speed, needle, thread pretension) and material used (fabric and sewing threads) was initially conducted by Jones R.J.R in 1975. Eventually, Carvalho M., et al., 1996, Carvalho H., et al., 2000, Silva L. F., et al., 2002, instrumented this machine with miniature piezoelectric force transducers on the presser foot and needle bars, as well as encoders and semiconductor strain gauge transducers on a threads' path. Also, signal acquisition and analysis equipment was also developed for measuring the presser foot bar compression force, the needle penetration and withdrawal forces and the needle and loppers threads consumption and tension. With this system, the performance of the sewing machine feeding system, made up by a standard presser foot, with a helical compression spring on the presser foot bar, a throat plate and a differential feed dog, has been studied. A linear variable differential transformer LVDT was also attached to the sewing machine to measure the presser foot bar displacement and, along with the kinematic analysis, enabled a better understanding of the feeding system dynamics. The "*critical*" points in the stitch cycle that greatly influence the quality of the produced seams were identified and correspond to the contact losses occurring between the presser foot and the fabric plies. To study the behavior of the presser foot mechanism an advanced "sewability" tester was used, where the performance of needles, presser feet, feed dogs, fabrics and sewing threads can be assessed during high speed sewing (Rocha A.M, et al., 1992, Rocha A.M, et al., 1996, Rocha A.M, et al., 1996, Carvalho M., Ferreira F.N., 1996, Carvalho H., et al., 1997, Carvalho H., et al., 1998). They have instrumented overlock sewing machine, with miniature piezoelectric force transducers on the presser foot and needle bars, encoders and semiconductors. Later the contribution towards the development of a new generation of sewing equipment was made by (Silva L.F., et al., 2004) who integrated auxiliary add-on kits to improve performance and flexibility in the production of high quality garments.

The aim of this paper is to investigate the influence of fabric thickness and sewing machine speed on lockstitch sewing machine needle thread consumption.

EXPERIMENTAL

A lockstitch sewing machine was equipped with several devices in order to acquire, store and analyze data reflecting the behavior of the most important parameters involved in the formation of the stitch type 301. The system consists of data collection devices (sensors - cantilever beams strain gauges, encoders, LVDT (Linear Variable Differential Transformer) and hardware for signal conditioning and processing (fig. 1). These devices are connected to a data acquisition board installed in a PC. The software program, which enables devices calibration, on-line graphical presentation and signal function processing, was developed. The program includes basic statistical calculations to shorten evaluation time.

Figure 1: Positioning of the data collecting device on a lockstitch sewing machine

For monitoring and measuring needle thread consumption, encoder is positioned at the needle thread path as it is shown on fig. 2. This way, one can get the total amount of thread consumed in a seam for every single experiment.

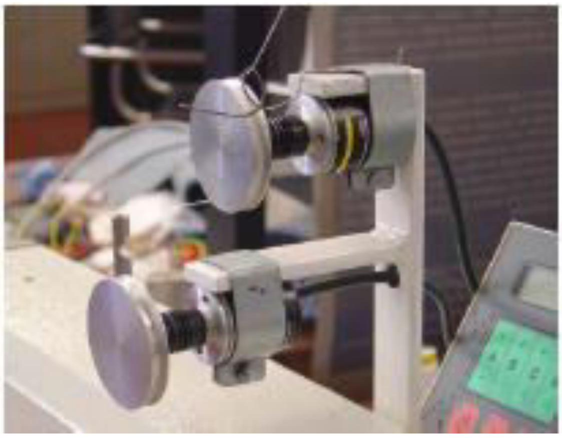

Figure 2: Encoder for measuring needle thread consumption on a lockstitch sewing machine

Ten wool and wool blended fabrics of various thicknesses were investigated for needle thread consumption on a lockstitch sewing machine. The thickness of the fabrics varies from 0.29 to 0.45mm. The samples were sewn at 3000spm and 4000spm. The seams type class 1 designation 1.01.01, according BS 3780-2 in warp and weft directions were produced. The results of the needle thread consumption were calculated as average value out of five measurements for each sample as it is shown on fig. 3.

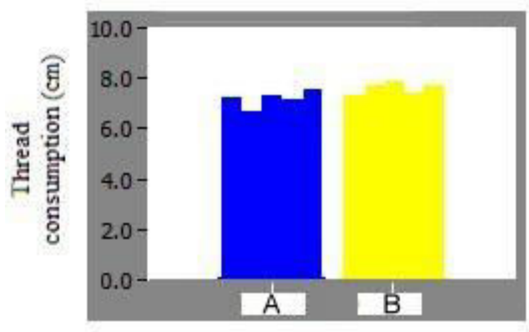

Figure 3: Sewing thread consumption of 5 experiments for two investigated fabrics

RESULTS AND DISCUSSION

The result of needle thread consumption of the investigated samples at sewing speed of 3000 spm in warp direction is shown in fig. 4. Increasing of the fabric thickness results in increasing of the needle thread consumption. There is high linear correlation between fabric thickness and needle thread consumption of 0.96.

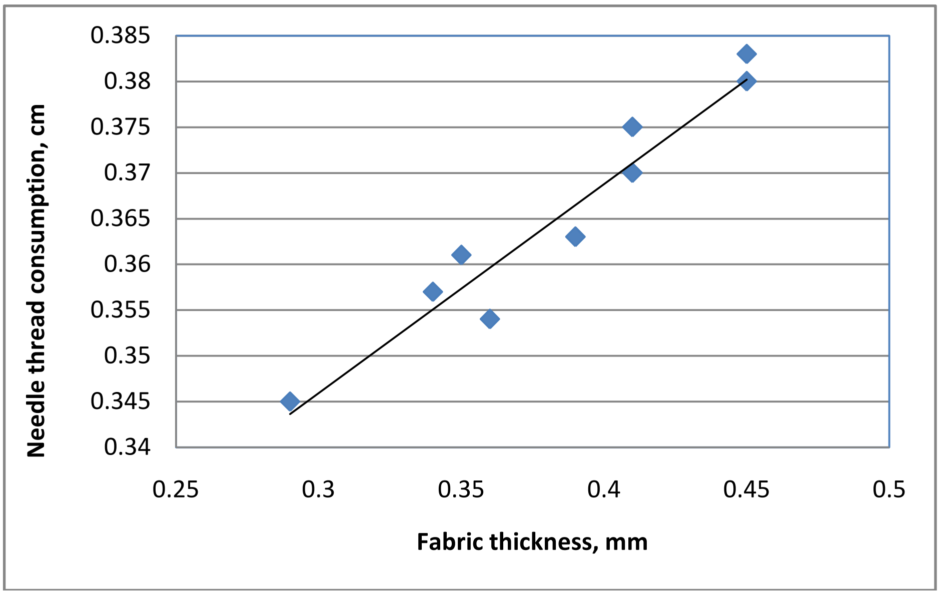

Figure 4: Sewing thread consumption against fabric thickness for sewing speed of 3000 spm

The consumption of needle thread at sewing speed of 4000 spm in warp direction is shown in fig. 5. There is also increasing of thread consumption with increasing of fabric thickness. Again, the high linear correlation between fabric thickness and needle thread consumption of 0.96 is obtained.

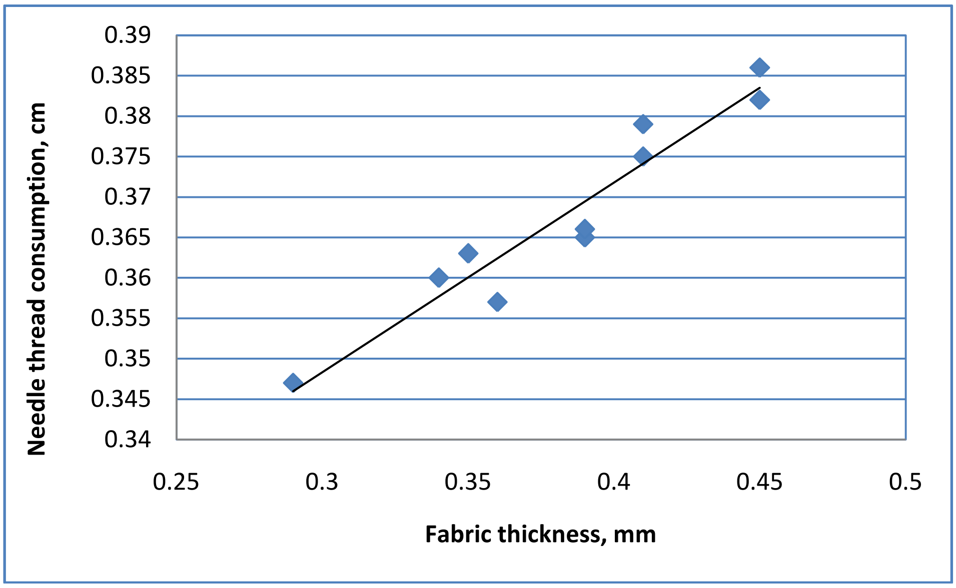

Figure 5: Sewing threads consumption against fabric thickness for sewing speed of 4000 spm

The same behavior is obtained for the seams in weft direction: the increase of fabric thickness results in increasing of the thread consumption.

Fig. 6 shows thread consumption for seams in warp directions for speed of 3000 spm and 4000 spm.

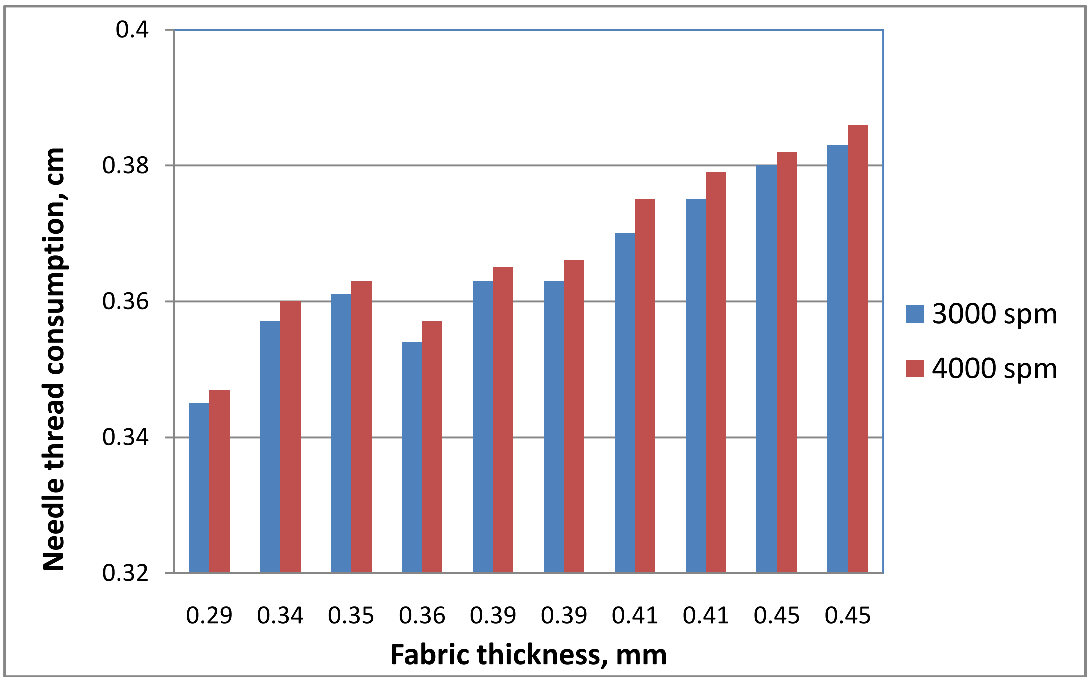

Figure 6: Comparison of sewing thread consumption for various fabric thickness for sewing speed of 3000 spm and 4000 spm

The results in fig. 6, show that in every single testing, there is increase of needle thread consumption with increasing of machine speed. The same results are obtained for the seams in weft direction. The percentage of needle thread consumption increment between speed of 3000 and 4000 spm is shown in table 1.

Table 1: The percentage of thread consumption increment by increasing sewing speed from 3000 spm to4000 spm

Sample	Fabric thickness, mm	Warp	Weft
A	0.29	0.58	0.58
B	0.34	0.84	0.84
C	0.35	0.55	0.28
D	0.36	0.85	0.85
E	0.39	0.55	0.83
F	0.39	0.83	0.55
G	0.41	1.35	1.35
H	0.41	1.07	1.34
I	0.45	0.53	0.26
J	0.45	0.78	0.52

As a result if increasing sewing speed, there is slight increasing of needle thread consumption. The increase of needle thread consumption for investigated seams ranges for seams in warp directions from 0.53% to 1.07%. In warp direction, increment of tread consumptions ranges from 0.26 to 1.34.

CONCLUSION

The results of monitoring sewing machine parameters for a range of wool and wool blend woven fabrics, showed that there is high linear correlation between fabric thickness and needle thread consumption.

There is no significant difference between thread consumption in warp and weft direction.
The investigations showed that thread needle consumption increases by increasing the machine speed. As a result of rising sewing speed from 3000 to 4000 spm, the thread consumption increases for all tested samples in both directions from 0.26 to 1.34%.

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MODEL OF REVIVAL OF THE TEXTILE AND CLOTHING INDUSTRY IN SERBIA

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ABSTRACT: For the development of the textile and clothing sector, as well as any other company, it is particulary necessary to include young people. However, with inadequate transition, the textile sector in Serbia has seen the closure of many businesses and the release of a large number of workers, which results in a negative attitude of young people towards this sector.
Therefore, this paper proposes a model of the revival of the textile and clothing industry. The basic idea is, through promotional activities in this sector, to include as many young people and, through the implementation of planned activities, to enable young people not to look for work, but to create it by themselves in the existing textile enterprises.
The model considers the cooperation of enterprises, higher education institutions, vocational schools and other local government institutions in real operating conditions of the Serbian textile industry.

Key words: Serbian textile industry, model of the revival of the textile and clothing industry, the promotion of the textile sector.

INTRODUCTION

The textile and clothing industry in Serbia has suffered a drastic decline in production. The problems that this industry is now facing is specific and related to the longer period of unfavorable economic conditions. The difficult situation in which the textile and clothing industry in Serbia is, is associated, in a great deal, with the global economic crisis. The turmoil in global financial markets and the recession of the global economy, strongly influences on the difficult business conditions of these industries. Difficult conditions are maintained mainly due to the lack of new investment and the lack of resources and strategies for the development of new innovative technologies that could overcome a plethora of conventional textiles market and competitive goods from Asian countries, especially China.

Serbia is a country that has welcomed the transition without any resources or development strategies, and entered the privatization process while waiting for new investments and increasing of the efficiency of existing public companies. However, when choosing the model of privatization, the state has opted for a model that provides the charge of the state budget, financing of expensive state apparatus and to the fullest extent the absence of new greenfield investments. In such circumstances, textile industry was the first that was effected, that was otherwise broached with prolonged isolation and sanctions, on the other hand it is dependent on both the import of raw materials and technology.

Businessmen from this sector, often made plans to take in imported quotas, in order to prevent the import of textiles from Asian countries. This would be a short-term solution, manely because the practice here has shown that all of the administrative prohibitive can be bypassed. The spread of the Asian, especially Chinese textile industry on the European and American market will continue to be a reality. In addition, significant investments of China in national infrastructure make this country an attractive market for the highly developed western industry. China is not just competing with their products because of low labor costs. Labor costs, for example. are up to 30% less in Laos and Vietnam. China's success is reflected in the combination of cheap labor, highly developed technology, which is accompanied by excellent logistics, high level of production and the extraordinary diligence of employees.

Competition in textile from highly populated countries will continue to be a reality in the region. The answer to this challenge of the competition should be sought primarily in the development of technologies capable of producing competitive products. Certainly, this sector can be directed to the manufacture of high fashion and innovative products in the primary textile industry.

The biggest loss for the textile sector, which was created by closing of the large Serbian companies, is that the basic resource of the sector was not exploited, and that would be the large number of skilled workers with industrial tradition.

Responsibility, for the described situation in Serbian textile industry, is not only of the state, which of course must provide adequate milieu and conditions for new development, but also in the training of highly creative people who have offered solutions and development of new products and technologies capable to cope with the fierce competition in the global market .

It is true that the problem of staff today in the textile sector is the main problem, but strong gruonds can hardly be presented that this problem only occurred in the state school system of medium to higher education. With the closure of large social textile companies all current private companies in the textile sector have emerged. The fact is that these private companies, at its foundation, mainly employed skilled workers with industrial tradition, which have lost their jobs in social companies. Therefore, the problem of personnel in the Serbian textile sector of the industry, is that as professionals with industry tradition, in which the training of social enterprises invested significant resources, today are in a growing number retireing. Unwillingness of private companies to invest in the training of highly qualified personnel for specific jobs that require only those companies and expectations of these companies from the state to do it for them, is the main problem and may result in diminishing the competitiveness of the sector today. Therefore, this paper proposes solving human problems in realistic conditions in which this sector operates in Serbia. The basic idea is, through promotional activities in this sector,to enclude a large number of young people and, with the implementation of planned activities, to enable young people not to look for work, but to create it by themselves in the existing textile enterprises [1-5].

CURRENT SITUATION IN THE TEXTILE AND CLOTHING INDUSTRY OF SERBIA

Serbian textile industry today, employs about 30,000 workers in 1,400 companies. Participation in GDP is 10%. Export amoun is approximately $ 900 million. The average gross wage is 340 €. Serbian companies can be divided into the following categories:

- More than 1000 employees - 3 companies
- 400 to 1,000 employees - about 20
- from 100 to 400 employed - 40
- fewer than 100 employees account for 90% of all enterprises in the garment industry.

According to the NCA, Serbian textile companies are registered in three groups:

- Production of textile materials - 17 companies
- Production of clothes - 1,230 companies,
- Production of knitwear - 201 company,

Serbian clothing industry employs 20,216 workers in 1,230 enterprises, of which, 88% are women. The average gross wage is 275 €.
Top 5 destinations for exports are: Italy, Germany, the Russian Federation, Bosnia and Herzegovina and Montenegro.
Serbia has no source of raw materials and, because of that, imports 90% of raw materials mostly from: Italy, China, Turkey, Germany and Bangladesh.
11 companies are still state-owned and are classified as large enterprises. 15% of Serbian SMEs produce their own brand.
Classification of enterprises by size, in the textile industry in Serbia, is shown in Figure 1:

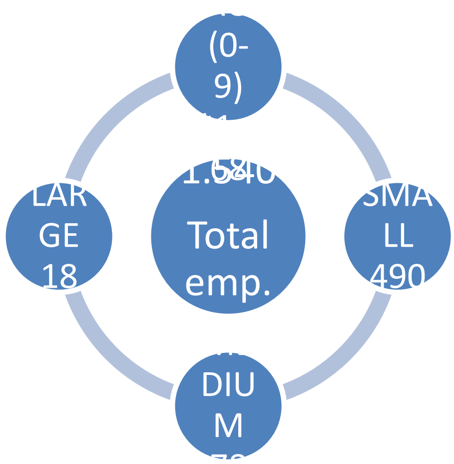

Figure 1: Source: Statistical Office of the Republic of Serbia

ADVANTAGES OF BUSSINES OPERATIONS IN TEXTILE AND CLOTHING INDUSTRY IN SERBIA

Today, companies from textile and clothing industry in Serbia have developed in terms of cheap and skilled labor force with an industrial tradition. Advantages in which this sector operates today, is, certainly, a number of favorable agreements signed by our country.

The first Free Trade Agreement was signed by Serbia and the Russian Federation. This agreement came into force in 2000. This contributed that a large number of retails in Russia, meanwhile, expressed great interest in placing Serbian highly designed readymade garments into this market.

Figure 2: Manufacturing plant for sewing garments

The first bilateral agreement that Serbia signed and ratified with the EU, was the agreement on free trade in textiles with the EU. This Agreement entered into force on 1 July 2005. Thanks to this agreement fairly good results in this branch were achieved. Thus, the surplus in foreign trade of Serbia, with finished garments to the EU, from a few tens of millions of dollars is consistently recorded over the past five years.

In addition to this Agreement with the European Union, the Free Trade Agreement is also signed with Turkey. These agreements give the possibility of application of diagonal cumulation of origin of goods, Turkey, Serbia, EU, CEFTA. The great advantage is that it will provide access to entrepreneurs in this sector of the market of nearly 800 million consumers. In addition to that,it should be considered that Turkey is one of the main suppliers of raw materials. Therefore, the application of pan - European rules of origin of goods, is gaining importance, because finished garments, which are manufactured from Turkish materials in Serbia will be able to be exported without customs duties to the EU and CEFTA.

The key advantage offered by these free trade agreements is the possibility of application of diagonal cumulation of origin of goods. This means that the clothing, made from basic materials from Turkey, the CEFTA countries can export to the EU, without duties and vice versa. Accordingly, one should bear in mind two facts. First, producers of basic materials and kit accessories Turkey, the CEFTA countries and the EU, according to the legal regulations in force, must provide to the market a certified goods, which means that the quantitative, qualitative reception of goods, is the obligations of the supplier. Another fact indicates that in addition to certificates, manufacturer of yarn, elementary materials and kit accessory is required to comply with the REACH Regulation on chemicals of the European Communities and their safe use, which entered into force on 01 June 2007.

In addition to the aforementioned agreement Serbia has the status of most favored nation, which she was awarded by the America in early 2005. With this the American market has become attractive for Serbian entrepreneurs, because American rules of origin of goods states that the country of origin is that country where the product was completed, "wholly obtained", regardless of the components that it is made of.

PROBLEMS AND SUGGESTIONS OF TRADESMAN FOR IMPROVEMENT OF TEXTILE SECTOR

At a recent meeting entitled "Have a word" in the Serbian Chamber of Commerce the problems and suggestions for improvement of the business of the textile sector were highlighted. In a short word you could say that it is about the following proposals:

1. Stimulus and the stimulation of exports through support programs,
2. Fight against the grey economy (the solution is seen in the increased customs supervision, increased labor market inspections, enhanced control of the workers that are registered at the labor market and working in the gray zone)
3. Adaptation of education to the real needs (the solution can be seen in the verification and extension of professional practice for a minimum of 6 months to 12 months through the possibility of subsidies. The lack of interest of children enrolled in secondary school is emphasized, lack of skilled personnel to the labor office, risk of not having personnel in the future from reasons of emigration from the country, etc..)
4. Grants related to the investments in technological development (the solution is seen in reducing taxes or quick recovery of VAT)
5. Lowering taxes and contributions on wages in the textile sector considering the tradition of the neighboring countries,
6. Return of the strategic importance of the textile industry in national priorities,
7. Boosting the textile industry through affordable credit conditions AOFI or fund development or commercial banks,
8. Better use of resources of the Serbian Chamber of Commerce (cooperation with Russia, education, etc..)

ISSUES IN EDUCATION - STUDENT REQUIREMENTS

Certainly there are also some problems in higher education of staff for textile and clothing sector. From the recent student protests it should perhaps be payed attention to some of their demands relating to quality of the teaching. The students propose to initiate work on finding long-term solutions to the problems of teaching and lack of clearly defined programs of study. They point out that in many programs of study it is not clearly known what competence and knowledge a student receives attending these programs of study. Also, students propose that it must be accurately determined why the student is attending a program of study, and to determine how much time is needed for it, exactly.

Figure 3: Students from the Tehnical Faculty in class

Of course, these problems stem from teachers who had access to other teaching duties in their long year of practice. Not only these teachers, but also teachers who acquired the same habits from the first ones. Today, the problems of staff training, is seen more clearly for one simple reason, and that is the use of social enterprises that significantly invested in the further training of staff that came from the university. Investments were mainly in the acquisition of specific skills that were needed for specific jobs in these companies. Today, however, private companies are used to easily acquire cheap, highly qualified staff with industry experience, on the labor market, and who have lost their jobs in SOEs, they can not possibly understand the need to invest in personnel. The best proof of this so far is repeatedly presented claims by some private companies that the state pays for a period of 6 to 12 months for the students that they will take for the practice. Today, serious companies in cooperation with universities, give scholarships to students that they need. Thus, for example. our students working in the German company Pirin teh, during their practice, have been provided with accommodation and average salary.

MODEL OF REVIVAL OF THE TEXTILE AND CLOTHIN INDUSTRY IN SERBIA

Today, Serbian companies in the textile and clothing industry, are operating in harsh conditions, and as things stand, these terms and conditions will soon be even worse. Therefore, the expectations of others or the state should not be high. Inadequate transition, made textile sector see the closure of many businesses and the release of a large number of workers, which results in a negative attitude of young people towards entering this sector. Additional repulsion of youth towards this sector is increased with the low income of employees and journalistic articles which often unduly emphasize this sector as an example of the grey economy.

Way out of this situation must be found only by those who are in this sector, only by, how they say, taking matters into their own hands. The solution is in finding good ideas. Such one good idea and gathering educational institutions and companies around the common idea of developing new fashion products that will be able to cope with the fierce competition in the market. Specifically, based on consideration of the above facts, imposed as a real possibility for a solution, to revive the textile serbian industry, is regional assembly of the companies, educational institutions and local government representatives in an innovative cluster in the fashion industry. The success of the implementation of these ideas can be guaranteed only if they involve a large number of young people in the implementation of these activities. The idea, of establishing reginalnih Innovative Clusters in the fashion industry, is primarily based on the inclusion of a large number of students and high school students in these activities.

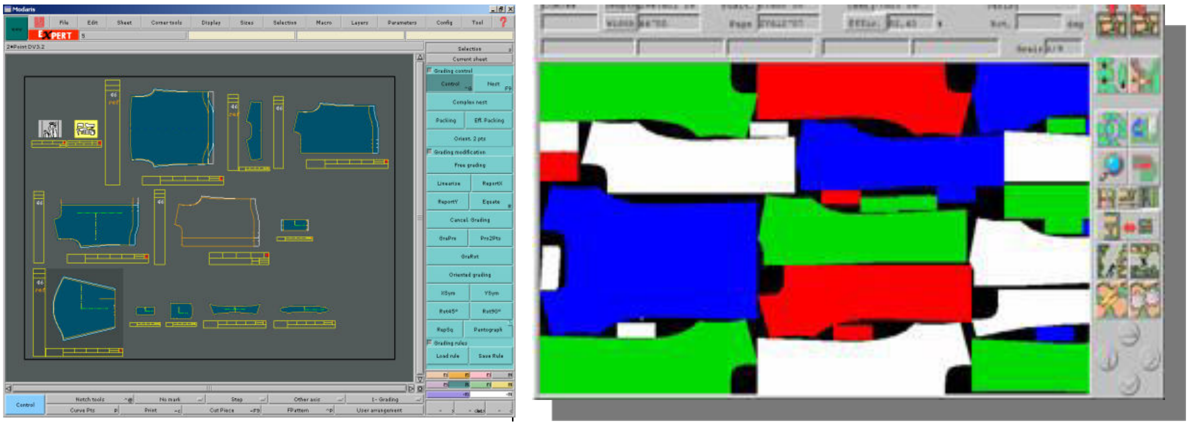

Figure 4: Industrial softwares that the Tehnical Faculty owns [6-9]

In previous work regarding the implementation of this idea, a large number of interviews was done, on which it was concluded that the best basis for the assembly is to work together on developing new fashion products. The Department of Textile clothing science and design of the Technical Faculty "Mihajlo Pupin", University of Novi Sad, in implementing this plan of cooperation with the industry, offered cooperation to the large number of companies from different regions of Serbia. Faculty is equipped with industrial CAD system from French company Lectra for construction, modeling and grading cuts as well as software for fitting and plotting cutting image in actual size. The Faculty also has software for design from the same manufacturer. The value of the equipment and software owned by University exceed the amount of 300,000 €. What is very important for the implementation of this idea, in addition to the teachers and staff, is that over 150 students, studying at the Faculty of Engineering and clothing are interested for this cooperation, with which they will gain much-needed experience while working on solving real industrial problems.

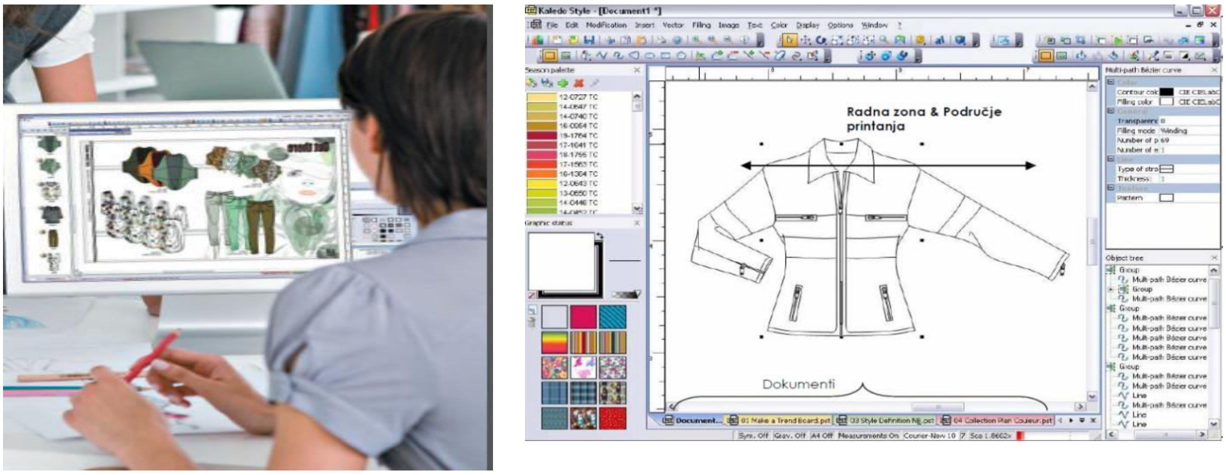

Figure 4: Industrial softwares that the Tehnical Faculty owns [6-9]

In discussions with the companies, joint ventures with technical preparations of fashion products have been indentified as the most acceptable forms of cooperation. Development of a model of revival of this sector, would evolve with the establishment of innovative clusters in different regions of Serbia, where a group of companies recognizes their gain in cooperation with the Faculty.

Nearest implementation of the agreement, is the establishment of the Innovative Cluster fashion industry of Arilje. With this direction in mind, interviews have been held with the interested companies, local authorities, the Textile High School and PCC for cluster manager, so far. The preparation of statutes and other supporting documents is in progress. The local government has pledged logistical support, and the most important is, certainly, the local media through which a significant promotion of the textile sector, can be made. This would be the first long-term step in attracting young people to get involved in this sector. It is realistic to expect that this cluster with joint work will start solving the problems, from which, the biggest one is perhaps the lack of sewers. Then production cuts, proposals and implementation of new collections, marketing and new ways of trade, and even international cooperation with similar groups in other countries.

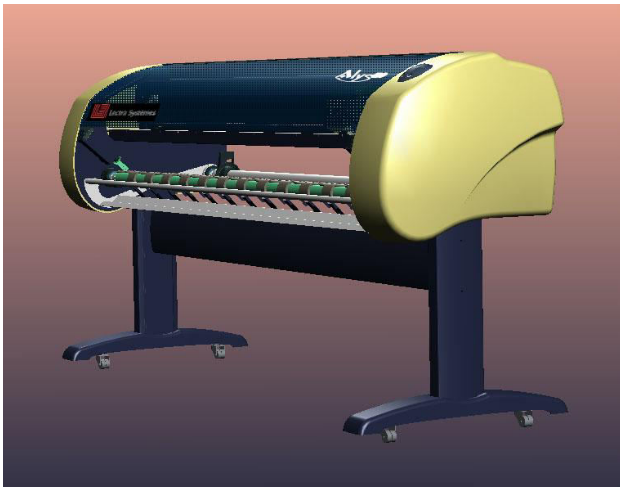

Figure 6: Industrial plotter who owned by the Tehnical Faculty

This approach is new in this region and represents a step forward in the project of our faculty – working for employment. The Faculty, has already, implemented a summer internship in cooperation with Zrenjanin businesses. The aim of this practice is that students, after they finish the practice, stay and work in these companies. The aim of the inclusion of students in this model of revival of the textile and clothing industry is the same, and that is to get students to be actively involved in solving real industrial problems. By gaining this knowledge they will definitely get a job after graduation, much easier.

SWOT ANALYSIS OF THE PROPOSED MODEL

Analysis of the proposed model is given in the following presentation of good sides, weakness, opportunities and threats.

Weaknesses:	Good sides:
- lack of interest of teachers and staff to devote more time and help students in these activities - the low purchasing power of the local population - a lack of skilled labor - companies do not have adequate technical preparation of production or preparation of technical documentation - the sector is 100% import dependent in the procurement of raw materials, machinery and equipment.	- a strong desire of students to engage in industrial operations - extensive experience of companies in garment manufacturing - flexibility of the companies that quickly adapt to market demands - product prices are competitive - developed entrepreneurial spirit and ability for business - geographic proximity to the EU market - satisfactory product quality - the company has its own manufacturing facilities, machinery and equipment - cheap labor - satisfactory labor market.

Treats:	Options:
- the pressure of imported goods - increased competition - not addressing the lack of skilled staff, particulary sewers - decline of the purchasing power of the population - the inability to cross over to the large foreign - markets - not introducing trained labor with fresh ideas, especially in business management, product design and technical preparation.	- establishment of the industrial training centre, which will train the workers needed, mainly sewing garments and technical staff - promotion of the sector among young people and their involvement in this sector - enabling the companies to produce small production series and a great variety of models of clothes, - the development of their own product - improving the quality of clothing products - enabling companies to plan and monitor the production and preparation of technical documentation - development of new and unique products - development of international cooperation.

CLOSING REMARKS

You do not need much to prove the fact that the success of each sector and the individual companies is crucial managerial, technological and technical knowledge and experience of experts in the company. This means intensive involvement of young people in the textile sector. However, inadequate transition, the textile sector in Serbia has seen the closure of many businesses and the release of a large number of workers, which results in a negative attitude of young people towards this sector.

Therefore, this paper proposes a model of the revival of the textile and clothing industry. The basic idea is, through promotional activities in this sector, to include as many young people and, through the implementation of planned activities, to enable young people not to look for work, but to create it by themselves in the existing textile enterprises. The model predicts intense involvement of students and pupils of secondary schools, primarily in the textile business, technical preparations and the development of new fashion products.

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OBESITY AND CHILDREN'S WEAR

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ABSTRACT: In recent years obesity known as an overweight problem has become a common problem in many countries which have high socioeconomic level. Obesity is an energy metabolism disorder that may cause physical and mental problem and occurs with excessive fat deposition in the body.

In addition to the health problems caused by obesity, choice of clothing is also a problem in this condition. As it's known, many firms has made special production for adults during the recent years. However, there has not been taken any step in this subject regarding children. This problem is tried to be avoid choosing especially elastic models produced from flexible fabric like knitting. When clothes is preferred according to their actual body size, it sticks to their body and that shows children much fatter than their actual weight. This causes low self-esteem in children. In addition, modifications of the lower garment like pants and skirts are inevitable. It also adversely affects the psychology of children, extra financial burden for families, and incorrect modifications have negative impact on comfort of their body movements.

Children want to imitate their peers about the choice of clothes but they are unable to fit into the models for their age group. They are forced to prefer product for the upper age group and this situation has destroyed their hopes to find models and patterns appropriate for their age.

The purpose of this study is to determine the ratio of obesity frequency in Turkey and also in the world. It is also aimed at defining the distribution of this ratio in children and encouraging the studies to carry out special production towards them.

Key words: obesity, children's clothing, over sized, nutrition type

INTRODUCTION

Obesity is derived from Latin word "obesus". World Health Organization has accepted obesity as one of 10 risky illnesses and defined as "excessive or abnormal fat accumulation that may be considered to cause impairment of health" (http://www.who.int/topics/obesity/en/). It is considered that genetic, environmental, social, cultural, physiologic, behavioral factors are effective for the formation of obesity (Uskun E. et al., 2005). Recent researches have demonstrated the increase of the obesity for all age groups in recent years.

There are various methods for evaluation of the obesity; body mass index (BMI) is the one of the mostly used methods for recognition of obesity. BMI is calculated from weight (kg) / tall stature (m)^2 formula. Obesity classification from measured finding is as shown in Figure 1.

Classification	BMI (kg/m^2)
Underweight	< 18.5
Normal range	18.5 to 24.9
Overweight	≥ 25
Pre-obese	25.0 to 29.9
Obese class 1	30.0 to 34.9
Obese class 2	35.0 to 39.9
Obese class 3	≥ 40.0

Figure 1. Classification of obesity according to the BMI values (James, Philip T. et al., 2001)

BMI values are is a standard accepted as a good indicator of subdermal and total body fat. Especially BMI reference values are recommended for the evaluation of obesity (Sivaslı E. et al., 2006). World Health Organization has defined obesity as values of 30 and more. Fat accumulation happens espacially at abdomen and thigh sections.

Recent searches demonstrated that obesity problem is not only depending on the uptaking of calories, but also the increase of the unhealty consumption of the saturated fat. It is observed that these people has not taken vitamins and various minerals at necessary amounts for nutriton. Researches demonstrated obesity created social, psychologic problemd as well as risk of developing hypertension, asthma, type II diabetes mellitus, dyslipidemia, cardiovascular system ilnesses and certain types of colon, breast, gallbladder and endometrium cancers (Eker E. et al., 2002). It is known that obese people have shorter life and their state goes back to their childhood ages (Ergül Ş. et al., 2011). Therefore, obesity epidemics must be controlled during childhood ages.

Today, obesity has become a serious problem with occurrence of one of the mostly chronic prevailing illnesses of adult and especially of children in recent years. Obesity of children progress as being a problem that cannot be tackled although taken under surveillance by determining percentile curves at the earliest ages.

Becoming of obesity a widespread public health problem, caused studied of fighting with obesity worldwide. Today many different policies are developed because of health problems focused on nutrition, on one hand there is a fight against hunger, on the other hand it is struggled against obesity. Notably United Nations' World Health Organization and United Nations Food and Agriculture Organization, many governments, public services develop different strategies, food sectors presenting better healthy food enter into the markets (Menlik İ. 2008).

Within this context, obesity ratios in Turkey and in the world are studied. Distribution of obesity among children was determined and it is aimed to encourage special wear production oriented to children. Wearing is a means to satisfaction of individual from his/ her body psychologically, to gain self-confidence, to become statue owner and to be acceptable among his/ her peers. It is aimed to incent to produce special wear for the children oriented to obesity – by determining the distribution of obesity among children. Wearing is an instrument of the individual for satisfaction from body psychologically, acceptability among peers, gaining self-confidence and owing status. Therefore it is required to investigate the wearing options of obese adults and children (Çivitçi Ş. et al., 2012). This realized research would be important for the obese young people and children to reveal the necessities of them having difficulty to find wear convenient for their body and their pleasure, to canalize their parents in order to provide psychological support and to clear up the people related with this sector (Çivitçi Ş. et al., 2012).

PREVIOUS STUDIES

According to study realized in Turkey, it is observed that 17.2% of the population with 15 or more ages were obese. Regarding the place and sexuality point of view, obesity ratios were 20.8% for women and 13.3% for men living in urban areas. For the rural areas this ratio was 21.1% for the women (http://www.tuik.gov.tr/PreHaberBultenleri.do?id=16056).

According to Research Report " Project for View of Growth for School-age Children in Turkey" (2009) conducted by the Ministry of Health, Ministry of Education and Hacettepe University Health Sciences Faculty Nutrition and Dietetic Department, the obese and overweight percentages are given in Table 1 below.

Table 1. Rates of overweight and oebese in Turkey (http://thsk.saglik.gov.tr/obezite-sismanlik/772-t%C3%BCrkiye-de-g%C3%B6r%C3%BClme-s%C4%B1kl%C4%B1%C4%9F%C4%B1.html)

Age	Overweight	Obese	Overweight + Obese
6	12,4	5,5	17,9
7	15,3	5,8	21,1
8	14,4	6,1	20,5
9	14,1	7,7	21,8
10	14,5	6,9	21,4
Total	14,3	6,5	20,8

According to result of another study conducted for children with 8-11 ages it was observed that children with longer sleep were not overweight because they consume less food and they were systematic and ordered (Hart C. N. et al., 2013).

In order to investigate the quality chosen from wear for the 6–16 aged obese children and young conducted at Gazi University Hospital Endocrinology Department, a survey is applied to 52 children with 6–16 ages. Results indicated that 6–16 aged obese young and children mostly preferred that wear would be suitable for their body sizes, and that they give importance to that wear would not block their motion, and they preferred trousers as the wear type, blue as wear color, elastic fabric as wear type (Çivitçi Ş. et al., 2012).

Obese women were examined for distribution of anthropometric measures with respect to their breast girth. Sample group consisted of 312 obese women applied to endocrinology polyclinics located in marmara region. Anthropometric measures with respect to their breast girth taken from sample group were classified in 6 groups and distribution of other measures were identified for each group, in this way a contribution is provided for improvement to make suitable wear to obese women by the wear producers (Kılınç N. et al., 2011).

Another study addressed to problems met by obese patients comprising an important part of population in Turkey and the world for the ready-made wear and gave recommendations to producer companies for the wear to be produced would be oriented to the expectation of obese patients (Yıldıran F. 2006).

In addition to scientific studies, ready-made trademarks like Pierre Cardin, Sabri Özel, Theorie also attempted to this sector. By thinking addressing to everybody is not possible by sex and age but also with body size, they present alternatives in various models and colors on men and women large sizes (http://tekstilkutuphane.blogspot.com.tr/2011/04/kilolular-icin-urun-yelpazesi-genis.html).

CAUSES OF OBESITY

For development of obesity; genetic, environmental, diet, psychological factors are determinants. Sociocultural and economic level, smoking during pregnancy, miscarriage, low or excess birth infant weight, less breastfeed time, grabbing a bite, nutrition with fast food type, beverages with intense high calorie, activation level of the child, negative relations inside family are important reasons (Üney E. 2014).

- Genetic Factors

When looked at recent studies, it is observed that genetic factors play important role in formation of obesity (Parlak A. et all (2007). Especially studies conducted on twins, genetic factors are 70% effective on obesity (Stunkard A. J. et al., 1990).

- Age

Obesity is seen at every age and as the age increases, prevalence increases (Güler Y. et al., 2009). It is known that 30% of obesity incidences seen at adult age depends on childhood ages. While obesity observed in babyhood recovers with age, it is highly probable that obesity of children and adolescent continues at the adult period (Öncü İ. 2009)

- Sex

Although seen in both sexes, rate of incidence in girls is much more (Figure 4). Seen more intensively for women arises from that estrogen has effect of increasing the fat (Habeş S. 2013). As for men, it is noted that there is decrease of fat structure upon entering puberty (Üney E. 2014).

- Diet

Receiving calorie more than the energy consumed always returns to the person as an excess kilogram. Here squash forms the most important group (Bundrick S. C. et al., 2013). Excess and quick eating is an important factor for development of obesity. Nutrition habits in the first years of life and afterwards and consummation of food with high calories causes development of obesity. During adolescence period people individuals get unhealthy nutrition habits causing obesity. In this period obesity is mostly observed for children that do not eat breakfast but that pass over meal at places like canteen and having other meals like fast food type and pass over meals.

- Physical Activity

Energy expenditure is important for developing obesity. One of the obesity risks during childhood is sedentary life. Increase of the housewares making the work easy at home, transport facilities, increase of using cars and television watching causes expenditure of less energy. As well as television watching decreases energy, advertisement of food products are usually by television. More snacks while watching television is another factor increasing obesity risk.

- Psychological Effects

Many reasons like restless house environment, domestic discord, separation of parents affects the mental health of individuals negatively. Behavior disorders like fall of school success, unable to make friends, failure to participate in activities develop and this situation drags the individual to passive and immobile life style, excessive eating habit is developed and causes obesity (Öztora S. 2005).

- Socioeconomic Cultural Level

Factors causing obesity are studying while sitting, limited mobility, travelling by car, condemnation to wheelchair, elevators, passive time in front of TV and computer, depression, abundance of food, excessive nutrition from childhood, nutrition with irregular times, ready food with high fat and additives, appetizing chemicals, food and drinks with food dyes and sweeteners and advertisements. Some studies demonstrated that obesity rate increases with high socioeconomic level while some demonstrated increase with low socioeconomic level. In families with high socioeconomic level obesity depends upon excess nutrition and in families with low socioeconomic level it depends upon irregular nutrition. Young and children not getting used to regular feeding have trend of much consuming prepared fast food with high sugar and fat content (Özenoğlu A. et al., 2002).

DISTRIBUTION OF OBESITY IN THE WORLD AND TURKEY

Obesity as an important public health issue at global scale shows an increase in both developed countries and developing countries day by day. It is announced that there is 10-30% increase at obesity prevalence of 10 years in the study of MONICA (Multinational Monitoring of Trends and Determinants in Cardiovascular Disease) which lasted 12 years at 6 different parts of Asia, Europe and Africa by World Health Organization and shown in Figure 2 (http://beslenme.gov.tr/index.php?lang=en&page=39).

Figure 2. Obesity in the World

In Figure 3, obesity rates with respect to countries are shown. When looked at obesity values in Organisation for Economic Co-operation and Development (OECD) countries, United States of America and Mexica have the highest rates. New Zealand, Hungary and Austria is following these two nations. Nations like India, Indonesia, China and Japan are among the lowest ratios at the classification.

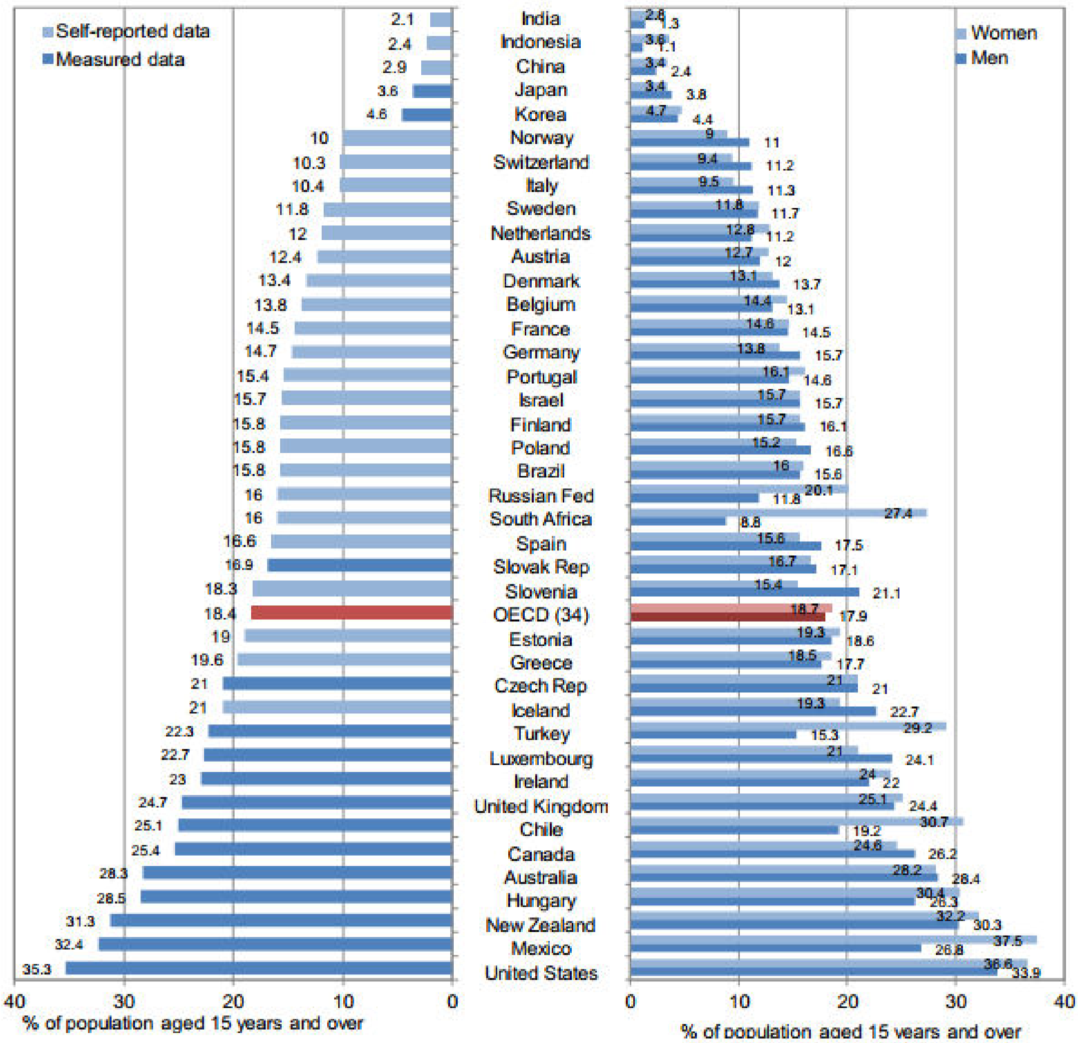

Figure 3. Obesity among adults , 2012 or nearest
(http://www.oecd.org/els/health-systems/Obesity-Update-2014.pdf)

Our country has lived a rapid demographic, epidemiologic, economic and social development process for the last 40 years and since 1970, population has increased twice. Obesity occurrence is found 20.5% for men and 41.0% for women and total 30.3% according to preliminary study report

“Nutrition and Health Research in Turkey” (2010) conducted by Ministry of Health (http://thsk.saglik.gov.tr/obezite-sismanlik/772-t%C3%BCrkiye-de-g%C3%B6r%C3%BClme-s%C4%B1kl%C4%B1%C4%9F%C4%B1.html). It is observed that this disturbance is frequently occurred with people having high or medium socioeconomic level.

Although no national study is made for childhood and adolescent periods, sectional studies on this age group in different regions are available. According to a preliminary study report “Nutrition and Health study-2010 conducted by the Ministry of Health, Hacettepe University Health Sciences Faculty Nutrition and Dietetic Department and Ankara Numune Research and Education Hospital for children and adolescents in Turkey, it was found that;

- Obesity occurrence during 0-5 ages 8.5% (for boys 10.1%, for girls 6.8%)
- Obesity occurrence during 6-18 ages 8.2% (for boys 9.1%, for girls 7.3%) (http://beslenme.gov.tr/index.php?lang=tr&page=40).

OBESITY IN CHILDREN AND EFFECTS ON WEAR

Obesity at children rises not only physical illnesses but psychological illnesses, too. Children living emotional problems are faced with problems also in school. They can be counted as disorders like depression, hyperactivity, mental disorders, learning difficulty. These children get twice more illnesses than other children with normal weight (Halfon N. et al., 2013).

Wear factor is also a subject that request close attention to mental health of the children. Finding a wear to children with normal body measures is not difficult however a child with overweight has to choose wear with a body size over his age. In this stage arm sizes of over sized top clothing becomes longer than enough. For sub-dress it is usually preferred large size track suit with rubber waist. These dresses cannot be worn after some adjustment. Therefore there is no reason of buying ready-made dresses. These negations must be removed and certain minorities must also have right of choosing among the ready-made wear to their delight. Especially during childhood, psychologies of the children who cannot wear like their friends are broken because of their weights. Even they get free from their weights during their later ages, their lives maybe affected negatively because of their loss of self-confidences. It is necessary to decrease their negative psychologies and to provide rights to choose wear the same or alike models as their peers. Some companied abroad produce intermediate sizes directed for these children. However the results of the researches revealed that there is no such type of production group in our country.

CONCLUSION

It is suggested that nutrition type, exercise scarcity, and lifestyle plays role in obesity development. Health authorities and press organs started to emphasize the importance of the subject because of this increase and resulting serious health problems. This problem is mostly neglected because of the reasons like nutrition and lifestyle change brought by modern living and less researches related with adolescent obesity and required attention is not shown by public. This study aims to get attention to obesity problem from childhood and to produce solution for wear problems of the children.

Feelings caused by wear may have extensive effects on future behavior of the individual. For example emotions giving disturbance may cause physiological changes like stress, shyness, anxiety; feelings from wear giving self- confidence cause adverse reactions. For this reason designed wear shall be produced consciously to every age and every size. Wear should provide psychological, physical, and physiological comfort together (Üstün G. 2009).

Our country owns very experienced and successful staff on the subject of ready-made wear. Therefore ready-made wear is ranked among the most important industry branches. However no production of body sizes directed for over weighted children is a great deficiency. Especially companies producing and marketing children clothes should have production in this direction and they should have preference alternatives. Increase of such special group has formed a market gap. In order to remove this problem it is planned to form size tables directed to children with obesity problem and to have studies for dress patterns conforming to these measures at the continuation of this study. Therefore wearing of every child like his peers is provided.

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THE INFLUENCE OF THE QUANTITY OF ELASTANE AND SILICONE SOFTENER ON THE PROPERTIES OF DIFFERENTLY FINISHED COTTON AND COTTON/ELASTANE KNITS

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ABSTRACT: The effects of the quantity of elastane and silicone softener on the properties of the single jersey knitted fabrics were studied. Knitted fabrics of 100% cotton, and cotton/elastane, having elastane yarns in alternating courses (half plating) and elastane yarns in every course (full plating) were prepared and bleached or dyed with reactive dyes and softened with silicone softener. Structural and mechanical properties on differently pretreated and softened fabrics were studied. There are considerable differences in properties between fabrics of various fiber compositions. The increase of the quantity of elastane increased the fabric weight, thickness, stiffness and elongation and decreased bursting strength. Silicone softener increased fabric weight of all knitted fabrics, stiffness of bleached and elongation of dyed knitted fabrics and decreased stiffness of dyed fabrics.

Key words: single jersey, elastane, structural properties, mechanical properties, silicone softener

INTRODUCTION

The revolution in the fashion knitwear industry has become inevitable due to the frequent changes in fashion trends, leading to the production of knitted apparels using different yarn types, fabric types, designs and style variations. These elements play very significant role in fashion trends, especially in segments such as casual wear and sportswear. Plain knitting takes up about 90% of all knitted fabric consumption (Kumar V., Sampath V. R., 2013).

Today, the knitting industry mostly uses elastane combined with cotton, especially for sportswear, foundation garments, intimate apparels, etc., due to the outstanding features of elastane such as higher elastic recovery, good shape retention properties, soft and smooth handle, abrasion and pilling resistance, resistance to the most chemicals and low moisture regain (Abramaviciute J., Mikucioniene D., 2011). Elastane is a long - chain synthetic polymer comprised of at least 85% of segmented polyurethane. For jersey knit constructions in circular knitting machines, the process of co – knitting elastane is called "plating" (Sedek R., et al, 2010). Plating means the simultaneous formation of one loop from two threads, so that one thread will lie on the face of the fabric while the other thread is fed to the needles in such a way that it forms the back or reverse of the final fabric (Abdessalem S. B., et al, 2009). When the cotton and elastane yarns are knitted parallel or side – by – side in every course, with the elastane yarn always kept on one side of the cotton yarn, the method is classified as "full plating". When the elastane is placed in the altering courses, the method is classified as "half plating" (Sedek R., et al, 2010).

Cotton and cotton blended fabrics are subjected to various chemical treatments during their processing. Finishing, the final step of chemical processing, is carried out to improve the properties, attractiveness and serviceability of textile materials (Chattopadhyay D. P., Vyas, D. D., 2010). Silicone softeners have a firm place in final finishing for a very important reason. The application of silicone softeners turns hard and brittle fabric into a soft pleasant textile with which the buyer can expect a high degree of wearing comfort. Silicones are the organo metallic polymers derived from the abundant raw material on earth, sand. Very small amounts are required to achieve the desired properties, which can improve the cost of textile operations and ensure a minimum environmental impact [www.bevafinishes.com]. Deposition of silicone polymers on the fibers results in a very good spreading action and excellent lubrication properties. This is due to the high flexibility of the Si – O – Si backbone of the silicone polymers.

EXPERIMENTAL

Materials

Single jersey 100% cotton and half and full plating cotton/elastane were knitted of 20 tex cotton ring–spun yarns and 22 dtex elastane yarns on Jumberca SYX – 3 circular knitted machine or on Paolo Orizio John/A circular knitted machine. All knitted tubular fabrics were silt opened and laid flat. 100% cotton knitted fabrics were kept on a flat surface under standard atmospheric conditions. Half and full plating single jersey fabrics were heat set with very small traverse tension on heat setting machine, Santa Lucia RAMA with a speed of 10 m/min at 193°C. After relaxing, structural parameters (fabric weight in g/m², thickness in mm and stitch density in cm^{-2}) were measured and presented in Table 1.

Table 1: Parameters of greige (R) single jersey fabrics

Fabric codes	Fabric structure	Fabric weight (g/cm^2)	Fabric thickness (mm)	Stitch density (s/cm^{-2})
CoR	100 % cotton	135,15	0,487	236,18
Co2ElR	Cotton/elastane half plating	159,67	0,545	256,72
CoElR	Cotton/elastane full plating	204,55	0,685	314,40

Pretreatments and treatments

Acid demineralization treatment of single jersey knitted fabric was conducted as a separate step before the H_2O_2 bleaching process. Greige cotton fabrics were treated with an aqueous solution containing 1g/l Invadine DA as wetting agent, 1g/l Invatex SA sequestering and dispersing agent in a bath with material to liquor ratio (LR) 1: 9 at 60°C for 15 min. After demineralization the fabric was rinsed with cold water and submitted to H_2O_2 bleaching process.

One bath scouring, peroxide bleaching and optical brightening started at 40°C in the bath with liquor ratio 1: 9 with 1g/l NaOH, 1g/l Albafluid CD, a crease preventing agent, 1g/l Clarite ONE as wetting agent, 8 g/l 50% H_2O_2, 0.8% Uvitex BHB as optical brightener and the bath was stabilizing 10 min. After that the temperature was raised to 100°C and bleaching and optical brightening proceeded for 30 min. The fabric was then rinsed with hot water at 80°C and neutralized with 0.4 g/l at Invatex AC at 60°C during 10 min. The half of the knitted fabrics was subjected to softening with 3% Ultratex FMV (silicone softener) at 45°C for 20 min and the other half only rinsed. The bleaching effects were measured on spectrophotometer and presented as WI–whiteness index. All bleached samples have great WI index.

Single jersey was dyed after alkaline scouring. Alkaline scouring was done in the bath heated at 60°C with 1g/l Invadine DA, 1g/l Albafluid CD during 10 min. After that 2g/l Na_2CO_3 was added and the temperature rose to 90°C and the fabrics treated for 30 min. Fabric was rinsed with hot water at 60°C 15 min, neutralized with 0.7 g/l Invatex AC 15 min at 60°C. In the next bath the fabrics were treated at 60°C with 1g/l Lyoprint RG protector of reduction of reactive dyes, 1g/l Albatex CO and 80g/l NaCl for 10 min, than 0.42 % Avitera Yellow SE, 4.6 % Avitera Navy SE, 0.15 % Avitera Red SE were added and dyeing was conduced at 80°C for 20 min. Temperature was decrease to 60°C and in 20 min time 1g/l Na_2CO_3 was added dyeing continued for the next 10 min, than 4 g/l Na_2CO_3 and 1 g/l NaOH were added and dyeing continued for the next 20 min if pH is between 10 and 11 the treatment continued for the next 40 min. After dyeing the fabric was rinsed with hot water for 40 min at 60°C, soapunified with 1g/l Eriopon R for 15 min at 60°C, rinsed with hot water for 15 min at 60°C and neutralized with 1g/l Invatex AC (pH 7). 2 g / L Albafluid ECO was added to fix the dye at 50°C 15 min. Half of the samples were treated with 3% Ultratex FMV (silicone softener) at 45°C for 20 min and the other half rinsed only. Fabrics were drained, dried and thermo stabilized. The shade of dyed samples was measured on spectrophotometer and the results showed that there are no shade difference $\Delta E < 0$.

Methods and standards

The following parameters were analyzed in the experiment: fabric weight (MK F.S2.016), fabric thickness (with load of 100 kPa) was tested by FAST, stiffness was tested by Digital Pneumatic Stiffness Tester M003F (ASTM D 4032- 94), bursting strength and elongation were tested by Timus Olsen (ASTM D 6797 – 02).

Tabel 2: Fabric codes

Code	Explanation
CoB	100 % cotton bleached
CoBS	100% cotton bleached and finished with silicone softener
CoD	100 % cotton dyed
CoDS	100 % cotton dyed and fished with silicone softener
Co2ELB	Cotton / elastane half plating bleached
Co2ELBS	Cotton / elastane half plating bleached and finished with silicone softener
Co2ElD	Cotton / elastane half plating dyed
Co2ELDS	Cotton / elastane half plating dyed and finished with silicone softener
CoELB	Cotton / elastane full plating bleached
CoELBS	Cotton / elastane full plating bleached and finished with silicone softener
CoELD	Cotton / elastane full plating dyed
CoELDS	Cotton / elastane full plating dyed and finished with silicone softener

RESULTS AND DISCUSSION

Fiber type and fiber content in the blends, yarn count, fabric construction, pretreatment processes, bleaching, dyeing and finishing are all found to have an influence on structural and mechanical properties of the treated knitted fabrics. The results for fabric weight, thickness, stiffness, bursting strength and elongation of bleached and dyed knitted fabrics will be discussed parallel as a function of quantity of elastane and finishing processes.

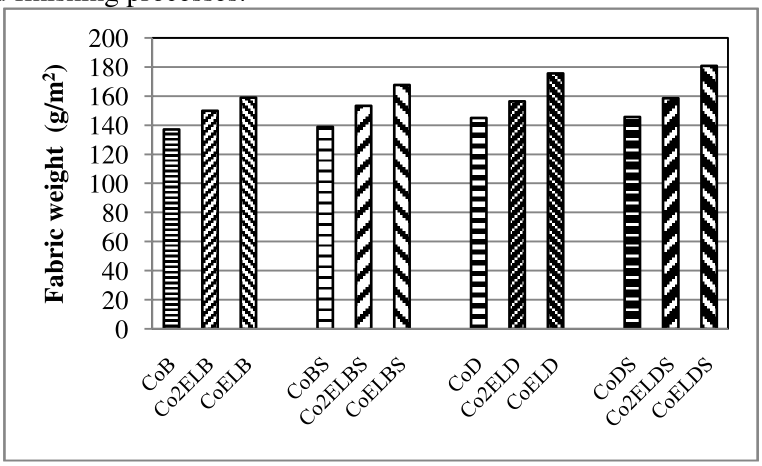

Fig 1. Fabric weight of bleached and dyed knitted fabrics before and after softening

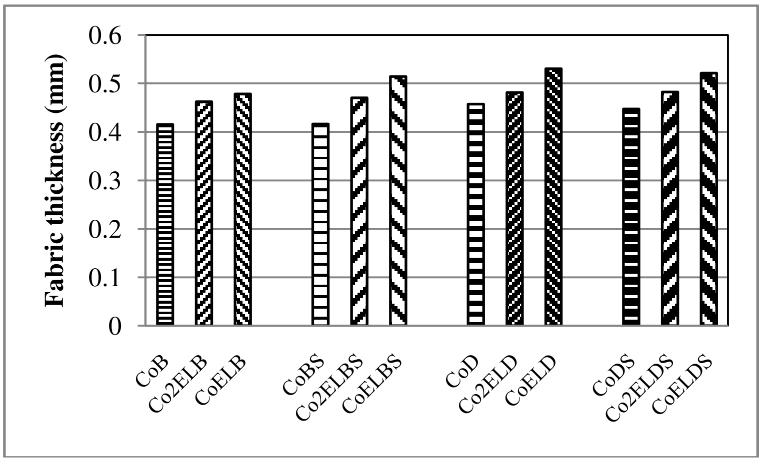

Fig 2. Fabric thickness of bleached and dyed knitted fabrics before and after softening

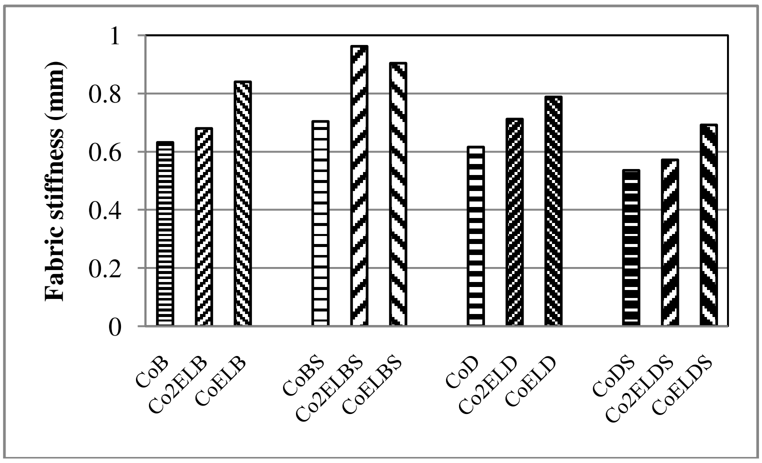

Fig 3. Fabric stiffness of bleached and dyed knitted fabrics before and after softening

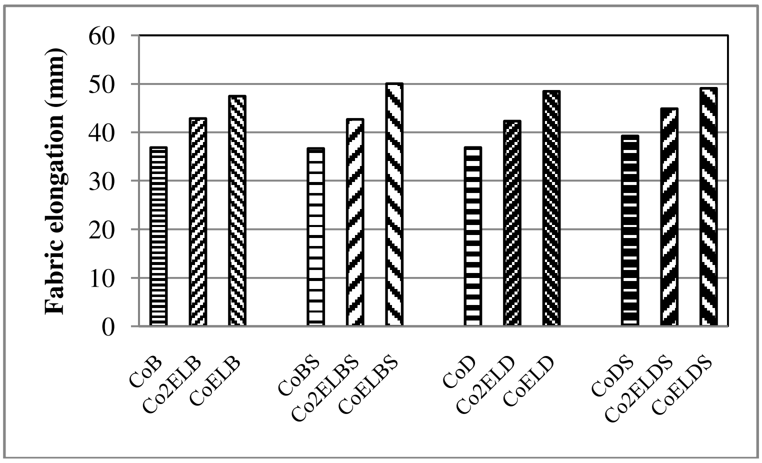

Fig 4. Fabric elongation of bleached and dyed knitted fabrics before and after softening

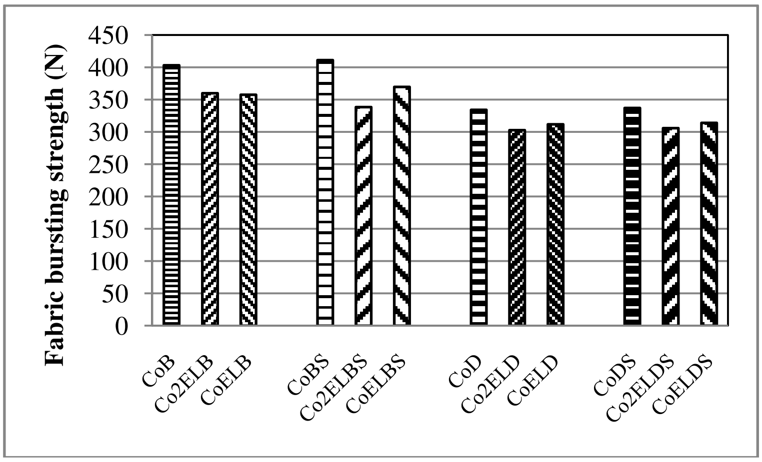

Fig 5. Fabric bursting strength of bleached and dyed knitted fabrics before and after softening

The results of different measurements are presented on Figure 1, 2, 3 4 and 5. The increase of quantity of elastane in the bleached and dyed knitted fabrics increased the fabric weight, thickness, stiffness, elongation and decreased the bursting strength. Elastane at half plating of the bleached knits increased the fabric weight for 8,51%, thickness for 10,17%, stiffness for 7,06%, elongation for 14,01%, and decreased the bursting strengths for 12,02% compared to 100% cotton knits, Fig.1, 2, 3, 4 and 5. The increase of these parameters on the dyed knit with elastane at half plating is lower compared to the bleached ones 7,29,%, 4,99%, 13,48%, and 12,87% and decrease of the bursting strength 10,39% respectably. Elastane at full plating of the bleached knit, increased the fabric weight for 13,71%, thickness for 13,18%, stiffness for 24,76%, elongation for 22,35% and decreased the bursting strength for 12,75%, compared to 100% cotton fabric. The dyed knit with elastane at full plating showed the increase of 17,42%, 13,77% ,21,83% and 23,91% for fabric weight, thickness, stiffness and elongation and decrease of bursting strength for 7,19% compared to 100% cotton fabric.

0.92 and 1 are correlations between stiffness and fabric weight and elongation and fabric weight, respectably. These correlations for dyed knits are 0.98 and 0.99.

The increase of fabric weight of the bleached and dyed single jersey fabrics depends on the fabric finishing stages. During pretreatment process, the fabric shrinks. Regardless of the quantity of elastane, softened single jersey knitted fabrics have higher fabric weight compared to the same without softener. The fabric weight of the bleached softened knits increased up to 5,19%, and for dyed softened up to 2,87% compared to the same without softener. After softening of bleached knitted fabrics, the stiffness increased maximum up to 29,31%. After softening of dyed knitted fabrics, the stiffness decreased maximum up to 24,47%, and the elongation increased maximum up to 6,07%.

The coefficient of variance of fabric weight and thickness is up to 3,76% while the coefficient of variance of fabric stiffness, elongation and bursting strength are higher: 13,18%, 6,27% to 10,37% respectably.

CONCLUSION

The increase of quantity of elastane in the bleached and dyed knitted fabrics increased the fabric weight, thickness, stiffness, elongation and decreased the bursting strength. Silicone softener additionally increased fabric weight, stiffness of bleached and elongation of dyed knitted fabrics and decreased stiffness of dyed fabrics.

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TEXTILE MATERIALS APRETURA

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ABSTRACT: One of more important final processing stages are considered to be so called apretures operations tend to improve the appearance and shine, as well as for fabrics softening and rotting prevention. It is impossible to place the textile on the market without previous done apretures operations, so that the final processing stage can be considred as one of the most important processes besides the creation of knitwear. Apretura represents the final finishing processes of textile materials, also dressings, which provide the final properties of the materials and appearance. Apretura is carried out by mechanical or chemical treatment, and often combined. The main purpose of apretura is to complete the unfinished cloth, remove all defects and faults, finishing it aesthetically or for some special purposes. Apretura can be variously resistant to washing and dry cleaning. The tentative apretura removed by the material after one or at most two after washing or dry cleaning, and stable should be on it permanently retained. This paper explains the finishing of textile materials, with special emphasis on dressing textile materials.

Key words: Apretura, chemical procedures dressing, volatile dressings, waterproof dressings (apretura).

INTRODUCTION

Textile final processing is one of the most significant segment in a textile production. In the course of this work one of its method is to be elaborated, apretura. Apretura provides material to be enriched by final density, fullness, elasticity, softness or stiffness, and the material surface can be radiant or dark, smooth or rought, like grain or hairy.

In the textile industry apretura can be used for presentation of a touch or an appearance presentation as well as for special purposes. Apretura of special purposes is always applicable, i. e. some apretura means are to be applied on the textile materials due to reach some specific features, for example: rumpling resistance, waterproofness, oilproofness, moths and microorganisms prevention, burning resistance, air impermeability, electrostatical congestion prevention etc. It is very often that apretura is applied to the material in order to enrich it with more special features and in most cases these are rumpling resistance, oilproofness and waterproofness.

GENERAL ABOUT KNITTED GOODS

The aim of final processing and enrichment is to improve current features, remove or hide any faults, giving new features depending on textile product purpose. Final processing methods are: textile scorching, washing, shaginning, cutting, rolling, dyeing. Formerly, it had been considered for knitting production to be more a kind of a skill than a real mechanical process. A worker made the knitting that was under asked characteristiscs and dimensions using strictly his/her own experience, not technical standard. Situation has been changed so far, so that nowdays there have been some devices enabling production controlling. Similarly, in many other textile production spheres, the controlling of technological process knitting quality in all production phases has become more significant as the demands for final product quality have been larger and both the producers and buyers have expected that comparably. Following this issue it is of importance to produce some knitting goods in any time that shall be of suitable features not only in a technological but also in an economical sense.
Supporting means have a great importance in a final processing operations. The preparation means the textile preparation for dyeing and printing. Row fabrics are covered by a great deal of a starch that should have a negative effect on dyeing and printing effects. For that reason in the process of preparation the textile has to be placed under the process of disstarching. The main effect of disstarching is to take off the starch from a fabric.

TEXTILE MATERIALS APRETURA

Apretura is the term used to name final processing operations due to reach better touch, finer appearance and different special effects on fabrics. The term comes from a word: appretere, (aprete) that means to prepare or to finalize something. At first, apretura makes fabrics better in order to remove all/any lacks made in the process of production. It provides fabrics with apparent or permanent features of better material. Apretura is carried out by mechanical or chemical procedures, and often in combined ones.

Apretura operations for appearance improvement and glow increase

Operations related to appearance improvement include: drying, shaggining, cutting, brushing, steaming and ratting. Glow increase operations include:

- callanding,
- decatting,
- aprets crushing and fabrics wetting.

Dressing special phases

Dressing special phases are:

- fabrics sanforization,
- syntetic materials termofixing,
- and placing.

Chemical procedures of apretura

Chemical procedures of apreting are:

- Apretura for filling and stiffening,
- Apretura for mass fabric increasing,
- Fabric softening,
- Apretura preventing rotting,
- Insects wool materials protection,
- Waterproof apretura (hydrofobing),
- Apretura preventing volatility,
- Apretura preventing rumpling,
- Protection of textile materials against battle toxins, biological agents and radioactive radiation.

Apretura for filling and stiffening

To reach more filled and tougher touch, fabrics are apretted by different chemical procedure dressings. The most frequent of them is starch and its biodegradable products, proteins, cellulose derivates and artificial pitch. These dressings are applied singly or in combination with other apretura dressings. Apretura has been mainly done on fullar (soft, thin, silk fabric in color that is made of boiled raw silk).

Apretura for mass fabrics increasing

In the process of degumming silk fabrics lose 20% - 30% of their mass, that is used to be returned to them aftermath. In most cases it is going to be done by soluble metal salts and chaolin. The whole process is carried out in a way that fabrics is being dressed for 1-2 hours in a previously prepared salt solution under normal temperature.

Fabrics softening

Fabrics of regenerating cellulose origin have a tough and stiffen touch that could be removed completely by apllying apretura softening dressings. So far, for softening some natural fats, oils and soaps had been strictly used, but nowdays some different dressing such as sulphonate fats and oils, anionic, kationic and neiogenic derivates of fat matters as well as some synthetical softeners have been used. Softening dressing applying on fabrics at the same time make an effect in increasing of a cellulose fibre resistance to friction, enhance the fabric possibility to garment manufacturing. Some chemical dressings provide to fabrics some hydrofobe features (waterproof).

Apretura preventing rotting

Having been exposed for a long time to moisture cellulose fibres come into danger by damage caused by microorganisms such as bacteria and mold. In order to prevent that, material is being processed by conservation agents due to provide active or passive protection to fibres.

Active protection has been done by bactericides that kill bacteria and fungicides that kill mold. Passive protection has been done by processing of materials using thermoactive pinch that has a great resistance to washing and light.

Insects wool materials protection

Clothes moths and different bugs are fed by ceratin, basic substance in a woolen fibre structure and in this way they destroy woolen material. Pest protection has been known for some decades. At first, mothcrystals and p-diclobenzol were used as pest protection agents.
Because of great volatility and unpleasant smell these agents are not used any more. Nowdays it is common to use some chemical colorless agents: eulan and mimitin, that could be applied from solution on a woolen material, similar to dyeing by acidic colors. These agents have been of a very good kind to washing persistence. Processing materials made by agents insects protection is possible to realize in different phases of technological process, washing, dyeing, to continuned and noncontinued method.

Waterproof apretura (hydrofibration)

Fibre processing towards waterproofness means to process it in a way to become impermeable, resistent to leaking and at the same time to keep air porosity. This kind of processing is possible to do in all sorts of fibres.
Agents that have been in use are: wax, fat substance, artificial/industrial pitch that function is to make waterproof layer on fibres.

Apretura preventing volatility

Decorative fibres, protecting clothes fibres, tent and waterproof sheets fibres have to be dressed by agents preventing volatility. The basic aim of dressing ist to prevent volatility of textile and in that way to fight fire.

Apretura preventing rumpling

Cellulose fibres are very prone to rumpling whatever being in dry or in wet conditions. That is the reason such fibres have to be dressed to prevent rumpling, and to provide them the possibility of a fast recovery from done folds. This apretura can be carried out by a dry method, a damp method and a wet method. Their common and basic work operations are: fibre water-proofing, drying and fastening. Recently a method called "Perament pres" has been used. This method is different from the others as its final operation of fastening IS being done in a ready-made clothes, i.e. after the product had been sewed up. Using this method beside fibre stability, dimension stability of final products have been reached too.

SWOT APRETURA TEXTILE MATERIALS ANALYSIS

All characteristics of apretura textile materials are shown in SWOT analysis that is shown in tables below, Table 1.

Table 1: Image SWOT analysis of apretura textile materials

APRETURA TEXTILE MATERIALS	
ADVANTAGES	WEAKNESSES
-rumpling resistance -waterproofness, oilproofness, - molds and microorganisms prevention - air unporosity, electrostatical congestion protection	-higher expenses -need to have certain knowledge in order to handle -more effects at materials that have not been dressed so far
CONDITIONS	THREATS
- doing on starting features such softness and fullness are, so that new features can be reached	-can affect color change

CONCLUSION

By dressing it is possible to reach some effects, finer appearance on a fibre, then, some particular faults can be removed, dimensional stability is obvious so that a better quality is to be reached. Apretura of textile materials is the term we use to name final operations on fibres, fibre yarn, knits, unweaved materials and final products and so on textiles can be reached the most appropriate using values. Priorly it is related to materials used for clothing. All parameters have to be fitted to EU standards as well as to methods of examination of textile-mechanical characteristics.

In recent time apretura have been applied on a final clothing, while jeans clothing softening after bleaching and so called stone washing. There are special kinds of apretura rewater-proofing that have been applied after washing in water or dry cleaning in organic solutions Their purpose is to renew starting features at materials, for example: soft touch and fullness or waterproofness that they had had before dressing.Using such kind of dressing, new features can be reached, except if material had not been dressed by special apretura so far.

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DESIGN KNITWEAR IN JACQUARD KNITTED INTENDED FOR MAKING DRESSES AND SKIRTS

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ABSTRACT: Projecting of a knitted garment, from conceptual design of clothing collection to final knitted product is a very complex process. Patterns, obtained by combining loops of different colors, are characteristic for their optical properties, whereby the forming elements are colors and loop. Technical possibilities of modern machinery revolutionary fashion trends have changed, because they enable the production of the desired pattern directly on the knitwear.

In this work is presented the procedure of designing knitwear, designed knitwear collection autumn - winter in industrial conditions for the development of the modern machines for flat knitting company "Stoll" model CMS 502 HP multi gauge. Making motif knitwear and proper function of the machine (for example, making the cut pieces of clothing) are fully programmed computer. Exploring ways of making knitwear and the formation of loops in these machines has enabled the design of the main characteristics of knitwear in jacquard knitted. Time in one place integrated design and creation of women's dresses and skirts, their design, and the design of the production process in jacquard, intertwining.

Key words: projecting knitwear, knit, pattern, yarn.

INTRODUCTION

Progress of the textile industry in recent years has led to the emergence of many different methods of producing textile products. One of those methods is knitting, which means the shaping process of yarn by which is obtained a knitwear. Knitted fabrics are flat textile products obtained from the large number of interconnected loops, which are the basic structural elements of knitwear [1, 2].

Life in today's world cannot be imagined without the knitted textile products made in the knitted machines. Knitted fabrics are made from different types of yarn, of different yarn fineness and composition of the raw material, and in addition to cotton, wool and acrylic yarn largely are used mixtures, because of its positive characteristics [3, 4]. For the processing in knitting technology elastic fibers are suitable, with uniform fineness and strength because that gives a soft and voluminous yarn.

Development of electromechanical industry has led to the emergence of a completely new generation of flat knitting machines. They fulfill the increasing demands of reliability, cost-effectiveness and flexibility. At a very high technical level with customized designs they are highly customizable, which opens up a whole new dimension of use of these machines. Based on designer creations, at this electronic controlled machines, knitted fabric sample is fully programmable on computer as well as appropriate machine functions. The memory capacity is significantly increased, so the pattern may have several thousands of loops and it is dependent of the number of colors [1].

In this paper is, based on the sketches of models of women's dresses and skirts presented a complete procedure for obtaining these models in industrial conditions on a very modern Stoll flat knitting machines [5]. Measurements and tests are made necessary to explain the ways of making knitwear and forming loops on these machines and projecting the basic characteristics of knitwear in jacquard, intertwining.

EXPERIMENTAL

Making fashion collection

This collection is designed with the intention that the traditional costume formed in accordance with the modern way of dressing. They are linked by the initial idea, the inspiration found in the beauty of textile products that are invaluable for exploring and preserving the traditions and beauty of the spirit of the Serbian people.

The collection represented national colors of women's costumes: red, green, blue, red, purple, pink and the other in a harmonious relationship with the gentle and uniform colors muted tones. Ornaments are circular and irregular shapes taken from nature and adapted to modern trends.

The models are made from different raw materials knitwear composition: cotton, wool, viscose and blends thereof.

During the manufacture of knitted motif was used jacquard weave. Background (reverse knitwear) to weave in a way that one color yarn on the back needle board weaves every other pin on the front needle board only pins on the places where the yarn and the color appears to C drawn picture. To cross the other colors on the back needle board used different needle. In one passage of the crankshaft machines, two colors on the back panel (needle board) knit one row, and on the front of each loop is woven in team colors as shown. If it is a multi-color jacquard intertwining the procedure is repeated. In the case of an odd number of colors must change the order of the needles on the back needle board where certain colors work. The work alternately on or off all four systems front and back needle board. Since the machine has 4 systems and weaves the five-color jacquard knitwear, knit in one pass, four colors, and then the crankshaft returns for a fifth color, while machine itself chooses a system that will work.

All knitwear items are made according to the motives Serbian folk costumes directly in the process of knitting in jacquard weave without fitting parts knitwear .

Way of making models of dresses and skirts is a classic where Mesh tailors in a similar way as the fabric: tailoring parts of the product by tailoring image and then combined to form the desired product.

Figure 1, shows only part of the collection of women's dresses and skirts designed for modern man and it is an expression of male sophistication. The perfect balance between classic and modern, which is achieved by a combination of different colors [7, 8].

Model 1 *Model 5* *Model 8*

Figure 1: Part of the collection of women's dresses and skirts

Knitwear for knitwear collection, whose creations are displayed, is designed for the development of the modern flat-knitting machines of the German "Stoll" (Table 1) in the program [1,5].

Table 1. Characteristics of flat knitting machines for company "Stoll"

Characteristics	Description of characteristics
Model	CMS 400
Width of the machine	Variable speed, up to 230 cm
Fineness machines	E 3, E 5, E 8, E 10, E 12
Speed knitting	Max 1.2 m/s (depending on the machine fineness)
Density knitting	Electronically controlled two-level (depending on the fineness of the machine)
Shifting	Is done by servo motors and systems, precision screws; maximum displacement is 2 "
Transfer	Simultaneous synchronous gear (front or rear), depending on the direction of movement of the crankshaft
Press the loop	Special regulation in knitting
Platinum system	Powered by a platinum system with spring
Types of needles	Full jacquard selection
Interruption of work	Yarn breakage, breakage of needles, bugs, etc.
Section	Direct section through a pulley, servo motor, the ability to work in both directions
Tension yarn	The introduction of the yarn is controlled by a computer
Cleaner yarn	It is equipped with a fan that works with a compressor, due to major nodes in the yarn comes to machine downtime

In order to start developing programs, it begins with a name that is stored in the JSA (Jacquard - Structure-Automatic). Then it determines the width and height of the image (motive), where each box (field on the screen) indicates the loop on knitting.

Draw a picture of the report or specified patterns (motifs) are made by characters (icons) that indicate the type of weave. Upon completion of the drawing technique of selecting the program (JSA), machine type, fineness and start knitwear.

The next step is to choose the option of the control panel, on which the 20 control lines (each with a specific function) containing data related to knits:ucrtavanje boja korišćenih u crtežu:

- selection guide,
- setting needle board,
- regulation of the cylinder to withdraw the goods,
- adjust the firmness of knitwear,
- setting the background NEC jacquard,
- setting making special knitwear,
- trimming work full fashion,
- Select the number of system operation,
- regulation of scissors for cutting the yarn,
- setting the direction of movement of the crankshaft.

Then choose the next steps in the further development PROG to weave drawn:

- Step 1 - is to produce FF (full fashion),
- Step 2 - Set the color yarn you will be withdrawing any guide,
- Step 3 - elaborate patterns (status reports are entered into the picture, the robustness of knitting, position guide)
- Step 4 - elaboration of the module (if there are no appropriate modules as a ready tool),
- Step 5 - Preparation of written sintral program (the computer works automatically if the previous steps well placed).

The program may continue to make changes that are commonly related to the knitting speed, the speed of withdrawal of goods drum, the determination of the width of knitwear (which is desired) with a number of needles.

This is followed by testing, after which the program is ready to connect to the machine via a direct connection.

After that follows the introduction of the yarn guides the program, bringing the value of the report and the preparation of test pieces. Test piece used for further adjustments in terms of strength and size of knitting before going into production.

Structural and geometrical properties of final products

Dresses and skirts is designed to develop the jacquard knitted from blend of cotton and viscose fibers (25x2 tex) and wool fibers (32x2 tex). Design characteristics of knitwear and the required amount of yarn, carried by the following calculation:

- Determination of the mean diameter of the yarn, which has a budget:

According to the raw material composition, a constant for calculating the average diameter of the yarn was prepared in the following manner:

c_1 = 0,0395 (for cotton yarn),

c_2 = 0,0395 (for viscose yarn),

c_3 = 0,0411 (for wool yarn).

$$c = c_1 \cdot \frac{u_1}{100} + c_2 \cdot \frac{u_2}{100} + c_3 \cdot \frac{u_3}{100} = 0{,}0399$$

Where is: u - percentage of each component.

- Longitudinal medium mass yarn that goes into the budget:

$$T_{t1} = 25 \times 2 \text{ tex}$$

$$T_{t2} = 32 \times 2 \text{ tex}$$

$$T_{tmed.} = T_{t1} \cdot \frac{u_1 + u_2}{100} + T_{t2} \cdot \frac{u_3}{100} = 50 \cdot \frac{74}{100} + 64 \cdot \frac{26}{100} = 53{,}64 \text{ tex}$$

- Average thickness (diameter) of the yarn:

$$d = c \cdot \sqrt{T_{tsr}} = 0.0399 \cdot \sqrt{53{,}64} = 0{,}292 \text{ mm}$$

- Loop height order to face knitwear:

$$B_f = 5 \cdot d = 5 \cdot 0{,}292 = 1{,}46\, mm$$

- Loop height order to reverse knitwear:

$$B_r = 2{,}5 \cdot d = 2{,}5 \cdot 0{,}292 = 0{,}73\, mm$$

- Loop step (width of a loop):

$$A = 5 \cdot d = 5 \cdot 0{,}292 = 1{,}46\, mm$$

- Density of the horizontal (at 5 cm):

$$G_h = \frac{50}{A} = \frac{50}{1{,}46} = 34{,}24 \text{ loops/5 cm}$$

➢ Density vertically on the face (at 5 cm):

$$G_{vf} = \frac{50}{B_f} = \frac{50}{1,46} = 34,24 \text{ loops/5 cm}$$

➢ Density vertically on the reverse (at 5 cm):

$$G_{vr} = \frac{50}{B_r} = \frac{50}{0,73} = 68,49 \text{ loops/5 cm}$$

➢ Loop length on the face of knitwear:

$$l_f = 1,57 \cdot A + 2 \cdot B_f + \pi \cdot d = 1,57 \cdot 1,46 + 2 \cdot 1,46 + 3,14 \cdot 0,292 = 6,13 \text{ mm}$$

➢ Loop length on the reverse knitwear:

$$l_r = 1,57 \cdot A + 2 \cdot B_r + \pi \cdot d = 1,57 \cdot 1,46 + 2 \cdot 0,73 + 3,14 \cdot 0,292 = 4,67 \text{ mm}$$

➢ Surface mass of knitwear:

$$Q = 4 \cdot 10^{-4} \cdot l \cdot G_h \cdot G_{vf} \cdot T_{tmed}(l_l + 2l_r) = 4 \cdot 10^{-4} \cdot 34,24 \cdot 34,24 \cdot 53,64 \cdot (6,13 + 2 \cdot 4,67) = 389,14 \text{ g/m}^2$$

➢ Lineal loop module on the face:

$$m_{Lf} = \frac{l_f}{d} = \frac{6,13}{0.292} = 21$$

➢ Lineal loop module on the reverse:

$$m_{mr} = \frac{l_r}{d} = \frac{4,67}{0.292} = 16$$

➢ Surface loop module on the face:

$$m_{mf} = \frac{A \cdot B_f}{l_f \cdot d} = \frac{1,46 \cdot 1,46}{6,13 \cdot 0,292} = 1,2$$

➢ Surface loop module on the reverse:

$$m_{mr} = \frac{A \cdot B_r}{l_r \cdot d} = \frac{1,46 \cdot 0,73}{4,67 \cdot 0,292} = 0,78$$

➢ Width loop coefficient:

$$\alpha = \frac{A}{d} = \frac{1,46}{0,292} = 5$$

➢ Height loop coefficient on the face:

$$\beta_f = \frac{B_f}{d} = \frac{1,46}{0,292} = 5$$

➢ Height loop coefficient on the reverse:

$$\beta_r = \frac{B_r}{d} = \frac{0,73}{0,292} = 2,5$$

- Cover factor on the face:

$$K_f = \frac{\sqrt{Tt}}{l_f} = \frac{\sqrt{53,64}}{6,13} = 1,2$$

- Cover factor on the reverse:

$$K_r = \frac{\sqrt{Tt}}{l_r} = \frac{\sqrt{53,64}}{4,67} = 1,57$$

- Padding of knitwear the horizontal:

$$E_p = 4 \cdot d \cdot G_h = 4 \cdot 0,292 \cdot 34,24 = 40$$

- Padding of knitwear vertically on the face:

$$E_{vf} = 2 \cdot d \cdot G_{vf} = 2 \cdot 0,292 \cdot 34,24 = 20$$

- Padding of knitwear vertically on the reverse:

$$E_{vr} = 2 \cdot d \cdot G_{vr} = 2 \cdot 0,292 \cdot 68,49 = 40$$

- Surface padding on the face:

$$E_{spf} = \frac{100 \cdot \left(d \cdot l_f - 4 \cdot d^2\right)}{A \cdot B_f} = \frac{100 \cdot \left(0,292 \cdot 6,13 - 4 \cdot 0,292^2\right)}{1,46 \cdot 1,46} = 67,97\,\%$$

- Surface padding on the reverse:

$$E_{spr} = \frac{100 \cdot \left(d \cdot l_r - 4 \cdot d^2\right)}{A \cdot B_r} = \frac{100 \cdot \left(0,292 \cdot 4,67 - 4 \cdot 0,292^2\right)}{1,46 \cdot 0,73} = 95,94\,\%$$

Table 2. Material demand for collection in width W_{knit} = 1,15 m

Models	**Item material**	**Number of pieces in the collection**			**The average length of the material models (m)**	**Length material models (m)**	**The mass of material models (kg)**
		Size 36	**Size 38**	**Size 40**			
1. dresses	01 - 01	30	40	30	1,2	120	53,7
2. dresses	01 - 02	30	40	30	1,2	120	53,7
3. dresses	02 - 01	30	40	30	1,1	110	49,25
4. dresses	02 - 02	30	40	30	1,1	110	49,25
5. dresses	03 - 01	30	40	30	1	100	44,75
6. dresses	03 - 02	30	40	30	1	100	44,75
7. skirt	04 - 01	20	30	20	0,7	49	21,94
8. skirt	04 - 02	20	30	20	0,65	45,5	20,36
9. skirt	04 - 03	20	30	20	0,6	42	18,8
					Total:	L_{knit} = 796,5 m	356,5 kg

- Total weight knitwear:

$$m_{knit} = W_{knit} \cdot L_{knit} \cdot Q \cdot 10^{-3} = 1{,}15 \cdot 796{,}5 \cdot 389{,}14 = 356{,}5 \text{ kg}$$

- The required amount of yarn:

$$m_{yarn} = \frac{m_{knit}}{1 - \frac{SW_{yarn}}{100}} = \frac{356{,}5}{1 - \frac{4}{100}} = 371{,}4 \text{ kg}$$

SW_{yarn} = 4 % - Solid waste yarn during the knitting process.

Table 3. The required amount of yarn for all models by colors

Model	**The amount of yarn by color (kg)**												**Sum (kg)**
	grey	***pink***	***dark pink***	***light purple***	***purple***	***white***	***tan***	***black***	***blue***	***bordeaux***	***green***	***red***	
1	27,82	5,64	8,5	11,09	2,89								55,94
2	11,09	27,82	5,64	2,89	8,5								55,94
3	9,23	17,95		11,8	6,16	6,16							51,3
4	11,8	6,16		9,23	17,95	6,16							51,3
5					16,3			6,06		6,06	12,13	6,06	46,61
6					6,06			6,06		16,3	6,06	12,13	46,61
7					3,2		15,15	1,5	1,5	1,5			22,85
8							13,77	1,49	1,49		2,97	1,49	21,21
9						12,72	1,37	1,37	2,75			1,37	19,58
											Total:		371,4

Shadow marquee fields for wool yarn.

CONCLUSION

Thanks to the process of designing knitwear products it is possible to obtain a high quality and modern women fashionable clothing product. Quality consists of a set of specific properties of knitted products, which are, to a greater or lesser extent, the impact on usability.

Design of woven garment items, from conceptual design and design clothing collections until the final woven product is a very complex process. Therefore, the project knitwear must contain all parameters necessary for the realization of its production in industrial conditions. Design requires prior knowledge of all the factors related to the structure, construction, and the process of formation of knitwear in the industry. Nowadays every modern facility cannot be imagined without a computer guided knitter which is the standard for manufacturing high quality products.

The advantage of using computerized machines is that they have a coordinated system of structural elements with a variety of options for customization and production models that follow the new fashion trends:

- Electronically controlled devices enabled the creation of the cut parts of the clothing. These garments can be done in jacquard intertwining with the possibility of "closing" of the report as well as the capture and relief of interlacing. This is possible with the simultaneous start of the preparation of the solid. The machine is provided with a transmission loop iglenicu rear to the front, and vice versa. Withdrawal of knitwear is perfected so that the achieved very good uniformity knitwear. The speed of the crankshaft is programmed in accordance with the type of knitwear.
- Apparatus for launching drones completely eliminate downtime and allow you to change the direction of movement of the crankshaft. Also, it is possible to three-dimensional knitting structure.
- Pattern knitwear is fully programmable computer, as well as proper function of the machine. The memory capacity is significantly increased so that the motive may have hundreds of thousands of loops and does not depend on the number of colors.

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PROPERTIES OF AGROTEXTILES AND THEIR USES

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ABSTRACT: Agrotextiles are application of textile materials in the agriculture field. In the manufacture of agricultural products for minimizing negative environmental effects and for the protection, collection and storage of crops, agriculture technical textiles have been used. These textiles used for their functional benefits in the agricultural field.
The essential properties required in agro textiles are strength, elongation, stiffness, resistance to sunlight and resistance to toxic environments. All these properties help with the growth and harvesting of crops and other foodstuffs. In this study, using areas of agrotextiles and properties of them have been examined.

Key words: Agrotech, agricultural applications, technical textiles

INTRODUCTION

Technical textiles are defined as 'textile materials and products manufactured primarily for their technical and performance properties rather than their aesthetic or decorative characteristics'. Technical textiles are reported to be the fastest growing sector of the textile industrial sector and account for almost 19% (10 million tonnes) of the total world fibre consumption for all textile uses. Agrotextiles is one of the forerunners in this growth within technical textiles (1).
Agrotextiles are special textiles that are manufactured for agricultural applications. In the manufacture of agricultural products for minimizing negative environmental effects and for the protection, collection and storage of crops, agriculture technical textiles have been used (2). These textiles used for their functional benefits in the agricultural field. The essential properties required are strength, elongation, stiffness, and bio-degradation, resistance to sunlight and resistance to toxic environment. All these properties help with the growth and harvesting of crops and other foodstuffs (3).
The benefits of agrotextiles are (4,5):
They prevent the soil from drying out increase crop yield.

- They improve product quality.
- Agro textiles protect farmer from harmful pesticides.
- Thermal protection textiles are treated with ultraviolet ray stabilisers.
- The best-known products are shade netting and thermal screens, the use of which can save up to 40% on energy in heating greenhouses.
- Their use prevents staining and improves uniformity of colour.

FIBRE TYPES AND MANUFACTORING TECHNIQUES OF AGROTEXTILES

Manufacturing of agrotextiles, both natural fibers and synthetic fibers are used, These are as follows: Nylon, polyester, polyethylene, polyolefin, polypropylene, jute, and wool.

PRODUCTION OF AGROTEXTILES

Several techniques of fabric production can be used to produce agro-textiles. Each techniqe provides specific advantages for particular product. The techniques are:

Woven

Woven products are produced by using Sulzer projectile weaving machines. The machines with weaving width of 540 cm to 846 cm are available for the production of agro textiles. The nets with a mesh width of 1.8 mm to 40 mm can be produced.

Knitting
Warp knitting technique is most widely used compared with the weft knitting. Warp knitted protective nets are used in different sectors, which are produced on raschel machines. Agro nets are produced in various constructions or lapping.

Nonwoven
There are many techniques to produce nonwoven fabrics. Spun bonding and needle punch techniques are mainly used for the production of nonwoven agro-textiles. The spun bonded fabric has high and constant tensile strength in all directions. It has also good tearing strength.
Needle punched fabric plant bags provide advantages over conventional fired clay pots. All natural fibres offer an added advantage of that the container decomposes after being planted in the ground.

FUNCTIONAL PROPARTIES OF AGROTEXTILES

The key functional properties that are required of agrotextile products keeping in mind their applications are as follows:

1. Weather resistance – They must work effectively in various climatic conditions involving wide ranging temperatures, precipitation, etc.
2. Resistance to micro-organisms – They must be resistant to microorganisms to protect the produce and prevent diseases
3. Stable construction – The construction must be such that they can undergo a fair amount of wear and tear
4. Light weight - The weight of the fabric should be such that it can be borne by the plant
5. Resistance to solar radiation. – They protect the plant from solar radiations
6. Resistance to ultraviolet radiation – They must protect the plant/living being from ultra violet radiations
7. Long service life – They ideally should have long life span
8. Biodegradability – Agro textile products should be biodegradable after their life so that they do not pollute the soil and environment.
9. Water conservation – They must have high potential to retain water and reduce evaporation (1).

CLASSIOFICATION OF AGROTEXTILES ON THE BASIS OF AREAS OF APPLICATION

a) Agrotextiles for crop production (agriculture)
b) Agrotextiles for horticulture (garden cultivation), floriculture and forestry.
c) Agrotextiles for animal husbandry and aqua culture.
d) Agrotextiles for agro packaging related applications.
These textile structures are used as controlling environment for plants/animals in applications like; Agriculture, Horticulture and Animal husbandry. Some of the main fields of agro-textiles (6):

1. Shade nets
2. Windshield Nets
3. Bird Protection Nets
4. Crop Covers/Anti-Frost Covers
5. Root Ball Nets
6. Mulch Mats/Ground Covers
7. Anti-hail nets
8. Turf Reinforcement/Protection Nets
9. Pallet Net Covers
10. Anti-Insect Nets
11. Plant Nets
12. Fishing Nets
13. Packing materials for agricultural products

1. Shade nets

Figure 1: Shade nets (7)

Shade Nets are nets made of Polyethylene or Polypropylene thread with specialized UV treatment having different shade percentages. These nets provide a partially controlled environment by primarily reducing light intensity and effective heat during day time to crops grown under it. This enables lengthening of the cultivation seasons and well as off-season cultivation depending on the conditions and type of crop.

2. Windshield Nets

They are designed for the protection of crops, small trees and plants from strong winds. They are UV stabilized in order to ensure durability and they are easy to install. There is loop line provision so that a beanpole can be used to hold the net towards the wind.

3. Bird Protection Nets

Enormous fatalities are caused by birds in most of the crops. The crops like grapes, guava, and pomegranate are harshly infected by parrots. From time to time the parrots can wipe out the whole crop within hours. To keep away from such huge losses, bird protection nets are used.

Figure 2: Windshield Nets (5)

Figure 3: Bird Nets (5)

4. Crop Covers/Anti-Frost Covers

Crop-covers generate an outstanding micro atmosphere for seed germination and seedling growth. A crop-cover is positioned over a huge area (a number of rows) of a harvest. In cooler atmosphere, crop-covers are often positioned over direct seeded rows or newly removed crops to create a warmer, more humid micro environment to assist quick plant establishment of warm season crops. These are called "*Floating Row Covers"*. Rope covers also offer crop shelter from pesticide.

5. Root Ball Nets

A root ball plant is prepared for planting with soil adhering to their roots. The soil and root forms compact mass, larger then bare roots. Root ball plants can be planted throughout the year, except when the ground is frozen, flooded or in periods of drought or high heat.

Figure 4: Cold and frost control fabrics

Figure 5: Root Ball Nets (8)

6. Mulch Mats/Ground Covers

Mulching is defined as covering up of soil around plants to preserve soil moisture, reduce nutrient loss by leaching and in weed control instead of traditional chemical fertilizers.Mulching is also used to modify soil temperature. Mats used for mulchingare commonly known as Mulch Mats or Ground Covers

7. Anti-Hail Nets

Anti-hail nets are generally used to guard the crops like apple, litchi, etc. from hails in hail prone areas and high height areas like. Each individual tree needs the anti hail nets. These are woven from HDPE yarn or are combination of HDPE monofilament and tape in knitted form, stabilized against UV rays.

Figure 6: Ground Covers (9)

Figure 7: Anti-Hail Nets (5)

8. Turf Reinforcement/Protection Nets

A turf reinforcement net is an extruded plastic mesh designed to help grass seedlings germinate and grow in a uniformly strong structure. The roots intertwine with the durable mesh and prevent separation from the soil when rolled. This allows turf producers to harvest a crop in half the time, providing the opportunity for a second planting during their season. Such nets also provide soil stabilization to make green areas available for pedestrian and vehicular use.

9. Pallet Net Covers

For safe transportation of fruits and vegetables to the market individual boxes are collected into larger units and these boxes are covered with wide, large mesh nets on pallets to stop the boxes being turned upside down or squashing each other. This prevents damage to goods during transportation. Nets used for this purpose generally have high tensile strength and are made from high tenacity Polypropylene in a diamond mesh pattern and an elastic cord on the surrounding edges.

Figure 8: Protection Nets

Figure 9: Pallet Net Covers

10. Anti-Insect Nets

An anti-insect net is a net that is placed over greenhouse openings to prevent flying insect and pests from entering growing areas. Various pests like Whitefly, scale insects attack some ornamental plants and vegetables frequently. The affected leaves of the plants of the plants give rise to the formation of black fungus because of the honey dew on the leaves left by the viruses. Insect nets can also be placed over the openings of greenhouses to prevent pollinating insects, such as bumblebees, from escaping.

11. Plant Nets

Plant nets are the made from polyolefin type of fibre. It is mainly used for the tomato type of plant. Fruits, which grow close to the ground, can be kept away from the damp soil by allowing them to grow through vertical or tiered nets in order to keep the amount of decayed fruit to minimum.

Figure 10: Anti-insect net (10)

Figure 11: Plant Nets (11)

12. Fishing Nets

Fishnets are one of the technical textiles utilized in fishing industry. Fishing nets are knitted fabrics used for marine and inland fishing by fisherman, fishing trawlers and boats.

13. Packing materials for agricultural products (Leno bags)

Nets can be used for packaging of farm products for many end uses. It includes packing sacks for vegetables, tubular packing nets for fruits and wrappers for Christmas trees, Net structures are preferred because of their high strength, low weight, air permeability and cheapness.

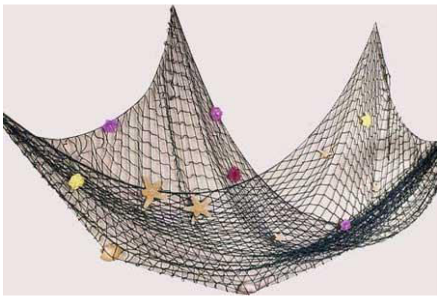

Figure 12: Fishing nets

Figure 13: Leno bags

RESULTS

The latest developments in textiles and their industrial uses have lead to the birth and development in technical textile. Technical textile goods are mostly manufactured for non-aesthetic purpose where the function is its criteria. This is a very vast and rapidly developing sector that supports many industries. Technical textiles used for agricultural applications are called as agro-textiles. Agrotextiles play a significant role to control environment for crop production, eliminate variations in climate, weather change and generate optimum condition for plant growth. Adopting the hi-tech farming technique, where textile structures are used, could enhance quality and overall yield of agro-products. The essential properties required in agro textiles are strength, elongation, stiffness, resistance to sunlight and resistance to toxic environments. All these properties help with the growth and harvesting of crops and other foodstuffs. With growing diseases due to various chemicals in and pollution, due emphasis is laid on organic foods and vegetables today. These are best done with controlled use of water, sunlight and composts duly achieved by use of agrotextiles.

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STUDY PARAMETERS KNITTED STRUCTURES AFFECT THE ABSORPTION CHARACTERISTIC AND REDUCES NOISE INSIDE THE VECHILE

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ABSTRACT: One of the important issues in modern cars the automotive industry is reducing their noise design.One solution is knitwear that can provide passive sound absorption; into upholstery and other interior parts.In addition to twists can also be used someone material, but he has less aesthetic appearance and drapability compared with knitted structures, which in 3D provide seamless structure with a pleasant appearance.In this study, we tested the sound absorption of the ordinary flat knitted structure in rows and series of loops and voids in the unit cells modeled in 3D as the diameter of the circle were compared with theoretical models. In this way, since there is a uniform distribution of the loops, that make up the braid, there is a unique set of cylinders in a circular area unit, so that the knitwear can be approximately modeled as a geometric layer with identical cylindrical pores perpendicular to the surface thereof.

Key words:Knitwear, noise absorption, unit cell, sound absorption, the length of yarn in a loop, yarn diameter,. surfaces crossed yarns.

INTRODUCTION

The passenger compartment of modern compact cars there is a low frequency noise whose range mainly below 4000 Hz and is more prevalent in the area from 100 to 1000 Hz. On long trips can cause fatigue for both driver and passengers. To solve this problem, there are two techniques and two methods, one as active and the other as passive. In active methods using interference phenomena of waves [1,2], while in the passive method of using acoustic materials to mitigate noise in the passenger compartment.Textile material is mainly used as an inexpensive and environmentally absorb sound inside the vehicle.Some studies [3-6], have been conducted on a non-woven fibrous bands in terms of their properties to absorb noise.

Also produced are commercial products such as acoustic non-woven fabric.And if their noise absorption properties of the ball is very difficult to produce a texture on their surface is not woven in order to obtain an aesthetic appearance.On woven structures were carried out only a few empirical studies [7,8], the absorption characteristics of noise.The most suitable material for covering the space above your head, carpets, seats, door panels and other interior was woven material that will be tested in this paper.

Absorption sound in knitted structures

Model ordinary knitted fabric as porous materials

One of the main sound absorbing (absorbent) material class is the porosit.It includes all materials in which the sound is spread (spreading) through a network of interconnected pores such that the acoustic energy is converted to heat mainly due to viscous boundary layer effects.To be effective, the air absorption should be able to pass through the material.The air is a viscous liquid, which establishes the energy is dissipated by friction with the walls of the pores.Moreover, changes in flow during the propagation of sound through the pores incorrectly lead to the loss of momentu. Behind the viscous effects are, heat losses due to heat conduction from the air to the absorber material.All textiles, nonwoven, woven or knitted, belong to this class.Typical textile materials as sound absorbers as carpets, curtains, blankets and pillows.Plain knitted structure is known as a smooth mesh (right-left), which has the right and the left that can be taken for face twists. Knitwear consists of elementary unit-loops that are arranged in rows C and W series (Figure 1). Loop is obtained interference exceeds the basic principles of knitting

Empty space within the unit cell can be approximated as a circular hole, as shown in Figure 1 From the pictures you can see the empty space unit cell can be approximated as a cylinder whose volume bounded yarn in the formation of loops.Thus, the empty space in the unit cell can be approximately represented as a circular cylinder. Since there is a uniform distribution of the loops, that make up the braid, there is a unique set of the circular cylinders per unit of surface area.This usually knitted knitwear can be geometrically modeled roughly as a layer with identical cylindrical pores perpendicular to its surface (Figure 2).

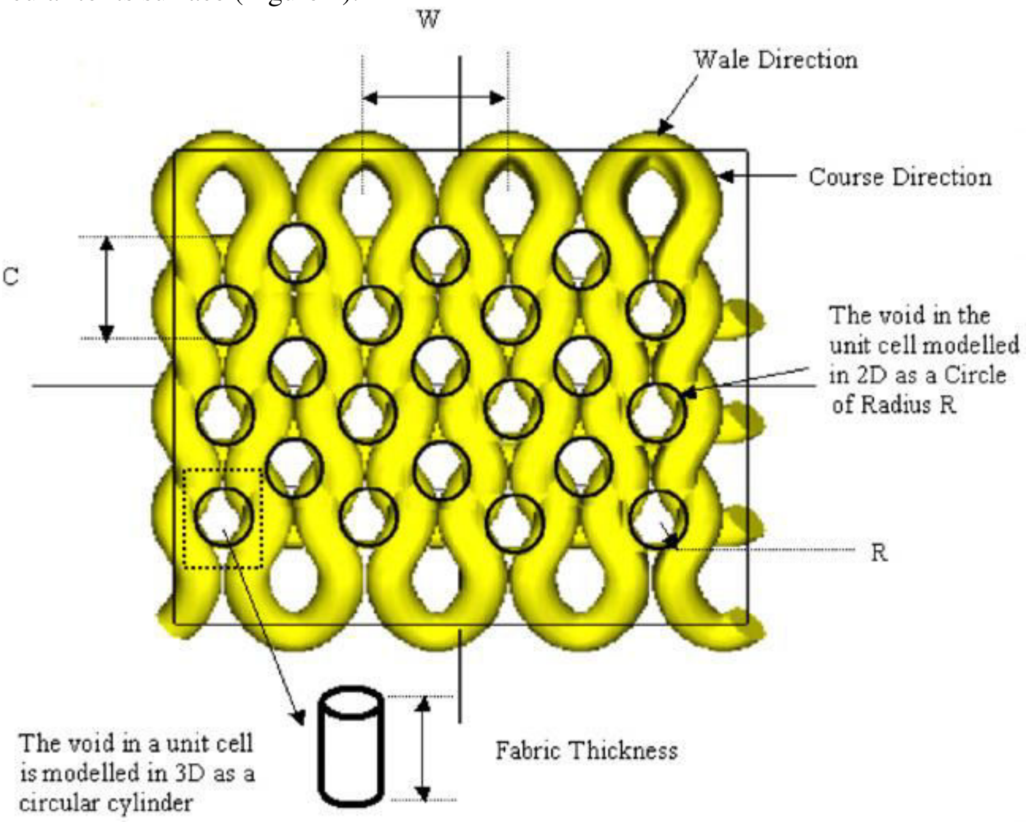

Figure 1.Face plain knitted structure

Analytical prediction of the sound absorption of braided twists

Consider the air inside the circular cylindrical pores formed by unit cells on a regular knit structure as a liquid layer of finite thickness l, which is also the thickness of the knitted fabric.Next, consider the mesh was placed on a rigid impermeable wall, such as a metal frame.
Some one-dimensional spatial sound wave propagation is normal to the incident surface unit cell as shown in Figure 2 Figure 2, A is a point on the surface of twists, B is a point inside the gaps of the unit cell near the surface twists and C is the point knitwear with solid wall. Acoustic impedance at B is given by [9, 10]

$$Z_B = -jZ_C \cot(\beta \cdot l), \tag{1}$$

wherein a characteristic impedance Z_C of fluid layer (which is in this case the air within the unit cell), and is a wave number β fluid. The characteristic impedance and wave number are complex quantities, which are given by the following relationship [10]:

$$\beta = \omega \sqrt{\frac{\rho}{K}}, \tag{2}$$

$$Z_C = \sqrt{K \cdot \rho_i}, \tag{3}$$

where ρ and K denote the effective density and the bulk of the module air in cylindrical pores, respectively, and ω is the angular frequency of the column of air. Zvikker and Kosten [9] have modeled the flow of air inside the circular cylinder of radius R as laminar and derived relations for ρ and K.These relations are derived by taking into account the thermal effects of exchange between the air and the walls of the cylinder, and viscous effects laminar airflow cylinder as two separate issues.The derived formulas are given below:

$$\rho = \frac{\rho_0}{1 - \dfrac{2 \cdot J_I\left(\psi\sqrt{-J}\right)}{\psi\sqrt{-J} \cdot J_0\left(\psi\sqrt{-J}\right)}}, \tag{4}$$

$$K = \frac{kp_0}{1 + \dfrac{2}{B\psi\sqrt{-J}} \cdot \dfrac{J_I\left(B\psi\sqrt{-J}\right)}{J_0\left(B\psi\sqrt{-J}\right)}} \tag{5}$$

and

$$\psi = \sqrt{\frac{\omega\rho_0 R^2}{\eta}}, \tag{6}$$

where ρ_0 is the air density, k is the thermal conductivity of air, B is the square root of the Prandtl number, J_0 is the Bessel function of zero order, J_1 is the Bessel function of the first order and η is the viscosity of air.

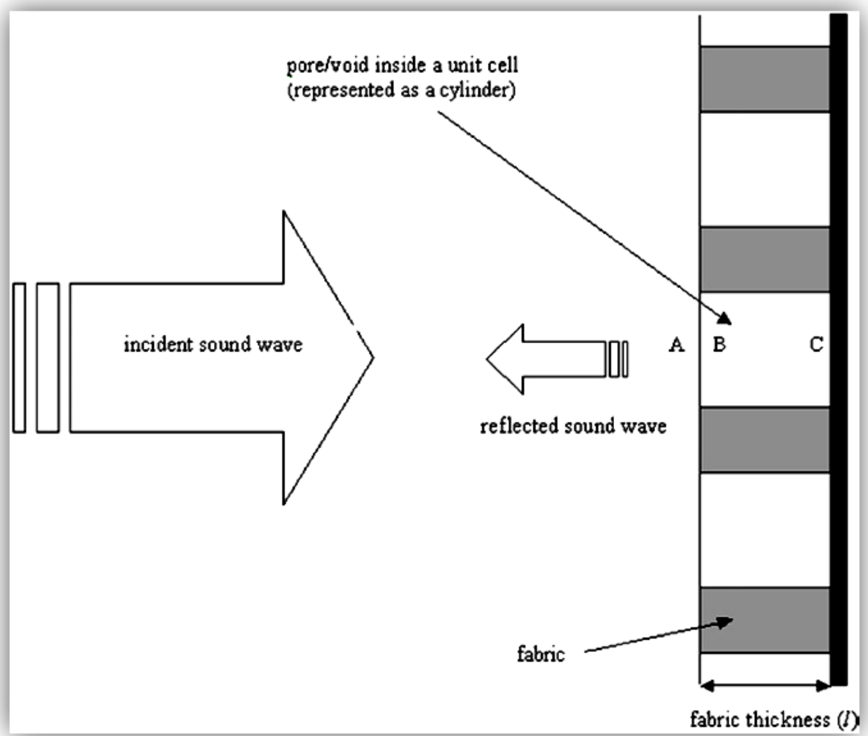

Figure 2. Absorption from the pores created by the gaps of the unit cell, which is supported by a rigid wall

Acoustic impedance and sound absorption flat knitting

As shown in Figure 2, when the sound energy is incident normal to the surface, the air flow is from the surface of the pores of knitting. Thus, the acoustic impedance at the surface of the knitting at point A can be given as [10]

$$Z_A = \frac{Z_B}{\phi}, \tag{7}$$

where Φ porous material that is air by volume (V_a) to the total volume of material (V_T). Absorption coefficient of the noise (KAN) knitting can be found using the following relationship [9,10]:

$$KAN = 1 - \left(\left| \frac{Z_A - Z_C}{Z_A - + Z_C} \right| \right)^2 . \tag{8}$$

KAN gives the amount of energy of the incident sound absorption wave knitted knitting. So analytically predict the sound is absorbed by the knitted knitting pore radius gaps forming unit cell porosity and knitting to be determined.

The radius of the pores in the mesh

To determine the pore radius of the cross-sectional area of the gap in the unit cell, we must consider the following assumption: (a) the surface of the pores in the unit cell is approximated to the area of (a) circle of radius R; (b) the gaps between the points of intersection of the loops and voids between fibers yarns are negligible; (c) the loops consist of ideal yarn, or, they are of circular cross-section and over the length of the constant diameter; (d) knitting is dry and relaxed; (e) deformation exceeds the intersection point is negligible.

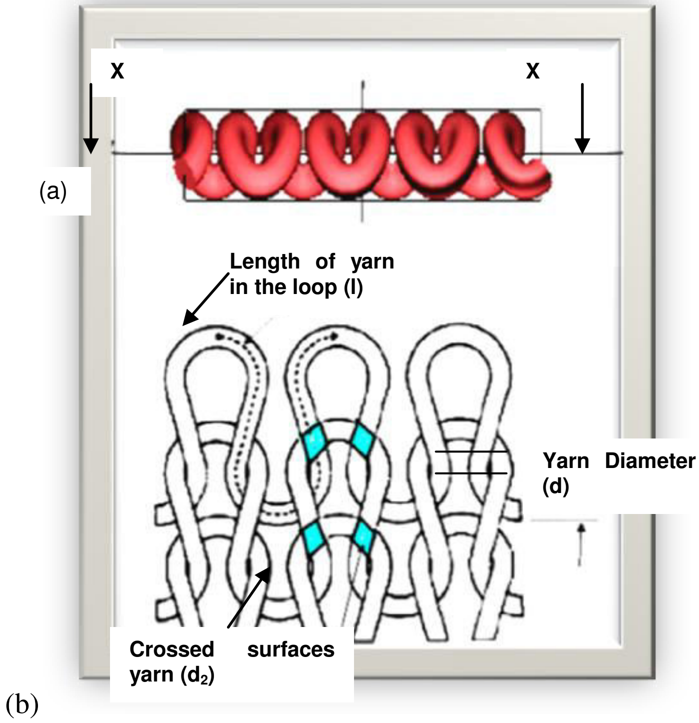

Figure 3.Segmentni looks plain knitted knit: (a) cross-section; (B) view of the x-x plane.

Pierce [11] is defined by the length of yarn in the loop (l) in cm, as follows:

$$l = 2/c + 1/\omega + 5{,}94d \tag{9}$$

where l is the length of the yarn in a loop (cm), c is the number of rows per cm, ω is number of threads per cm and the diameter of the yarns
(cm) .Number loops per cm^2 or density of the loop of knitting, s, is defined as follo

$$s=c\ \omega. \tag{10}$$

Yarn in knitting can be considered as a flat rectangular strip when the flat structure observed in the x-x plane as shown in Figure 3. The total area yarn (A_{yarn}) occupied in $1cm^2$ can be shown as
A_{yarn} = density of loops x (cross the busy area of $1cm^2$ using the unit cell) as

$$A_{yarn} = s\ (ld\text{-}4d2). \tag{11}$$

Thus, the total open area of knitting (A_{open}) in $1cm^2$ is given by

$$A_{sl} = \frac{1-s(ld-4d)}{2s}. \tag{12}$$

Approximation of the area as a perfect circle of radius R, the radius of the pores can be taken as

$$R = \sqrt{\frac{1-s(ld-4d)^2}{2s\pi}}. \tag{13}$$

Thus, the radius of a pore loop of plain knitted knitting can be calculated by using the density of the loop, yarn diameter and length of yarn loop.

Porosity

Guidoin and second [12] are defined as the ratio of the porosity of the area, or pore volume of the pores within the range of the solid material to the total volume.The porosity, or void of solid particles of material is often expressed as a percentage, and is derived from it, as shown below.

$$P = 100\left[\frac{V_v}{V_t}\right]. \tag{14}$$

where V_v is the volume of pore space (cm^3), V_t is the total volume of knitting (cm^3).
Considering the density of fibers in the knitting, and the overall density ρ_m and ρ_t,

$$P = 100\left[1-\frac{\rho_t}{\rho_m}\right]. \tag{17}$$

The definition of density is
• density = mass / volume
• Or, density = mass / (area × thickness) Defining M as the mass per unit area of knitting and t as the thickness of yarn,

$$\rho_t = \frac{M}{t}. \tag{18}$$

Using this relationship in Equation (17) gives the following equation

$$P = 100\left[1-\frac{M}{t\rho_m}\right]. \tag{19}$$

Thus, in order to obtain a porosity of knitted knitting, has to give a fiber density, mass per unit area and the thickness of the material This value is used in equation (7)

MEASUREMENT OF THE COEFFICIENT OF ABSORPTION OF THE NOISE

To verify the mathematical prediction of KAN on a regular knitting (right-left smooth knitting) measuring KAN is done using a standard two - microphone impedance tube provides Spectronics Inc USA, which was designed by the ISO 10534-2 standard.The tube was 1m in length and 34 mm in diameter and is designed for the measurement of the normal incident sound absorption of the sound within the 50-5000 Hz Pseudo random white noise signal from 50 to 4000 Hz, are required for the internal sound source to the impedance tube is made using LabVIEV This signal is sent to the impedance of the tube through the National Instrument M6259 device for data collection. Similarly, dual channel spectrum analyzer required to calculate complex acoustic transfer function of the microphone signal as the standard, was carried out using LabVIEV The microphone signals are taken to the appropriate X and Y channel dual-channel analyzer through two analog input devices for data collection. In real-time data readings of the transfer function are then averaged for 100 cycles in the loop are repeated in the software obtained reading is then saved as a text file and used by ACUPRO Software, which was provided by the pipe manufacturer, calculated and graphically display the KAN knitting for frequencies between 50 and 4000 Hz According to the ISO standard and the instructions of the impedance tube for each knitting KAN measurements were performed on three identical samples taken from different areas of twists and their averages were.

Table 1.Plain knitted structure sample details

Sample number	Course per cm	Wales per cm	Calculate stitch length (cm)	Measured stitch length (cm)	%(Error) in stitch length data	Measured pore area (mm^2)	Knitting thicknews (mm)
A1	10.8	8.8	0.441	0.461	4.5	0.147	0.6
A2	10.23	4.52	0.559	0.538	3.8	0.427	0.6
A3	4.92	4.31	0.78	0.856	9.7	1.437	0.6

Table 2.Pore size and porosity data of the fabric samples

Sample number	Pore radius from calculated data (cmm)	Pore radius from measured data (cm)	Error (%)	Masa of 1 cm^2 of knitting (g)	Porosity (%)
A1	10.8	8.8	0.441	0.461	4.5
A2	10.23	4.52	0.559	0.538	3.8
A3	4.92	4.31	0.78	0.856	9.7

PLAIN SAMPLES KNITTED

For initial validation of mathematical prediction was used, the sheer knitted structures made of PE yarn the density of 1.37 g cm^{-3} and the diameter exceeds 0.2 mm (with longitudinal weight yarn 430 dtex) .flat structure of the samples is given in table 1. length of the loop were calculated according to equation (9) using the number of lines per cm and rows per cm of a given knitting.The thickness of knitted is measured using the key debljinomera with a pressure of 100 kPa Samples of the knitted are conditioned at atmospheric pressure, 20 ^oC and a relative humidity of 63% for 48 hours Areas pore loop and loop length are measured by the projection optical microscope, and PIA 4000 digital image analysis software.Length of the loop was determined by measuring the length of yarn in ten loops.In practice, the gaps in the unit cell of plain of knitted knitting are not uniform when viewed under a microscope, and the variation was 10% of the measured area of the pores. Therefore, the pore space is obtained in the average of 50 readings to obtain a more accurate value is better Calculated the radius of the pore knitted using equation (13)

The porosity of a given knitting is obtained by first measuring the weights of the three samples (in grams) each of which has an area of 100 cm^2 Each sample of 10cm x10cm cut for this purpose The weights were then averaged and divided by 100 to obtain a mass per unit area knitted in grams per cm^2.This value with the measured thickness of the knitting is used in equation (18) and (19) to obtain porosity knitting.The results are given in table 2.

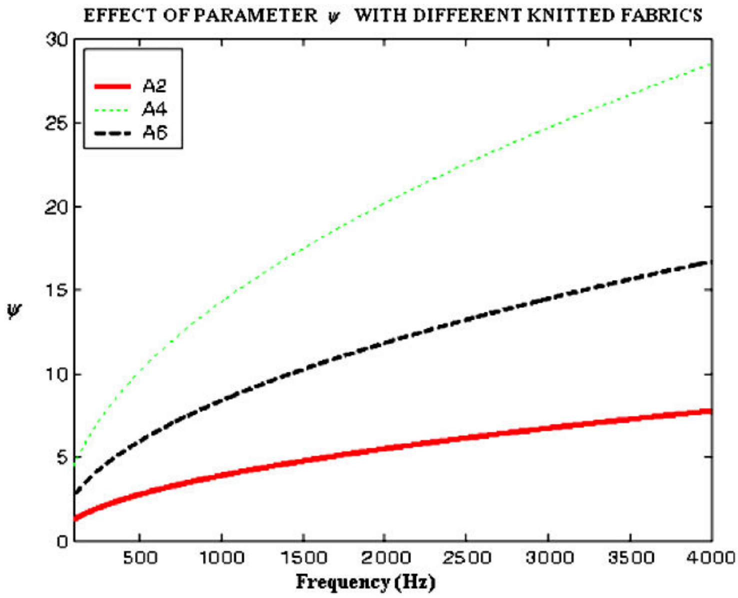

Figure 4. Variation of dimensionless parameter ps with pore radius and frequency

SIMPLIFICATION OF MATHEMATICAL ANALYSIS BASED ON DATA KNITTED

The calculated values of the radius of the pores in Table 2 are used in equation (6) Figure 4 illustrates the variation of the dimensionless parameter ψ equation (6) in relation to the frequency Figure 4 shows that the parameter ψ is greater than 1 for the pore sizes of the knitted listed in Table 2, the observed spectrum As $\psi \geq 1$, the following approximation $(-J)^{1/2} = (-1 + j) / \sqrt{2}$ and $J_1/J_0 = J$ can be used in equations (5) and (6) Therefore, the effective density and the largest module of the air inside the pores of the flat knitted knitting can be simplified further [9, 10]:

$$\rho = \rho_0 \left(1 - \frac{2(-1)}{\psi} \right). \tag{20}$$

$$K = \gamma \rho_0 \left[1 + \frac{\sqrt{2(-1) + J(\gamma - 1))}}{B\psi} \right]. \tag{21}$$

These two simplified equations are then used for equations (2) and (3) used in equation (1).

CONCLUSION

Based on the obtained results, it was determined that the knitted structure with smaller pore size and reduced porosity have good noise absorption by knitted structure with smaller pore sizes and with increased thickness would be suitable material to absorb sound in the passenger compartment inside the car, or thicker and thicker knitted knitting has better sound absorbed traits.The analytical model is in accordance with reasonable experimental data. KAN value of the experimental data are more correlated with the predicted values when the thickness of knitted increases.

Differences may be because (1) the analytical model considers that the pores in the knitting to be unique array of cylinders, but the practice is not unique and true cylinders; (2) the accuracy of the measurement of the impedance tube at this low level of KAN's poor. However, it is obvious that the predicted data and experimental data to the structure when placed against the impermeable solid substrate becomes effective sound absorber only when frequencies above 1000 Hz so that this methodology will be suitable for the reduction of higher-frequency noise level in the vehicle, such as wind noise and noise from the road

In our opinion it is necessary to use a microfiber knitting, which can be knitted or woven into any form, microfiber knitted are increased sound absorption, because their fibers have a larger surface area than regular fiber yarn, which leads to increased flow resistance.

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LEGAL PROTECTION OF INDUSTRIAL DESIGN

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ABSTRACT: The authors of this paper are studying industrial design interdisciplinary primarily defining its notion and significance. Design must give quality to a product in technological, functional, aesthetic, economic and ergonomic sense. A product must function optimally, it should be attractive, economically strong and powerful as well as ergonomic. If all these criteria are satisfied a product will be successful on the market. The role of design is to make a quality and attractive product. Beside all this it is significant to stress the importance of legal protection of industrial design whereas the special attention is paid on the contents of industrial design application in Serbian Law. Taking into consideration that a process of harmonization of our laws to the laws of EU is in progress it can be said that the adopted Law on the Legal Protection of Industrial Designs Republic of Serbia is in harmonization with the Directive 2004/48/ of EC of European Parliament and Council from April 2004 on inforcement of intellectual property rights and Directive on Legal Protection of Design 98/71/EC of EU Parliament and Council.

Key words: industrial desing, legal protection, Serbian Law.

INTRODUCTION

Activities in the process of creating new and modifying the existing products which are related to satisfaction of aesthetic, ergonomic and economic requirements and principles represent the task of industrial design. Design should make a harmonious relation among visual, spatial elements of a product and the environment as well as the person that uses it. A product has to be formed so that it has: aesthetic level, functional level, to be easy to handle, safe, attractive and that it has a correct price. Design has a significant influence on technological process choice and on the methods in the process of making and shaping the product. On the other hand, design should take consideration of the relevant national and international standards, regulations and laws.

Talking about design one should differentiate industrial design or design of industrially produced items (car design, household appliances, furniture, phones, clothes and footware, toys, etc.), graphic design (books, posters, packages, etc.), WEB design, fashion design, accessories design, design of glass and ceramics, eco design, etc. In the field of industrial design the methods that are used are oriented towards making of industrial products of high aesthetic values and other important characteristics for industry. Complementarity between industrial and engineering design is present and team approach necessary. (Ognjanovic, 2007.) The issue of shaping is interesting and is present in all products so nowdays there are numerous products on the market with similar function and purpose but with different design. (Kuzmanovic, 2001)

Industrial production makes a competition among producers. There is a struggle for domination on the market which causes production of more quality products. This situation influences a development of design and the process of designing and improving products. More and more demanding criteria of customers lead to increasing selection at buying. In the same time a product must satisfy quality requirements. Both, design as a creative discipline and marketing are operating parallel and integrated in a company in interaction with other functions as well. To conclude, the function, design and marketing provide designing a product according to customers’ requirements.

Design must give quality to a product in technological, functional, aesthetic, economic and ergonomic sense. A product must function optimally, it should be attractive, economically strong and powerful as well as ergonomic. If all these criteria are satisfied a product will be successful on the market. The role of design is to make a quality and attractive product.

Quality is material feature and a consequence of a product structure. The level of quality - low, medium, high or luxury – satisfies human needs differently. The process of design should be adjusted to required quality level and the price. The crucial thing is to find a customer for a product in order to make a profit for a producer. Product quality in material and usability sense represents its ability to: to serve, satisfy buyers' needs, last long, to be functional, easy to handle and service, to spend minimum energy, to be economical, ergonomical and aesthetic.

A product is made by a professional team of designers and their assistants. The quality depends on professional abilities, experience and skill of designers as well as on other factors: technical, technological, organizational. They include the level of technology, quality of materials, skills of workers and production control. A product must be within quality system, in other words, it is subject to TQM.

In theory and practice design is the other name of product quality. In order to be successful a product should be made by professional, skillful, creative and experienced designer or a team of designers. Such designers are valuable for a company because they are creators of qulity products with great influence on company business.

Because of that esthetic formation of goods is economically very worthy and, at the same time, very complex activity. It is very true that for successful industrial design is necessary to employ various experts. In relation to all of that it is necessary to provide legal protection of holders of results attained with such endeavor against parasite practices of those who do not want to invest enough time, money and efforts in esthetic modeling of goods. (Ljubojev,Varga, 2010)

NOTION AND DEFINITION OF DESIGN

Design is interdisciplinary in scientific and professional sense. Its studying includes technology, technical science, IT, economy, organization, psychology, art and even medicine because of ergonomy.

In theory, industrial design is defined as creative activity whose aim is to determine formal qualities of industrially made products. These formal qualities include also a shape but they are mainly related to structural and functional elements and relations which transform a system into coherent unity from the view of producer and buyer as well. Design includes all aspects of the environment which are conditioned by industrial production. (Tomás Maldonado).
Paul C. Reilly, Head of the Committee for industrial designthinks that the spheres of design are extended. According to him, design is not related only to mass production but to unique areas as well. Therefore, design has become an object of different criteria and values. On one hand, styles, tastes and fashion influences still play an important role when viewed from financial side and on the other hand, social, political and economic factors and values are more influential and dominating.

A designer Harold Livingston Van Doren states that industrial design represents a practice of analysis, creation and development of mass production. Accordingly, a product must be accepted by customers before entering high investments. The final aim is reasonable profit.

The head of a School for industrial design in Vienna Franz Hoffman defines “industrial design as an activity based on development and realization of industrial products made on the bases of scientific knowledge and technological achievements in order to achieve functional, economical and close – to man product according to its aesthetic, ergonomic, social and psychoshysical characteristics, factors and qualities which most frequently cause making a close contact between a man and a product.”

A designer Andrew N. Sapinski thinks that philosophy and the essence of design is to provide a customer a wider number of solutions in order to secure criteria – firstly, design should make a harmonious connection among the environment, a product and a user and secondly, design as a discipline should connect a product, a market and the conditions of manufacturing in order to achieve economic success.

According to American designer Leon Gordon Miller, industrial design represents a process of designing and creating a form or the image of a product. His opinion is that design represents a process of problem- solving that is relied on creativity, aesthetics and technical disciplines.
One of the leading figures in Russian design in the second half of the 20th century, Yuri Soloviev says that "industrial design is a creative activity whose aim is to define the environment which, in great possible extent, satisfies material and spiritual needs of an individual and the society as a whole."

According to our theory "design is scientific, professional and creative discipline, a symbol of product's quality as well as a system, function, a union of activities, organizational entity and the field of management in a company, oriented towards a complete satisfaction of needs, requirements and wishes of customers, economical and developing aims of individual companies and the economy, improvement of the environment and work ambience and towards a progress of a society as a whole." (Vasiljevic,)

Industrial design is determined by visual characteristics such as: lines, contours, colours, shapes, textures, materials the product is produced of or decorated by, as well as their combinations (Fruht, M. et al. 1999).
The philosophy of modern man is to live and work more beautifully with less material investments and expenses of mental and physical energy. In this way, design helps him by making useful items or products. Men have made usable objects since ancient time. These objects were, in the beginning, primitive viewed from the aspect of modern design. Throughout history development of usable objects was influenced by, except design, art, architecture, crafts, science, technology and other spheres of human creativity. Picture 1. shows development of design of some products.

a) RCA TV set (1954.)

b) LED 3D TV

c) Nokia 3310

d) Apple iphone

e) Plane of brothers „Wright"(1903)

f) Plane of the newest Stealth generation F-22 Raptor

Picture 1.Development of TV design (a,b), mobile phones (c,d) and aircrafts (e,f)

Industrial design is determined by visual characteristics such as: lines, contours, colours, shapes, textures, materials the product is produced of or decorated by, as well as their combinations (Fruht, M. et al.; Kuzmanovic, S., 2008; Novakovic, Lj., 2002; Vasiljevic, M. R., 1999).

LEGAL PROTECTION OF INDUSTRIAL DESIGN IN EUROPEAN UNION LEGISLATION

European Union as regional organization has rich normative activity in various fields of intellectual property and in the field of industrial design protection as well. Taken into account that European Union market is unique the final aim of these regulations is to create intellectual property right in European Union in this field. This process is performed through two forms of regulations - by Regulations on Community Design, which has supernational character and is directly applied in all European Union member countries a system of industrial design protection is being formed. By adoption of Directives EU, such as Directive on Industrial Design Protection all member countries are obliged to harmonize their national legislation in this field with this Directive. Directives are, in fact, instruments of harmonization of national regulations of member countries of European Union.

The main laws in this field are: Basic Regulation (CDR) Council Regulation (EC) 6/2002 of 12 December 2001 on Community Designs, (with introduction of New Member States in Article 110a and the link with Hague Agreement), Implementing Regulation (CDIR) Commission Regulation (EC) n 2245/2002 of 21 October 2002 implementing Council Regulation (EC) No 6/2002 on Community designs, Fee Regulation (CDFR) Commission Regulation (EC) n 2246/2002 of 16 December 2002 on the fees payable to the Office for Harmonization in the Internal Market (Trade Marks and Designs) in respect of the registration of Community designs, Regulation laying down the rules of procedure of the Board of Appeal , Commission Regulation (EC) No 216/96 of 5 February 1996 laying down the rules of procedure of the Boards of Appeal of the Office for Harmonization in the Internal Market (Trade Marks and Designs) and Directive, Directive 98/71/EC of the European Parliament and of the Council of 13 October 1998 on the legal protection of designs.

The basic laws and regulations which regulate protection of industrial design in European Union are two basic laws from this field: *Regulations on Community Design* and *Directive on Protection of Industrial Design.* The Community Designs Regulation was adopted on 2001. A rule is a legal basis for design protection on the whole territory of European Union although there is a possibility of the existence of national design as well. It is not possible to limit the geographic scope of protection to certain Member States. Directive 98/71 EC preceded this rule. Protection right belongs to the author and to his/her legal successor. In cases when a design of a product is created by two or more persons this right belongs to all of them. According to the Rule there is registered and unregistered design. Registered design enjoys protection for the period of 25 years, along with an obligation to be prolonged every 5 years. Unregistered design is protected for 3 years. The rights of design holders are subject to limitations if unregistered design is used in personal and noncommercial purposes, in research, undisturbed international traffic and because of exhaustion. The right on design can be terminated by waiving the right, annulation or termination of the right holder if there are no successors.

Directive 98/71/EC of the European Parliament and of the Council of the European Union, 1998 on the legal protection of designs does not contain provisions on the procedures of design protection. The aim of the Directive 98/71 EC is to equalize regulations of the countries-members of EU in relation to legal protection of design. Conditions for protection of external form of product design originality and novelty are anticipated. According to regulations of country members it should be anticipated that the right on design is achieved in national body for intellectual property or by registration in international bureau. By national legislation it should be predicted limitation related to holders of rights on design in cases when it is used in personal non-commercial purposes, in teaching and research, in undisturbed international traffic, exhaustion of rights and use of design created at the same time as the protected one. Term of duration should be predicted to last 25 years from the day of submission of application. This right should be prolonged every 5 years with payment of mandatory tax. The right can be terminated before deadline if it is determined later that in the time of design registration the prescribed conditions for the right recognition were not fulfilled.

By adoption of The Law on the Legal Protection of Industrial Designs Republic of Serbia a harmonization with the Directive 2004/48/ of EC of European Parliament and Council from April 2004 on inforcement of intellectual property rights and Directive on Legal Protection of Design 98/71/EC of EU Parliament and Council. The significance of the Law of intellectual property of EU for Republic of Serbia lies in the fact that even the countries which are not currently members of European Union take over solution from European Union regulations when forming their national legislation.

LEGAL PROTECTION OF INDUSTRIAL DESIGN IN THE REPUBLIC OF SERBIA

There are two general affirmative conditions which have to be fulfilled in order the right on industrial design would be granted. These are: *novelty* and *individual character.*

Requriments for registration

Novelty of industrial design. Industrial design is deemed as a new one if no identical design has been made available to the public before the date on which the design for which protection is claimed has first been made available to the public as well as before the date of filing of the application for registration of the design for which protection is claimed, or, if priority is claimed, the date of priority. The first question in connection with the novelty of industrial design is the question of identity of industrial design. Identity exists not only when comparable designs are the same - identic but also when they differ but not in intrinsic details. Intrinsic details of industrial design are those elements of industrial design which are dominant over appearance of a product. Inversely, immaterial details of industrial design are its less perceivable elements. Difference in immaterial details is a complex legal standard and has to be ascertain in every new case. It exists if informed user is not able to distinguish two designs on the first sight. For this legal standard is said that is complex because its contents are determined by two legal standards: *informed user* and *on the first sight*. Industrial design is new unless have been made available to the public. A disclosure of an industrial design has not being taken into account if an industrial design has been made availabe to the public by the designer, his successor in title or a third person as a result of information provided or action taken by the designer or his successor in title. This legal fiction is a temporary one - lasts for 12 month and during the period persons authorised to claim protection are able to check marketing value of appearance and by virtue of that to decide is it worthy to invest effort, money and time in obtaining of exclussive legal protection. The same term is valid in the case of an industrial design disclosure beside designer or his successor in title volition (Art. 7(3) of 2002 Council Regulation (EC) on Community designs). Consequently, industrial design irremissible terminates to be new if available to the public has been made by the act of third person which is not in any legal or factual relationship with designer or his successor in title. (Ljubojev, N. Varga,S. 2011)

Individual character of industrial design. The second general requirement for legal protection of industrial design is individual character. Industrial design has individual character if the overall impression it produces on the informed user differs from the overall impression produced on such a user by any design which has been made available to the public before the date on which the design for which protection is claimed has first been made available to the public or before the date of filing the application for registration or - if a priority is claimed - the date of priority. (Ljubojev, N. Varga.S 2011) This requirment refers to creative work criterion, i.e. inventive contribution as an element for estimation if filed industrial design is eligible for registration.

There are two common rules for novelty and individual character. The first related to novelty and individual character of components and the second is related to moment when requirements for protection have to be fulfilled. In such a way, the legal protection of industrial design is not extended to those component parts which are not visible drugin normal use of a product, nor to those features of such part which are not visible when the part is mounted or which would not, in themselves, fulfil the requirements as to novelty and individual character. As for the second common rule, the moment when requirements for legal protection must be fulfilled is the moment of application filing i.e. moment of application priority, if claimed. Regardless if mentioned requirements for protection are fulfilled or no, industrial design *can not be registered* if: 1) publication or use of these is contrary to public policy or moral, 2) violate copyright or indutrial property right of the other person, 3) contain armorial bearings, flags and other State emblems, armorial bearings, flags, names or abreviations of international intergovernmental organizations, religious and national symbols as well as their imitations, unless authority approval is procured,4) represents image of a person, unless explicit approval of the person is procured, 5) represents image of deceased person, unless alowance of its parents, spouse or children is not provided,6) represents image of historical or other person, unless authority approval is procured and allowance of its consanguinity third degree relatives is provided.

The legal procedure for industrial design registracion

Registration of industrial design is the subject matter of a special administrative procedure that is, after filling in the application, launched and conducted by authority which is in Republic of Serbia Intellectual Property Office (IPO) in Belgrade.

The application of industrial design contains: request for industrial design registration, description of the industrial design, two-dimensional representation of industrial design.The request for industrial design registration is filled in two copies on D-1 form. The description of industrial design must be precise, concise and literally focused onto design. It means that an industrial design description firstly should contain assignement to esthetic characteristics of overall appearance of the product - appearance of the product in full and secondly descriptions of industrial design elements, especially those esthetic components which are distinctive and by virtue of which the discribed industrial design is dinstinct to any other known industrial design.

An industrial design description must be terminologically clear and readable. An industrial design description must contain: information identifying applicant (on the left corner of the top of the page), short and real but no commercial name of the designed product (centered), information by virtue of which one may conclude that industrial design is new, information on intented purpose of industrial design, if it is not deducable from the name of the designed product, applicant's signature.

For every industrial design an applicant must file *two copies* of the industrial design description. Industrial design application may be filed as multiple. Towards Serbian law, one may file industrial design application for up to 100 designs, under condition that all of them are eligible to be applied on the same class products as it envisaged by Agreement establishing an international classification for industrial designes (Locarno, 1968). In the case of multiple application, it is necessary to write separate descriptions on a new sheet of paper (two copies) for every industrial design.

An industrial design description must be based on the industrial design representation. In that sense parts of descriptions contain numerical signs (arabic numbers written in brackets) identical to those contained in industrial design representation marking the component that is described.

The representation of industrial design must be filed in two copies. The first copy should be fixed or written in by computer in so called block-house - a bordered space located on the D-1 form reverse side on a such a way that around the representation must be left empty space the least 5 mm. The second copy, maximal dimension is filed separately. The same as description, representation must be literally focused on industrial design. It means that industrial design representation must not contain image of any other thing, face or animal. Industrial design must bi represented so that all details are clearly visible. By the way, applicant is not obliged that along to short and real name of a designed product or in any other part of the application denote the class of international classification.(Varga, S, 2010) If it is not possible to be done by one representation, then is filed more representation of the same industrial design either from different angles or of different parts of designed product. In that case the rules on numbering are applied. Numbering of industrial design representation has being done by writing in two arabic numbers separated by full point towards general numerical queue (1.1, 1.2,...). On the representation copy which is adhered to or written in by computer in the D-1 form reverse side numbering has being done on the front side and on the industrial design representation copy filing separately, numbering has been done on the reverse side. Additional rules on numbering are applied in the case of multiple application. IIn any case, representations must be fixed on the D-1 form reverse side on that queue as they are numbered. For these purpose there are 20 "block-houses" available on the one form specimen. Representation of the industrial design can be filed as a photograph or graphic reproduction of industrial design. Photograph must be of professional quality, with flat angles and neutral background. It must be got by virtue on photo negative or slide.

An applicant file industrial design representation in the form of graphic reproduction must be original, of professional quality, made by equipment for technical drawing or by computer both on opaque white paper. Industrial design must be presented in perspective, but it is allowed to contain shadows due to reliefs presentation. Graphic reproduction must not be technical drawing where industrial design is presented in elevation views (projections) or cross-mode and especially it must not be a technical drawing that contains centerlines and dimensions. (Varga, S. 2010) Graphic reproduction of industrial design must not contain explanations or legends (as those on maps) and must be siutable for offset reproduction.Howsoever filed, industrial design representation must not be folded or stapled.

In Serbian law is prescribed that applicant is allowed to file a specimen instead of two-dimensional representation of industrial design. Specimen is filed fixed on the paper (A4 paper size) and regularly numbered. Must not be folded. In such cases application will be deemed formally regular under condition that in next 6 months applicant file two-dimensional representation of industrial design prepared in accordance to law to IPO. Products that are suitable for spoilage or dangerous for storage will not be accepted as specimens. After the application had been filed, the representation of industrial design can not be amended so that the scope and contents of it are essentially different from that as it described.

CONCLUSIONS

Industrial design in scientific and professional meaning is multidisciplinnary. Creation of new appearance of goods means application of knowledge from many areas such as: (applied) art, economics, marketing, psychology, sociology, esthetics, even ecology and customers security. Because of that esthetic formation of goods is economically very worthy and, at the same time, very complex activity. It is very true that for successful industrial design is necessary to employ various experts. In relation to all of that it is necessary to provide legal protection of holders of results attained with such endeavor against parasite practices of those who do not want to invest enough time, money and efforts in esthetic modeling of goods.

The subject-matter of the industrial design rights is appearance of industrial or handicraft product. There are two general affirmative conditions which have to be fulfilled in order that the right on industrial design is granted: novelty and individual character. Fulfillment of the mentioned requirements is the subject matter of a special administrative procedure that, after the application is filled, is launched and conducted by authority that in the Republic of Serbia is Intellectual Property Office (IPO) in Belgrade. The right on industrial design is granted for 25 years. During the period, commercial exploitation of the registered industrial design is reserved for the right holder(s) (and their successors in title) exclusivelly.

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ONE OF THE PROMISING TECHNICAL TEXTILE FIBER: POLYBENZIMIDAZOLE (PBI) FIBERS

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ABSTRACT: Polybenzimidazole (PBI) polymer which has an excellent thermal and chemical resistance is one of the most important polymer class for high performance textile industry. A PBI fiber is formed of a long chain aromatic polymer having integrated imidazole groups that can be used in different textile forms such as fibers, fabrics, nonwovens for various specific purposes. Protective technical textiles and environmental friendly application types such as fuel cells, carbon capture systems and osmosis techniques are the main application areas of PBI fibers. Information about production, properties and application areas of PBI fibers are reported in this review.

Key words: Polybenzimidome, fibers.

INTRODUCTION

Polybenzimidazole (PBI) fiber, firstly developed by Celanese Co. in 1961, is a significant organic fiber for military, aerospace applications and protective products because of its very high melting point, excellent thermal and chemical resistance [1,2]. The chemical structure of PBI fiber which is formed of a long chain aromatic polymer having integrated imidazole groups is given in Figure 1[1-3].

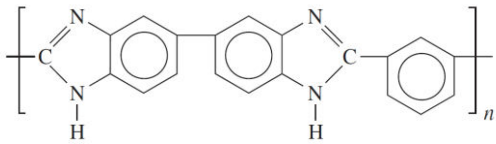

Figure 1: PBI chemical structure [4]

It is common to find sulphonated PBI fibers in high performance fibers market since sulphuric acid results in flame resistance performance increase on PBI fibers. Sulphonated PBI fibers shrink %10 less in comparison with regular PBI fibers when exposed to direct open flame [4]. Figure 2 demonstrates the chemical structure of sulphonated PBI fiber [3].

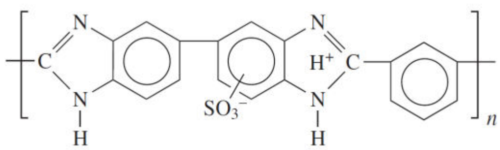

Figure 2: Sulphonated PBI chemical structure [4]

SYNTHESIS OF PBI POLYMER AND PBI FIBER MANUFACTURE

Polymerization of PBI polymer is carried out by two stage reactions with tetra-aminobiphenil (TAB) and diphenylisophthalate (DPIP) (Figure 3) [3,5-7].

In the first stage, after oxygen removal from the reaction system via vacuum following system cleansing with nitrogen, equimolar portions of monomers are heated and melt polymerization process is achieved in an inert atmosphere [3,6,7]. After monomers reaction, water and phenol are occurred as by-products which then causes foam formation of the pre-polymer [3,6,7]. The temperature of the pre-polymer is increased to 275 °C for 1-2 hours in order to remove the foam structure afterwards pre-polymer is allowed to cool down. Finally, it is crushed to fine powder form [3,6,7].

In the second stage, reaction involves heating of this powder at 375-400 °C under nitrogen in order to complete polymerization process. When the reaction is completed, obtained PBI polymer is fine gold, or brown, powder [3,6,7].

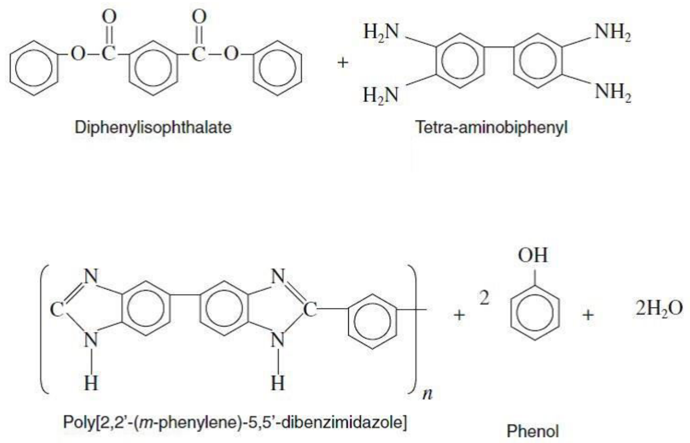

Figure 3: Synthesis of PBI polymer[3]

Although many spinning methods can be used in PBI fiber manufacturing, dry spinning method is widely preferred with DMAC (dimethyl acetamide) solvent [5]. A typical dope solution contains %20-25 PBI, DMAC and lithium chloride. The main goal of lithium chloride usage is stabilization and shelf life increase of the dope solution [5].

FIBER PROPERTIES

Due to PBI's imidazole derivatives structure, PBI has a high melting point and high stability at even over 400 °C [8]. PBI fibers neither burns in air, nor melt or drip [9]. Its limited oxygen index (LOI) is %41 [9]. Furthermore, it emits little or no smoke, when exposed to open flame directly. PBI shows exceptional durability against flame exposure and can resist high temperatures as much as 600 °C for 3-5 seconds without softening and/or degradation and may have an all-day resistance up to 300-350 °C [10].

Table 1: Some properties of PBI fibers [8,11,12].

Density (g/cm^3)	1,43
Specific volume (cm^3/g)	0,70
Tenacity (N/tex)	0,24
Breaking Extansion (%)	28,5
Initial Modulus (N/tex)	2,8
Moisture Regain (%)	15

Table 2: LOI values of various fibers [5,13]

Fiber Type	**LOI (%)**
PBI	41
Nomex, Kevlar, Kermel	27-30
Polyester	21-22
Wool, PA, Silk	18-25
Cotton	18

In addition to thermal and flame stability, PBI fiber has good chemical resistance performance. As can be seen from *Table **3***, when PBI fiber is exposed to different concentrations of some chemicals under different temperatures during various time periods, it retains its strength, especially in acidic compounds, even after long exposure time periods [3].

Table 3: Tensile strength of PBI fibers after exposure to some chemicals [3]

Compound	Concentration (%)	Temperature (˚C)	Time (hour)	Tensile strength retained (%)
Sulphuric acid	50	70	24	95
Hydrochloric acid	35	30	144	90
Nitric acid	70	30	144	100
Sodium hydroxide	10	93	2	65
Potassium hydroxide	10	25	24	88

PBI fibers have excellent textile properties such as good moisture regain (%15) and easy processability using traditional textile equipment [11,12]. Because of these good properties, PBI fibers do not only provide a protection against flame, but also is comfortable like cotton [3,10,11].

End-uses of PBI

PBI can be widely used in different forms such as yarns, fabrics, nonwovens, composites or membranes. For instance,

- Fire-fighting turnout gears manufactured from yarns and fabrics [14]
- Industrial flash-fire protective clothing and aircraft fire blocking made from nonwovens [3]
- High-temperature paper products made from nonwovens or composites [3]
- Proton exchange membranes for fuel cell electrolytes [15]
- Hollow PBI fibers in osmosis technique for filtration [16]

End-uses of PBI in Textiles

PBI is a powerful candidate for protective technical textiles such as fire-fighter turnout gears, astronaut and racing car suits, protective clothes, gloves and hoods especially for military or industry usage by means of its exceptional thermal and chemical stability [2,10,14]. Also, it can be used as fire blocking fabrics in aircraft seats [10].

Figure 4: Shirt with PBI [17] (a), PBI-astronaut clothes [18] (b), PBI/Kevlar gloves (c), PBI turnout gears (d, f, g)[19], PBI fabric (e)[20]

Other end-uses of PBI

Other end-uses of PBI fibers are generally environmental friendly applications such as fuel cell electrolytes, filtrations and carbon capture systems. PBI membranes made from PBI hollow fibers can be use in osmosis applications, gas or liquid filtrations for waste water treatment, seawater desalination and water reuse for space applications, etc. [16,21]. PBI doped with strong acids are used in fuel cells as proton exchange membranes. Fuel cells which use hydrogen is high in energy and produces almost no pollution [15]. PBI membranes are used in carbon capture systems with the purpose of capturing waste carbon dioxide in atmosphere to prevent global warming [22].

Figure 5: Hollow PBI fibers (g)[23] which uses in osmosis technique, carbon capture systems (b, d)[24,25] and gas filtrations (f)[26]. Proton exchange membrane from PBI (h)[27] in fuel cells and its uses (a, c, e)[28-30]

CONCLUSION

PBI fiber is one of the promising technical textile fiber for new generation applications with its excellent properties. The use of PBI fibers in protective textile products has been increasingly growing day by day and it is now also an excellent candidate in the use of environmentally conscious products and techniques that may significantly contribute to planet's life time.

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FASHION STYLES AS AN ASPECT OF MARCETING PROGRAMS OF FASHION COMPANIES

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ABSTRACT: A style of a fashion product is, primarily their appearance and a sense for that appearance from the view of the customer. Style is a way of expression for the fashion designer, or their inventiveness and ability to explore the unexploited capabilities of the form, texture, color, fabric and ornament. All the significant styles of products once get widely accepted- they become a trend. Some of the fashion trends tend to come back in fashion after some time.
Skill of a fashion designer originates from the ability to identify social and cultural developments, as well as future fashion trends, and adapt their own creativity to that. Marketing experts have to encourage their aspirations. Particular impact on designer's creativity had the turbulent events that happened in the 20^{th} century.
Fashion designers, employed in fashion companies or hired by them had the assignment to create number of styles of fashion products that had to be aligned with the rest of the marketing program. Marketing program involves a number of activity such as: marketing research, marketing mix (development/designing the product, price, promotion, distribution) and sales. Fashion products with recognizable style have more chance to be accepted on the market, their designers can achieve enviable reputation, and their fashion companies make a profit.

Key words: style, fashion style, fashion designers, creativity, marketing program, marketing research, sales.

INTRODUCTION

Fashion companies have to design continuously new models of garments or redesign them from the previous season. Growth of the purchasing power of the buyer leads to much greater need for differentiation of fashion garments by means of design, style and fashion.

The subjects of this work are styles of fashion products, their features and their impact on marketing programs and plans of fashion companies.

Expression –style, has a number of meanings. From the aspect of fashion products style is primarily appearance of that products. But also style is a way of expressing with constructing a product.
Styles of fashion products can differ in: size, form, color, ornament, fabric, method of producing or their function.

Styles that were widely accepted, for some time, turn into fashion. Fashion in general represents change. Fashion, usually associates with fashion garments and is always based on some style.

In the past the big styles ruled that marked of fashion products. In renaissance, baroque and rococo time clothes were glamorous. Some of the fashion styles, after some time, have come back in fashion.
In addition to the mutual interdependence with fashion, styles are also connected with design. Fashion designers create products of a certain style, and once they get widely accepted turn into fashion. Design, therefore represents a strong creative background for the making of style and fashion. Fashion, also, represents proper design component, especially when it comes to fashion clothes.

Fashion designers have to continuously search for unexploited abilities of the form, shape, color and ornament, in which they can always express new ideas and inspirations. Skills of a designer comes from the ability to identify ongoings in the surroundings and future fashion trends, and adapt their creativity to that.

Fashion companies set marketing plans whose key component is creating models of garments of certain style, which is suppose to different them in regards to their competition and ensure the desired position on the market.

For marketing, as a business concept, of particular importance is the fact that the fashion products, for their customers, mean much more than their physical properties. Experts in fashion marketing know that for the customer very the important thing is identity and the image of product. They explore the motivations of buyers and product features that serve as the basis for the formation of product images and his style.

MEANING OF STYLE

The term style has a number of meanings. The term originally comes from the Latin word "stilus", which means a device for writing. A certain device was used for writing on wax-coated plates in ancient Greece and Rome. With time, the meaning of the term style, spread on the way of writing and expressing thoughts or a way of playing sports.

Authors who explored styles, offer number of definitions, coming from different aspects.
From the artistic point of view, "style is a set of characteristics of a work of art in which it differs from other works of art of the same type that originated in a narrow or wide area in a particular social environment and the specific historical, cultural, and economic conditions (2, 326-327)." Style is, therefore, a way of expressing the artists as individuals, art schools, courses or periods. If there is a known carrier of style, then the given style was named after them (Louis XIV, Elizabethan, Victorian, e.tc.).

From the aspect of the game and sport, the style is kind of performance, so the swimming style uses the term "free style", and certain teams are recognizable by their style of play on the field.

From the standpoint of psychology to have style is to have your own personality. A person recognizable by his or her style is not addicted to fashion, but instead carefully selects and approves only those elements of fashion that underlines his or her individuality. Style is, therefore, a reflection of personal choice that relies on taste. It is, also, a way of life of every individual, so therefore the style is actually the man himself.

From the technological point, style is related to the method of making the product, or the technology used for its making.

From the economic aspect of the product, style represents an appearance of products and a sense of that look from the buyers perspective (7, 25). Recognizable style does not always include high-performance products. When it comes to the product, style is mostly expressed through the construction, as a key of the design process. Through the means of construction, the shape is formed as is the size of the product, and it is said that the shape of the product, in fact, is one's interpretation of the style, and the way to combine line, form and color.

The range of products is manufactured in number of styles. Style expresses the diversity that is hard to copy.

According to Đ. Dorfelsu (1.69), some aesthetics point out that the style has two meanings. According to the first, style is a general category, or absolute value. Style is absolute, or eternal value, meaning it’s a model and steady quality. Other meaning suggests that the style is a variable value, which is mostly related to fashion products, such as clothing, furniture, etc.

In the past, big styles ruled that marked features of products. Powerful styles such as Baroque, Rococo, Empire, Gothic, Biedermeier fashion and other, even today in modern times have their tracks. Secession, as a style was dominant at the turn of the 19th to 20th-century.

The styles varied in size, shapes, colors, ornaments, fabrics, method of preparation, and the use of the product (9, 67).

Today's product creation, marked mainly in the form of geometric shapes of the body (pure form), irregular surface or aerodynamic properties.

Proceeding from the above-mentioned meanings of style, we can make a common denominator, and that is that the style is primarily a way of expression (manifestation, presentation, presentation), construction or appearance, especially in the arts, but also sports, as well as creating a product.

MEANING OF FASHION STYLES

Fashion Style is primarily prevalent form of clothing at a time period. Often, fashion style got the name after a direction in art (Renaissance, Baroque, Empire, Gothic, Romanticism, etc.). Likewise, fashion styles get the name after the mass social movements such as pop, hippie, punk, etc. The name can come from the similarity in shape (forms), apparel (crinolines, S-silhouette), or by which creators it can be recognized (K. Lagerfeld, K. Chanel).

Fashion designers are responsible for creating new styles. They continually engage in research of unexplored possibilities of form, texture, fabric, color and ornamentation to express new ideas. How much these solutions will be successful in aesthetic and functional sense, depends on their inventiveness, sense of fashion trends and constant readiness for art "game", or drawing inspirational paintings, drawings and sketches. Their aesthetics often arises from imaginative transformation of shape during time. Flow of time offers plenty inspirations. According to Dorfels (1, p 100) beauty, harmony and wealth of forms, details and ornamentation in the fashion clothing, antique furniture and cultural heritage in general, are part of the universal lasting harmony that offers an inexhaustible source of opportunities for creation. Art of switching and combining highly stylized ethnic motifs and modern, even futuristic shapes or forms that are also derived from old forms -leads to always having new fashion solutions.

However, the skill of the designer stems from the ability to recognize all the social and cultural trends, and future fashion trends, and based on that adapt their own creativity and express through the creation of new styles of fashion products or improve existing ones.

GFK Institute of Ninbetg (4.82) explored the types of people –buyers of fashion clothes in the countries of the EU and made the classification of sixteen so called euro styles, which can be classified into four major groups, namely:
a) dendies, rockers, activists, careerists-fashion apparel shoppers that tend to change and are willing to pay a higher price.
b) suspicious, funky, careful, romantic and Defansive-fashion apparel buyers that are willing to pay high prices, but are very loyal to certain quality-style, brand, or manufacturer.
c) altruistic, alternatives, and Contras –buyers subjected to frequent changes and sensitive to price fashion apparel.
d) good citizens, gentlemen, good neighbors and Puritans-buyers who are not willing to pay much, but they are committed to quality that they once embraced.
In this sense, it is necessary to use the results of the lifestyles of individuals, which are manifested through their activities, interests and opinions. According to Kotler (7,116), lifestyle reflects something more than a social class of a particular person, on the one hand, or her personality, on the other. Some of the members of the same social layer would wear old-fashioned clothes, the other will be play sports or hiking, some will prefer clothes from high fashion district, others will want a comfortable, but informal clothes, etc.

The greatest success of the fashion designer is manifested in their contributions, and recognition in creating fashion brands. To be permanently recognizable, it does not stand for sticking within one style. Creativity of the designers is constantly pulsing, fashion experiments begin already in the final stage when the fashion product receives the fourth dimension, or when the use becomes a communication tool and a reflection of one's lifestyle (1,101).

CORRELATION BETWEEN STYLE, FASHION AND DESIGN

Designing fashion products, creating a style and the emergence of fashion are interconnected and conditioned activities. Design represents a strong creative background for the emergence of style and fashion. Fashion designers create products of a certain style, that when they experience success with customers became fashion. All major styles of clothing, furniture, which have been widely accepted, they became fashion. Styles are numerous, but the number of fashion is restricted. Fashion, therefore implies a strong design component, particularly for fashion apparel.

Fashion is any style that is widely accepted by the customers in a particular time frame. Fashion is always based on style. Style becomes fashion when it has been accepted by the buyer. Some of the styles can last a relatively long time, but fashion is susceptible to changes. Fashion is, by its essence, a change, defined as a series of short-term trends and hits. Success of fashion companies in the market is caused by the creation of such a style for which there is a high degree of probability that it will become a fashion. From this reason fashion has been for a long time a subject of interest not only to the avant-garde and idlers. Fashion today is a worldwide phenomenon and a major factor in demand, especially for such a great activity as the fashion industry is (4,3).

Fashion companies are very serious in approaching to the phenomenon of fashion, as evidenced by the existence of the Institute for prediction of mode, such as "Delphi" from Milan. In it, the forecasting fashion is based on three different aspects of research. Designers are conducting the first and important research. Some of them gather information about fabrics, others knitwear, line, colors, etc. Other aspect of this study, examine the sociological and psychological moments and the connection of fashion with this phenomenon. This is very important for predicting the color and lines that will be best received. The third area of research is based on the detection of events in other areas such as music, painting, film, graphics, etc…, which could have an impact on the fashion styles.

By designing a specific product, creating a distinctive style, fashion companies want to provoke interest among customers, who will buy fashion products. This will contribute to the mass-market sales and pave the way for the emergence of fashion.

For products in which the style and fashion is important, there is a cyclical nature, which requires that the phenomenon is studied and predicted. When the style is once created, it can be held in a few generations, winning and losing popularity. The cycle of the style shows that the interest for it is renewed for several times.

Fashion, as a currently accepted style, has also cyclical movement that resembles the life cycle of the product. It is considered that fashion goes through four stages, namely: diversity, competition, mass fashion and the decline of mass fashion.

In the phase of difference, a number of buyers show interest in something new and different that has appeared on the market.

In the phase of competition customers enhance interest in the new style, which leads to the emergence of new manufacturers of fashion products.
In the phase of mass fashion, the style is so popular that significantly impacts on producers to increase production.

Finally, in the decline stage, customers change their orientation to the new styles that have emerged in the market.

In the first stage of the fashion cycle, there are numerous styles emerging. Fashion companies are trying to launch a new style that is different from the existing one. Given style encounters, first to the acceptance of a relatively limited number of buyers. If other categories of customers follow the "bearers of fashion" it leads to style popularity, which in competition with each other, becomes fashion. In stage where style gains popularity, it is important to make it more accessible for customer categories with lower-income. This makes faster acceptance of the style possible, because the product is sold only in stores with the prestige, but also stores where the buyers are customers with average-income.

INFLUENCE OF THE EARLIER STYLE ON FASHION DESIGNERS

It is not excluded that some out of date style, later, within a few decades or centuries come back into fashion. According to Dörfles (1, p 68), a characteristic case art Nouveau or Liberty, as well as modernism –movement at the end of the nineteenth century, which raises again in the fifties in the twentieth century, though, in a slightly different form. In Italy, where the phenomenon was most pronounced, this style is called neoliberty.

A similar example is the return of the Gothic style in fashion during the nineteenth century in Germany, France, and particularly in the UK, and after centuries of pause. In field of dressing, the appearance of neogothic style in the eighties, in the past century, is identified in the appearance of boys and girls wearing mostly black color. Followers of a given style can be encountered today in the XXI century, in certain urban areas.

The famous fashion house "Certain style", created and offered to the market, a high-fashion lingerie based on the Baroque style of lingerie of the Empress Maria Anthonaete.

In the period of the Empire as a fashion style clothing is influenced by the Antique. Big cleavage is used in female dress, which is hidden with a shawl. Gradually the skirt was shortening, first showing the shoes, and then even the ankles. First fur coats and shawls from real cashmere were transported from Egypt to Paris. Fashion styles are starting to promote the fashion magazines that come out for the first time in the 1770.

Some fashion styles, although occasionally experience adjustments, remain essentially similar. They are called fashion classic. Women Chanel suit is largely an example of fashion classics, which are core elements of the jacket cardigan style and decorative ribbon. Chanel company shows same suit each season, but it remains essentially recognizable. Fashion classic stands for design and style of the product that has gained glory. Such fashion items are still white skirt, dark blue jeans, dresses, etc.

Also, there are known as the fashion hits or styles that do not last long, usually for only one season. An example for that is the tiny shorts, known as "hot pants" that appeared 70-ies of the last century.

Some theorists of fashion and styles argue that, in the twentieth century, there were no major fashion styles, but only more or less successful imitation and combination of individual features of fashion styles from the past.

Social movements in 20th century and their influence on fashion styles and trends. At the beginning of the 20th century, largely was dominated by fashion trends from the previous period (http://moda.pushitmagayine.com/moda blog / me). In this period appears Art Nouveau style, which had an impact on the fashion of clothing as well. Instead of the skirts in the form of a bell, a suit in a shape of the holster was designed, which gives a slim figure look. In fashion are big hats as well.

In the year of 1913, fashionable clothes are inspired by Botticelli's paintings. Fashion creations now have released the waist. In this period, an important role is played by Japanese style of clothing. The clothes based on the kimono, turbans, wide screen and playful colors are being designed.

During the World War I, the role of women in society is changing, which leads to changes in fashion and clothing. Clothing extravagance, in accordance with the drama of time, is reduced.

After the World War I, jazz music, dances, Tango and Charleston, cars, swimming, etc., become very popular. Accordingly, clothes are being created, that resembles the male costume. It becomes extremely interesting and a unique style of clothing. It even emerges the style of clothes for swimming.

Art or style of Art Deco, influences the fashion clothing. Designers are more interested in art as inspiration. Given style promotes the unification of harmony and harmony of movement in one system. These are the styles of Surrealism and Futurism.

The main feature of the fashion styles in the period 1930-1945 was clothing with accentuated shoulders. An attempt was made, to emphasize broad shoulders with powerful visual accent. Some say that this is the period of return to femininity, as opposed to the previous period when the youthful and sporty look was desirable. Skirts become longer, a waist again emphasizes femininity. For this purpose, the straps of leather, or of the same material as the skirt, were used. Skirts were in a shape of the bell. Until the late 30's, the hats were worn.

The development of technology has contributed to the emergence of new materials and new functional and fashion accessory-zipper. Fashion designer, Elza Schiapireli, is responsible for the popularization of viscose, the zipper and the first boutique that was selling clothes. She was inspired by Dali's surrealism paintings, who designed textile patterns for her. While the famous designer, Coco Chanel, created functional clothing for the modern, working woman, Elza Schiapireli weighed decor, imagination, and that ancient thing about fashion. Her provocation, joke and theatricality was later taken over by the famous designer Karl Lagerfeld. Elza sought to unite art and fashion, which will then be continued through the work of Yves Saint Laurent.

Film Center of Hollywood and fashion styles in this period become dependent on each other. Popularity of Greta Garbo and Vivian Li, and their films was huge. Waredrobe of these big movie stars are increasingly copied. A new fashion house appears, headed by Nina Richie. Her models had the feeling of elegance and confidence, without provocation and experimentation.

Styles and trends in the period 1945-1960, reflects the use of nylon as a fabric, and elements of petticoats, when it comes to women's clothing. In the year 1947., a new fashion house is established, headed by Christian Dior, which brings huge changes in fashion and clothing. He launches a new form known to America as "new look". The waist was accentuated, shoulders are softer and skirts are long and wide, clinging to the upper and reinforced hips. Shoes are more rounded and closed, but their heels are becoming pointed. In the year 1952, on fashion scene arrives a famous designer Givenchy, opening the haute couture boutiques.

In this period comes a revival of Edvardian elegance of the early centuries, embodied in the new retro-style and recognized over the popular "Teddy boy look". Teddy is abbreviated name of Edvard. New fashion trend started in London 50's, and soon became the association of the American musical rock and roll scene. Teddy boys were teens who were wearing coats to the knee hight, known as drapes, tight jeans pants and shoes called creapers. They are responsible for the establishment of a new market segment, for the fashion industry-teenage market. Huge popularity of this fashion style has given impetus to the rapid development of pop culture and rock and roll. Combination of leather jackets a nd tight trousers, was the main feature of the young clothing of the period.

Fashion styles of the 60s, in the 20^{th} century are characterized by a multitude of different trends. Appearance and popularization of the bikini was closely tied to the popular James Bond films, such as "Dr. No" and "Beach Party". The fashion and clothing are strongly influenced by the sexual revolution that occurs in this period in the United States and spreads throughout western world. These years a fashion icon, known for its elegance, is Jackline Kennedy, wife of the murdered man, and a favorite president of the United States John F. Kennedy.

In 1964, a revolution occurred, perhaps the greatest in the history of fashion and clothing, caused by the British designer Mary Quant, with its famous mini skirt. Very quickly, mini skirt will be an indispensable garment of young girls in the United States and Western Europe, but also in the former SFRJ. In the time the fashion A- line was still dominant, which was launched in the 50's, by Christian Dior.

The end of the 60s, was marked with the hippie movement, that influenced clothing and fashion trends of young people across the world. The extended trapezoidal pants were worn. Elements of clothing from the East, such as a scarf, and Gipsy look, look Africa, etc., were very popular.

In 1965 Yves Saint Laurent has launched "Mondrian look", and in 1966 "Pop Art look". Mondrian is the most representative of the artistic movement of neoplasticism. Art, again becomes the inspiration and motivation for fashion designers.

Yves Saint Laurent, in Paris 1968., promotes a new look based on the pants, which had previously been taboo in public. He creates a safari suit that represents the transformation of a functional hunting clothing in urban clothing.

In these given years, Pierre Cardin has a futuristic style of clothing. His geometric and simple designs are, above all, functional and custom designed for apparel market (supporting collection). Pierre Cardin will be remembered for having changed the men's clothing that has not been redesigned since the French revolution.

In 1966, Pacco Rabanne founded his fashion house and shocked audiences by using new materials.
The 70's, are starting fashion trends that are transmitted from the late 60's, from which the most notable is the hippie style. Hippie fashion has the use of Eastern and India fabric shawls, promoting the ethno-look and going back to nature. The long hair and hand-made clothing are in style. It is a time of jeans and fashion elements with unisex characteristics. Jeans are presented as a kind of clothing that does not know the age, gender, class and national boundaries. Almost everyone-from students to folk singer are wearing T-shirts with short sleeves and jeans pants.

The most important fashion designers of the 70's in the 20th century, are the Japanese Kenzo Takuda and a Frenchwoman Sonja Rykiel. Takuda drew his inspiration from the world's resources, combining folklore of East and West with a clear knowledge of what kind of clothes was needed for the young people. His style was simple, comfortable and combined with esoteric performance of Japan. He was fitting for the growth of demand for clothing that was created.

Sonja Rykiel has promoted the skinny women figure. She transformed sweaters and cardigans, which were known as daily wear for relaxing- in fashion at that time.

During the 70's, on the Italian and global fashion stage will approach Giorgio Armani and Nino Cerutti.

From this period comes the punk movement of young people who, in conjunction with the music, promote a fashion that will be named after them. Practical clothing, pins, needles, metal, become recognizable features of punk fashion. Given combination of music and fashion quickly crossed national boundaries.

Designer such as McLaren and Vivian Westwood opens their own boutique. British designer Vivian Westwood is credited for the fashion styles of punk and new ware that "emerged from the underground" and began to rule the catwalks.

Since that time, street fashion, punk, surfer and scooters -affect the fashion world and dressing of the young people.

The period of the 80's can be recognized by a mixture of different styles and the crossing of the national and regional borders. Fashion trends in the West are rapidly expanding and are being accepted throughout the world. New material appeared, known as Lycra or Elastin that quickly became interesting for fashion designers. In this period, the application of previously founded viscose experienced full expansion. Fashion shows began to appear on TV, winning such an important position in the society.

Designer who became famous for his experiments related to new materials was a Tunisian Azedin Ali who worked in Paris. His creations are worn by Tina Turner, Madonna, Naomi Campbell, and the first ladies Michelle Obama and Carla Bruni.

In the American fashion scene designers who play an important role in fashion are Donna Karan and Ralph Lauren. They are responsible for the new look of clothing associated collections (ready-to-wear), also known as casual. Lauren is particularly responsible for the popularization of sports apparel, enabling him to his influence extended to all social and age groups.

Norma Kamali is credited for popularizing jogging look, using short skirts, ankle warmers and sweat glands. That sporty look is reflected in the colorful and vibrant colors, shiny tights, Leotards, etc. Also, there are possible combinations with high heels and blazers.

Sports clothing is becoming more and more popular. The famous hip-hop group Run DMC, wearing sports clothes and the single "My Adidas" in 1986 strongly influenced the expansion and popularization of a trend of sports clothing.

Shoe designer Manolo Blahnic in this period became very popular.
French designer Jean Paul Gaultier uses new fabrics in trying to create clothes that will be functional enough for everyday use. He uses traditional elements like a corset, and his creations look like parts of the underwear.

Period of the 90's indicates the signs of post-modernism in fashion and clothing. In use are different, sometimes conflicting styles and historical and ethnic characteristics. There is a desire to emphasize physicality. This is most noticeable in women's suits of the designer, Galliano in 1996. Combining elasticity of synthetic fabric and decorative tattoos that have meaning in ancient times - something called "new" skin is formed.

Japanese designer Miyake created garments featuring traditional Japanese theatre. He applyes offbeat photo collages on women's dresses. Jean Paul Gaulteir is inspired with the artist Lindremen.

Vivian Westwood was using corsets and underwear, trying to highlight the new style of femininity. Her creations are worn by actors in the cult movie series "Sex and the City", recorded in 2008. They reflect the fashion style of modern, urban women in the West.

STYLES OF FASHION PRODUCTS IN CONTEXT OF MARKETING PROGRAMS

Marketing program and plans of the fashion companies, taken as a whole, include: marketing research, marketing mix program (development / design product, price, promotion, distribution) and sales.

Marketing research, in addition to the needs, demands and desires of customers, competitor analysis, price, and product – include a research of consumer behavior. Achieve comprehensive and keen insight into the behavior of consumers when buying certain fashion products, the choice of a particular brand, style and the place of purchase or to study the process formation of needs, desires, attitudes, motives, gaining experience and learning, to study environmental factors, such as social groups, layers, the mobility, etc.-means to deepen market research to a level that will improve the efficiency and effectiveness of the marketing plan, program marketing activities fashion companies (5,115).

Marketing mix program includes a set of elements or a combination of fashion and other companies use to realize their marketing goals. Given elements are known as the "4P" are: product (product); price (price); distribution/location (place) and promotion (promotion). They are to meet four conditions:

- -to be adapted to the needs of the customer
- -to create certain competitors advantage
- -to have a well combined elements
- to be in line with the available resources of the company.

Fashion product as a key element of the marketing program must meet all sophisticated customers needs in order to be accepted on the market. In addition to that, the marketing components of the product are the object of attention and a sign of a serious marketing considerations and approaches to the customers. Marketing components are an integral part of, not only marketing but also business strategies of fashion companies. They are significant support of business strategies product and other elements of marketing programs (6, 117). These are the components of products that make a visible and an invisible force, such as:

- a built-in features of the product (functionality, durability, safety, comfort, etc..)
- a built in concept of quality (ISO standards, TQM;)
- design (material, line, color, style, ornamentation, shape)
- name of the product or brand

All these marketing components, as well as style fashion products are integrally connected and involved not only in politics products, but also integral marketing program that enables a synergistic effect of all elements of the marketing program.

Style or look of fashion products is an effective competitive tool that not only creates a preference among customers for the benefit of date fashion companies, but also in distribution and sales channels. Recognizable style, at the same time facilitates the promotion and establishment of prices. In this way style as a marketing and design component of fashion products, plays an important role in marketing programs fashion companies.

Improving the style is one of the main ways of differentiating fashion products in order to contribute to their favorable positioning in market. In addition to that, the emphasis is on the aesthetic components of the product design, and not on the functionality. High level presentation of products on the market is an important factor in his acceptance. A fashion product, which has an attractive appearance, not only attracts attention of customers, but also inspires confidence in his quality. Therefore, improving the style is focused on better aesthetic appearance of the product.

According to Milosavljevic (8, 163), style of fashion products creates the first, immediate impression on customers, and if it is not favorable, usually the sale doesn't occur. That why it is very important that the fashion company promptly felt the demands of changing styles and accordingly creates a new style of their products. In addition to that the marketing experts have to calculate the cost of changes to the style, as well as to predict the acceptance of a new style by the customers. If such analysis indicates that the fashion companys achieve projected profit, it can be accessed by changing the style.

Marketing experts try to uncover the connection between fashion products and customer-representative of a certain style of life. Style lives of individuals as customers represent the way in which they live and spend their money and time. Psychography is a science that has been measuring and categorizing lifestyles of buyers. She represents measuring basic dimensions of customer behavior, such as:

- activities (work, hobbies, social events, holidays, parties, clubs, community, shopping, sports).
- interests (family, house / apartment, community, recreation, fashion, food, media, success)
- opinions (about themselves, social issues, politics, jobs, economy, education, products, culture).

- demography (age, education, income, occupation, family size, place of residence, geographic location, size of the city; phase of the life cycle)

CONCLUSION

The common denominator of most definitions is that the style, first of all means of expression (manifestation, presentation, presentation), the structure or appearance, especially in the field of art, creating a fashion product, the personality of the individual, as well as sports.

Fashion designers seek to continually create products of a certain style, which, if they are widely accepted in the market are becoming fashionable styles, and current fashion. Styles are numerous, but the limited number of fashion styles. Fashion styles, therefore, imply a strong design component.The task of fashion designers and monitoring of cultural and general social events and trends in the environment and identify future fashion trends, and how to adapt their own creativity to that. The turbulent events during the past 20^{th} century had a pronounced influence on the design and fashion styles. Two world wars, mass popularity of movie, sports, emancipation of women, sexual freedom, new materials and technology, street fashion, hippie and punk band, popular music and painting Just some of the phenomena that reflected a lifestyle and fashion of the time.

It happens that some past styles through the decades or centuries re-enter the fashion. Some fashion styles, although occasionally experience adjustments, remain basically the same. They are called fashion classics.

However, the creation of fashion styles implies an important role of marketing experts, who, along with designers, work in fashion companies. Marketing experts know that the style of fashion products creates, first, an immediate impression on the customer, and if it is not favorable, usually, there is no sale. Therefore, it is very important for marketing researchers, sales staff and loyal customers, to timely receive or experience the indications for modifying an existing style, as well as to predict the acceptance of a new style of the customers. If, marketing experts through analysis determine the viability of a change of style, fashion designers will get a "green light" for their creative activities. They will design a planned range of products distinctive style and marketing experts will seek to thereby cause the interest of customers, which will begin to buy. That will contribute to the mass market, and thereby help for the given style to become a fashion.

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ACOUSTIC TEXTILES: AN OVERWIEV

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ABSTRACT: Acoustics is the interdisciplinary science that deals with the study of all mechanical waves in gases, liquids, and solids including vibration, sound, ultrasound and infrasound. The application of acoustics is present in almost all aspects of modern society with the most obvious being the audio and noise control industries. Acoustic is defined as the scientific study of sound which includes the effect of reflection, recraction, diffraction, and interference. The use of textiles for noise reduction is based on two major advantages of these materials, namely low production costs and small specific gravity.
In this study, acoustic textile materials have been investigated. The areas of use and properties are studied.

Key words: *Acoustic textile, Sound absorbing textile, Noise, Noise reduction, Acoustic panels.*

INTRODUCTON

Noise is an unwanted sound and most of the machines that have been developed for industrial purposes, for high-speed transportation, or to make life more enjoyable are accompanied by noise. Noise is an increasing public health problem. It can have the following adverse health effects: hearing loss, sleep disturbances, feel tiredness, cardiovascular and psycho physiologic problems, performance reduction, annoyance responses, and adverse social behaviour. Therefore, it is very important to control or reduce noise from traffic, and in factories, offices, and houses. Noise also significantly decreases productivity in various environments (1).

The problem of noise generated within the closed space can be particularly acute, but several practical solutions do exist. One of the important solutions is to use textile products that name is acoustic textile (sound absorbing textile) (2).

Acoustics is defined as the scientific study of sound which includes the effect of reflection, refraction, absorption, diffraction and interference .(3)

An acoustic textile must have acoustic properties in its own. It must be specifically engineered to absorb sound. In general terms, acoustic textiles fall in two classes of porous sound absorber (1) :

•Bulky, high-loft textiles, which essentially behave as a rigid, porous sound absorber.
•Lightweight, compact woven and nonwoven textiles that behaves as porous screen.

MATERIALS FOR ACOUSTIC TEXTILES

Porous materials used for noise control are generally categorised as fibrous medium or porous foam. Fibrous media usually consists of glass, stone wool or polyester fibres and have high acoustic absorption. Often sound barriers are confused with sound absorbing materials. Generally materials that provide good absorption are poor barriers. Unlike, barriers and damping materials, the mass of the material has no direct effect on the performance of the absorptive materials(1).

Stone wool: Energy of acoustic vibrations travels through the stone wool structure and transforms into the heat. The stone wool structure with its intertwined fibres simply eliminates and absorbs the vibrations in the air. Such fibre structure makes the stone wool one of the most reliable construction materials for acoustic insulation (4).

Polyester Wool: The acoustic properties of polyester wools are well known. These materials are more sustainable and recyclable than mineral wools and are less dangerous for users.(5)

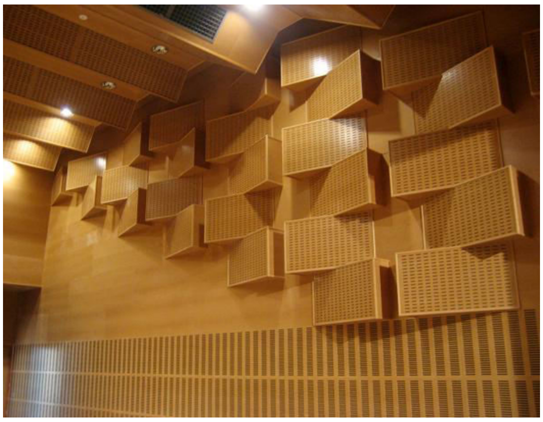
Glass Fibre: Glass fibre is a material consisting of numerous extremely fine fibers of glass. Glass-reinforced plastic (GRP) is a composite material or fiber-reinforced plastic made of a plastic reinforced by fine glass fibers. Uses for regular glass fiber include mats and fabrics for thermal insulation, electrical insulation, sound insulation, high-strength fabrics or heat- and corrosion-resistant fabrics. (6)

Nonwoven: Out of textiles, Nonwoven are preferred to use as acoustic due to its more porous structure ,more surface area and low cost of production. Use of recyclable raw material further reduced down the cost and like recycled PET. Renewable material is based on two alternatives for the production of ecologically friendly products and low production costs . From architectural point of view textile as an acoustic , good knowledge of textile material is required to control sound (1).

USE OF AREA

Textiles are used in many applications involving acoustics, including: (1)

- Acoustic panels (board) : An acoustic board is a special kind of board made of sound absorbing materials. Its job is to provide sound insulation. Between two outer walls sound absorbing material is inserted and the wall is porous. Thus, when sound passes through an acoustic board, the intensity of sound is decreased. The loss of sound energy is balanced by producing heat energy. They are used in auditoriums, halls, seminar rooms, libraries, courts and wherever sound insulation is needed. Acoustic boards are also used in speaker boxes.(7)




- Automotive: Car noise is essentially caused by the unit sound, the exhaust system noise, air-suction noise, rolling and wind noises. All the sources mentioned emit noise directly. While the major part of the sound energy and is spread outwards, some of it reaches the car interior via the body, the running gear or directly. The airborne-noise transmissions or those transmitted via the car interior appear in diverse ways, which partly influence each other. Both noise-reducing measures at the sound sources as well as specific interference the sound transmission mechanisms are important considerations in the achievement of low car noise levels.
  The car seats have large surface areas, and they even absorb airborne noise in low frequency ranges, if covered with an air permeable textile because of their thick moulded upholstery. The moulded upholstery of car seats is usually constructed using polyurethane foam. Moulded upholstery based on PET fibres, are still in the stage of development (1).

- Curtains

Quiet Curtains are particularly well suited to the following types of rooms:

- Lofts
- Houses
- Residential & Commercial
- Classrooms (e.g. band practice rooms, special education classrooms)
- Auditoriums
- Meeting/Conference rooms
- Churches (stage, sanctuary, children's rooms)
- Home theaters
- Vocal booths
- Dance studios
- Home recording studios
- Restaurants
- Hotel & Motel Rooms
- Medical offices
- Hospitals
- Counseling offices (8)

- Millitary: Sound-absorbing functions or the suppression of unwanted noise are often an integral requirement of equipment and clothing for military use. the noise created by equipment must also be controlled and minimised depending on their areas of use. Active noise protection prevents soldiers from being detected prematurely by electronic monitoring systems or enemy soldiers as a result of crackling or rustling combat dress or grinding boots when nearing their intended target. The “acoustic camouflage” of combat dress is therefore an important addition to the classical camouflage print.(9)

- Architectural design.
  Architectural acoustics (also known as room acoustics and building acoustics) is the science and engineering of achieving a good sound within a building and is a branch of acoustical engineering.
  Architectural acoustics can be about achieving good speech intelligibility in a theatre, restaurant or railway station, enhancing the quality of music in a concert hall or recording studio, or suppressing noise to make offices and homes more productive and pleasant places to work and live in. Architectural acoustic design is usually done by acoustic consultants(10)

Theatre, Beijing (11)

Maglev Train Station, Shanghai(11)

Woodland Station MRT, Singapore (11)

RESULTS

The need for soundproofing and acoustical room conditioning has been growing dramatically during the past few years. Noise pollution is out of control in our expanding cities and suburbs. Numerous studies have shown the adverse effects of noisy environments on sleep, learning, productivity and the overall quality of life. A closely related problem is improper room acoustics where reverberation, echo and noise reflection interfere with the comfortable listening of voice or music (8). If we are protected from negative effects of noise, we have to take precautions. One of these precautions is to use acoustic textiles.

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ELABORATION OF TEXTILE MATERIAL FOR RESPIRATORY PROTECTION

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ABSTRACT: As a result, the analysis of security of the organism against negative environmental influences was pointed scientific objectives and chosen object to study. The article provides an analysis of the impact of the environment on the human respiratory system and the body as a whole. This led to the classification and range of protective equipment, made recommendations to the use of respiratory protection from the negative effects of the environment, depending on the operating conditions. The paper presents examples of masks that we developed for further research and introducing them into operation.
Set targets and identify areas for further study and design of individual means of protection from the effects of the environment. Were held analysis and classification of adaptability of respiratory masks as individual respiratory protection, depending on their specific application. Actual ecological situation related with air pollution and industrial waste of water causes the necessity to develop new technologies, the use of cheap filter elements that allow multiple regeneration.

Key words: filter materials, structure, knitwear, ecology, protection.

INTRODUCTION

In a wholerange of textile manufacture, textiles for protection of human respiratory stand on special place. Today air pollution by industrial and automobile exhaust fumes causing irreparable damage to the human respiratory organs. Even difficult to say who suffers most, residents of cities, cyclists, traffic police, or people whose work is directly related to the constant movement of the city.

Nowadays the production of textiles for respiratory functions is quite profitable area in which there is a possibility of increasing the volume by replenishing therange of new types of products. Due to its properties that distinguish jersey from other textile materials, it is used in the production of various fabrics: technical (air filters, barriers, reinforcing fiberglass in the automotive, aviation and agriculture branches), medical (sanitary ware clothing for patients with special properties, compression preventive products - tights, stockings, socks, bandages, bandages and belts that have varying degrees of pressure, sanitary napkins, clothing for medical personnel, materials and products for common-medicine: gauze - hemostatic, multilayer, gypsum and simple, dressings, materials for compression of medical action, therapeutic lingerie and underwear to prevent occupational diseases, surgical materials: suture materials; implants - dentures various vessels, meninges, larynx, ear shells, abdominal membranes, artificial tendons etc.; other materials for cardiac surgery, fixing materials, filter materials).

Knitted cloth is more widely used for sewing for sports, tourism and active recreation. The peculiarity of these products is that they are directly adjacent to the body.

Nowadays, thanks to the emergence of new non-traditional commodities, there is a tendency to look for opportunities knitting equipment in the production of technical and medical knitted fabric.
The special attention of scientists to studying the influence of the environment on human respiratory organs, led to the realization of their exposure to modern types of diseases. Insufficient range of respirators and amount of information about ways of respiratory protection results the multiple respiratory diseases of human. Improving the quality and expanding the range of consumer goods - one of the main tasks of the economy of any country. In a market economy, quality products largely determine its competitiveness. The range and quality of textile products, is inextricably linked with the material and cultural standard of living.

Today the consumer does not have enough choice of respiratory protection, although the demand for this product is growing every day. Consumer quality of human respiratory protection greatly depends on the material and technology of their production.

Creating a filter material that combineshigh performance with high holding ability is the most important task at present, which contributes to the successful solution as the right choice of designs filter system, filtration process conditions and by the choice of filter material. Depending on the purpose and size of the input and output concentrations filters conventionally divided into three classes: fine filters, air filters, industrial filters.

To ensure adequate respiratory protection is necessary to have information on the composition and concentration of hazardous substances polluting the air and clearly understand the purpose and limitations in the operation of facilities for respiratory protection. It is necessary to take into account such factors as the state of health of the user, the degree of physical activity, time spent in the contaminated area, the need for freedom of movement, temperature and humidity, the individual characteristics of the user, possibility to provide remedies. Requirements for most respirators set forth in the standard.

At the core of porous filters of all kinds is the process of gas filtration through the walls, in which solid particles are trapped, and the gas passes completely through them. Filtering partitions varied in structure, but they are composed of fibrous or granular elements and are divided into the following types: flexible porous walls - woven materials from natural, synthetic or mineral fibers; Nonwoven fibrous materials (felt, glued and punched materials, paper, cardboard, fibrous mother); mesh sheets (spongy rubber, polyurethane, membrane filters); semi porous membrane; rigid porous walls.

Currently, for the manufacture of filter elements, a broad range of synthetic polymers. Along with polyethylene, polypropylene, polyamide and polyester fibers advantage of using thermoplastics that are very suitable for extrusion processing, which makes it possible to obtain single thread or yarn.
The most common means of filtering gases or steam are activated carbon, which has a huge internal surface and is able to hold molecules of organic vapors. In order to keep the molecules or inorganic acid gases, or ammonia, activated carbon is subjected to an appropriate chemical treatment [Vincent J., 2006]. Filtering elements with activated carbon having no life indicators should be used only to protect against gases or vapors, which have evident identification characteristics.

RESULTS AND DISCUSION

Perform basic functions of respiratory protection can be achieved by performing a thickness fabric, combination of materials, multi-layer structure. Recently there was a question in the development of multifunctional textile materials, layers which would be diametrically opposite properties. There are several ways to get the desired result: 1) a combination of materials with different properties in the weaving or knitting; 2) creation of multifunctional multilayer composite textile material layers are made of materials with different properties.

In order to identify functionality of bicomponent jersey formed from materials with opposite hygroscopic properties we selected two-layer jersey. During respiration between the body and the respiratory mask there is condensation whichneeds to be removed to bring comfortable feeling. Therefore, the inner layer of samples is responsible for the excretion of moisture and external - for filtering and absorbing. (Fig. 1)

To develop experimental models of knitted fabrics used roundknittingdouble needle-holder machine "Bentley", which is designed to produce linenlastic, bilastic, forging,jacquardand combined weaving and has 24 knitting systems.

One of the important properties of the filter fabric is resistant to physical and chemical effects of water vapor, high temperature, acid, alkali and other chemicals. Most textile fibers characterized by high resistance to various physical and chemical effects. Certain types of fibers exhibit these properties in different ways [Nikolaev S., 2001]. For example, the moisture has little effect on synthetic fibers - polyester (PE), polypropylene (PP) Polyamide (PA), polyvinyl chloride (PVC). When wet extensibility of all types of fibers, with the exception of a number of synthetic increases in some cases up to 25-30%. Strength when exposed to water increases only natural cellulose fibers - cotton, elementary flax fibers, hemp fibers in the other species, with the exception of certain plastics, synthetic fibers - viscose, copper-ammonia, acetate and protein fiber strength is reduced by 40-60%.

Figure. 1 - Production of textile samples of respiratory masks based on two-layer knitwear

Most textile fibers are not affected by water and steam of temperature under 100 °. Influenced by light and nature fibers due to oxidation processes gradually are getting old, resulting in a decrease in strength and elasticity, increased hardness, brittleness and fragility. Found that the most destructive light and nature affects on silk fiber, and the most stable in this action is wool and fiber of nitron.

Figure. 2 - feedstock used for the production of two-layer knitted fabric samples

Most textile fibers satisfactorily tolerate temperatures of about 120-150 °, and when moisture and higher temperatures. However, synthetic fibers - nylon, PP, PE, etc. - is thermoplastic, it means with high temperature they first deformed and then melted. Therefore, products made from these fibers or mixed with other fibers, can’t be exposed to high temperatures.
Acids, alkalis and other chemical reagents consumed in the processing and use of textiles, textile fibers acting on differently. Satisfy most of the above specific requirements can only materials with synthetic strings.

The most commonly used linen with polyester, polypropylene, nylon yarns. For sample making, as a hydrophilic type of raw material used yarn whose composition - 34% cotton, 33% linen, viscose 33%, as well as hydrophobic - polypropylene multifilament yarn complex. The combination of natural and synthetic materials as a result gives different kinds of masks for different conditions (see Fig. 2).

CONCLUSIONS

As a result of the research and analysis of the impact properties of textile materials, knitted fabrics on quality indexof products from them, has been developed and manufactured dual-layer jersey respiratory masks for human respiratory protection from exposure to harmful substances. Was analyzed the range of protective masks for sport and domestic purpose.

Tasked with designing means of protection of human respiratory, upgrading existing samples on market by application or proposal developed weaves and new raw materials and study the basic properties of samples and the development of multifunctional textile materials with layers with diametrically opposite properties.

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PARTICULAR PROCESSING AND FILTRATION EFFICIENCY OIL FILTERS IN A COMPACT APPLICATIVE HYDRAULIC SYSTEMS

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ABSTRACT: During the process planning component parts of internal combustion engines and other hydraulic systems, there is a backlog of producing and contaminants, which are manifested through various particular (metal shavings as products of machining and wear debris sticky components due to the use of inadequate funding for cutting and cooling products exploitation, accumulation of dust, debris manufacturing processes (casting, forging, various machining, heat treatment, and many other substances.

In addition to the presence of various contaminants, treatment processes caused by the components of the hydraulic system during operation can occur and an additional oil contaminants, such as the products of wear, water, fuel and air.

In the developed world have different construction solutions oil filters, using the appropriate new materials with the possibility of variable decontamination of solid particles, water, fuel, air and so on.

This paper provides a brief overview of processing contaminants in general hydraulic systems. U for efficient filtration are shown in a compact solution filter cartridges of various synthetic materials and different weaving density. The paper gives a brief overview of formation and classification of contaminants, their size and the efficiency of purification by application of hydraulic systems, with less emphasis on internal combustion engines

Key words: Cloth, Filter, Contamination, Purification, Oil, Engine

INTRODUCTION

During the process planning of hydraulic components, manifested in different contaminants in the form of a variety of metal shavings, residue adhesive components due to the use of inadequate funding for cutting and cooling, accumulation of dust, debris cells foundry sand cores and carbon from the forging process, the presence of water, air and other substances. Despite technological procedures prescribed in order to remove these contaminants, or minimize, one of the remains of the parts in the process of working these contaminants could enter the lubricating system and thereby jeopardize the proper functioning primarily through various forms of mechanical damage (erosion and abrasive wear, stamping, cavitation, etc.).

If we observe the internal combustion engine whose operation is conditioned by the presence of lubricating oils, complex technological presence in the production of engine components globally is based on the application of the following methods: casting (in the sand and molds), forging, various machining (scraping- fine and coarse, milling, planing, grinding-fine and coarse, drilling, reaming, lapping, honing, polishing, shaving), metal works (pressing, bending, pulling, punching, welding (electric, gas, brazing and soldering), thermal treatment (hardening, improving, cementation, release, nitriding, annealing, carbonation, normalization), sintering, methods of removing impurities (use of compressed air, degreasing, cleaning, conservation, protection and paint finish, aging), packaging, storage, transport and other operations.

The very fact of such a large number of representation of technological processes in the development of components of fluid systems, and thus the engine, leading to virtually impossible situation that the manufacturer, in entirety, can free particular caused by impurities despite the use of different methods of washing and decontamination of components. In addition to the presence of impurities, caused by the processes of the processing components of the motor, during operation can occur and an additional oil contaminants, such as the products of wear, water, fuel and air.[1]

All that said, when it comes to the engine, that it must have a compact integral oil filter. The main part of the oil filter is filtration material, which may be manufactured from a variety of materials envisaged for this purpose, that fully satisfy the required characteristics. This paper presents a brief analysis of the formation and classification of contaminants and several possible solutions to creating compact oil filter for internal combustion engines and other hydraulic systems.

MECHANISM, PROCESSING AND CONSEQUENCES OF OIL CONTAMINATION

The lubricating oils of aggregates can be found many kinds of contaminants, such as particulate matter, water, fuel, air, and other materials and their volume percentage, and the mechanism of their action in the oil is very complex and mutually correlative process. Dissolved air is seamless in oil, but it can affect the performance of an oily film. The insoluble oil in the air is dispersed in the form of bubbles. It accelerates the chemical degradation of the oil, the local heating oil, reducing the strength of oil film between the contact surface and leads to aeration wear. Changing the state of the air in the oil is particularly important for systems with sliding bearings. Examples include internal combustion engines, in which, in the bed, forming two zones - the low pressure zone and the zone of overpressure.

Speed separation of air is defined during movement of air bubbles through the oil mass to the surface where it creates the foam. Bubble foam must create the conditions for rapid bursting period that is shorter than the mechanism of forming new bubbles. This is achieved by the provision of the natural characteristics of oils and additives the action of the so-called. defoamer to reduce the surface tension forces of the foam membranes.[1],[2]

Water in oil has negative impacts on the oil mass and the acceleration of the process of corrosive wear. In highly additive oils, the water may be eluted and the additives. Negative effects on the oil in particular a process manifested by the creation of a solid milky emulsion-yellow color, more quickly increase the viscosity and the creation of acidic compounds in the oil. In some cases the emulsion was transformed into a high viscosity paste.

Lubricating oil, and other oil, must have a high degree of resistance oil molecules to the molecules of water and good demulsibility feature. Different base oils and base chemistry have varying degrees of tolerance in relation to the present water.

Oils with higher additive content have weaker demulsibility characteristics, which affect the intensity of mixing water and oil.

The solid particles in the oil to occur due to impurity components of the system lag, lack of sealing in the environment, or as a result of wear of the sliding surfaces are lubricated. These particles can be classified into groups and divide to form, composition, hardness, chemical composition, size, solubility in oil and electrical conductivity.

The oil can be in solid particles sized from 1 to 100 μm, sometimes more so you can register them and the human eye (from 25 to 40 μm). [9][6]

Solids present in the oils can be divided into:

- micro-particles 1 to 3μm,
- the finest particulates 3 to 5 μm,
- the fine solid particles of 5 to 20 μm,
- coarse solid particles 20 to 50 μm,
- dirt than 50μm.

Solid particles are mainly multiangular, ellipsoidal, plates, foam, stars, wedges and fiber. Rarely are round in shape.

All cases of contact of solids with contact surfaces of mechanical components, can be classified into three main types that form the shape of the kinematics wear erosive, abrasive wear and embossing.

Most adverse effect of particulate matter in the clearance area under load that are in relative motion. An example is the piston engine assembly in which there is a gap, variable normal force and movement of the piston.

The intensity of wear surfaces affect the hardness of surfaces and solids, size gap and the size and shape of the solid particles.

Particles smaller than the gap, probably, will not damage the sliding surface, but those particles that are approximately the same size gap, roll or slide along the clearance and intensive acting on the damage area as a function of time of work (Fig. 1).

The oil should not to find solid particles whose size is above 1/3 the size of a gap.

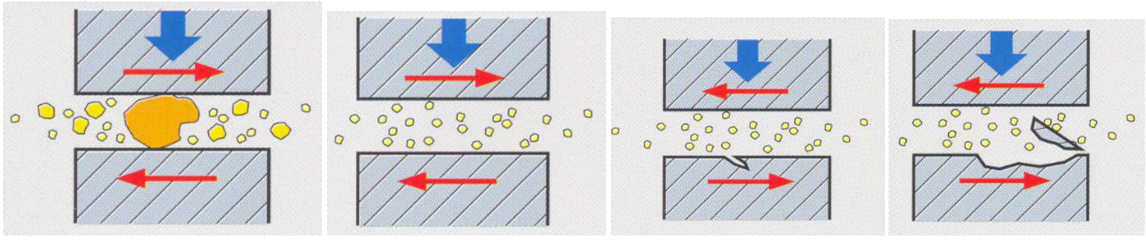
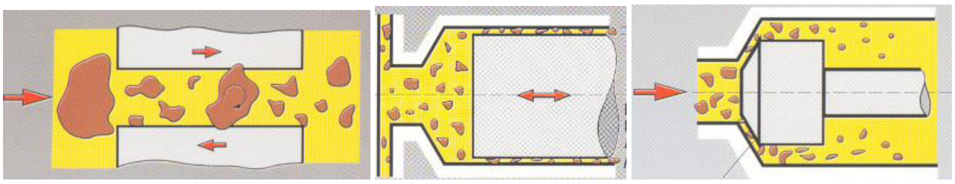


Fig. 1: Possibilities and effects of the initial damage to the hydraulic components due to oil contamination[1]

In some specific cases, in some systems that require oil for lubrication, contamination effects can be, depending on the relative motion of the components and pressures which vary during operation (Fig. 2).



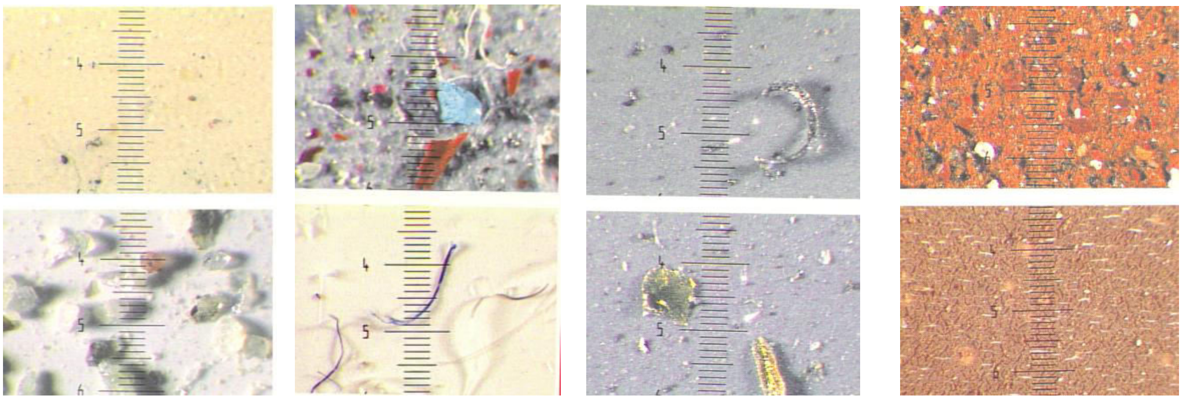
b) b) c)

Fig.2.Options damage some systems due to oil contamination

a) radial piston ring damage, b) damage cylinder and piston in the zone of low and high pressure, c) damage to the valve seat.[1]

CLASSIFICATION CONTAMINANTS

The introduction of the possibility of these contaminants in the preparation of engine components, but new contaminants occur and during the operation of engines, and mobile units where the motor is applied. Size of contaminants may be very different, both in terms of size, shape, and type. Microscopic appearance of some contaminants is shown in Fig. 3.[6] [9] [5]



a) b) c) d)

Fig. 3. Possible types of oil contamination.

a) contaminants in the form of metal shavings (top); contaminants chip paint and gel (bottom)
b) colloidal particular (top); particular based synthetic fibers (bottom)

b) Possible contamination by metal shavings

Looking at the diagram in Fig. 4, in terms of the degree of oil contamination and impact on further economic justification for the exploitation of the hydraulic system, it can be concluded that the diagram can be divided into three zones:

-Zone with enormously large amount of particulate matter (left side), which is, in effect, further work is very critical and, in a short period of work, we should expect more failures and breakdowns of individual components;
-Zone economic viability of labor, in which the system can operate reliably (middle part of the diagram),
-Zone where almost no solid contaminants (right side), which is in fact the most desirable but practically impossible given that it is unrealistic to expect any hydraulic system without the presence of solid contaminants, even if they were minimal in terms of size and number of particles.

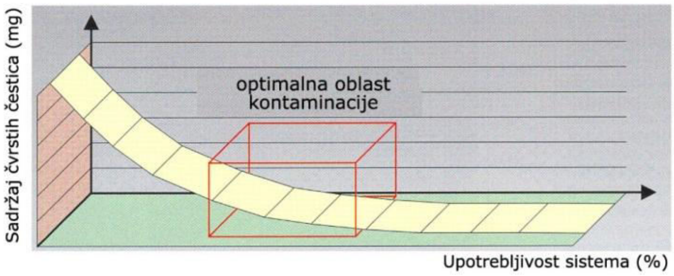


Fig. 4. The optimal field operation of hydraulic systems, depending on the amount of solid contaminants

Criteria for evaluation of the purity of the oil defined by the number of solid particles of a certain size in a volume of 100 ml oil sample, that is, 1 ml, regardless of the origin of the material and the shape. Number of measured particles classified into the class of (codes) which are related to the number of solid particles of certain size parameters.

In the world there are several standards that are classified according to particle size. ISO 4402 (the old standard), which defines the sufficient facilities of solid particles 5 and 15µm, respectively 2, 5 and 15 µm in 100 ml of oil. ISO 4406/1999 (new standard) defines the allowed contents of solid particles the size of 4, 6 and 14 µm to 1 ml of the sample oil.[6]

There are other standards for the classification of particles, such as, for example, the American NAS 1638, which defines the class of purity of the oil in relation to the solids content in the range of 2 to 5; 5 to 15; 15 to 25; 25 to 50; 50 to 100 µm and more than 100 µm. The new standard NAS 1638-01 / 1964 defines 16 classes purity of the oil.

There is a standard SAE AS 4059: D[14][13]

FILTERING CAPABILITY AND DEVICES FOR THE TREATMENT OF OIL

The world's developed special purpose different mobile and stationary structures filter oil. Some of them, in addition to the solid contaminants, with the possibility of contaminant the decontamination liquid (fuel and water), and can be used in various hydraulic systems.

Manufacturers of filter cartridges, are forced to find opportunities in terms increasing degree of filtration of solid particles, and the last time, and liquid contaminants (water, fuel, etc.), With the application of new technologies and new materials.

The oldest, but also the least efficient in terms of the degree of filtration, the metal filters. They are, usually, in a shape of a cylinder with a different perforation, and in terms of their efficiency filtration the particle size may be 50, 100, 150, 200, 300, 500, 1000, 2000 and 3000 µm. However, the trend of the last few year, such filters, was very progressive and they are, their structures and internal structure, have reached an enviable level of degree of filtration.

In Fig. 5 is shown in several different types of filter elements, that have the possibility of different applications and the degree of filtration of solid and liquid contaminants.

a) b) c) d) e)

Fig. 5. Several types of filter cartridges of different applications and the level of filtering

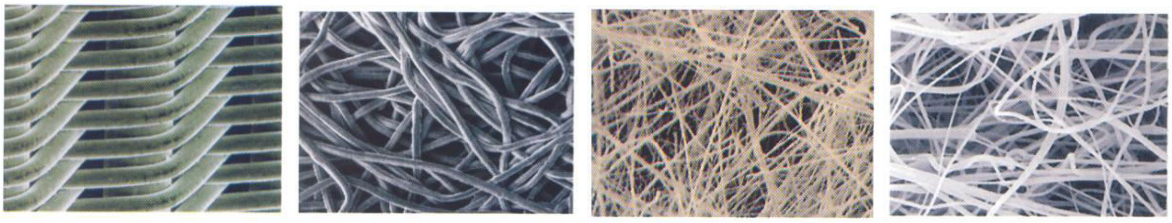
Fig. 5a, Typ-Betamicron, made of multi-layered inorganic materials-glass fiber, the range of filtering 3, 5, 10, 20 µm, the application of pressures above 210 bar, the label BN3HC, BH3HC.

Fig. 5b, Typ-Aquamicron, filtering capacity of water is 2.2 lit., used to lower levels of filtration ranges up to 40 µm, the application of pressures above 10 bar, the label AM

Fig. 5c, Typ-Betamicron / Aquamicron for high levels of filtration, range 3, 10 µm, filtering capacity of water is 2.2 liters, the application of pressures above 10 bar, the label BN / AM.

Fig. 5d, Type-S-elements are used for suction systems above 1 bar, the range of filtering 75, 125 µm, the label S.

The structure of the filter elements may vary, based on type of material, and the workmanship, and of those factors mainly depend on the degree of filtering oil (Fig. 6).



a) b) c) d)

Fig. 6. Microscopic view several runs structures filter elements

Fig. 6a, the filter element from the wire mesh with the possibility of purification, the range of filtration 25, 40, 60, 100, 150, 200, 250, 500 µm.

Fig. 6b Typ Chemicron authentic of metal fibers, three-dimensional structure, with a high degree of filtration and for the convenience of the use at high temperatures (> 400^{0}C), the range of filtration: 1, 3, 5, 10, 20, 25, 30, 40 , 60, 100 µm.

Fig. 6c, Typ Betamicron composed of inorganic fiber mesh, with a high degree of filtering, band 3, 5, 10, 20 µm, with a low cost price.

Fig. 6d, is used for helical filters (filters in the form of a truncated cone) with the fibers of polypropylene or polyester in the form of dense and porous structure, range of filtration 1, 3, 5, 10, 20, 40, 50, 70, 90, 100, 120, 150 µm, is used to lower the pressure and the temperature to 80^{0}C with fibers of polypropylene and up to 100^{0}C with the fibers of the polyester. [1][6] [3]

AUTOMATIC SELF FILTERS

There are also automatic self-cleaning filters, which, on the basis of a pressure difference, as measured by a differential pressure gauge (encoder), the low viscosity oil, or other fluid (of up to 50 mm^2 /s), changing the direction of fluid flow, exert a certain degree of purification of soiling, whereby it automatically changes direction of flow and shall be self-cleaning and filtration process is not interrupted while the contaminants are deposited in special containers (Fig. 7)

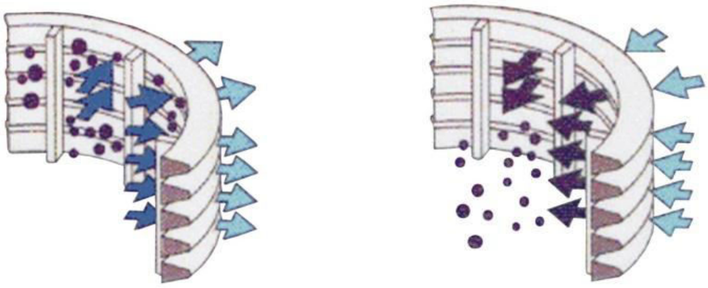
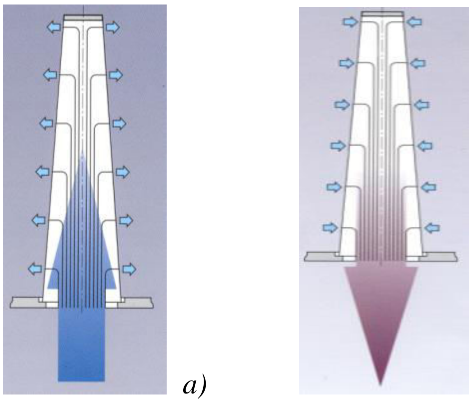


Fig. 7. Self-cleaning filter cartridges (back-flushing), with continuous filtration

A similar self-cleaning process can be implemented with a special filter shape and configuration (Fig. 8). These filters can be conical or conical-cylindrical, depending on the application or the operating pressure of the complete hydraulic system has systems. All frequent cleaning cycle, low loss and high efficiency relative.

Control mode EPT or PT provides self-cleaning for a few seconds. As in the previous case, on the basis of the difference of differential pressure, generates a pressure that initiates the opening of a pneumatic valve, which is in the process causing the effect of additional purification. In the event that the system has more of these filters, such a process takes place in each particular that opens and closes the valve for each element in the cleaning process.[4][6]



a) *b)*

a) a process of filtering b) the process of cleansing
Fig. 8. Overview of the process self-cleaning filter special shapes and configurations

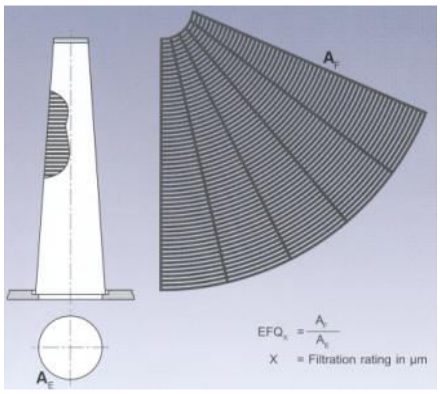


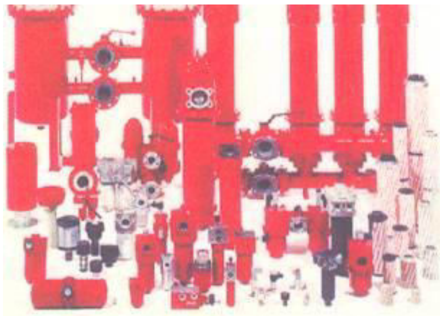
Fig. 9. View calculating the coefficient EFQX self-filter special shapes- Auto Filt RF3

The efficiency of such filters is measured by the coefficient of the working of the filter element. It is determined, and the constancy of the flow through the filter element during the filtering or cleaning. The coefficient is the ratio of the total EFQ_x filtration surface area and the openings through which the cleaning is carried out (Fig. 9).

For example: $EFQ_x = \frac{A_F}{A_E}$, where X is-filtration range. If $EFQ_X < 3$, it is a filter - elements whose range of filtration 100 µm.[11]

Range of filters for purification of oil is very high, so that the factory filter FRAD from Aleksinac production program had over a thousand different types of filters in production. Today, the situation is even worse. In Fig. 10, showing several types of filters for various hydraulic systems using felted or some other type of fabric as filtration.

a)



b)

Fig. 10: Some types of filters for different applications of hydraulic systems.

CONCLUSION

The application of technology and other methods can potentially lead to a backlog of some kind, shape, composition and origin of impurities, which in the later stages, the installation and operation of the hydraulic system, and the engine could enter the lubricating system and thus cause premature contamination of oil .Contamination may adversely affect the functionality of lubrication, premature oil degradation, increased wear of parts that are in mutual relative motion, shorter period of oil change, and even more serious consequences, such as failures of individual systems which are directly related to the primary Engine functionaly

In this regard, many world renowned manufacturers of engines and their components, as defined by regulation TECS and its component standards, basic guidelines on the methods, procedures, tools and other necessary conditions, in order to reduce impurities in the parts of the engine. Engine manufacturers have their own internal standards that define the types of engines allowed concentrations of impurities, both for complete engines, and the main parts separately.

Therefore it is very important systematic approach to oil contamination, in terms of the creation and removal of contaminants, the detection and classification of the current ISO, NAS, SAE AS and other standards in order to timely identify the levels and dynamics of the increase in the content of contaminants in the oil.

With a view to the decontamination of oil in the form of solid, liquid and gaseous contaminants, they are used by many elements, and by means of devices which are used for purification of oil. Usually were used filter cartridges of different size and material, shape and the microstructure, followed by self-cleaning filters, devices for the dehydration of oils and many other types of decontamination.

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MULTIFUNCTIONALITY OF FASHION DESIGNER ON CASE STUDY OF MAURIZIO GALANTE

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ABSTRACT: This is an owerview Maurizio Galante`s work which has aim to show how as fashion designer you can implement your creative ideas to other fields of creative industries which in first hand are not directly conected to the fashion design. His work is mainly focused on experimenting in field of space. When we look at his work and put paralels accros various fileds in which he is working, it is obvious that one concept which was exposed first in fashion design can be succesfuly exported. It is an exellent example to follow for future generations of fashion designers. Essence is to multply and convert concept shown in fashion design, for example questioning of space, to other fields such as interior design, industrial design, furinture design etc. That is how fashion designers can progress in future since global market require more and more multifunctionality and upgrade of knowledge and skills.

Key words: fashion design 1, textile design 2, Maurizio galante3, mutifunctionality4, concept6
Maurizio Galante is an exellent and extra ordinary example of how succsesfully can creativity implemented into fashion design can be exported and implemented to other fields of creative industries and fields.

BIOGRAPHY

Maurizio was born in 1963 in city called Latina, Italy. [1] He studied design and architecture. He started design studies during 1980 year at „Accademia di Costume e Moda" in Rome.[1] From 1996 he is based in Paris, France.[5]
He is active in various areas. First we need to consider his work as fashion designer, after that he has successful projects in area of industrial deisgn (product design). Third area of his work where he leaves reasonable goals is in field of textile art. He did also projects in other areas such as jewelery and stamp design. According to all these areas where Maurizio is active we can see that we are speaking about multi talented artist.

From 1992 he was invited member of 1992 French "Chambre Syndicale de la Haute Couture" and from 2008 he joined as permanent member. He signed partnership with „Felissmo" and opened his first company named „Maurizio Galante" in Paris,France during 1997.

In 2003 he established a company under the name „Interware" in cooperation with Tal Lacman, with who he is working since then. Company`s core bussiness is design and consulting services. He also received award in Haute-Couture „Oscar de la Moda" in Milan, Italy in 2005.

He received one very presticious award from French minister of culture in 2014. It is award of „Chevalier of the Order of Arts and Letters". [3]

Picture 1 and 2: Maurizio Galante`s „Chevalier of the Order of Arts and Letters" (left) and receiving of it on ceremony (right). [3]

MAURIZIO GALANTE`S WORK AS FASHION DESIGNER

His work in mainly in Haute- Couture, this is for what he is most known and famous. He did his first collection in 1985 under the name "Maurizio Galante X Circolare".[1] He was working for fashion designer Roberto Capucci.[5] He debuted in 1987 in Milan, Italy and in 1991 in Paris, France.[2] During 1986 he was collaborating with Italian yarn company "Lineapiu" at Pitti Filati in Florence, Italy.

Picture 3: Dress from label Maurizio Galante Circolare, spring/summer 1992, Pale green silk organdy dress with fabric tubes in the same material all over.[2]

In 1988 he wins his first fashion design award "Occhiolino d' Oro" in Milan. Year after his first award for best new designer of year he won his second "Occhiolino d' Oro" also. He showed his collection on "Milano Collezioni" in 1990. Next year he appeared on official Paris fashion week calendar. After that, in 1992, he presented his new collection in Kobe, Japan. That collection was presented in front of Japan royal family. He showed his collection in 1993 Schiller Theater in Berlin, Germany. In 1994 he presented for first time his collection in America, on group fashion show with some of the most influential French Haute- Couture fashion designers, at the Armony in New York, USA.

Picture 4: Pullover from label :Maurizio Galante, autumn/winter 1994, green arimatsu shibori[2]

Pullover which is shown on picture above from 1994 become a part of Kyoto Costume Institute`s collection, Japan, as well as pale green silk dress made out of tubes from 1991. Green pullover is made from shibori. Shibori is Japanese twisted and dyed silk fabric. This material gives it a feel new to the touch.[2]

During 1995 he showed his collection in Caracas, Venezuela. Same year he exhibited his creations at the People`s Palace in Beijing, Japan. After that, next year, 1996 he presented his collection in Tokyo, Japan. Soon after that, in 1998, he started his second clothing line in Japan under the name “Galante”. Same year he again shows his creations in Caracas, Venezuela at the Atena Foundation.

During 2000 he launched his official web site: www.maurizio-galante.com and opened sales on web site. Next year he presented his collection in Moscow, Russia. He also presented his Haute- Couture collection in Zurich, Switzerland and during same year, 2002 on fashion week in Belgrade, Serbia. Next new destination for showing of his new collection was Havana, Cuba in 2003.

For 20th anniversary of Galleria del Costume in Palazzo Pitti, Florence, Italy, he was invited by Pitti Imagine to show a collection and to make a retrospective of his work in museum. For this occasion he showed, this time menswear collection. Name of collection was: “Collection 0”. Until then he was famous just for womenswear and this was the point of turnover when he entered menswear.

During 2004 he was invited by “The Cartier Foundation of Contemporary Art” to show his collection on fashion week in Paris, France. He choose new way of presenting his Haute- Couture collection. Name of Haute – Couture collection presented then is “Galanterie echelle 1/5”. All creations were made in small size that they would fit the dolls. Collection was not presented by female models as usually but by female dolls without faces which were moved by male models. Male models were naked from waist up. During event pink light was in background of male models and attention to dolls was drawn with classical round yellow reflector light. Observers had a list of creations so after that they could order in atelier creations which they wanted in their size.

After this he was continuously presenting his Haute- Couture collections in Paris, France for next four years. In 2007 he was invited to show his collection in French Embassy in Belgrade, Serbia. In past few years he continues to show one Haute- Couture collection per year on fashion week in Paris, France.[1]

In 2013 he was guest of honor of 50th anniversary of “Accademia di Costume e di Moda” in Rome, Italy. Maurizio together with one more former student, accepted to share personal views about importance of the professional and cultural training that Accademia did for past 50 years.[3]

We can see that he is very productive in terms of Haute- Couture fashion, also he has big attitude to show his work to different nations, countries worldwide.

Through his Haute – Couture work he is playing a lot with essence of the skin and makes various expressions about it. He presents modern style which is infused with warmth and the strength of human life.[2]

If we look at his work retrospectively we can see that he has periods when collections are very colorful. He is experimenting with space in terms of fashion design. That attitude he also moves and works out it in his work as textile artist. He is working a lot in questioning and moving the borders of texture perception in area of fashion design. Opposite from his colorful collections he had also collections with very few colors in color palette of collection. In those collections we can mainly see white or black dominating. Some pastel, bright colors are also present in those “less colorful” collections of Galante.

Picture 5: Maurizio`s Haute- Couture collections from 2001 till 2011 year [4]

MAURIZIO GALANTE AS TEXTILE ARTIST

Maurizio has exhibited his work on some of most prestigious places in the world. Chronologically his work in area of textile art started parallel with his fashion design work. In recent years it becomes more significant and concrete. In past decade we can see that he is more and more active in this area exhibiting more then before.

In 1990 he was participating in “Creativeitalia: The Joy of Italian Design” in Tokyo, Japan. He participated in “Das Goldene Zeitalter” at the Wurttembergischer Kunstverein in Stuttgart, Germany in 1992. [1] In 1998 he did exhibition of his Haute- Couture dresses in Edinburg, England.

Picture 6: Maurizio Galante and Tal Lacman`s work during weed festival in Chaumont sur Loire, France, 2003[4]

He was participating in “Vision of the Body” exhibition held during 1999 at the National Museum of Modern Art in Kyoto and at the Museum of Contemporary Art in Tokyo, Japan. Same year he participate in exhibition “Black in Fashion” which was held in Victoria & Albert Museum in London.[1] Next year he participated in the exhibition “Aristocratic Artisans” at the Ace Gallery in New York, USA. Also in New York in 2001 he did Artistic Direction for “Design 21” exhibition for UNESCO. Same year he was participating in exhibition called “Ultranoir” in Paris, France at the magazine Printemps. In 2003 he was participating in exhibition called “Methamorphosis” also for Printemps.

He participated together with Tal Lacman in exhibition “Mauvais Herbes” during weed festival which was held in garden in French town Chaumont sur Loire. In cooperation with “Harp group” they created a plot which was aimed at furthering the botanical and aesthetic effects of a family of unusually vigorous, uncultivated, yet absolutely charming “rabble” plants. At first look you have impression that is an old abandoned field which is ruled by wild plants. It looks like there are just forgotten clothes but when you look deeper you realize that clothes are stretched on laundry lines in elegant structure. The structure of naturally dyed clothes is designed like that to be taken over by plants. There are some interesting details that some plants are growing from weeds which are in pockets of clothes, while others are climbing the hangers and clothes which are recognized by plants like climbers. Everything was designed like that to encourage the plants to create new landscape.[4]

During 2006 Maurizio was participating in exhibition held in MOMA, New York, USA. One of very presticious places in art world. Name of exhibition „Safe: design takes on risk”. It was a chalange which he brought till the end together with Tal Lacman and Arik Levy. Task was to innovate in themrs of protection. They took everyday clothing and made new designs with concept of „minimazing the risk”. On simple garments they applied on targeted positions invisible platelets. Here protection is in wearer`s notion of comfort which is more in sense of psychological comfort and security.

Picture 7: Work exhibited in MOMA,New York, USA,made for exhibition:”Safe: design takes on risk”, 2006[4]

ESTIMATION OF EPIC WORK WITH NAME „DANAE”

„Danae” was born in 2007. This creature was made together with Tal Lacman in cooperation with company „Boffi”. It was exhibited in their show room in Paris, France. „Danae” is made out of 25000 sachets of water. In the same time the structure is very organic and artificial because of plastic material from which saches are made. Drop of water is the starting point and the end point of whole concept. One drop of water becomes a cell of whole structure. It is named „Danae” because of inspiration of impossible love story of Danae and Zeus. Zeus metamorphosized into golden rain to show and proof his love to Danae. From this love, Persues, a son was born. This work shows artists attitude and relationship to tradition for which they are showing a big respect. They placed it into very modern place but still with very refined attitued of paying attention to every detail. In art this subject is usually shown as golden drops but they are here focusing of subject and to what it represents without symbolism of color. Whole ceiling is covered with saches of water which represent Zeus. Like this they are showing strongness of Zeus. Water saches are slowly from ceiling forming a pilar which is ending into the bathtub. The bathtub represents Danae. It has very femimine form. From this piece of art later in 2008 was born a lamp with same name that is made out of saches filled with air.

Picture 8: „Danae", Paris, France 2007[4]

In 2008 Maurizio made work with title „3 in 1". It was exhibited in frame during exhibition „Rrripp!Paper fashion" which was held in Museum of Modern Art Grand, Duc Jean, Luxembourg. This work was made out of 3 vintage paper dresses as it could be guessed according to title.

Significant textile sculpture done in cooperation with Tal Lancman is „Rouge de 5 heures". It was exhibited in the ballroom of Marie-Laure de Noalie, Maison Baccarat`s headquaters in Paris, France in 2009. It is soft textile sculpture of tiger which is entirely floating in space. Around it is a ring which can associate us maybe on circus. On that ring are placed various glasses which are turned into the direction from the ring to space around. This sculpture was made out of 2500 layers of tulle. It was all cuted, assemled by hand.

Picture 9: „Rouge de 5 heures", 2500 layers of tule, 2009[4]

Next signficant work is done same year and it can be told that it is on border of textile art and industrial design. It was made in cooperation with Tal Lacman. The exhibition was made in Greenhouse, Paris, France and it was named „Docks en Seine". Instalation is made out of stool cusshions on which was printed image of cactus with high quality digital printing technique on textile. Cusshion stools were nicknamed „Mother in law cusshion" and instalation was made like that to evoke a cactus nursery. With this high quality textile digital print technique Maurizio did few other projects which are very exciting but more in the field of industrial design, so it will be considered closer in section considering his work in that field.

Very interesting work which Maurizio did together with Tal Lacman was exhibited in 2009 in Grand Palace, Paris, France. It is titled „Red Room". It is instalation of big dimensions made out of red textile. It is a soft architecture which tends to be a „memory object". „Red Room" reflects on original space and it can be inslated elsewhere in the city as well.

Picture 10: „Red Room", Paris, France, 2009[4]

In 2011 Maurizio was participating in presticious manifestation of „Musee d`Art et d`Industrie" in Saint- Etiene, France. For this occasion he was exhibiting "design transversal". Here he is again coming back to his experimentation field of expanding the space in field of clothing as well as question of protection and security. "Design transversal" is made of jacket and pants made out of blue jeans into which are inserted pins with yellow ending.

MAURIZIO`S WORK IN FIELD OF INDUSTRIAL DESIGN

From second half of 2000`s he has become more and more active in field of industrial design. He has designed chairs, tables, lamps, shelfs, soundsysthems etc. In 2006 he did armchair „Aura Riccio" from which he made different version in 2010 called „Aura Fiorita". Like title says because of texture surface armchair looks like it is emiting it`s own aura. At „Aura Riccio" is also visually available since here he is experimenting with his good known subject - space. Armchair is made out of technical fabric which is hand embrodiered with glass tubes and beads. „Aura Fiorita" has same form but another surface and patterns. Both are available in different colors. During Maurizio`s very beginings in 2006, he did a table „Undici" and armchair „Valentina C" from which he made Haute – Couture version in 2008. All these products were manufactured in coolaboration with Cerruti Baleri.

In 2007 Maurizio designed two types of head boards named „Vapori". These are produced by his company „Interware" together with Tal Lacman. „Vapori" is made of tull in two ways of texture - pattern. Interesting piece which Maurizio designed for requirnents of one interior is buffet „Gaga" which he made available with same pattern in three different products: buffet, suspended buffet and a mirror. It was made by Opinion Ciatti.

During that year he established a series of stools which will be very fruitfull for him. One series of stools are called „Tattoo, animals in danger" from which there are there styles: „Hippo", „Orango" and „Tiger". Each one is representing a head sceleton of mantioned animal according to which is titled. It is done with high definition digital printing technique on textile. Textile is streched onto a round stool. Second series of stools are called : "Tattoo, Object Companion: name of animal". Names of animals are representing various styles such as : cat, flamingo, baby tiger, snakes, koi and rabbit. These stool series were produced in cooperation with Cerruti Baleri and it was a big inspiration for Maurizio since he continued to produce stool series based on this concept.

During 2011 he continues with his fruitfull period and makes a Canape „Cactus", which is sofa established from „Tatto cactus" pieces which are multiplied and put together in interesting composition that formes a sofa. For next pieces he has a concept established from inspiration that comes from history. Those pieces are „Battaglie" table/desk, „Louis XV goes to Sparta" armchair (together with Tal Lacman). Armchair is available in various versions that are named with following titles: „carrara"; "grand antique"; „sparta"; „extra large". Each of these versions is playing with our perception of weight, according to different patterns which are taken from nature (mostly pattern of marble). This concept was used once again to make another series of „Tattoo" stools which are named „Tattoo marble" they are available in same versions as armchair exept „extra large" version which is acctually expanding of armchair to sofa. New theme which Maurizio and Tal used to create new versions of popular stools is theme of well known story of snow white. They created version of green apple which is named „Eva" and version of red apple which is named „Snow white". All these were established in coopertion with Italian company „Cerruti Baleri". Piece which was established that year in different cooperation, was screen named „Zebra", made in cooperation with „Opinion Ciatti". „Zebra" is moveable screen made out of wood and polished stainless steel.

Picture 11: „Zebra", wood and polished stainless steel, 2011[4]

Next year was very fruitfull year in terms of Maurizio`s work in field of industrial design was 2012. That year he marketed new pieces of furniture with new concepts."Blow up" stool, „Flirt"chair and table, „Galasutra" chaise longue. All these pieces were produced and marketed by company named „Mussi". The common threat here is that he is in very smooth way bringing the attitude of expanding the space of object and questioning it. Most of these pieces has stainles steel as basic structure which he combines with with mostly soft materials according to steel which are in these cases leather or like in „Flirt" tick plastic threads. The only product which he did not made during that year in cooperation with „Mussi" is a „Tattoo cactus" stool, which he used for exhibition of „cactus nursery".

He entered togther with Tal another area of product design which is design of sound system. First one designed by them is named „Sound tree". It is modular, speakers are in round shape, hanging down from ceiling. For this project another author joined well known team of Maurizio and Tal, his name is Jean-Yvesle Porcher. With this project they established cooperation with company „Elipson". Next project for that company which team of Maurizio and Tal did was also a deisgn of sound system. It was marketed in 2012 and includes two size of round speakers which are covered with marble pattern. New type of products in field of furniture design were various cabinets which Maurizio designed together with Tal during 2012. „Collectors cabinet" specialy designed to fit need of exhibiting small objects which are collected. This cabinet was made in cooperation with Cerutti Baleri. Another one in cooperation with Opinion Ciatti is called "Waves". With same company he did another version of well knows stool model called „Tatto Stones", this time in two versions „Amethyst" and „Malachite" which are well representing pattern of materials from which they got their names.

OTHER FIELDS OF MAURIZIO`S WORK

Maurizio Galante`s work is covering few various areas. He designed a jewellery line. Also designed costumes for thearters such as : „Teatro Nuovo", Teratro dell` opera di Roma", "Piccolo teatro", „Theatre Monparnasse". Interiors of private homes in Italy and France as well interiors for hotels such as hotel „Foro Apio” and institutions for example „Ecole de la chambre syndicale de la couture parisene”. He did also extraordinary project such as designing a rose garden in the Paul and Virginie Parc, Guyancourt, France. Onemore extraordinary field of design which he did is designing of stamps for French post. Each year for Valentine`s Day French post has a special edition of stamps and Maurizio did two designs of stamps for 2011 year edition of stamps. His designs are unique because leaves space for everybody to finish the stamp and create unique color combination by coloring hearts in different colors or by writting inicals of your love.

In his company „Inerware”, which provides sevices in field of design and consulting, they had some of presticious clinets such as : „American Express”; „Absolut vodka”; „Swarovski”; „L`oreal” etc.

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AUTOMATED CUTTING ROOM MANAGEMENT SYSTEMS TO REDUCE FABRIC CONSUMPTION

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ABSTRACT: Material prices are growing but their costs in garment manufacturing still account for more then half - 50 to 70% of total product costs. That way a cutting room has become the most vital place in an apparel enterprise as exactly its management and manufacturing processes determine fabric consumption efficiency. Traditional material requirement planning, material inventory and lay planning processes are often organized superficially and unreasonably. Unlike a traditional sequential step-by-step approach, the management software processes all factors simultaneously, in high speed and provides an optimal solution considering a large range of inputs. The automated management system effectively streamlines cutting room organization and ensures maximal utilization of raw materials and equipment. Small orders, the large diversity of raw materials and ready products are the reasons for maximal automation and use of advanced technologies in the industry.

Key words: materials requirement planning material inventory, material remnants, fabric width loss, cut planning

INTRODUCTION

Textile manufacturers face constant increase in raw material costs. The price for cotton, which is the clothing sector's most used raw material, is rising constantly in the past few years. It was in its spike in 2010 and 2011. Then garment retailers and manufacturers already had to push up their product prices 10% and more. The raise of raw cotton and wool price has increased demand for alternate man-made fibres. As the result, high price of natural materials, growing demand for man-made fibres and raising oil price have boosted also polyester price.

Material prices are growing but their costs in garment manufacturing still account for more then half - 50 to 70% of total product costs. Realizing the importance of fabric costs on product price, companies are looking for the easiest solution - lower price materials. Now blends and synthetic fabrics are often used as an alternative to expensive cotton. Spandex and viscose are added to cotton fabrics to change their qualities and reduce the price. Blended woolen fabrics where the raw wool content is less than 20% have become widely used by the woolen garment manufacturers. However, raised or unbalanced amount of man-made fibres in fabrics can come with quality problems which negatively influence garment exploitation and complicate its manufacturing process. In the situation when high product quality is one of the main conditions to keep place in the market this solution is too risky

Now, time has come to make good and well-grounded fabric savings in the garment manufacturing process. Therefore a cutting room has become the most vital place in an apparel enterprise as exactly its management and manufacturing processes determine fabric consumption efficiency.

Reduction of material use was widely discussed in 90th and beginning of 00th when many researchers were working with production planning and scheduling problems [1, 2, 3] and the analysis and prediction of fabric loss during material spreading [2, 4, 5, 6]. Later the first management software for apparel industry became available commercially. During the last two decades it is improved and supplemented with new parts [7, 8]. Although many apparel companies valuate considerable advantages of automated management systems, there are still a lot of brand-owners and manufacturers which use them partly or do not use at all preferring traditional manual performance of calculations.

EXISTING SHORTAGES AND CHALLENGES TO IMPROVE MATERIAL UTILIZATION

Observing and analyzing traditional material requirement planning, material inventory and lay planning processes in different companies, it is often noticed that they are organized superficially and unreasonably. A lot of paperwork, manual performance of calculations and inexistence of united and easy accessible data base complicates work process and reduces its quality. Traditionally, material requirement planning, material inventory and lay planning are separate work steps fulfilled in different departments by different specialists which are weakly connected with manufacturing process (specialists have insufficient knowledge about production, often departments are located far from real production sites, even abroad).

Materials requirement planning

Usually material requirement is calculated using rules which do not take in account work efficiency of spreading and cutting equipment used, fabric utilization results of previously produced the same or similar styles and analysis of the fabric remnants left at the end of production. Even worse, taking into account that all this information is not available, companies obtain certain amount of extra material to save their weakly overseen and controlled production process, but at the end of it - accumulate material remnants in their warehouses. Situation shows that fabric consumption could be reduced:

- Using new ways of material calculations;
- Basing material calculations on closer monitoring of fabric consumption throughout the entire lifecycle of every product.

Material inventory

Material inventory ensures information about material availability for the production process. That is the main and often the only way how inventory data are used. Depending on the way of inventory system, the data about materials are kept in simple (article, colour number and available total footage) or more detailed way (additionally: code, width, footage of every material roll). If the inventory is done manually, it is time and work consuming. Besides, there is a risk to have erroneous data, as material flow is intensive and there is always large number of fabric rolls to register. After production is finished, material remnants are stored with very primitive inventory data (article, total footage) or without it at all. As warehouse employees are not responsible for efficient fabric utilization, they are not interested to see and understand material flow tendencies. The valuable information about material utilization, which should be used in material requirement and cutting planning processes, is not collected, stored and analyzed.

The work process in a material warehouse can be improved:

- Eliminating inventory complexity;
- Speeding up inventory process;
- Ensuring maximally wide accumulation of data;
- Making available the fabric utilization data to material requirement and cut planning departments.

Lay planning

If the orders are simple, manual planning gives sufficient results. The planning becomes problematic working with large, complicated orders (complicated size range, large variety of materials, their colours and shades). Theoretically, thousands of markers and their combinations, which give different impact to the fabric use, exist for every order. For processing should be chosen the one lay planning way which ensures the best solution in between fabric consumption and work productivity. Because of time limits, the manual planning process can not ensure generation and screening of large amount of lay planning scenarios for one order. Problematic are also situations when, because of some unexpected reasons (all fabric is not received in time, some part of the fabric has serious and frequent faults), part of material is not available for developed lay planning variant. As manual process can not ensure quick recalculations, cutting process has to be stopped to wait for a new lay planning scenario or continued in ineffective way.

The lay planning can be improved:

- Screening and completing large amount of lay planning variants to choose the best one;
- Ensuring quick fabric utilization calculations for every lay planning variant;

- Using special tools to perform needed calculations and speed up significantly lay planning process.

Material remnants

As it was mentioned before, there is always place in a warehouse where material remnants are kept. The further use of them is very limited, complicated and ineffective. The fabric remnants can appear as a result of imprecise material requirement calculations. The material has been purchased too much and certain amount of fabric rolls is left unused. An ineffective lay planning also can be a reason for fabric remnant accumulation. In this situation, unused fabric roll ends return to the warehouse after cutting process. Material remnants could be reduced:

- Improving material requirement planning;
- Making easy available material inventory data to lay planning process;
- Improving lay planning.

Fabric width loss

One more problem influencing fabric utilization is irregular fabric width in fabric rolls used to cut one order. To avoid a situation when a marker is wider then the fabric (then cutting can not be performed and markers have to be redone), the markers are often created for the narrowest part of the material. This way cutting process is secured but fabric utilization - reduced. Possibility to create shorter markers (increasing material utilization) for wider material is not used and edges of the wider material part are cut of and wasted. Fabric width losses could be avoided:

- precisely inventorying the width of every fabric roll;
- Using special tools to speed up inventory process;
- Creating markers and performing lay planning for every group of fabrics with identical width;
- Using special tools to perform calculations and speed up lay planning process.

AUTOMATED MANAGEMENT SYSTEMS TO IMPROVE FABRIC INVENTORY, MATERIAL REQUIREMENT PLANNING, LAY PLANNING

Unlike a traditional sequential step-by-step approach the management software processes all factors simultaneously, in high speed and provides an optimal solution considering a large range of inputs. It is able to schedule jobs to production, select optimal raw material and utilize remnants, generate cut-plans and nests, track production activities and provide management reports for analysis and future planning [9].

The main part of the computerized management system its centralized database. It ensures possibility to view and edit style, inventory, labor, costing, an order, cut planning and manufacturing information. The data is transparent and easy available for all members of authorized staff. There is no need to enter identical information more than one time. Once a change is made it is instantly available for all database users. During work process all data is accumulated and a company gradually gains knowledge and valuable experience about its material consumption, costs and their optimization options.

Often the management system includes also material requirement planning software. Optimal material purchase is calculated using a set of special techniques and data from the database - previous bills of material and production orders, as well as, current inventory data.

The management systems include two inventory systems: finished good inventory and raw material inventory. The finished goods inventory system provides the ability to enter incoming stock from manufacturing orders or a raw material purchase orders. The raw materials inventory system tracks everything not covered by the finished goods inventory. The system is able to transfer and maintain inventory levels between different warehouses and contractors. At any point in time the company knows the current status of its inventory. The system ensures information about raw materials on-hand, ordered raw materials, raw materials in work process, available inventory amounts, as well as, raw material utilization and raw material requirements.

Based on inventory data, cutting orders or finished goods requirements, material purchasing software can automatically generate a purchase order for needed items and post them directly to suppliers. Thus materials are delivered just before their processing. There is not need to do long term purchases of regularly used materials, such as, interlinings, elastic bands, packing material, labels.

Management systems for apparel industry is developed by companies: AIMS Technology, AMS, Apparel Business Systems, Apparel Data Solutions, ASAP Apparel Software, Assyst, Jomar Softcorp International, Jonar Systems, Lectra, Olotech, Optitex, Plataine, Polygon Software, Reach Technologies, Texbase, TradeStone Software, others.

Cut planning

The part of the management system coordinating work process in a cutting room is a cut planning software. It links together ERP (Enterprise Recourse Planning), fabric management system, CAD and CAM, exchanges information in between these systems and creates the best solutions to cut material for manufacturing orders. With the help of the cut planning software, a cutting room becomes the most advanced department at an apparel manufacturing enterprise and use to be called "Intellectual cutting room" (the concept of "Intellectual cutting room" was developed by a company Lectra promoting their cut planning software Optiplan).

Cut planning software is developed by companies: Lectra (Optiplan), Polygon Software (Cut Planning), AMS (CutPlan), Option Systems (Cutting Room Planning), Optitex (CutPlan), Assyst (Lago), FK Group (Future Cutplanner), Plataine (Cut-Order Planning), Reach Technologies (Reach Cut Planner), others.

Methodology

Cut planning software imports customer orders from internal or any external system. It runs different cutting plan scenarios (markers and their combinations) to see their impact to the fabric use, cutting time, productivity and choose the best of them. System is designed to reuse already existing suitable nests from maker library and only after that sends requests for new markers directly to CAD system. Defining which markers are necessary for the order it creates the optimal cutting plan for one or multiple factories considering specific product and manufacturing characteristics (fabric qualities, technological limits of the spreading and cutting processes). To perform the created cutting plan the system firstly selects (using material inventory data) fabric rolls that can be 100% consumed then it takes those pieces that result in the least end and width loss. If reusable fabric remnants appear, there can be used, giving preference to the smallest pieces. The system can determine where to lay and how to cut selected fabric in order to achieve most effective fabric savings.

Then the system generates optimized cutting schedule in sync with sewing plan, print manufacturing reports and send the orders to the cutting room. Spreading and cutting operations are monitored at each stage of the cutting process (using barcode scanners). Reports are provided to monitor production throughput and efficiencies across multiple plants. Fabric utilization reports can be used for efficient material requirement planning of further manufacturing processes.

Most important steps of automated cut planning process are: running of different planning scenarios, establishing the marker processing time, performing marker calculations, spreading planning and processing of manufacturing reports.

Running of different planning scenarios

After the user fills up all necessary order data (order quantity for each fabric type, fabric, initial marker and spreading settings), the program tries all possible size combinations in markers. Based on a model information and marker library (data from previously used the same or similar styles) the program estimates length and efficiency of every yet uncreated marker. Finally the program selects and displays the best marker combinations for certain order.

Establishing the marker processing time

The yet uncreated markers are classified by their importance depending on the number of sizes in a marker, lays in a spread and garment peaces produced from the marker. More time to find the best fabric consumption is given to progress more important markers. Marker progressing time can be determined:

- Automatically - the program distributes the time for each marker considering the markers size;
- Semi-automatically - the user can indicate how much time he wants the program to spend for each marker.

Performing marker calculations

Getting ready markers back from CAD, the program obtains the exact length and the efficiency of every performed marker. The fabric amount needed to produce the order is calculated now using data of markers length. The available info is also used to calculate statistics regarding average fabric use per product, per fabric type or total, fabric input, total average efficiency, etc.
Working with Lectra cut planning software (Optiplan) and also with their spreading and cutting equipment, the program can calculate: garment costs, fabric costs, manufacturing time (spreading time, cutting time, bundling time) and total costs. This information can be obtained for every of markers to choose the best solution.

Spreading planning

Trying to respect the maximum number of fabric plies in the lay, program generates all spreads. Fabrics with similar properties are grouped together for one spread to reduce spreading time. If disproportioned number of layers (very small number) appears for separate spreads, the program can make automatic balancing.
Processing of manufacturing reports

During and at the end of planning process several reports could be generated: marker making, spreading and cutting instructions as well as fabric use reports. To avoid mistakes, barcode scanning can be used to deliver data for automated spreading. The barcode can be used also to load a marker for a cutting process. Fabric report is send to warehouse to know how much fabric has to be taken to spreading. It can also go down to a roll level. Planning then will be done for every roll separately, finding its best usage.

CONCLUSIONS

Apparel manufactures have to make their own decisions and strategies how to keep a place in the fashion market. Are traditional work methods, could be said, traditional thinking way, still capable to keep the company competitive or it is already time to follow the novelties of the industry? Actually, it is not the question about material consumption and a product price reduction only. The automated management system effectively streamlines cutting room organization, ensures maximal utilization of existing and newly purchased equipment thus ensuring rhythmical and highly organized work process also in the further departments.

The use of powerful software and high-tech equipment is reality of many industries already several decades. Apparel manufacturing has been devoted to human mind potential and manual work too long. Small orders, the large diversity of raw materials and ready products were considered as impediment for high level automation. Now it has became directly opposite, exactly because of these reasons, the industry can not survive anymore without maximal automation and use of advanced technologies.

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THE PROBLEM OF THE LABOUR DEFICIT IN THE TEXTILE INDUSTRY OF IVANJICA MUNCIPALITY

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ABSTRACT: The textile industry as a part of the overall economy has been facing a series of problems over the last twenty years which has been manifested in insolvency, debt, obsolete equipment, low productivity, unfair competition, low-income employees and the like. The economic crisis that has affected the entire economy has negatively affected the entire textile industry, which resulted in the closure of many businesses and job loss of a large number of employees. The aim of this survey is to show how the students of Secondary Technical School in Ivanjica- Fashion Designer Course, are interested, informed, and motivated for their future occupation. The survey included sixty students from first to fourth grade, the age structure of 15-19 years, of which 55 female students and five male students. The subjects responded to the fourteen questions.

Key words: survey, Technical School Ivanjica, Textile industry

INTRODUCTION

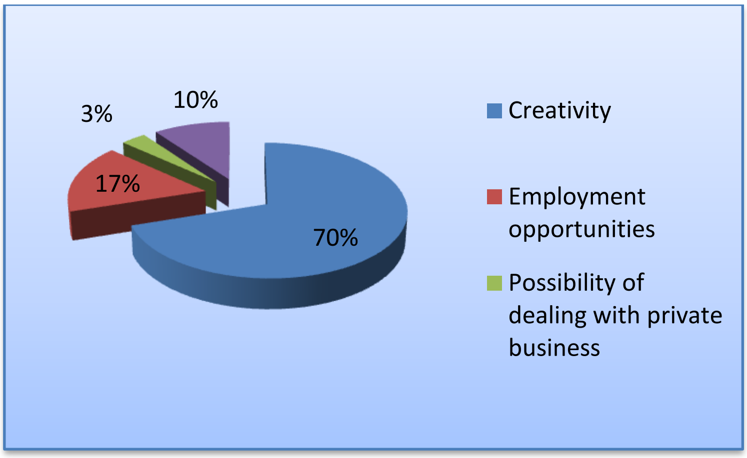
According to the latest data from the National Employment Service in Ivanjica, there are 228 people waiting for employment as qualified spinners, sewers and weavers, and 123 of them are technicians in this field. There are also 60 people from other professions who have retrained for a job of tailors. In the area of Ivanjica municipality there is a large number of private sewing companies dealing with light and heavy clothing, but not many people are interested to get a job there because of low wages, failure to create permanent jobs, and prices of a working hour, which is below the national average (for example, in some factories price amounts to 80 dinars per hour, the minimum wage is a republican 125 dinars). People are increasingly being registered with the National Employment Service. Not long ago the situation used to be far better for the textile branch of the economy. There existed big giants in Ivanjica like factory "Javor" which even employed 3700 workers, while the other companies for the production of carpets "ITI IVANJICA" employed up to 1400 workers. Unsuccessful privatization and poor organizational management have resulted in the fact that the former giant "Javor" today employs about 650 workers, while the facilities of "ITI IVANJICA" have become warehouses for furniture. In the period from 2009 until 2012, 71 students enrolled a textile designer course while from 2012 until 2014 there were only 40 students to enroll . Sometimes the interest for this field used to be much bigger since in some generations 90 students have enrolled over a period of one year only. 60 out of 67 students attending the textile designer course were interviewed in the survey with the aim to see how students today perceive the textile field and their employment prospects in this sector of the economy.

PRESENTATION OF RESULTS

Motive for enrolling in Secondary Professional Textile School?

What were the motives for deciding to enter Secondary Professional Textile School?	Year 2014
	The age of respondents
	15-19
Creativity	42
Employment opportunities	10
Possibility of dealing with private business	2
None of the above	6

Figure 1: Respondents' answers to the question: What were the motives for deciding to enter secondary Professional Textile School?

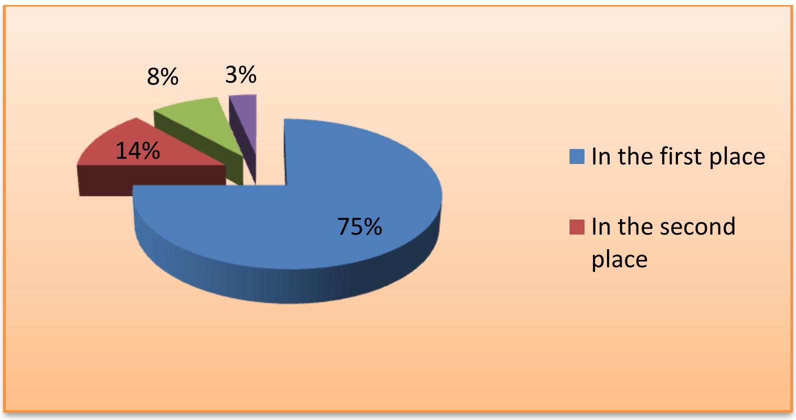


The majority of respondents to the question: What were the motives for deciding to enter Secondary Professional Textile School, 70% gave the answer that creativity which they consider to have has been their main motive, 16% of them chose it because of job opportunities , 4% stated that possibility of dealing with private businesses was the main reason , and 10% of the respondents declared that it was none of the answers offered.

Wish List for Secondary School Enrollment

When you were filling out your wish list to enroll in secondary school where on the list did you put the textile course?	Year 2014
	The age of respondents
	15-19
In the first place	45
In the second place	8
In the third place	5
None of the above	2

Figure 2: Respondents' answers to the question: When you were to filling out your wish list to enroll in secondary school where on the list did you put the textile course ?

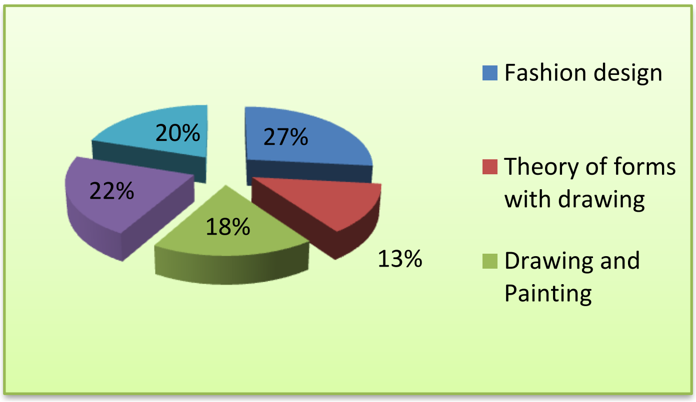


From the table below it can be concluded that 75% of respondents answered that they in the first place put a wish to enroll in the textile school, 14% put it in the second place, 8% in the third, and 3% of respondents opted for none of the answers offered .

Favorite Vocational Subject

What is your favorite vocational subject?	Year 2014
	The age of respondents
	15-19
Fashion design	16
Theory of forms with drawing	8
Drawing and Painting	11
Technology of Textile Materials	13
Practical Classes	12

Figure 3: Respondents' answers to the question: What is your favorite vocational subject?

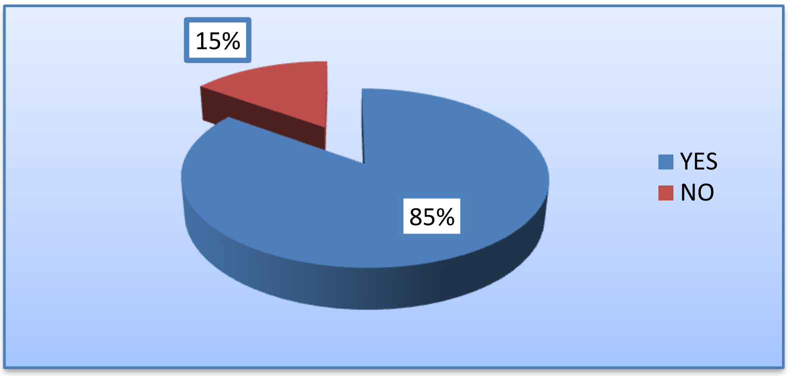


To the question: What is your favorite vocational subject, the respondents answered as follows: 16 surveyed, or 26% opted for Fashion Design , Theory of Form with Drawing was chosen by the 8 surveyed, or 14%, Drawing and Painting by the 11 surveyed, or 18 %, Technology of Textile Materials was favoured by the 13 surveyed, or 22%, and Practical Classes by 12 surveyed, or 20%.

Design in the Textile Industry

Do you think you have an aptitude and talent for engaging in design in the textile industry?	Year 2014
	The age of respondents
	15-19
YES	51
NO	9

Figure 4 Respondents' answers to the question: Do you think you have an aptitude and talent for engaging in design in the textile industry?

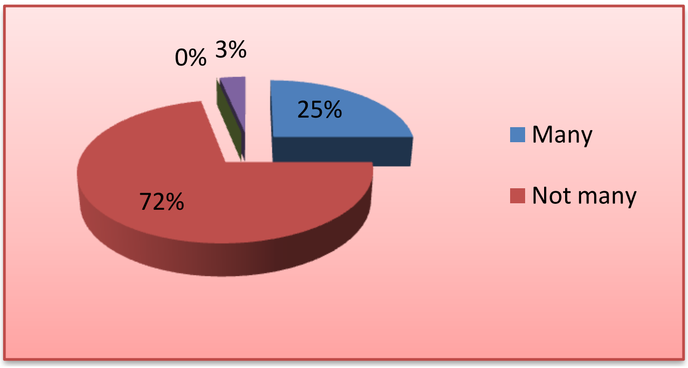


51 respondents, or 85% chose to deal with the design of the textile industry, and 9 of them or 15% said they had no inclination to engage in design.

Education Facilities

How many facilities for acquiring new skills does your school provide?	Year 2014
	The age of respondents
	15-19
Many	15
Not many	43
A few	-
None of the above	2

Figure 5: Respondents' answers to the question: How many facilities for acquiring new skills does your school provide?

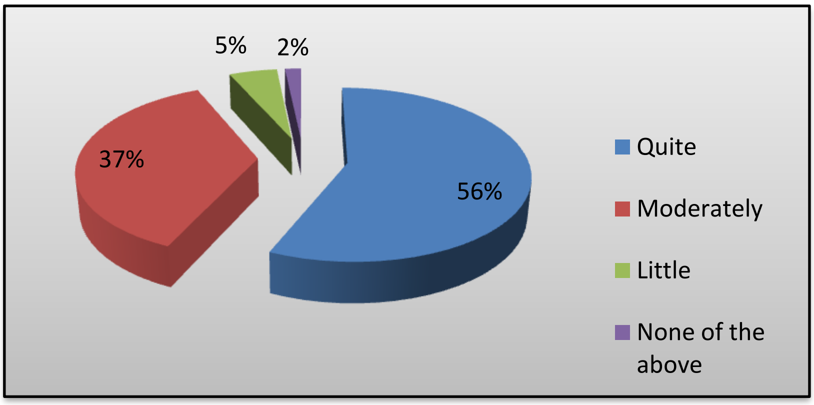


Answering to the question: How many facilities for acquiring new skills does your school provide? 43 or 72% opted for the the second answer, 15 respondents or 25% said they have many opportunities, and 3% of the respondents opted for none of the above.

Getting Informed by the Teachers about the Prospects of Practicing Textile Industry

How well are you informed on the part of your teachers concerning your future engagement in the textile industry?	Year 2014
	The age of respondents
	15-19
Quite	34
Moderately	22
Little	3
None of the above	1

Figure 6: Respondents' answers to the question: How well are you informed on the part of your teachers concerning your future engagement in the textile industry?

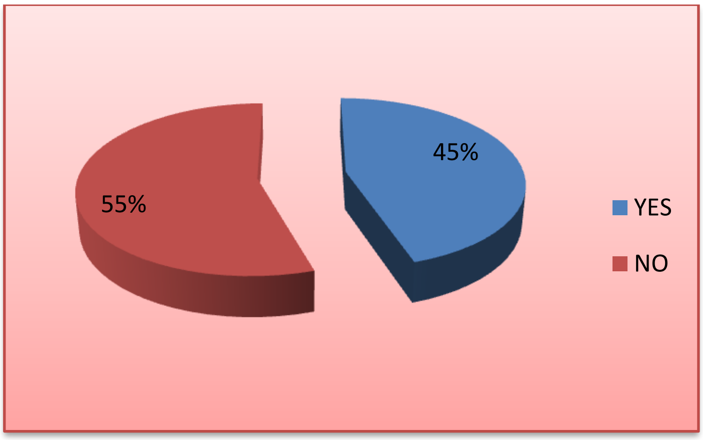


Answering to the question How well are you informed on the part of your teachers concerning your future engagement in the textile industry? the respondents gave the following answers: 34 or 56% declared that they are quite informed ,37%, or 22 respondents opted for the second option, 5% or 3 respondents said they got a little knowledge, and for none of the above set of questions voted only 1 respondent or 2% of the total.

Professional Work after Finishing Secondary School

Would you like to get engaged in the textile industry after finishing secondary school?	Year 2014
	The age of respondents
	15-19
YES	27
NO	33

Figure 7: Respondents' answers to the question: Would you like to get engaged in the textile industry after finishing secondary school?

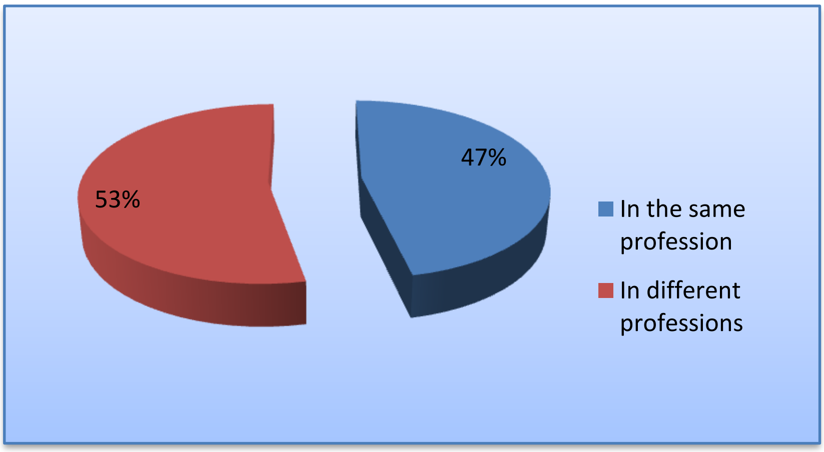


Answering to the question: Would you like to get engaged in the textile industry after finishing secondary school? , 27 of those surveyed, or 45% voted for it, while 33 respondents or 55% said they would not work in the textile industry. As a part of this question the students had a sub-question to explain their answer. 45% of respondents believe that they are most likely to find a job in this field, and 55% of them see no prospect of successful employment.

Education after Finishing Secondary School

Are you going to continue your education after finishing secondary school?	Year 2014
	The age of respondents
	15-19
In the same profession	28
In different professions	32

Figure 8: Respondents' answers to the question: Are you going to continue your education after finishing secondary school?

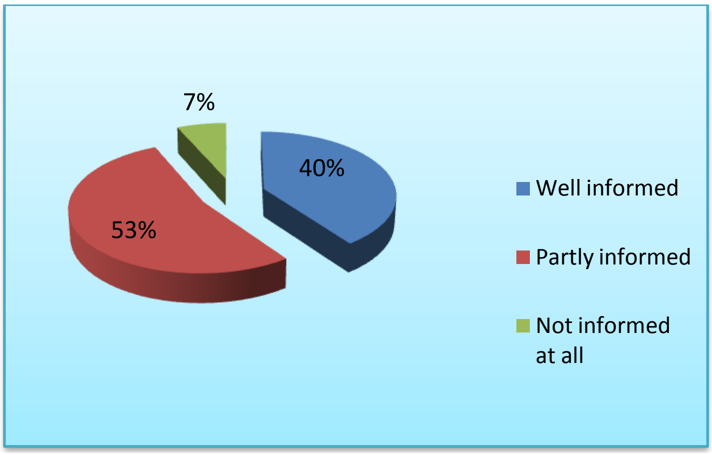


To the question: Are you going to continue your education in the same profession, 28 of those surveyed, or 46% voted for YES, and 32 respondents or 54% said they would continue their education in a variety of professions.

How well are you informed about further education in textile vocation?

How well are you informed about possibilities of further education in textile industry?	Year 2014 Respondent' age 15-19
Well informed	24
Partly informed	32
Not informed at all	4

Figure 9: Respondent's answers to the question: How well are you informed about possibilities of further education in textile industry?

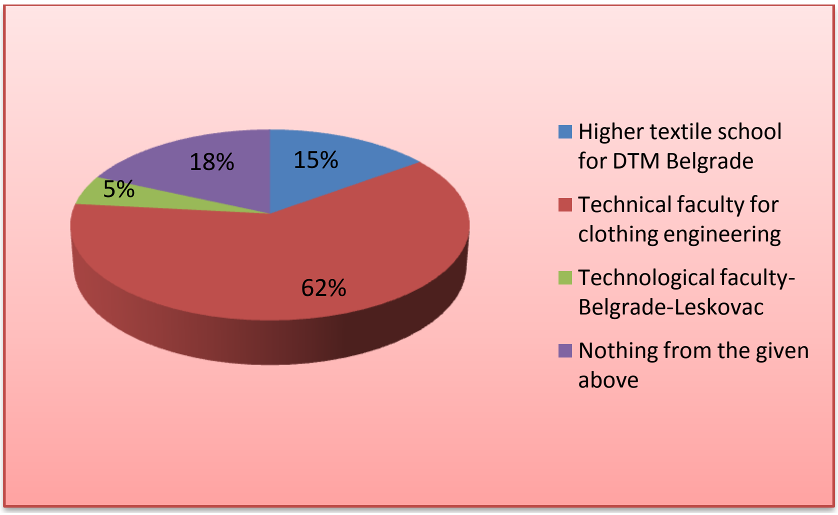


To the question: How well are you informed about possibilities of further education in textile industry? 40% or 24 respondents consider themselves as well informed , 53% or 32 respondents consider themselves as partly informed, and 7% or 4 of respondents consider themselves as not informed at all.

Further education in textile industry

If you continue your education connected with textile vocation which profile would you choose?	Year2014 Respondent's age 15-19
Higher textile school for DTM Belgrade	9
Technical faculty for clothing engineering	37
Technological faculty- Belgrade-Leskovac	3
Nothing from the given above	11

Figure 10*:* Respondent's answers to the question: If you continue your education connected with textile vocation which profile would you choose?

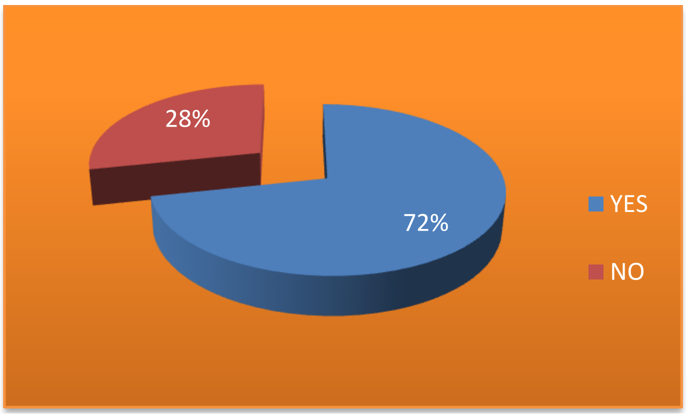


As we can see from the table 10. the highest number of respondents, 37 or 62% would continue further education at Technical Faculty in Zrenjanin, department for clothing engineering. The reason is that they are well informed about studying at this faculty through the cooperation with Secondary Technical school in Ivanjica. Professors of this faculty each year redo the presentation of this faculty about studying possibilities, enrollment conditions, employment as well as possibilities of setting up a private business.

Possibilities of setting up a private business

Are you informed about possibilities of setting up a private business after your graduation?	Year 2014
	Age of respondents
	15-19
YES	43
NO	17

Figure 11. Respondent's answers to the question: Are you informed about possibilities of setting up a private business after your graduation?

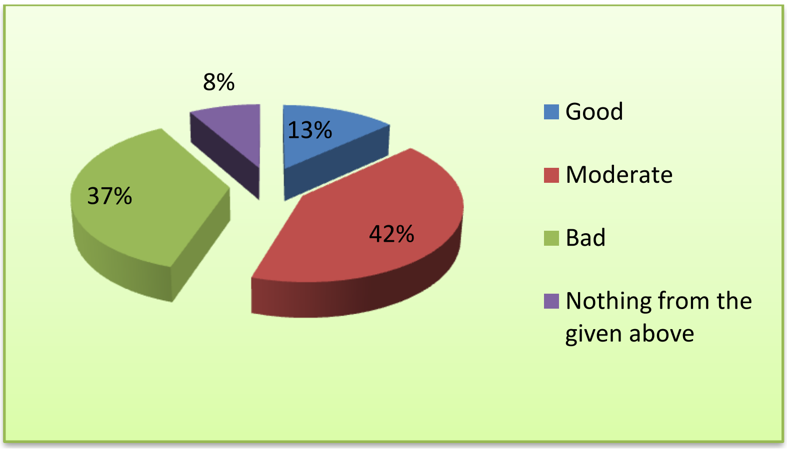


To the question: Are you informed about possibilities of setting up a private business after the graduation 43 respondents or 72 of them gave a positive answer and 17 respondents or 28% consider themselves as not well informed.

Working conditions in textile industry

In opinion,how would you define working conditions in textile industry?	Year 2014
	Age of respondents
	15-19
Good	8
Moderate	25
Bad	22
Nothing from the given above	5

Figure 12: Respondent's answers to the question: What is your opinion of working conditions in textile industry?

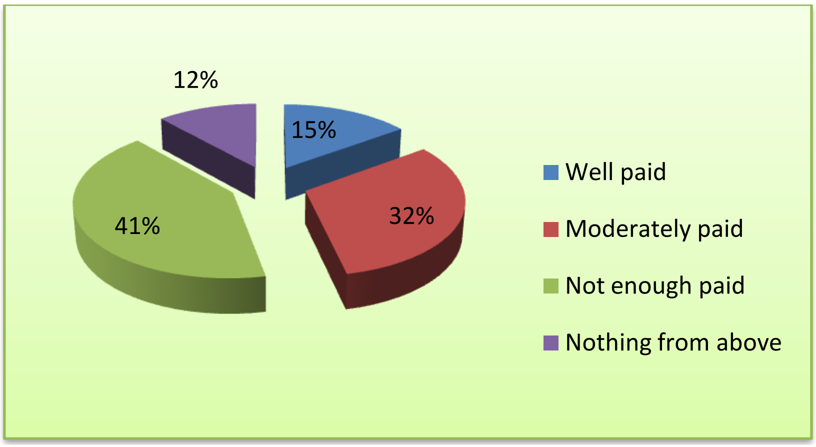


From the table given above it can be concluded that 8 respondents or 14% consider working conditions as good, 25 or 42% voted for moderate opinion, 22 respondents or 36% consider working conditions in textile industry as bad and 5 of respondents or 8% voted for- nothing from the given above.

Wages in textile industry

In your opinion, how well are the employees in textile industry are paid?	Year 2014
	Respondents' age
	15-19
Well paid	9
Moderately paid	19
Not enough paid	25
Nothing from above	7

Figure 13. Respondents' answers to the question: In your opinion, how well the employees in textile industry are paid?

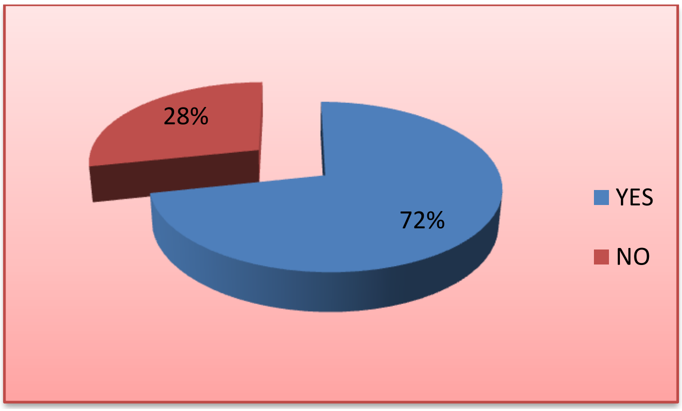


To the question „In your opinion how well the employees in textile industry are paid?“, 9 respondents or 15% opted for the first answer, 19 of them or 32% for the second, 25 or 42% were of the opinion that they were not well paid and 7 or 11% of respondents chose none of the offered answers.

The position which textile industry takes on the market

Are you familiar with the fact that textile industry takes the second place in the Serbia's total exports?	Year 2014 Respondents' age 15-19
YES	43
NO	17

Figure 14. Respondents' answers to the question: "Are you familiar with the fact that textile industry takes the second place in the Serbia's total exports?"



To the question: "Are you familiar with the fact that textile industry takes the second place in the total Serbia's total exports?", 43 respondents or 72% said YES, and 17 respondents or 28% claimed that they were not familiar with the fact.

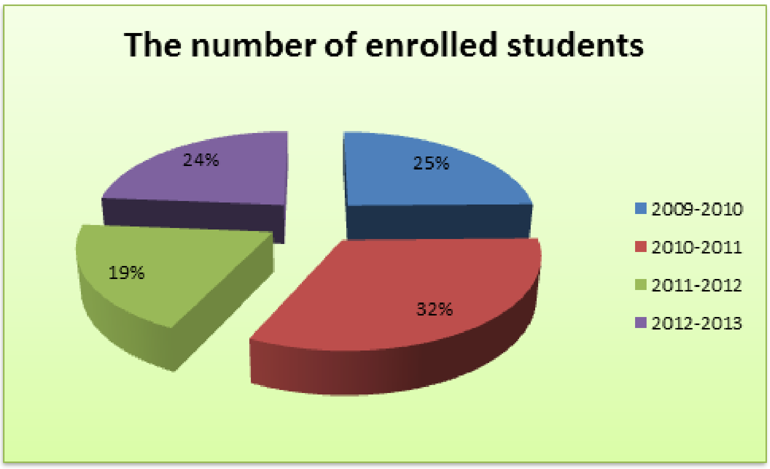
CONCLUSION

From the given survey it can be seen that most of the respondents think that motivation, creativity, aptitude for design influenced the enrollment to the Secondary Textile School. To questions how well students are informed by the teachers about their future prospects in textile industry, the most of the participants think that they are well informed, the majority of students claim that they don't want to work in textile industry after graduation from secondary school and that they would change the vocation in the further education because of low salaries, bad working conditions and so on. The results of the survey also show that the majority of respondents think that they are well informed about starting a private business after graduation from Textile School.

The conclusion is that there must be made some changes in this branch of economy, in the first place to provide better working conditions, correct norms , increase labour costs per hour, motivate employees to work harder and so on.
The number of the students enrolled in the period from 2009 to 2014

School year	The number of enrolled students
2009-2010	23
2010-2011	30
2011-2012	18
2012-2013	22
2013-2014	18

Figure 15. The number of the students enrolled to the Secondary Technical School in Ivanjica, department Clothes Designer



As we can see from the table, 22 students graduated in school year 2012-2013, and 30 students graduated in 2013-2014 school year. 2 out of 53 students who graduated from Secondary Technical School, department Clothes Designer, continued education in the same vocation, while just five of them were engaged in private sewing companies dealing with light clothing.

REFERENCE:

Datum of the National Employment Service in Ivanjica
Datum of the Secondary Technical School in Ivanjica

EXPERIMENTING WITH PATTERNS IN CREATING GARMENTS WITH JUST A FEW CUTS AND STITCHES

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ABSTRACT: During the research of how the patterns evolved through the history of costume all around the world, an idea was born, to try and create a garment with minimal cutting of material that was comfortable and easy to wear. Inspired with the origami- a technique of paper folding, with costumes of nomadic tribes in Tibet and with Japanese traditional costume – kimono, a form of costume that emerged in Japan, made out of strictly geometrical patterns that didn't follow the form of the human body. Despite that, kimono gave the human body sophisticated appearance, and the form of the body was anticipated under the many layers of silk, from which the kimono was usually made. Idea was simple, and started as an experiment. Experiment started with folding rectangle pieces of paper, similar to origami, to help envision the process that would later be used in making a final product. It still is just an idea, that has an opportunity to evolve and lead to some greater discoveries in garment making.

Key word: patterns, geometry, fashion, origami, kimono

A SHORT OVERLOOK ON PATTERN DEVELOPMENT IN GARMENT MAKING, THROUGHOUT THE HYSTORY OF COSTUME

With historical overview on creating a costume we can see a lot of differences throughout the years of development of patterns that build a form of the costume, but also a lot of differences between different cultures in making a pattern. Costume was always one of the more obvious ways that helped segregating two cultures, different in their religious views or cultural development. Forms of the costume depended on cultural growth of the country but also it depended a lot on the climate it was stated in and on the influence of the culture of their neighbors.

In Ancient Greek culture, with the influence of their neighbors in Asia, they formed draped look with almost no patterns at all. The wide piece of heavy wool fabric , was draped on the body and pinned with a couple of clasps. The weight of that wool fabric made many cascade folds on the costume and exactly this attribute made the Ancient Greek costume famous and admired. Despite the weight of the fabric and no patterns used to make that garment, human figure was presented in a very leisure manner, in a soft silhouette, with comfortable garment that indicated the human figure.

Figure 1: Illustration on the left shows the Ancient Greek costume, but the picture on the right shows a detail of the east pediment sculpture of Parthenon, made by the famous Greek sculptor Phidias, where he sculptured in a very realistic manner, draped fabric that embraced the human body

At that ancient times some of the cultures found their own ways of creating a costume. Minoan Empire situated on an island of Crete, that was the first neighbor to the Greeks, and had similar influences from the East, had a very different outcome when it came to making a costume. They were making patterns for sewing the costume, and even something that was very close to a corset, that only later emerged in the medieval and renaissance costume.

Figure 2: Minoan figure of the Snake Goddess, from Crete, in her costume that fits the body, very similar to the corsets shown on the right, pattern that was developed centuries later, in the renaissance

And while the Europe was trying to fit the suit to the body, or even creating exaggerated forms when cutting the fabric to make unrealistic silhouettes from early renaissance till the 20th century, other parts of the world seamed that have been frozen in time. That was just at first impression, because some of the non-European cultures had isolated development with very few or nothing of the influence from the rest of the world. Something that Japanese culture was going through, with isolation by demand from the first shogun of the Tokugawa shogunate in Japan ,Tokugawa Ieyasu , lead to one of the greatest development of culture and art. The costume was nothing like the one developing in the Europe and had no influence on the side. Also, tribes from Tibet, that had a lifestyle like no other, and still today remain in that manner, Nomads, in their way of living that does not involve steady place to live or a steady place to grow food, evolved wrapped looking garments, accidentally, a silhouette that has inspired many who decided to go beyond the borders of the strict European costume.

JAPANESE CULTURE AND COSTUME AS AN INSPIRATION FOR EXPERIMENTING WITH PATTERNS

Inspired with the costume of the far East, that was made out of strictly geometrical forms, and had no cuts that shaped the costume so it would fit the body, idea was born- to create modern forms that were functional but the process of making them was easy and no part of the fabric was wasted.

Geometric form of Japanese costume, or the kimono, was a great inspiration for this experiment. The form of the pattern for making a kimono is strictly geometrical, totally opposite to the human body with all its curves, and shapes. Yet, the kimono gives a body full mobility, and a very sophisticated and exotic silhouette.

 

Figure 4: Kimono on the left that clearly shows the geometric pattern and on the right a young woman wearing a kimono that gently wraps her body in creating this sophisticated silhouette

Origami was also one of the greatest starting point , in changing the way of thinking when it came to pattern making for garments. Origami-traditional Japanese art of paper folding , made possible for a two-dimensional surface to become a three-dimensional form.

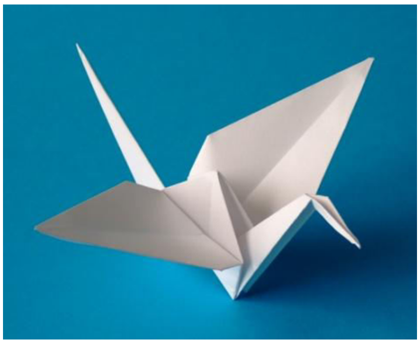

Figure 3: Paper crane, the most famous origami figure

Inspired with origami and geometry, experiment started with paper folding. That was the easiest way to express the idea and try out all the possibilities of this direction in sculpting a form of a garment.
A great knowledge of the human anatomy was necessary so that the form could be created just out of a rectangle piece of paper. Hands need full mobility, so the sleeve line had to be comfortable for the shoulders and hands, despite the untailored lines that were used in this technique.

This technique made possible that the whole width of the fabric was used with no cut off parts, and no material wasted. All of the cuts were used as a sleeve line and the part of the fabric that seemed like it was a surplus, was actually turned into a pocket or a collar, using a folding technique that emerged from that origami inspiration. These folding that were folded so they would create a pocket also had to consider human anatomy so that they would be functional.

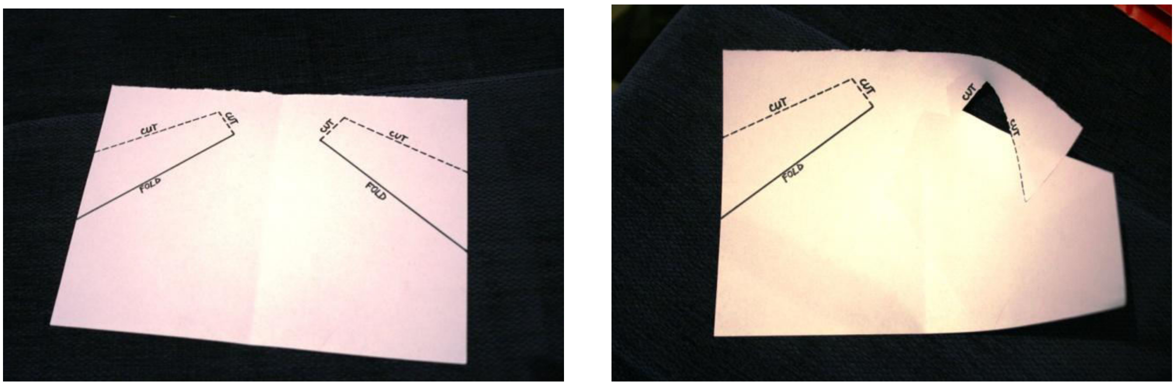

Figure 4: First phase of this experiment was done with a rectangular piece of paper that was accurately marked with lines that specify where to cut and fold

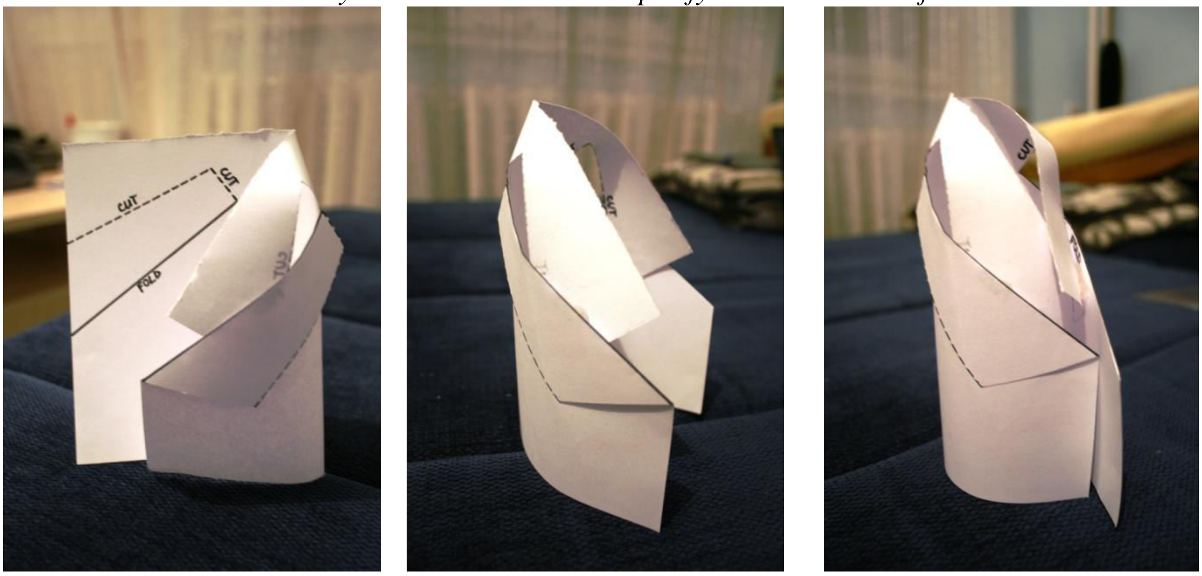

Figure 5: Photographs above illustrate step by step process of folding a paper in creating a three-dimensional form

Next thing that had to be considered was the fabric that was suitable for this type of garment making with minimal stitches and sewing in general. Fabric, that would be most appropriate for this experiment, had to be the one that wasn't woven and wasn't knitted, so the edges wouldn't rip. Very few fabrics had that attribute, so it would either be leather or some kind of wool that is used for coats, at least for this experiment, later when the idea evolved, all kind of materials were used, they just had to have a lining.

Figure 6: Model wearing a west from the collection NOMADIK, where this technique in pattern making was applied

This technique was applied in developing a men's collection for the season AW 11/12, called Nomadik. This whole experiment has actually emerged from the research that was done in developing this collection. Nomadik collection was inspired by the Japan culture and costume, but mostly it was inspired with the Japanese way of thinking. Also, the inspiration for this unconventional collection originated from Nomadic tribes costume, where the name of the collection came from. Nomadik doesn't just stand for that, it stands for every thought that calls in question all of these things that we take for granted, like a nomad that never stops searching, never stops wandering around the planet, but also inside their own microcosm. The same is for the garments that we use every day, never calling in question the functionality of it or the symbolism that it stands for, that we don't consider searching for.

CONCLUSION

Fashion is a playful game, and the essence of it is to never stop experimenting, it doesn't matter if the experiment is about the fabric used, pattern, or experiment that includes a forms and shapes of a garment or an experiment with color and printed textile. The most important thing for a designer and an initial point in starting any creative process when looking for inspiration, always has to be - a wide field of interest and a deep research process. Inspiration is much greater and more unique, when the field of interest of a designer, gets wider. Then, there are more possibilities and more opportunities to experiment. That is the best way to progress as a designer, especially because of the fashion industry- always in need for new forms and new looks, because if it is new, it's fashion.

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THE IMPORTANCE OF ECOLOGY IN THE TEXTILE INDUSTRY

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ABSTRACT: With the population growing gradually and economy booming in the world, the need of textile product accordingly increases rapidly, which results in the big generation of textile waste. The disposal of textile waste brings in many adverse effects on environment, such as the landfill occupation. The production of textile product itself also causes much environmental concerning. In order to cope with the increasing textile waste and reduce the pressure of waste management, waste prevention is primary, as well as effective choice. The prevention of waste from textile can return ideal revenue from economic, social and environmental aspects.

Key words: Textile industry,waste prevention, textile waste

INTRODUCTION

Everyone is familiar with textile, since it surrounds our daily life. The quilt, the toothbrush, the towel and your clothes are connected with textile. Except for the household life, the textile also appears in military field, such as the bullet-proof vest, the helmet. In the upholstery, the carpet on the floor is textile. In the hospital, the medicaltextile plays an important role. In the electronic field, textile also takes up some space,such as the electronic textile which is fabrics that have electronics and interconnectionswoven into them. In one word, beyond the apparel, textiles are used in miscellaneousproducts, sometimes hidden from your view, but mainly demanded in clothing, home furnish and industrial use.[1]

When concerning the textile product, the environmental problem derived from materialresource, process procedure, end-of-pipe disposal and increasing consumption of textileappears. In order to relieve the environmental problem from textile product and waste,the prevention of textile waste needs to be researched.[1]

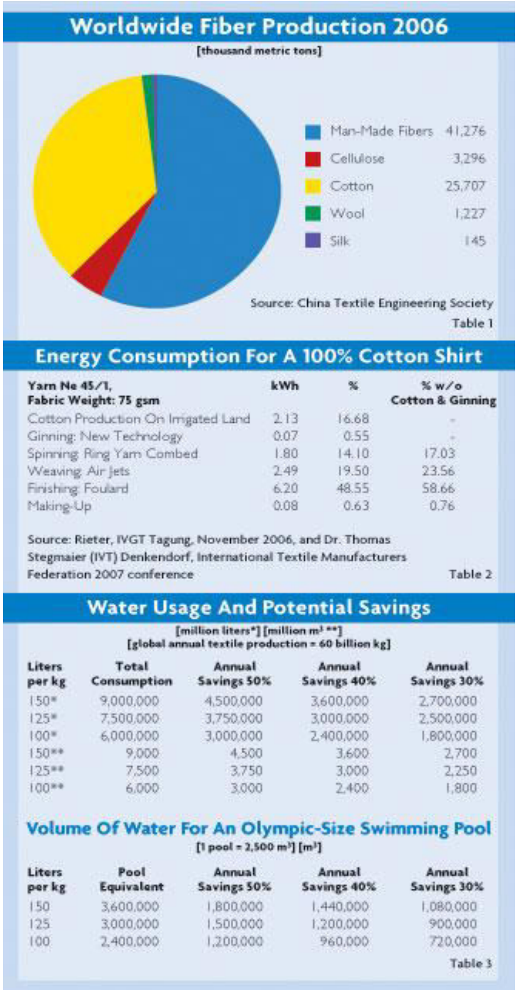
ENERGY USE BY THE TEXTILE INDUSTRY

Today, some Western countries are blaming the East for using too much energy. The Eastern world just started its industrial development a short time ago. For example, one-third or even more of the world population lives in China and India. Who would deny that these people also have the right to a better life? At the moment, China is producing more carbon dioxide (CO2) emissions than the United States. However, China's 11th Five-Year Plan sets targets of reducing energy consumption per unit of gross domestic product by 20 percent, and cutting total emissions of major pollutants by 10 percent by the year 2010. [2]

The total global production of man-made fibers in 2006 rose to 41.27 million metric tons, of which China and India accounted for 51.8 percent and 6.2 percent, respectively, and man-made fiber consumption is steadily increasing.[2]

The textile industry uses a lot of energy. Figure 1 shows the energy consumption in kilowatthours (kWh) to produce a 100-percent cotton shirt. It takes 4 square meters of land to grow the cotton, and there are 300 grams of fabric in the shirt. The following benchmarks show the difference in energy consumption of the dry process steps of knitting and weaving versus the wet finishing:

- knitting: 1.2 kWh/kg;
- weaving: 6.2 kWh/kg;
- finishing: 17.9 kWh/kg. [2]



Worldwide Fiber Production 2006

[thousand metric tons]

Man-Made Fibers	41,276
Cellulose	3,296
Cotton	25,707
Wool	1,227
Silk	145

Source: China Textile Engineering Society

Table 1

Energy Consumption For A 100% Cotton Shirt

Yarn Ne 45/1, Fabric Weight: 75 gsm	kWh	%	% w/o Cotton & Ginning
Cotton Production On Irrigated Land	2.13	16.68	-
Ginning: New Technology	0.07	0.55	-
Spinning: Ring Yarn Combed	1.80	14.10	17.03
Weaving: Air Jets	2.49	19.50	23.56
Finishing: Foulard	6.20	48.55	58.66
Making-Up	0.08	0.63	0.76

Source: Rieter, IVGT Tagung, November 2006, and Dr. Thomas Stegmaier (IVT) Denkendorf, International Textile Manufacturers Federation 2007 conference

Table 2

Water Usage And Potential Savings

[million liters*] [million m^3 **]
[global annual textile production = 60 billion kg]

Liters per kg	Total Consumption	Annual Savings 50%	Annual Savings 40%	Annual Savings 30%
150*	9,000,000	4,500,000	3,600,000	2,700,000
125*	7,500,000	3,750,000	3,000,000	2,500,000
100*	6,000,000	3,000,000	2,400,000	1,800,000
150**	9,000	4,500	3,600	2,700
125**	7,500	3,750	3,000	2,250
100**	6,000	3,000	2,400	1,800

Volume Of Water For An Olympic-Size Swimming Pool

[1 pool = 2,500 m^3] [m^3]

Liters per kg	Pool Equivalent	Annual Savings 50%	Annual Savings 40%	Annual Savings 30%
150	3,600,000	1,800,000	1,440,000	1,080,000
125	3,000,000	1,500,000	1,200,000	900,000
100	2,400,000	1,200,000	960,000	720,000

Table 3

Figure 1. Energy use by the textile industry

BIODEGRADABILITY OF FIBERS

Fiber can divided into different types based on different guidelines. According to the length, fiber can be divided into two types: staple fiber and filament. According to the origin, fibers can be classified into two types: natural fiber and manmade fiber, while the manmade fiber can be divided further into regenerated fiber and synthetic fiber. Table 1 gives a summary of the textile type for clothing. This report chooses two representatives from every type to be interpreted.[3]

	Natural	Man-made	
		Regenerated	Synthetic
Existing	Cotton, Flax (line), Silk, Wool	Viscose	Acrylic, Nylon, Polyester
Emerging	Flax (Short), Hemp, Jute, Nettle, Ramie, Spanish Bloom	Bamboo, Lyocell, Modal, Soybean	PLA, PTT

Table 1. Categorization of fiber types

According to table 2, it is obvious that all of the fibers selected in this report have adverse environmental impact, but can be recycled for reuse. The fibers from the naturecan be biodegradable, while the synthetic fiber can't be biodegradable.[3]

Textile product	Nonpolluting to obtain, process, and fabricate	Made from renewable resources	Fully biodegradable	Reusable/Recyclable
Cotton	No	Yes	Yes	Yes
Wool	No	Yes	Yes	Yes
Rayon	No	No	Yes	Yes
Lyocell	No	Yes	Yes	Yes
Nylon	No	No	No	Yes
Polyester	No	No	No	Yes

Table 2. The environmental analysis of fiber

THEORY OF WASTE PREVENTION

By reviewing EU waste directive (European Commission, 2008), the waste hierarchy canbe summarized into the following, see figure 1. [3]

Figure 2. EU waste hierarchy

As figure 2 showed, waste prevention is the most preferable option for the wastemanagement. As the first and also the most effective step of waste management system,waste prevention gets more and more attention recently due to the great defects oftraditional pollution control, for example, as a kind of pollution control measure, theincineration of textile waste will result in the effluent of waste gas. Pollution control, as akind of end-of-pipe treatment method, brings huge improvement for the environmentquality. But it also brings in great side-effects when reducing pollutants, such as thesecondary pollution problem, the extra investment for the treatment facility and so on.[4]

Totally, the pollution control is an inefficient way for waste management. Inversely, wasteprevention has much more superiors than pollution control. For example, wasteprevention can reduce the landfill use and material consumption. Although wasteprevention can’t solve the entire waste emission problem, it offers a cost-effective waysto minimize the generation of waste and finally can improve the public fame for acompany or a country.

Encompassing the textile waste and textile product, many environmental problems comeinto being. These environmental problems resulted from the textile waste inspire someEuropean countries to transfer the attention to the waste prevention, not only theend-of-pipe disposal.[5]

PROBLEM FROM THE END-OF-PIPE DISPOSAL

Recycle is an environmental choice for the post-consumer textile, since it can improvethe material efficiency and reduce the consumption of the energy. But the recycling rateof textile is very low because of the diversity of fibrous waste, structure and highrecycling cost. For example, the cotton is usually not recycled due to the presence ofdyes and other fibers. In the USA, only 15.9% of textile waste was recovered in 2007 (USEPA, 2008), the unrecovered textile waste accounted for about 4% of the content oflandfills. That proves the textile recycle is still not enough, whichresults in the high cost of the final disposal. Except for that, the recycling process is verycomplicate. Figure 3 depicts the explicit recycling process. As can be seen from thisdiagram, the recycling process itself will involve not only energy but alsosecond-pollution (such as the waste water from cleaning process) and consequentlydoesn’t have significant environmental benefits over the prevention of textile waste.[6]

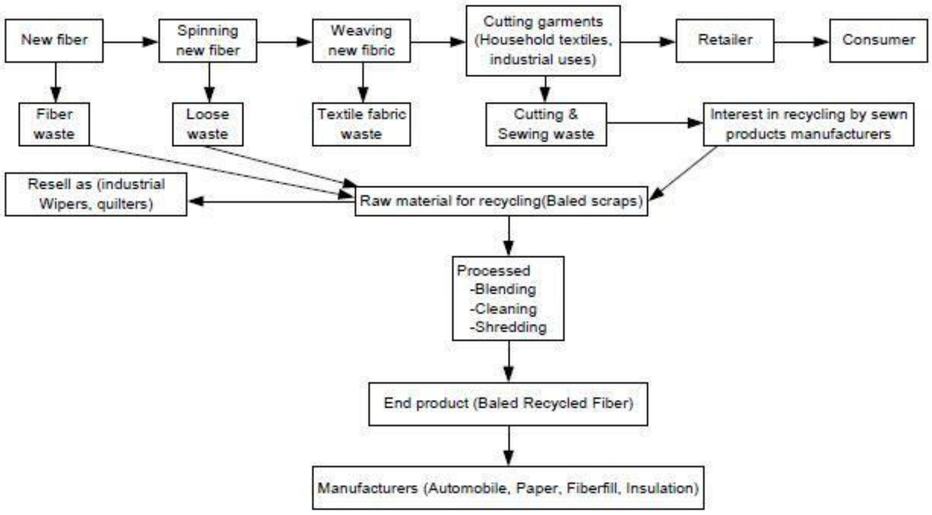


Figure 3. Recycling fabric cutting waste: process and relationships

Landfill is the last and inefficient choice for the textile waste disposal. The biodegrade oforganic textile, such as the cotton, will generate the methane and ammonia, while theformer is an important greenhouse gas, the latter is highly toxic in terrestrial and aquaticenvironment. In terms of economic aspect, the increase of landfill fee is also aformidable obstacle for the textile waste disposal.Clearly, as landfill disposal of solid waste is less and less option, other means on handlingtextile waste must be found. Some experts suggested waste-to-energy conversionthrough the incineration of textile waste, but incineration is accompanied with theemission of hazardous substance such as dioxin, heavy metal, acid gas and dust particle,all of which are harmful to human health and environment. Although some facilities areequipped in the incineration plant, it is impossible to remove the hazardous substancethoroughly.[6]

REVIEW OF THE PREVENTION METHOD

Waste prevention is an effective way to attain the compliance of the environmentalrequirement, so is the textile industry. Overall, the waste prevention methods can bedivided into the following sectors: industry, agriculture, commerce, mining, construction,transport, energy and consumers. Considering this report just focuses on the preventionof waste from textile product itself, especially the apparel, this report just discusses theindustrial, commercial and consumptive prevention methods.[7]

Industrial prevention method analyzes the life-cycle impact of the product onenvironment and then prevents the waste generation from product design, improvedplant operations, in-process recycling, process modification, materials and productsubstitutions, and material separations.
Either for the pre-consumer textile or for the post-consumer textile, the common andpopular method to prevent the waste is to collect and then reuse them.[8]

As for the pre-consumer textiles, they are usually broken down and remade into similaror different materials, or sold to the third-party buyer as the raw material to produceproducts. According to the Council for Textile Recycling (1997), each year 750,000 tons ofpre-consumer textiles are recycled into raw materials for the automotive, furniture,mattress, home furnishings, paper and other industries, which divert almost 75% of thepre-consumer textile waste from the landfills and recycled.[8]

About the post-consumer textiles, figure 4 shows a typical disposal process. According tothe definition of prevention in this report, the primary and secondary recycling measurescould be regarded as the waste prevention methods. Primary recycling involves recyclingscraps, namely, reuse, while secondary recycling involves simple mechanical processingof a post-consumer product. In figure 4, donating the post-consumer textile waste to thecharity is a typical primary method to prevent the waste from textile. These donatedclothes are sold as secondhand clothes to consumers especially in third-world countries.[9]

Another prevention method showed in figure 4 is to reuse the textile waste after somesimple mechanical disposal, such as shredding. The shredded textiles are treated as rawmaterial of other functions, such as the cleaning cloth, stuffing material, roofing material.Reusing the clothes between siblings or relatives is also a popular way to prevent thewaste from textile.[9]

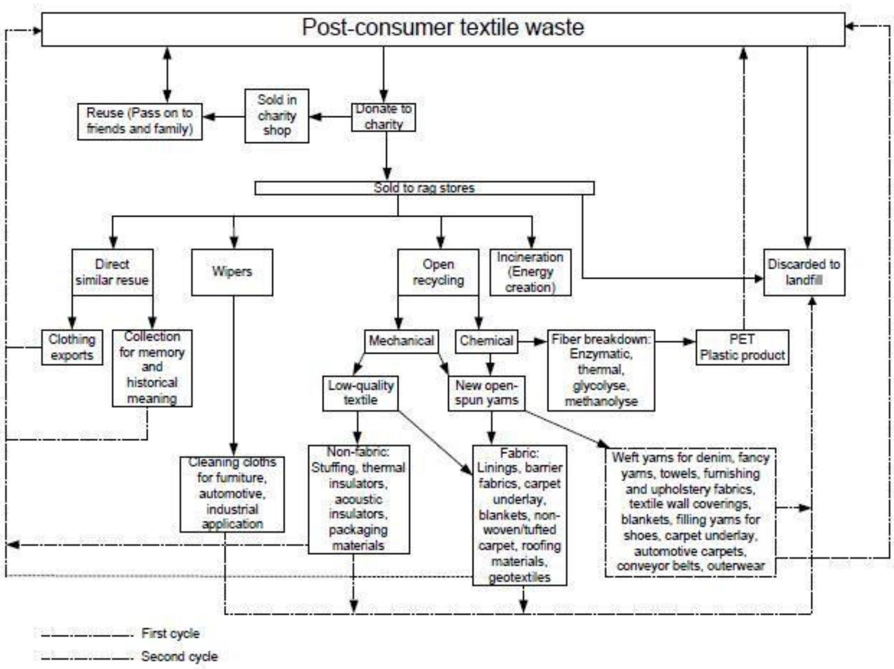


Figure 4. Schematic of post-consumer textile option

CONCLUSION

Even if the textile waste just takes up a small proportion in the total MSW, the amount is very big. In order to reduce the textile waste, some countries give high priority to waste prevention. As for the prevention of waste from textile, reuse is a common method. Actually the designer and consumer can contribute much to prevent the textile waste, while the practical situation makes the prevention of textile waste difficult, since the dominant element for the designer and consumer is apparel itself, not the environmental issue of the textile product, although they understand deeply the environmental concerning is very important for a product.

Clothing, manufactured from textile, is a very important part of our life both in function and for fashion. According to the study in European countries, clothing accounts for 3% of all expenditure on consumption products, which is on the similar level to health and communication products.

Beyond fiber production, the dyeing and finishing sector is the largest energy and water consumer in the whole textile chain and has the highest potential for energy and water savings and efficiency improvements. Action is needed, but the industry cannot do it alone. National and multinational governments should support the industry with incentive plans to change old technology with modern equipment.

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Textile science and economy 2014

STUDENTS PAPERS

THE INFLUENCE OF THE PUNK MOVEMENT ON FASHION THROUGHOUT THE YEARS

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ABSTRACT: Punk subculture developed in a society as an underground network in all artistic forms, with one goal: to fight the capitalystic system, and as such, it was an explosión of creativity, so it had to become a plaything for the mainstream society - the one it was fighthing against in the first place. Exploiting the resorces that punk has, brought to the mainstream culture genres and forms it could never have if it wasn't for punk. Punk influencend on the most prominent fashion designers, such as Vivienne Westwood, Jean Paul Gaulthier, Yohji Yamamoto and Alexander McQueen, back then in the 80's. Even today, punk has a big influence on fashion designers such as Martin Margiela, Dries van Noten, Alexander Wang and many others. Moreover, punk has influenced a lot of the fashion blogers and fashionistas too, that offer their critic of the fashion, but also set up trends for the next seasons on their blogs, what has become a whole industry for itself in the last decade. Influenced by that, celebrities also embraced punk fashion in all its form, and with that help punk can be accepted by the world at last.

Key words: punk, punk rock, punk fashion, Vivienne Westwood

HISTORICAL ORIGIN OF PUNK

Early period of twentieth century proved that we can divorce ourselves from the constraints of the traditional ways of thinking, whith new art movements that were emerging, but also through social and political relations that were developing at that time. Throughout the entire twentieth century, artists were engaged in moving the boundaries within one cultural climate, until they would seemingly exhaust all of its potential and led the audience to the edges of boredom and thus create comfortable conditions that would form a counter-climate in art and coulture in general. Souch leap from one extreme to another created many inovating findings in art and culture, but also in some periods led to disastrous results including World Wars. After the World War II all what art and culture needed was a period of regeneration, but in a short time it fell into a routine, monotony, and started to turn more and more tworwards the industry, mass production, mass media and making icons out of celebrities, especially movie stars that were promoting careless and comfortable life style. Most of the people lost the idea of true values and slowely turned into a society of consumers, suitable organizam that nourished the industry. Still, today, system of capitalism and mass production rules the world and manipulates with people. Design, by the understanding of many, became just one of the weapons that made that manipulation possible.

However, 70's gave some hope, to the development of the culture, that all of that can come to an end, or at least, for just a moment, it's possible to stop this industrial machine, so people can ask themselves whether thay can do something to fight that system that has been established.

Hippie movement is starting to emerge among young people worldwide, as a consciousness of the wrong track that the culture was headed, but still not as a rebellion, just a quiet, existent awareness about it. The hippie movement, does nothing to stop it,in fact, whit its hypnotic and calming aesthetics draws the individual more and more in a state of sleep, in the world of opiates, daydreaming and psychadelic rock that obscures the real picture of cruel system of capitalism in society that surrounds them. The music, that was reduced to endless soloing on the guitar, which reached its peak, actually created very couzy cradle for a big ugly baby that will burst from its throat a screaming cry of punk. A cry so loud that pierces the ears and awakens the world from that sleep that it has fallen into. It doesn't alow anyone to go to sleep and in a very aggressive manner exclaims great truth about the world regardless of any authority and institutions.

Punk emerged everywhere at the same time, and exact place of origin of punk rock, the music genre, remains unknown. The reason for this is the need for rebellion everywhere around the globe at the same time. Punk rock, a music genre that entrhroned the punk subculture in all its forms, emerged in England, America and Australia all at the same time.

Forerunner of this genre can be recognized in the Garage rock, music genre from the 60's that has the similar guidelines as his famous descendant, however the climate in society at the time was not convenient for the further evolution of that genre. Protopunk came after that with the same wild untamned energy, and this genre still did not have the need to be heard and to change things in society that gave birth to this angre, it was just an explosion of aggression that boiled up inside of the protagonists of this climate in music. Punk, however, came to the scene very dramatically and cried for attention. Punk wanted to send the message for the whole world to hear, to wake them up from this painfull aghony, so they will come to their scences and see this capitalistic system for what it really is, a neverending track that leads to downfall of all creativity and true human freedom.

Figure 1: Punk band performances in the 70's. (Sex Pistols showed on the left picture and on the right picture The Ramones, punk rock band)

Drummer of the legendary punk rock band "The Ramones", Marky Ramone stated that the raw rock'n'roll is just what a world needed: "In it's initial form, a lot of 1960's stuff was innovative and exciting. Unfortunately, what happens is that people who could not hold a candle to the likes of Hendrix, started noodling away. Soon you had endless solos that went nowhere. By the 1973, I knew that what was needed was some pure, stripped down rock'n'roll."

John Holmstrom, a man who started the "Punk" magazine, gave a statement at one point that the Punk rock had to arrise, manly because rock scene bacame exousting to such an extent that Billy Joel and Simon and Gurfunkel was considdered to be rock, when everybody who was a true fan and rock musician knew that true rock had to be dirty and rebbelious. Also he stated that punk rock is acctually Rock'n'roll but played by the individuals who are not so good at being musicians but on the other hand excelent in expressing their opinión and themselves. In december, 1976., bulletin "Sideburns" published a very famous and iconic illustration that portrayed three simple chords and stated: "This is a chord, this is another and this is a third. Now form a band."

Musical elements of Punk rock were similar to those in Garage rock of the 60's. Short tunes that often lasted under three minutes, made out of three chords, fast paced and aggressive, with strong loud vocals that turns into a noise instead a harmonized melodic voice. Lyrics are short and carry out a clear, strong message with themes of love or political nature, depending of the ideology of the band.

Ideology of the punk subculture is a group of social and political beliefs and convictions. It is a concept of rebellion, against all authority, individualism, free thought and expression of dissatisfaction through the means of music in punk rock, but also in other disciplines in that subculture-punk literature, punk visual art and also, very meaningfull, punk fashion, that changed the cours of fashion like it was done never before, with any other rebellion in fashion so far.

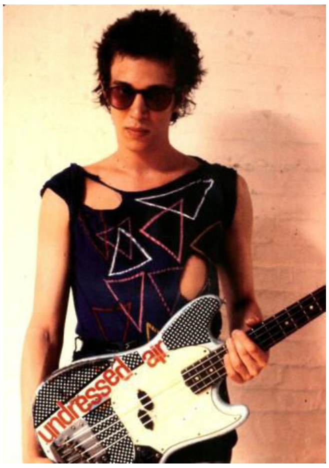
PUNK FASHION

In its initial form, punk fashion was an expression on noncomformity and opposition to mainstream culture, but also opposition to the hippie movement, that was already by itself a counterculture. Playing against everything that was established in society at that moment, punk fashion often showed aggression, rebellion and individualism. Marked with aggressive tattooes and clothes, jewelry with spikes, that served as a political or social statement. A lot of punks buy second hand clothes so they would mark themselves as an anti-consumer.

The original punk fashion did not come out of nowhere, in fact, it has a lot of influences from various side, but all of them had a rebellious twist: moto jackets that worn the bad guys – motorcyclists, T-shirt with statement inscriptions that emerged with industrialism in fashion in 50's, with a difference that punks worn it with sarcasm, jeans that was most famous amongst greasers of the rockabilly era and british rockers from the 60's.

Figure 2: The Ramones album cover from the 1976.Band members in a photo that made a famous punk photographer Roberta Bayley, and set the basic elements of punk fashion, that, soon, musicians of all music genres would accept and live up to, even today.

Richard Hell, the leader of the punk band "The Voidoids", was the founder of punk fashion. He was the first one that made his hair in spikes, made cuts in his T-shirts, and than that separated parts patched up with just a couple of safety pins. He is considered to be the first one that used safety pins as a fashion accessorie. Malcom McLaren stated that Richard Hell is the main inspiration for the whole aesthetic of his band Sex Pistols and also inspiration to his wife, Vivienne Westwood, who designed all of the clothes for this band. His androgenus appearance and innovation with safety pins and his hairstyles indeed influenced on Malcom, and in addition to that influenced the entire British punk world.



Richard Hell in his original outfit and on the right with his band members from the "The Voidoids"

Malcom McLaren and the band that he was a menager of, the famous"Sex Pistols"

In female punk bands came a much grater change than in male bands, not in oppose to male bands, but in oppose all of the former female bands in earlier stages in music. They accepted exactly the same elements in fashion as male, wearing leather jackets with chains and spikes, with cut off jeans and moto boots and old sneakers, and thus create a very masculine look for them. Aggressive, fetishistic attitude, that is tottaly divorced from any kind of female form and silhouettes.

A female artist from a female music band Siouxsie Sioux, and a female lead vocal band "The Plasmatics"

In oppose to fetishist and vixen look Patti Smith created a androgenous look divorced from any kind of female silhouette

With time, tattoos and piercings all over the face and body, metal spikes on clothes and accessories such as belts and bracelets, rings, even shoes and bags, become much more common in puk clothing, among the musicians and also among fans. In fact, anything that would schock and scare people away was welcomed into punk fashion. Somewhere along the way someone introduced punk with moahawk, a hairstyle of the North American tribes, and until today it is the most recognized punk fashion hairstyle.

Figure 3: The Punk Qrown, famous Mohawk hairstyle

Never before has a fashion been so aggressive and so closely related to music, like the punk fashion was. That is why the subculture emerged, underground network that gathered young minds, showing them how to stop the treadmill, that industry track that everyone else obediently marched on. At first a small group of young people who don't run away from this problem of society, instead, they jump in the center of the battle, armed with thorns, safety pins, blades, chains, Dr. Martens boots that are reinforced with metal on top, in moto jackets, cut off jeans, saying with every garment they wear that they are ready to fight and keeping everybody else on distance with all the spikes like a barbwired fence. Every part of clothing had a message, nothing was there without a reason. There are differences among punks and they are related to the music genres. As the punk rock evolved and new forms of punk were created in music, the punks started to vary among themselves depending on what the ideology and genre of punk they accepted.

VIVIENNE WESTWOOD, THE QUEEN OF PUNK

In the very beginning of punk history, Vivienne Westwood, famous and iconic fashion designer today, recognizes all of the treasure that punk holds in its assets. She arrives in London at the age of 17, enrolling a “Harrow school of art” where she studies fashion design and jewelry. However she abandones art in stating that she doesn't know how a working class-girl intends to make a living out of art. She finds a job in a factory, while studying to be a teacher. Later, she finds a job in some elementary school, and meets Derek Weswood in 1961. , and next year she marries him. While she was workin as a teacher she had a hobby making jewelry at home and selling it on the streets, and for the occasion of her own wedding she makes a wedding gown all by herself and in her own design. Punk that was always there in her personality had to emerge at some point, and when it finally did it was loud. At some point she met Malcom McLaren, a thing that eventtially ended her merryage with Derek. A life with Malcom set her in the center of punk subculture and at the very beginning of it. She designs clothes following Malcom ideas and selling them in a punk clothes shop, that was called “Let it rock” at the beginning, later at the influence of a band that Malcom menaged it was called “Sex” and than “Too fast to live, too young to die”.

Inspired with bikers, prostitutes and fetishists, with Richard Hell – aesthetic, both deep involved in punk culture, they dedicate their work to that ideology. Every fashion garment has to shock and send a message, it has to break all bounderies that exist in clothing. One of the most interasting moments of her creativity is when she used classical patterns for historical costume of the 18th and 19th century, and changed it so it almost can't be recognized, and by doing that ridicules the traditional.

The band Sex Pistols celebrated her work, wearing her clothes on every one of their performance, so son she bacame known to the world as The Queen of Punk. Not only the world of punk but supprisingly fashion all over the world welcomed her as if it was waiting for someone just like her to bring the life in a industry that was boring and uptight. She oppened the big doors later for the famous Jean Paul Gaultier, but also inovational japanese designers who moved the boundaries of a garment in the East, but now the door was open for tham that lead to Europe. Johji Yamamoto and Rai Kawakubo also knew what pnk was just didnot call it by that name. Coulture of Japan did not have this great change that Europe and America gone through, the punk was already there in some form. The creativity never stopped there, but now the door to the rest of the world was oppen for them, thanks to Vivienne, and the punk subculture that was behinde of all of her work.

Figure 4: VivienneWestwood back in 70's. Wearing her own work, on the left and in the center with her partner Malcom McLaren

Figure 5: Vivienne Westwood work today, on fashion show and posing in one of her one designs for a magazine. Seems like nothing has changed for her.

PUNK IN FASHION TODAY

The same door that led the mainstream culture to peak and see the world of punk, also led the punk out in the world , out in the sunlight, maybe even unvillingly, because punk was not set out for that, punk did not have that need to be a part of that world, on the contary it was formed so it can confront that world. Punk started to change but also it evolved and made genres that waren't posible in the mainstream until than. Mainstream culture has been given a new zest, a world had a new plaything to exploit.

Today, punk doesn’t have exactly differented styles, and groups in fashion, simpply beacuse it is not folowed by the music genres. Punk in music still exists, and punks have the same caracteristics in clothing like they did back than, but when we say punk fashion today we don’t mean the punk subculture at all. That expression is left to haute couture or a trend that appears from time to time in fashion industry.

Celebrities exepted punk fashion and celebrate it, ussually when they want to say they too can be rebellious, they too have something to say. They accept the style, but usually they are far from understanding the reasons why it was created or how it evolved, what was the message that it wanted to send.

Figure 6: Lady Gaga in one of her outfits as oppose to a punk band The Misfits

Figure 7: Fashion today, influenced by The Punk Era

The question remains; is what Vivienne Westwood has done to punk, did she rescued it from the bottom of the world by showing it to the world? Would the punk be extinguish by now if it was left in the dark where nobody could hear it or understand it? Or, is what she did to punk a betraual, did she hand it over to the enemy?

Offcourse, if she wouldn’t do it back than, somebody elese would by now. The golden toy had to be revealed to the world, and even today the world uses all of the punks creativity, without trying to understand its ideals and what the rebellion, of it, was.

Punk lives even today in this modern world, it evolved so it can share the stage with the beasts of capitalism. Still today, punk has a very strong message, the same it did in the very beginning, and still today the punk is shouting to the world, but the question is, is somebody today even listening?

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THE PROCESS OF TRANSFORMATION OF THE UPPER GARMENTS OF PRIZREN AREA IN THE 19-TH AND 20-TH CENTURY

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ABSTRACT: Dress code native of Serbia in Prizren in the 19th century is greatly interesting to study, how the cultural and aesthetic, and sociological aspects. In Prizren in the 19th century the main garment was "dzube". The city as an important trade center was in progress with changes of clothing in Scadar and Constantinople, and through them it was in a relationship with Venice and Trieste. In the 19th century was present exchange of upper garments between Prizren and Scadar. "Dzube" in Scadar was was short to mid hip, in Prizren "dzube" was structured as a long garment to half sheets. International clothing of Serb women were short garments embroideres west – "jelek" , "mintan", "salt", "misiraba"and "libade"; long clothing – "dzube", "anterija", "dolama, "fistan" and "curak" (coat). In the period from the second half of the 19th century to the third decade of the 20th century, the upper garment postures have undergone significant changes in the cut and fit.

Key words:Traditional clothes, upper garments, transformation, Prizren

INTRODUCTION

Prizren is a town located in the southern Metohija. The city is located at the foot of theSar mountains near the Macedonian border. From the middle ages it was the main shopping center in Metohijasince the end of the middle ages until 1912. Traditional costumes of serbs in urban areas in Kosovo was werry interesting and werry important as a cultural event in the past of Serbs. It was a reflection of economic conditions, historical circumstances and patriarchal way of life. Especially the costume of urban wealthy population stands out for its exceptional beauty, richness, abundance of shapes and decorations. Untill the late 19th century, the basic type of clothing in Prizren was influenced by Turkish costume with oriental patterns, and the use of it retained until the Second World war. In addition to the influence of turkish costume contains elements of Greek costumes, but also characterized by authentic clothing for the urban enviroment in the rest of Serbia. The richness of inagination and artistry visible on the upper garments were sewed by craftsmen-tailors, and decorated by "terzije". Decoration of the Serbian town costumes with embroidery from Kosovo, is the foundation and seal according to which the same are recognized Serbina civil suit formed from the beginning of the 19th century, has evolved over time and transformed. It was a good indication of the growing power of Serbian town. This form of dress was shaped and lasted within the complex political, demographic, economic, social and cultural enviroment.[23]

THE WAY OF DRESSING

The basic form of women's clothing was on bare skin woman wore a shirt "Cenara" made of the domestic cotton cloth, or a home-made silk fabric. In winter they wore cotton "fanela" and over it wide-sleeved
shirt decorated with lace. Over the shirt was dressed "jelek" –silk or cloth vest. During the summer they wore "mintan" also, with narrow sleeves, decorated with metal and gold embroidery. Parellel with the shirt they wore the pants and the linen which were tied with sort of a belt around the waist, over thet they wore the trousers "dimije" –harem pants, decorated with ribbons and gold. Everyday harem pants were from "basma" or "jum basma" (silk and velvet fabric). These pants were surrounded in waist with colorful wool or silk belt and over it also filigree belt buckles from the front (for special occasions). Over waistcoat they wore "dzube" – dolman of cloth, usually red, richly embroidered. "Anterija" was worn over "dimije" it was more for for a home ceremony, not for events in public. It has buttons and was slit along the whole length decorated with gold embroidery and silk braid.

[23] Mirijana M. Menković, Građanska nošnja srba u Prizrenu u XIX i prvoj polovini XX veka, Etnografski muzej u Beogradu 2013.

Usually with "anterija" they wore "pregaca" (apron) made of the same color and the same cloth. It was an older phase of women's "alaturka" clothing. Another type of women clothing from the beginning of the 19th century is characterized by richness of gold embroidery on the upper garments made of velvet, dark cloth. In winter they worn "curce" short dolman with lenght was to mid thigh, black silk front slit the entire lenght and it was set with fur (fox, wolf). Women of lower classes instead "curce" wore the large- loop wool hall, whose ends by the front of the chest, under the arms. Older women wore dolman made of velvet or cloth, decorated with black ribbons socks were made of wool and cotton, woven and embroidered with silk, wool, beads. Clogs were worn on bare feet, only in the house and yard. They use also slippers for summer, and for a winter rubber "kondure". Over the weekdays, women wore "bosca"-apron woven from colorful wool yarn. Young women wore white silk "bosca" with gold embroidery, while older women wore "bosca" made of brown color with striped pattern.

Figure 1. Prizren girls (1925-1930) (photo from Ethnographic museum Belgrade), Ilustration Djordje Bascarevic

Upper garments

In the 19th century was present exchange of upper garments between Priyren and Skadar. "Dzube" in Skadar was short to mid hip, in Prizren "Dzube" was structured as a long garment to half sheets. International clothing of serb women were short garments – jelek, mintan, salt, misiraba, libade; long clothing-dyube, anterija, dolama, fistan and curak (coat).

Jelek

A short sleevless vest. According to the length of this vest, there are two types, long that reaches above the waist and shorter that ends just below or on the chest. Most abundant material in the development of this vest are silk, brocade, scarf, velvet and corduroy various shades of red and purple, light blue, green and black. Often used also striped silk material. Special graip of "jelek" vests make the switdres. They are made of brocade and velvet. Decoration is distributed across the entire surface of this vest, from which the color of the base material is almost invisible, usually embroidered with gold embroidery and ribbons. Ornament is stylized and geometric. All vests are artisan craftmanship.


a) b)

Figure 2. a)Jelek, b) Mintan

Mintan

Mintan is a short vest with long sleeves. There are three types: the first is mintan whose length is below the breasts with a flat or partially cut back and that make deep cutout on the chest and fastened beneath the breasts. The sleeves are long and straight cut, ends are straight, heart-shaped or fanlike, and the back is partially dissected and decorated with tiny buckles or buttons. These mintans are of the finest velvet and corduroy in a dark red and purple, decorated with rich floral embroidery in gold thread, cords and straps and have decorative buttons 'buttonholes' on his chest. The second group consists straight tailored mintan made of silk with striped pattern, bright colors and decorated with rows of dark silk cord. This variant is usually created of plush and velvet, belong to the second half of the nineteenth century. The third group of mintans consists of half-silk fabric, velvet, brocade blue, navy blue and brown or red, and their cut is significantly different from the first two groups. No larger hole on the back of the sleevs, made of velvet dark blue and brown color.

Salta

Special types of mintan are salta. By the cut they are different from the basic type of mintans- sleeves are wider and shorter than the length of the case, and they are carried in the wider area of Serbia. They are characterized by a rich relationship that completely covers the basic material. The most common are the brown, red and navy scarf, brocade and atlas.


a) b)

Figure 3. a)Salta, b) Misiraba

Misiraba

Misiraba is a short upper tunic with sleeves that are open throughout the length and are attached only at the top of the shoulder. The rich decoration of ribbons of silver covers the basic material and decorative buttons are made of the same material . According to the shape of the front side of misiraba, we distinguish two types: slightly rounded with buttons below the bust and straight. The shape and size of the sleeve can be varied slightly flat, and tapered at the bottom can be shaped to a point, rounded. The colors range is from red to purple and dark blue to black, and the base material is velvet and Čoja.

Libade

Libade is short upper garment of older women with long bell-shaped sleeves. It was carried on the wider territory of Serbia. Front side is slightly rounded and the jacket does not close on that side. Materials used for making libade are velvet, satin and atlas. Libade is decorated with gold and silver braid around the edges and around the sleeves, usually floral motifs. Typical colors are black, red, dark blue and dark purple.

a) b)

Figure 4. a)Libade, b) Dzube

Dzube

Dzube was international garment in Kosovo, a long with false dolama (open) sleeves. Dzube is the traditional craft and belongs to the second half of the nineteenth century, in terms of cut, material and decorations can be classified into three groups. The first group consists of objects a knee-length, sleeveless garment, whose front side entire length is open. They are made mostly of homespun, velvet and plush red, blue, dark purple and rarely brown color. The fronts are straight-cut, a short or long pegs are inserted down the middle of the back and that is what džube gives a distinctive look that is reflected in the extremely wavy bottom edge. Decoration is rich, mostly on the front, along the front edge and the back (trimmings, fringes, sequins and ribbons).
The second group consists of items typically cut up to half of the thigh or knee, sleeveless cut through the entire length. A special feature is the decoration. On background, dark or bright red colors with black or gold silk braid embroidery is made in the form of circles or Kuljača. Belong to the last half of the nineteenth century, and originate from Skadar.

Anterija and dolman

Anterija is the women's tunic length top half of leaves, long and open or partially open sleeves, tailored to the upper body, from the waist bell. Chest cutout is oval or flat shape, and fasten below the bust. They are made of the atlas, brocade, velvet and silk patterned material. Profusely decorated with the bust and sleeves with black silk braid and haberdashery.The second group consists of objects that are characterized by the existence of cepken (false) sleeves

.

Dolama is at the top of a narrow waist spreads in a semicircle. The sleeves are flat or semi bell and long. It was made of cloth or satin predominantly brown and dark brown color. Profusely decorated with gold embroidery and ribbons of sterling silver.

 

a) b)

Figure 5. a) Anterija, b) Dolman

Dress (fistan)

Dress or 'fistan' is a long tunic cut at the waist so that the upper and lower sections are clearly separated. The upper part above the waist with a tight body and tailored with the dorsal part without the cut on his shoulders. Deep heart-shaped neckline is lowered to below the waist and sleeves are docked safely on a flat or non-assembled from the forearm and 20 cm longer than that. The lower part consists of four pole that are arranged in a tiny creases. The base material is a thin silk rips of lighter colors. Mooring lines, which gives the effect of the entire length of the fabric alternately indicate broader and narrower vertical fields. Wider vertical fields are filled with stylized floral embroidery. Fistan is lined with a cotton cloth and sleeves Taft bright colors. Along the edges are sewn braid and silver threads. Around the neckline and cleavage, as in the field along the hole closure,are stitched the gold haberdashery tapes.

 

a) b)

Figure 6. a) Fistan b) Curak - photo: Ljubica and Blagoje Čemerikić, St. George in 1926. Prizren (photos property of the Ethnographic Museum in Belgrade)

Ćurak (coat)

Luxury garment or coat of crimson velvet, set with foxes' fur and decorated with embroidery of silver thread. Ćurak can bemade of lamb skin of red baize and studded with fox fur, richly decorated with embroidery in black braid. Ćurak can be shorter (Curci), to the waist. It has a shorter wider sleeves and spread collar, long (coat) to below the knee, with collar, fitted, flat back and long bell sleeves. Curak is open to the entire length on the front and side at the level of the hips have engraved pocket. The sleeves are in the upper part of a wider and corrugated, and the lower edge is narrowing. They are made of the atlas, brocade and rep with woven floral patterns. The bright colors (beige, light green, pink ...). This coats are newer garment dating from the early twentieth century, and made them artisans-skinners.

The transformation of the upper garments

In clothing of Serbian women in the second half of the nineteenth century and the first half of the twentieth century, dominate traditional oriental style. According to field recordings Hristifor Crnilović, oriental type of clothing Serbian women in the nineteenth century, they did not wear harem pants, but long dresses with laterally inserted pins. The adoption of the oriental way of dressing in the nineteenth century caused a shortening of the shirt and carrying more upper garments simultaneously in layers so that each doublet somewhat see. Put to the formation of images of clothing that is now recognized as a Serbian female costume in the town of Prizren was long, and the stabilization of the dominant short-form upper garment has gone through four parallel phases.

- The first phase (1830-1870) Clothing rich in handicraft making
- The second phase (the last decade of the nineteenth century) transforming long garments
- The third phase (the beginning of the twentieth century, the period before the First World War) distortion of long women's apparel
- The fourth phase (the period after the First World War) The predominance of short articles of clothing-motifs of the purchase of cotton material and highlighting shirts.

Figure 7: a) Transformation of the upper garmets. b) Prizrenka, the beginning of the twentieth century (photo property of the Ethnographic Museum in Belgrade)

The first phase (1830-1870)

First phase comprises the long garments rich in handicrafts and decorations dominated by golden embroidery on velvet and homespun. Dominant garment is džube, and next to him is anterija and dolama. Dzuba is used as a wedding garment. It was widespread in all confessional groups and in all classes of Prizren. Luxury clothing in the first phase are džube sleeves and anterija of velvet. It is believed that dzube was configured under the influence of Venice. These items of clothing were available to a small number of rich people. Džube sleeveless with a discreet connection is available and preserved in a large number of copies to date. In the period around 1850, there was an exchange of Prizren and Lake džube which was then finalized within faiths in the new environment. Besides dzube in the first phase there were present vests and mintans, they worn layers under dzube and it was richly embroidered with gilt thread, gold ribbons and haberdashery strips on a bed of homespun and velvet. In the second half of the nineteenth century, strengthen trade links Prizren and Skadar, and over Skadar with Constantinople and Trieste. Prizren population due to the fact up to date with modern trends of European fashion. In 1863, wealthier women stop wearing gilt ornate bodice, and replace it with 'vest of velvet', mostly dark colors from light materials, modeled after the French fashion. Changing the way of clothing, Serbs wanted to show that they were closer to the success of Catholics and Muslims.[24]

The second phase (the last decade of the nineteenth century)

In The records of Hristifor Crnilović the last decades of the nineteenth century, the Christian population began to defend wearing clothes embroidered in gold and metal thread (municipal decision against luxury, 1876.). This has contributed to women replacing dolman anterija, and then rejected all long clothes and replaced them with Jelek and mintan. In the last decades of the nineteenth century there become stronger tendency to move closer to the European fashion, but the traditional way of dressing was still dominant. The second phase will continue shaping the long garments and phasing out of certain Sleeveless (fistan). Dolman replaced anterija. For making an Anterija they start to use ready-patterned materials, thus becoming the most common item of clothing in all urban areas in Kosovo. Dominant decorating, dark threads and cords. They used motifs taken from Skadar dzube.

Figure 8: Prizren, the family early twentieth century (photo property of the Ethnographic Museum in Belgrade)

The third phase (the beginning of the twentieth century, the period before the First World War)

In the third phase came to a complete deforming of long women's clothing. Predominance mintan of silk and cotton patterned or monochrome fabrics with embroidery dark silk cords. The traditional way of dressing was retained in the older population, and young people quickly accepted changes. With the arrival of women's magazines from the Kingdom of Yugoslavia in Prizren changing consciousness of women about modern trends in clothing. They Begin to use the finished cotton and plush materials, the dominant dark color. Salta and ćurak become an integral part of women's clothing. In the years before the First World War began to wear the clothes of modern cuts and so-called 'alafranka' dresses. Women begin to transmit traditional clothes from generation to generation in the form of girls' education.

[24] Mirijana M. Menković, Građanska nošnja srba u Prizrenu u XIX i prvoj polovini XX veka, Etnografski muzej u Beogradu 2013


Figure 9: Prizren girls, XX century (photo property of the Ethnographic Museum in Belgrade)

The fourth phase (the period after the First World War)

Time corresponds to the period after the First World War. With the advent of various demographic, social and economic change leads to a change in the culture of dressing. This phase is characterized by garments made of very light-finished materials (cotton brocade). Dominant short bodice, and therefore the shirt in the foreground. In addition to wearing a waistcoat and mintan fabricated from lightweight materials, In the fourth stage, but in parallel with altered traditional clothing mass occurs the European way of dressing, which was reflected in the wearing of dress. There were organized sewing courses,accepted by artisans. Women started their own sewing garments of a modern cut, but they adapted Prizren occasions. Alafranka dress quickly paved the way for the fashion clothes of the twenties and thirties of the twentieth century. Judging by fotos of the period in young women of the twenties and thirties of the twentieth century there was a gradual replacement of costumes with a waistcoat, a pantaloons and apron, dresses up to half a sheet or two-part kit with a skirt. These generations were available to have both types of clothing.

EXPERIMENTAL PART

Experimental part: collection inspired by traditional upper garments from Prizren *made by author*

CONCLUSION

Prizren in the middle of the nineteenth century was the fashion center for the wider area Metohija and southern Serbia, because its trading relationships allow the transit of fashion influence, but the creation of local fashion occurred in the relation between the artisans and the population, in the direct market. Clothing pattern Serbs in Prizren, deep structure enabled craftsmen some kind of independence from other guilds. In the nineteenth century was shaped by a new type of clothing a women and that was in the region observed and evaluated. Alternately shaped long and short garments and traditional pattern reluctant to accept innovations in contemporary fashion. At the beginning of the twentieth century, there was complete dominance of short upper garments in Serbian female population. In the twentieth century has progressed faster process of adopting European ways of dressing. Interweaving of handicrafts and handicraft making some garments within the civil suits allow the maintenance of steady form of clothing: long form for brides and young women in formal occasions and short forms for each day. Familiar form indicating the tradition and social stability, and that was the only surviving form of Serbian civil form of dressing as a true representative of the Serbian civic culture, whose universal beauty achievements dress fascinates today with its modern design which fits perfectly into the mainstream of contemporary fashion and serve as an inspiration.

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STREET FASHION

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ABSTRACT: In this work street fashion, originated in Japan, was presented. The youth changed traditional Japanese look. They mixed their national and foreign clothes creating a recognizable Japanese street style. Street fashion is influenced by different subcultures, such as hippie, rasta, hip hop, gothic, etc. Nowdays young people in the streets present their view of fashion by their way of dressing and making their own clothing combinations. Their clothes show their feelings, individuality, social membership and their national culture.

Key words: Street fashion, street style, fashion, Japanese street fashion

INTRODUCTION

Street fashion is the way of dressing which is considered not to originate from studios, studios' trends, fashion shows and from the minds of creators and designers, i.e. the fashion like this one wasn't enforced from "the top". It originated from "the bottom", from the streets, so that is how it got its name "street fashion". In English the term "grassroots" is often used to accentuate " indigenousness " of this fashion, i.e. to say that it is "grass with roots", which grew wild and wasn't implanted artificially. Although it isn't a general rule, "street fashion" or "street style" (in English: abbreviation "SS") is generally connected with the youth and their culture, and is often seen in big urban centres, and less often in towns and rural areas. So, street fashion is going to be studied best in the streets of London, New York, Berlin, Tokyo, Moscow, etc.

Figure 1: Visualkey fashion in Japan

Street fashion is highly dependant on the geographic area, psychology, demographic conditions, and historical and political circumstances. For example, street fashion in Japan is unbreakably connected to some very contradictory cultural and political trends: the westernization of the country after the World War II, the influences of the traditional religion and mythology (demons, ghosts, gods, etc,), modern pop influences (mange, anime), the fascination with futurism (because of the sudden economic growth which catapulted Japan literally into the future before other countries of the world) and national suppression which merges on depression (suicides, etc., which leads to many “gothic” movements, including famous subculture movement ‘gothic Lolita”. “Schizoidness” of large urban centres and “schizoidness of Japanese culture cause Japanese street fashion to be consisted of the collision of multiple mutually distant and opposite influences in any moment of time; all of this makes it one of the most exciting in the world. One example of it can be seen in the Picture 1 where the modern Visualki style in Japan, which is the mixture of new wave, punk, gothic style, manga style, and Lolita style is presented.

In the same way “Babylon” quality which the cities like London, Paris, Berlin, Moscow and especially New York have, ere the melting pots of all kinds of influences from all over the world (all these capitals used to be the centres of big colonial and imperial countries which had been the melting pots of the influences of a huge number of cultures), that is an arable land for the development of street fashion. Street fashion, once was the synonym for “fashion without the fashion” or for “people who have no style and don’t follow the trends” or “can’t afford high fashion”, during the decades of its development became an eminent and admired branch of fashion and many high fashion designers carefully listens and watch what happens in the streets of big cities to create their own collections for the following season. Street fashion became so strong and influencing that it highly influences high fashion lately.

Figure 2: Dorothy Perkins found her inspiration in street fashion

One shouldn’t forget the economic influence in fashion as well. Fashion sometimes derives from highly unusual sources. For example, in Victorian Britain the price of the haircut for someone’s hair was two times the price of the haircut of “only in the back of the head or on the sides of his/her head”. That made most of workers (employees) to have their haircuts “only in the back or on the sides” and hide the rest of their hair under the caps, hats, etc. During the time this fashion influenced the upper class to accept the haircuts like these, and these haircuts will be the base of new wave fashion and the haircuts from the 1980s which were directly based on Victorian era, among all the rest.

Political conditions, such as the position of the Western Berlin as an island inside DDR, where different cultural norms were valid, influenced a special psychology of “reticence” to be formed. It strongly influenced the street fashion of Western Berlin, and this special political situation continued after the uniting of two Germanies and two Berlins and lately this city has been one of the most significant centres of street fashion in the world because it is consisted of two “sewn up’ parts which had been operating as two organisms for a very long time, and that created a unique psychological situation in Berlin. Unlike Berlin, Hamburg, which was the fashion centre of Germany and its avanguard for a very long time, owes its status to the fact that it is a port city with many outer influences. So, each centre of street fashion became the centre thanks to a specific element of historical, political, economic or demographic development.

STREET FASHION AND SUBCULTURES

Street fashion is characteristic for the fact that it gave an authentic swing to many subcultures which had existed as countercultures and, at first, they were opposite to the mainstream and in a direct ideological and the conflict of values with the establishment. Street fashions which had evolved in special styles became so influencing and couldn't be ignored by fashion designers who began using their ideas for their own collections.

The main subcultures of the youth which brought street fashion to the big stage and which couldn't be ignored because they were persistently against the system which dictated the standards of clothing, behaving and thinking, and so far they have been inexhaustible sources of fashion and eclectic connections, are:
Hippies (jeans, t-shirts, long hair,("flower power"), psychedelic image, derivations from the peaceful cultures of the Indians and the American Indians, bell-bottoms and the like, multi-colourness)
Teddy boys (tight and shortened trousers, tight jackets, checqered shirts)
Punkers (torn clothes, safety pins, BDSM image, provocative mottos, short hair, bristling hair, Mohican hairstyle, hair colouring into eye-catching colours – everything in Punk fashion was reversed in regard to Hippy fashion which they wanted to underestimate and to be its opposition
Skinheads (bald head or very short hair, Dr Martin shoes, Spitfayer jackets, etc.)
Darkers or Gothics (black clothes of all kinds, make up, never short hair)
Rappers (very wide trousers, trainers, hockey or basketball t-shirts, short hair)
Rockers (Levi's 501, white t-shirts, leather jackets, slicked hair, cowboy boots)
Hipsters (new subculture, very difficult to be defined, except the fact that they intentionally try to look "clever", "geek", as they have never watched TV in their lifetime, and they don't do any organized sport (the opposite to the rugby and basketball players in American educational institutions)), picture 3.

Figure 3: Hipster style

THE IMPORTANCE OF STREET FASHION NOWDAYS

In 2012, street fashion met a huge popularization and many celebrities paid the attention to street fashion, and not only to high fashion. It can be said that street fashion today has reached the very same top which was reached by high fashion ("haute couture"), because the celebrities are the best litmus paper for fashion, and thanks to them the importance of some brands can be seen. Some stars tried to get “street credibility” by wearing items of street fashion with equal courage and determination as if they wear high fashion items, and we must give them the credit for that, because they gave an extra legitimacy to street fashion and brought it into higher spheres. But, again, each street fashion which is the part of higher spheres and mainstream denied itself and became the part of the establishment, which means that a change will happen soon and that a new street fashion which will be the opponent of the previous one that has already been established.

Some of the things which are characteristic for street fashion today can be noticed in the forms of several unwritten rules. For example, the amount of jewelry worn by a woman will determine her accessories, together with her purse. That jewelry can be bijouterie (imitation jewelry), something expensive in combination with something obviously cheap, or several contradictory budget details with originality. Wearing everything that is expensive is the mark of high fashion, either upstarters or snobbery, and an excessive amount of expensive decorations can be the association of either the lack of style or of some of these subcultures which support the approach like this one (hip hop subculture). Unlike this, men are considered not to wear too much jewelry, except if they are Hippies, or Hip-hoppers, so the fashion “all can be seen through the watch” can be applied to them. If a man decides to combine an expensive watch and cheap clothes, he wants to create the feeling of being wealthy but nonchalant at the same time. Or he can decide to do the opposite to this, to wear a watch bought in a Chinese store, paid a few Euros, and to combine it with a very expensive shirt and trousers or shoes, so in this case he can show all of us that even if he likes nice and expensive clothes and famous brands, he can still afford himself an open contempt to the system by wearing a cheap watch, and in that way he makes a statement saying that he is special. Common combination consists of some pieces (items) of cheap clothes and accessories and some obviously expensive and quality clothing items or accessories, and all of this creates the impression of an unexpected style as well as the belonging to the mainstream and the contempt to it.

It is also possible to do something like : having the latest iPod and an old phone, or quite the reverse, having the latest and the most modern cell phone and not having an iPod at all. In men’s fashion hat is the example of possibility to make some forgotten clothing items alive even if they went out of fashion in 1960s. Though, at the very beginning of the 21st century the hat made a huge comeback and nowdays it expresses the belonging to the urban population, and not to the rural one as it used to, where it was in, even after it was excluded from the mainstream fashion in the second half of the 20th century.

It doesn’t also matter if you will use brands from the expensive shops or not. Urban, street fashion is deprived of each kind of snobbery even if the depriving of the snobbery and contempt to it is a kind of snobbery itself. But it’s all the same if a person, who wants to create the impression of belonging to the street fashion, will buy the clothes in a second-hand shop or in Zara or Mango or at Armani’s. Street style is what each person creates using the available clothing items, bought brand name products, no name products bought at the open markets, in second-hand shops, from his/her own wardrobe, and the ones taken from parents or grandparents. It’s all the same what the combination is like as long as there is an element of “cool” dressing in all of it. Well, it isn’t always so simple: neither one can wear absolutely all combinations of colours, nor can be absolutely relaxed, because it will produce very bad results. Street fashion is relaxed and eclectic, but it’s the result of careful thinking and aesthetic criteria, as well as the poetry written in blank verse is everything except a leap into the simplicity and vulgarity (“the rejection of rhyme is not a leap at facility). Street fashion consists of the provocation, sophisticated combining, creativity and self-confidence.

Shoes are also considered a basic element of each fashion, even the street fashion. It is necessary to say that having good shoes or trainers, or at least new ones, even if they are cheap and from the budget shops, is crucial for everyone who wants to be considered elegant and to have the element of street style. If the shoes aren’t new, it’s good to be clean and their laces to be clean and new, the experts say. So, even here there is a valid rule which says that a part has to be “sparkling” while the rest ones can be completely under-class (low-class) and at the same time they can be a perfect match.

More and more brands have the basic motive in street fashion. One convenient and typical example is the brand “Gata”. Even if this term means “cat” in Italian, Spanish and Portuguese, it doesn’t have anything in common with this animal. The designer of this brand considered herself as a child of the street and just because of that her brand got this name. The literal translation of the name of this brand means “street” in Swedish. Many different cuts, materials and styles are the things that are characteristic for this brand which pretends to be very successful.

According to the words of the main designer , the girl wearing models of “Gata” is self-confident, romantic and brave. She likes to stand out and risk, go to romantic dinners, but also to sit in the park with her friends playing the guitar. When the designer was asked what direction the brand will develop in, she said that it would depend on her momentary inspiration.

So, this brand is the best example how the street fashion is perceived nowdays, and some of the models are shown in the picture below- picture 4.

Figure 4: Some models of the brand “Gata” which literally means “street”

CONCLUSION

Shortly said, urban style, street style or street fashion is the way of expressing yourself in an original way, and it often goes into the diverse (opposite) direction to the mainstream, enforced standards and high fashion. Though, designers are always on the track of new, fresh ideas which come from the streets, and in last several decades we are the witnesses of the fact that high fashion seeks for its inspiration mostly in the streets.

Many trends and subcultures came to the big scene and persistently stayed on it, and, as we had already said, at first were in confrontation with the mainstream and in a direct ideological confront (conflict) with the establishment. All those street fashions which evolved into special styles, slowly became so influencing that fashion designers couldn’t ignore them and they started using their ideas for their collections.

Here we come to the element of permanent renewal of street fashion, because street fashion itself represents a riot, an autochthonous expression of creativity that comes directly from the people(folks).

As we had already mentioned, each street fashion which becomes a part of higher spheres and the main stream has denied itself and become a part of the establishment; that means that a change will happen soon and a new street fashion which will confront the etabled, previous one will appear. Because of that there is a constant renewal of high fashion and street fashion, because street fashion appears in metropolitan cities, and designers find their inspiration in it. Because of this, it becomes a main stream and then new street fashion and new trend replace it with their originality and confront to the previous fashion. This is how the constant flow of fresh blood comes into high fashion, well as to its democratization, because it is influenced from the "bottom".

Street fashion is both, free and creative and democratic, but very "gentle" at the same time. One can't wear absolutely any combination, or be absolutely relaxed, because it will come to very bad results then. Street fashion is relaxed and eclectic, but it is the result of careful thinking and high aesthetic criteria. It is the result of refined trends and common style which was filtrated throw several creative individuals from the crowd. Recently many young women, but also some man who have style in the spirit of street fashion, have their blogs as a tools to dictate the fashion taste of the others, even of designers. Street fashion has never been so present, and overall informing of the society contributed democratic voices to be heard farther then ever before, even in the world of fashion.

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ANALYSIS OF RIGHT DAYED AND BLEACHED KNITWEAR

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Abstract: This paper analyzes the dimensional stability of the right - right knitwear. Six samples of knitwear were made for the test. The first samples is bleached and it is made of 100% cotton yarn fineness of 50 tex in 1x1 ribbed weave of different fineness knitting machine. The second sample is colored and has the same production characteristic like first one. The third sample bleached and it is made of yarn of the same composition but with different machine fineness. The forth sample is colored and has the same characteristic like third sample. Fifth sample is made on sam machine finesses like third and fourth sample but it is bleached and it is made form 96% cotton and 4% lycra. The sixt sample is colored and has the same composition like fifth one. The obtained results show that the shrinkage in width knitwear are significantly higher than the shrinkage in length for all samples. This work has shown that machine and fineness of weave types significantly affect the value of the collection of knitted material.

Key words: cotton right - right knitwear, knitwear dimensional stability, shrinkage of knitted fabrics after washing.

INTRODUCTION

Knitted fabrics are flat textile products resulting from the large number of interconnected loops. Loops are the main structural elements of knitwear and their shape and size depend on the appearance and properties of knitted products. The woven product loops are connected in different ways with each other and intersect at different angles. This position of the yarn in knitting knitwear seems to get excellent elasticity, porosity and ability to adapt to the shape of the users body. Layout and size of the loop is to obtain a large number of different weaves. Due to the exceptionally good property of knits, as well as highly developed and economical production of knitted products on the market, today there are a lot of these products. In addition to making clothes these products have found their application in many other areas of human needs. The appearance on the market of a large number of different materials allows the range of knitted products to increases significantly.

Production conditions in which the knitted fabric is made plays an important role in achieving the desired quality of knitwear. Production capacity of knitting machines and their adjustment largely determined physical and chemical characteristics of knitwear and therefore usability of knitted products, all of which affect the very comfort while wearing clothes made of these knitwear. Therefore, it is necessary to properly design their structure for the desired purpose of clothing [1].

RIB KNITWEAR

Ribbed knits are a group of two-sided - right cultural knitwear. Their main characteristic is that on the one hand and on the other hand of the knitwear both the left and right loops can be seen. In these knitwear by using platinum loop sided knitwear for sampling, and thus using needles other fonture, loop transforms into a new needle or catcher loop. In the knitwear, one or more interspersed with strings of right loops with one or more strings of left loops [4].

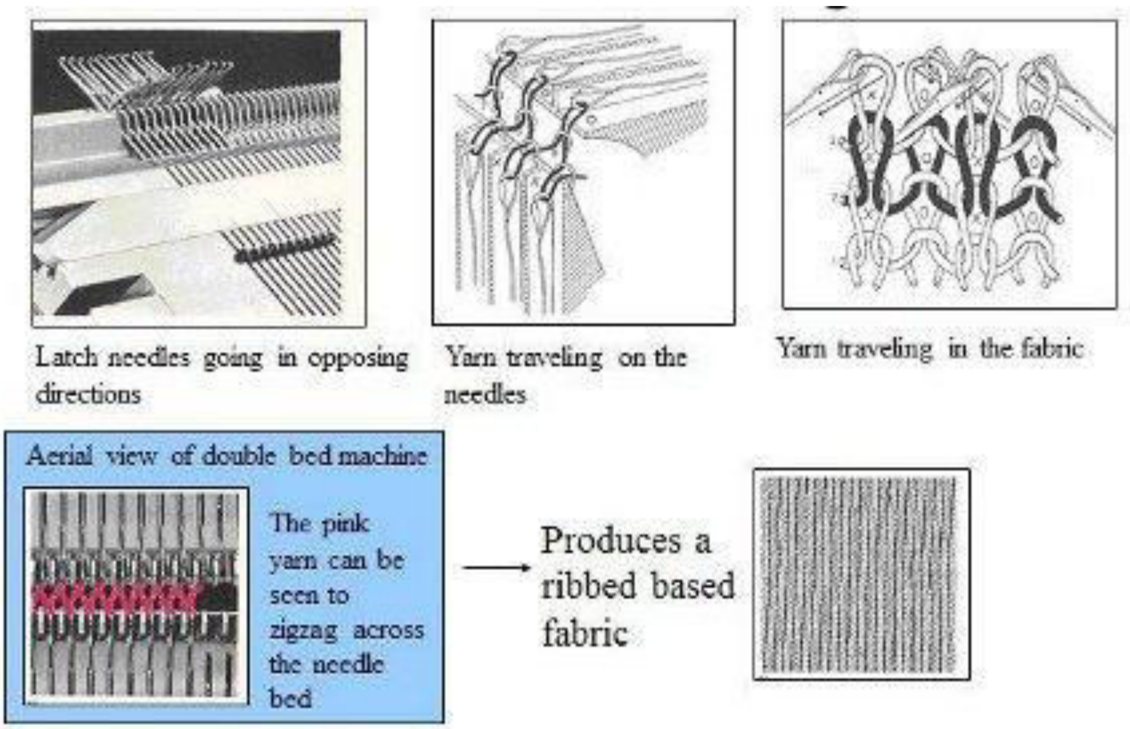

Figure. 1: The system of needles that form a rib knitwear and the face of 1x1 rib knitwear.

Right knits are made in double bed flat and circular knitting machines. They consist of open-loop form two inter-related parts in the thickness of fabric. On both sides of the knitwear only the right strings loop is visible. The simplest combination of right and left loop is 1x1 ribbed structure. Width report of this fabric is Rš = 2 and height Rv = 1 [4].

Right 1x1 knits have a well-balanced structure. Rotation moment in the yarn is neutralized by the loops which are formed on both sides of the knitted fabric alternatively. There is no curling at the edges. Elastic recovery ribbed knitwear 1x1 structure is very high along the entire width. When knitted into a relaxed state it shrinks so much that only the shorter loops can be seen on both sides.
1x1 ribbed knits with flat knitting machine is mainly used to handle cuff and collar, due to its high elasticity and ability to retain its shape. They are also used for making men's underwear, sweaters and similar. For clothes that are cut and sewn, 1x1 ribbed knits are also applied in making sweaters in wool or acrylic socks as a renderer using the elastic. [5].

Similar to the structure of the 1x1, the 2x2 rib there is repetition in the structure. The main difference is that this structure consists of repeating of 2 front loops and 2 reverse loops. The rib structure is the most popular for making cuffs and waist.

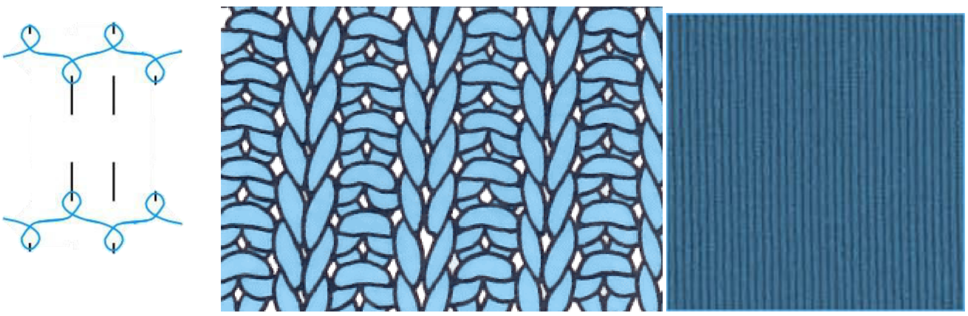

Figure. 2 Appearance of 1x1 ribbed knitwear and schematic formation of 1x1 ribbed knitwear

The basic parameters of the knitted structure include:
• The width of knitwear
• The density of the row of the loop (Horizontal) (Dh)
• The density of loops in a series of twists (Vertical) (DV)
• Utoršak of yarn in the loop (l)
• Thickness of knitwear (Dp)
• Surface mass knitwear (m)

MATERIALS AND METHODS

Ribbed knitwear, that were used in this experiment, were made on a circular double needle knitting machine. Six samples of knitwear were made for the test. The first samples is bleached and it is made of 100% cotton yarn fineness of 50 tex in 1x1 ribbed weave and it is made on circular machines, fineness E15. The second sample is colored and has the same production characteristic like first one. The third sample is bleached and it is made of yarn of the same composition but with different machine fineness, E18. The forth sample is colored and has the same production characteristic like third sample. Fifth sample is made on same machine finesses like third and fourth sample but it is bleached and it is made from 96% cotton fineness 20texa and 4% Lycra fineness 44dtexa. The sixt sample is colored and has the same composition like fifth one.

The comparison of this sample with another sample can be seen as a different composition (while finesse machines and interlacement are the same) affects the physical - mechanical characteristics of knitwear. Also in this paper we can see differences between colored and bleached knittwear.

Table 1 Basic characteristics of the ribbed knitwear samples

Sample	Interlacement, RIB	Material composition and the finnes if the yarn (tex)	Machine finesses	Finishing
Ia	1:1	cotton 100% tex 20/1	E15	bleached
Ib	1:1	cotton 100% tex 20/1	E15	colored
IIa	1:1	cotton 100% tex 20/1	E18	bleached
IIb	1:1	cotton 100% tex 20/1	E18	colored
IIIa	1:1	cotton 96% (tex 20/1) lykra 4% (dtex 44)	E18	bleached
IIIb	1:1	cotton 96% (tex 20/1) lykra 4% (dtex 44)	E18	colored

A magnifying glass was used for determining vertical and horizontal density of loops by counting in rows. Samples were tested according to SRPS F.S2.013 in atmospheric conditions that are defined by ISO 139.

Test sample must be large enough to allow the counting of rows of loops from five different places, chosen to better represent the entire knitwear. Samples for testing must be without edges of knitwear.

Figure 3. Magnifying glass with a ruler for determining the density of loos

THE RESULTS AND DISCUSION

The analysis of selected samples knitwear obtained the following parameters:

• loop density (density of horizontal (Dh), the density of the vertical (Dv), the density per unit of an area (D), density ratio (C), the height of the loop (B) and step loop (A)

•shrinkage

Table 2 shows the number of loops measured by the vertical D_v and by horizontal D_h, the average aritmetic value(x) , deviation degree(s) and loop density per unit of an area(D) of a sample after it's been washed at 40C.

Table 2 Loop density of crude knitwear by vertical and horizontal (D_h) and (D_v), loop density on the surface by density unit ratio (C) , step loop(A),, the loop height (B)

	Ia		Ib		IIa		IIb		IIIa		IIIb	
	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}
1.	25	16	23	17	28	22	25	15	23	15	25	18
2.	23	16	23	15	27	23	24	15	21	16	28	18
3.	23	15	23	16	27	22	24	14	25	15	27	18
4.	23	17	22,5	16	25	22	24	14	24	16	28	18
5.	22,5	15	23	15	26	23	25	15	25	14	25	18
Σ	**116,5**	**79**	**114,5**	**79**	**133**	**112**	**122**	**73**	**118**	**76**	**133**	**90**
n	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
x	**23,3**	**15,8**	**22,9**	**15,8**	**26,6**	**22,4**	**24,4**	**14,6**	**23,6**	**15,2**	**26,6**	**18**
D	**368,14** cm^{-2}		**361,82** cm^{-2}		**595,84** cm^{-2}		**356,24** cm^{-2}		**358,72** cm^{-2}		**478,8** cm^{-2}	
C	1,47		1,44		1,18		1,67		1,55		1,47	
A	0,42mm		0,43mm		0,37mm		0,41mm		0,42mm		0,37mm	
B	0,66mm		0,55mm		0,63mm		0,63mm		0,44mm		0,68mm	

To calculate the number of loops per square inch (D) use the following equation:

$$D = D_h \cdot D_v$$

To calculated density in knitting (C) following equation is used:

$$C = \frac{D_h}{D_v}$$

To calculate the step of the loop and the height of the loop the following equation is used:

$$A = \frac{10}{D_h} \ , \ B = \frac{10}{D_v}$$

After machine washing raw knitwear at 40C with the time of washing of 30 min the shrinkage of fabric was measured horizontally and vertically. Shrinkage of knitwear was determined by F.S2.020/1958 standard, and can be determined by the ASTM D 3759 standard. The shrinkage can usually be determined in the following equation:

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

S - shrinkage of knitwear in %
lo - lenght of the sample before washing in cm
l1 - lenght of sample after washing in cm

Since this is a knitwear, after washing at 40 for 30 min. there is a large shrinkage of knitwear, and therefore a change in density of the loop. The density of loops in the washed knitwear, after washing is given in Table 3

Table 3 The density of the loop knits after washing, by the vertical and horizontal(D_h) and(D_v), loop density on the surface unit(D), density ratio(C) , loop step(A),, the loop height (B)

	Ia		Ib		IIa		IIb		IIIa		IIIb	
	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}	Dh cm^{-1}	Dv cm^{-1}
1.	21	16	23	17	19	16	21	16	25	11	27	10
2.	19	16	22	16	20	16	22	15	25	11	26	10
3.	20	17	23	17	19	17	20	15	25	12	27	10
4.	21	15	23	15	19	17	22	16	25	11	26	10
5.	19	15	22	16	20	16	21	16	26	12	26	10
Σ	**100**	**79**	**114**	**81**	**97**	**82**	**106**	**78**	**126**	**57**	**132**	**50**
n	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
x	**20**	**15,8**	**22,8**	**16,2**	**19,4**	**16,4**	**21,2**	**15,6**	**22,2**	**11,4**	**26,4**	**10**
D	**316** cm^{-2}		**369,36** cm^{-2}		**318,16** cm^{-2}		**330,72** cm^{-2}		**253,08** cm^{-2}		**264** cm^{-2}	
C	1,27		1,41		1,18		1,36		1,95		2,64	
A	0,5mm		0,44mm		0,51mm		0,47mm		0,45mm		0,38mm	
B	0,63mm		0,62mm		0,61mm		0,64mm		0,88mm		1mm	

The table 4 shows the values of shrinkage for all samples in length and width.

Table 4. Shrinkage of knitwear horizontally and vertically

	Ia		Ib		IIa		IIb		IIIa		IIIb	
	h	v	h	v	h	v	h	v	h	v	h	v
1.	48,5	37,2	41,2	39,2	49,5	37,8	54,5	37,7	41,2	38,1	42,5	39,2
2.	46,5	36,7	40	37,7	46,3	37,8	52,8	36,4	41,6	37,7	41,2	39
3.	48,5	38,5	43	38,1	47	39	55,2	38	41,3	38,1	41,5	39
x	**47,83**	**37,47**	**41,4**	**38,23**	**47,6**	**38,2**	**54,17**	**37,37**	**41,37**	**37,97**	**41,73**	**39**
s	**-19,6%**	**6,3%**	**-3,5%**	**4,4%**	**-19%**	**4,5%**	**-35,4%**	**6,58%**	**-3,4%**	**5%**	**-4,3%**	**2,5%**

h - shrinkage horizontally (by width) of sample in mm,
v - shrinkage vertically (by length) of sample in mm.

Changes in physical and mechanical properties of knitwear appear after washing the 40s. Density of knitwear changes after washing and shrinkage occurs vertically and horizontally occures elongation in all tested samples, bleached and dyed. Percentage of knitwear shrinkage varies by horizontal and vertical. The greatest difference was observed in the second staining sample where the percentage of elongation drastically higher compared to the other samples tested, even 35.4%, while the percentage of vertical shrinkage 6.58%. The lowest percentage of elongation was detected in the third bleached sample, only 3.4%, while the lowest percentage of shrinkage detected in the third colored sample, only 2.5%. We can notice that percentage of shrinking depend on raw material composition, machice finesses and also on finishing procedure, in this case bleaching an cloring.

Acknowledgements

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CONCLUSION

The dimensional stability of knitwear is an important indicator of their quality. It creates difficulties in finishing of garments and later during use or wear and maintenance of knitwear garment. Dimensional stability of knitwear depends on their structural and constructional solutions, as well as the technological requirements of making the knitting process. In addition, the most important role of the material have the structural, physical and mechanical properties of used yarn, horizontal and vertical loop density, depth of cooling, finesse of machines and applied interlacement of knitwear and also of finishing procedure. Knowing the connections of structural and mechanical properties of knitwear is the possibility of their proper design depending on the future use. This paper therefore analyzes the dimensional stability of the right - right knitwear after washing. The present study showed that after washing, significant changes of the sample dimensions. This work has shown that machine fineness, raw composition and procedure of finishing significantly affect the value of the shrinkage of knitted material.

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HISTORICAL EPOCH AS INSPIRATION FOR A FASHION COLLECTION

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ABSTRACT: Inspiration for a fashion collection can be found everywhere. So it is no surprise that, very often, it is found in historical periods. In this paper, the connection between history and creating a fashion collection is presented and described. History and fashion have much in common.Fashion designers create forms, structure, lines and shape based on historical reviews and costume knowlegde. In this paper, the process from inspiration to the development of the complete fashion sketch based on the Byzantine period and costume.

Key words: fashion, byzantine, collection, history, design

INTRODUCTION

When historical period is the inspiration, the selected compound is deeply analyzed and it's form and details are studied and researched. Generally, it is advisable to focus on a few details of the historical period: textiles,classic art, costumes, architecture and overall shape. The environment of the certain period can also be taken into consideration. Made sketches of details act as a guide in deciding which details will be used and which will be discarded when creating the collection. When historical period is the inspiration it is possible to detect very interesting forms glamorous costumes and some period trademarks, which reflect their origin and represent a concept of their own style.

When a historical period or a detail of a costume is used as inspiration for a fashion collection, a lot of useful ideas can be developed for garment creation. Fashion is considered to be transient and superficial with the use of rich materials while byzantine history is considered grand, rich and lasting. A fashion designer should experiment with forms and shapes and at the same time ensure that the design and construction of clothes suit the human body.

HISTORICAL PERIOD AS INSPIRATION

History and fashion have a lot in common. Costume shapes can be clean and minimalist or bold and mind-blowingly wild such as byzantine costume. In any case, the key to good-looking clothes with historical elements is good balance.

Over the past 30 years, fashion designers have considered hisotorical period as guide line in designing textiles and clothing embracing new forms and materials based on historical researches. Technological advancement has revolutionized the design and construction of facilities and techniques such as knitting, folding, draping as a daily supplement the vocabulary of old handcrafts that are being replicated.

A good designer must be a constant observer, a creative thinker and a good listener to understand the style, composition, balance, aesthetics and human emotions and to understand the psychology of vision and perception. Inspiration for the design of the designer can be found everywhere in history, from a form of costume to old tale.

In Image 1 byzantine nobles are shown. Modesty was important for all except the very rich, and most women appear almost entirely covered by rather shapeless clothes, which needed to be able to accommodate a full pregnancy. The basic garment in the early Empire comes down to the ankles, with a high round collar and tight sleeves to the wrist. The fringes and cuffs might be decorated with embroidery, with a band around the upper arm as well.

Early decorated cloth is mostly embroidered in wool on a linen base, and linen is generally more common than cotton throughout the period.

The house of Dolce and Gabbana was inspired to create their Byzantine collection inspired by this historical empire in which prevailing elements are of luxury and richness (Figure 2).

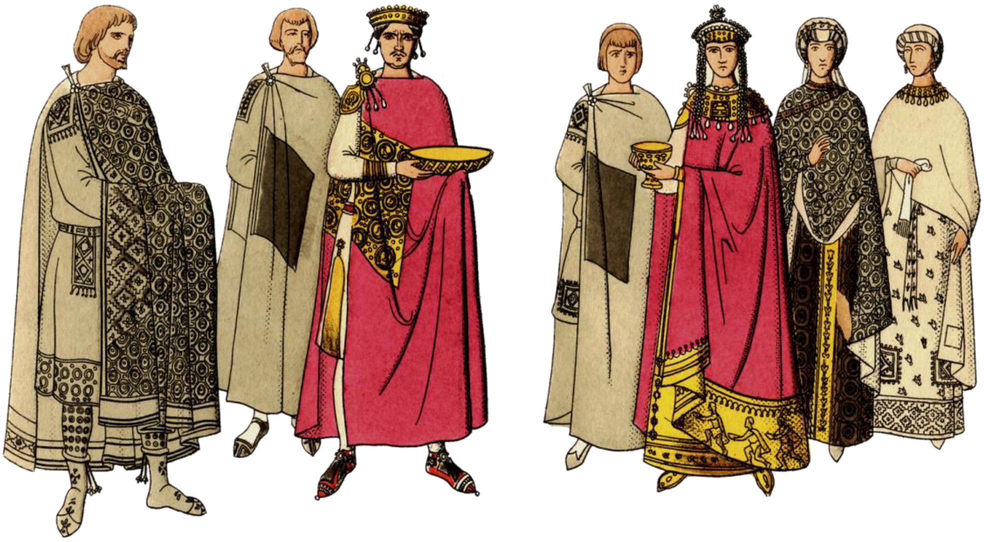

Figure 1: Byzantine nobles

Figure 2: Dolce and Gabbana creation inspired by Byzantine costume

Figure 3 shows the byzantine footwear in 12th centurz, which is a unique example colliding colors and rich fabrics, motives and ornaments. The creation of Alexander McQueen causes similar feelings with because his inspiration was this building (Figure 4).

Figure 3: Byzantine footwear

Figure 4: Alexander McQueen's creation inspired by Byzantine footwear

Figure 5 shows a Byzantine costume which can be linked to Alexander McQueen's inspiration for his collection (Figure 6).

Figure 5: Byzantine costume

Figure 6: Alexander McQueen's creations

INSPIRATION FOR THE COLLECTION

For the inspiration of this fashion collection a very byzantine nobles costume. It is an emporers and nobelty dress that is the main course of the collection inspiration.

The distinctive garments of the Emperors (often there were two at a time) and Empresses were the crown and the heavily jeweled Imperial loros or pallium, a version of the Roman toga worn by Consuls (Consulship became part of the imperial status), and worn by the Emperor and Empress as a quasi-ecclesiastical garment. It was also worn by the twelve most important officials and the imperial bodyguard, and hence by Archangels in icons, who were seen as divine bodyguards. In fact it was only normally worn on Easter Sunday, but it was very commonly used for depictions in art. The men's version of the loros was a long strip, dropping down straight in front to below the waist, and with the portion behind pulled round to the front and hung gracefully over the left arm. The female loros was similar at the front end, but the back end was wider and tucked under a belt after pulling through to the front again. Apart from jewels and embroidery, small enamelled plaques were sewn into the clothes; the dress of Manuel I Comnenus was described as being like a meadow covered with flowers. Generally sleeves were closely fitted to the arm and the outer dress comes to the ankles (although often called a scaramangion), and is also rather closely fitted.

In the early and later periods (approximately before 600 and after 1,000) Emperors may be shown in military dress, with gold breastplates, red boots, and a crown. Crowns had pendilia and became closed on top during the 12th century.

In figure 7 Emperors and Empresses costume is shown. Costume is represented as lawish, very decorated with handcraft and embroidery in red and gold color which represented social status.

Figure 7: Byzantine Emperor and Empress

MODEL DESCRIPTION

Analyzing the inspiration - the Byzantine costume and this historical period in whole, the models that were created are of long clean shaped lines, and materials are hand embroided with gold stiching. The decorative fabrics have a red and golden shine and are in combination with softer matt fabrics that are the base of the model.

Model sketches

Model 1.

Model 2.

CONCLUSION

In this paper the relationship between historical epoch and costume with fashion design is described. From the work, we can conclude that costume and fashion are very closely related and that many famous designers were inspired by the historical epoches. By using the Byzantine period, the collection was resulted in high glamour. The clothing from the collection, presented in the paper are for special occasions, which require special glamorous accessories. On both models gold colors and structured shapes dominateas they do on the inspiration as well.

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ENGINEERING OF KNITTED UNDERWEAR FABRICS

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ABSTRACT: This chapter reviews the recent developments in fabric engineering and product innovation. Underwear is a type of apparel worn next to the skin for reasons of hygiene and comfort. Knitted underwear fabrics can be better engineered with improved understanding of the effects of fabric composition, yarn properties and fabric structure. Since such effects are far from fully understood, the following discussion serves to contribute towards the knowledge base for the engineering of knitted underwear fabrics.

Key words: *fabric composition, thickness, structure, starfish,advances in knitting fabrics*

INTRODUCTION

Underwear are clothes worn beneath under clothes usually next to skin, and not normally seen in public. It is traditionally made from cotton in single jersey or interlock knitted structures.These clothes are highly demanded mainly by the urban population. It should provide comfort for the wearer, possess good sewability, retain its appearance during wear, be durable and have easy-care properties. The primary requirement of underwear is hygiene and comfort. Aesthetic comfort is the subjective perception of clothing by visual sensation, which is influenced by color, style, garment fitting, fashion compatibility, fabric construction and finish.

Fig. 1. Performance underwear for men and women

EFFECT OF YARN CHARACTERISTICS ON THE DURABILITY OF UNDERWEAR FABRICS

Yarn type and structure affect the durability of underwear fabrics. Fabrics made from open-end spun yarns are less resistant to both abrasion and bursting than those made of the comparable ring-spun yarns. Conversely, ring-spun yarn is more resistant to pilling than open-end spun yarn. Research showed that fabric constructed from air-jet-spun yarn was the most pill-resistant and a fabric constructed from rotor-spun yarn was the least pill-resistant. Those spinning methods that control the fibers, such that the finer fibers tend to stay in the center of the yarn and the coarser fibers remain at the outside, produce yarns with a lower tendency to pill. Conversely, spinning systems that produce yarns in which the longer fibers tend to stay in the center of the yarn and the shorter fibers at the outside produce yarns with a higher pilling tendency. The propensity for pilling is also related to the yarn twist. The higher the twist in the yarn, the less the tendency to pill because the twist compacts the yarn and reduces the number of protruding fibers that cause pilling. Consequently, double yarn gives less pilling than single yarn.

Structure affects of fabrics for underwear development

Knitted structure affects some degree of dimensional deformation. Slackly knitted fabrics have a higher tendency to shrink more, attaining complete relaxation at raised temperatures, than tight knits. Fabrics containing miss stitches pull the wales closer together, so they have higher relaxation shrinkage in the width direction than the plain single-jersey structure.

Cotton is the most common material used to make underwear. It was found that cotton is associated with both physical and psychological comfort, and is viewed as youthful, honest, pure and dependable. Cotton is seen to be close to the ideal material for making sports shirts – the only disadvantage of cotton is that it is crushable. It is difficult to find any fiber matching the advantages of cotton. On the other hand, cotton could be more likely to cause skin irritation. Other knitted underwear materials, such as nylon and polyester were regarded as artificial, low quality, unfashionable, clammy, sweaty, clingy, synthetic and causing itchiness. In recent years, the scene has totally changed. A number of studies have shown that by using appropriate yarn and fabric structures, clothes made from synthetic fibers can be as comfortable to wear as those made from natural fibers, especially the newly developed polyester fabrics.

With respect to cotton knitted fabrics, the International Cotton Technology Institute in Manchester developed a software program, Starfish, to predict the dimensional behavior of the fabric based on the knitting parameters (the size and type of the yarn, the stitch length, the size of the knitting machine), the finishing process and the nominal finished dimensions. The name Starfish is derived from 'Start as You Mean to Finish'. The Starfish program can be used to predict the shrinkage of cotton rib, single jersey, interlock and pique fabrics.

Starfish predicts shrinkage mathematically and is based on the following three logical foundations:

- Determining a particular state of relaxation for cotton knits that is stable and reproducible; the reference state on which all measurements will be made and all calculations based;
- Developing a comprehensive database of measurements made on a systematic series of cotton fabrics that have been manufactured and processed under close quality control but nevertheless on a commercial scale and under commercially realistic conditions;
- Developing suitable mathematical models for the reference that link the knitting and finishing parameters to the dimensions of the relaxed, finished fabrics in a simple and reliable way

Many researchers stated that 100% cotton, or cotton-rich blends, were more comfortable underwear materials as these were more effective to absorb water vapor and perspiration than synthetic fibers. Cotton is a vegetable fiber that consists mainly of natural (plant) cellulose with a thin coating of wax. During finishing, this wax coating will be removed, so the cotton fiber can absorb moisture effectively and allow it to evaporate easily. However, fibers with a higher ability to absorb moisture can increase the weight of the garment when it is worn during exercise, and cause discomfort after cooling down. On the other hand, composition is a contributory factor to fabric shrinkage.

Quaynor*et al* conducted research to investigate the shrinkage of different knitted fabrics including polyester and cotton. It was found that cotton knitted fabric seems to undergo some progressive shrinkage. Polyester, another common fabric type used for making underwear, shows better performance in preventing shrinkage. It can be explained by its low moisture regaining property, which is about 0.4%. Polyester knitted fabrics also do not become swollen in water and therefore have a high resistance to deformation. It has also been found that fabrics knitted from blended yarns (50% cotton/50% polyester) had a better dimensional stability compared to the fabrics from 100% cotton ring and open-end yarns.

The fabric composition is directly related to its appearance after laundering. Bresee et al conducted research to evaluate the pilling problems of six different kinds of single knitted underwear fabrics made from 100% cotton, 50/50 polyester–cotton and 60/40 polyester–cotton. The three samples were bleached and the rest were both bleached and treated with a durable press finish. The unworn, unabridged and unlaundered fabrics were pill free, and laundering caused pilling and affected pill grades of 100% cotton fabrics more than in the polyester blended fabrics. They found that the pills formed on the cotton fabrics were more easily removed during laundering than the pills anchored by the higher tenacity polyester fibers. Fabric composition is also very much related to durability. It was reported that cotton/polyester fabrics possess greater strength than the all cotton fabrics.

Fabric structure also affects durability. Plain knitted fabric, one of the popular knitted structures used for making underwear, have the worst abrasion resistance. It may be improved by knitting the structure to high area densities. Anand et al found that there was a linear relationship between the stitch density and the bursting strength. The higher the stitch density, the higher was the bursting strength of the fabric. In their fully relaxed state, knitted fabrics with miss stitches in their structure had higher stitch densities that, again, were linearly related to its abrasion resistance. Single jersey fabric containing tuck stitches had lower bursting strengths than fabrics with miss stitches. The construction of a fabric also directly determines its susceptibility to pilling. Pilling problems are often associated with a loosely knitted fabric when continually worn or cleaned as there are more fibers anchored loosely on the fabric surface than on a tightly knitted fabric.
Fabric structure is also an important factor affecting the comfort properties. Fabrics with more pores or bigger sizes of pore, potentially allow more air movement through the fabric which results in a cooler feeling for the wearer. Conversely, the tighter the fabrics, the smaller the spaces and the lower the air permeability. So the tightness and area density of fabrics are important considerations when designing underwear.

FABRIC THICKNESS AND THERMAL COMFORT

Fabric thickness has a direct effect on thermal transmittance, where the thicker the material, the lower the thermal transmittance. Fabric thickness is one of the most important factors determining thermal comfort. Thermal resistance through individual layers of dry fabrics was primarily dependent upon their thickness and was approximately two togs per 1 cm thickness varying from about 0.05 for cotton poplin to about 1 tog for a heavy overcoat. This value would be lower if the wind was present to cause more air penetration and higher natural convective heat loss. Thermal comfort is primarily related to the efficiency of heat dissipation from a clothed human body and is viewed as the ‘neither too hot nor too cold feeling of the wearer. The body is in a state of comfort when the core temperature of the body is maintained at 37˚C and the average skin temperature is approximately 33˚C without the presence of sweat. One of the primary functions of underwear is to act as a buffer against environmental changes in order to maintain a thermal balance between the heat generated by the body and the heat lost to the environment while allowing the skin to remain free of liquid.

PROPERTIES OF COMMERCIALLY KNITTED UNDERWEAR

For the comparison of commercially knitted underwear fabrics, it is useful to establish reference values of the different properties of these fabrics. In a study, there have been tested nine different types of commercial single jersey knitted fabrics and eight different types of commercial interlock knitted fabrics in terms of thickness, mass per unit area, air permeability, thermal conductivity, q-max (warm/cool contact feeling), contact angle and time to full water absorption. The 10%, 20%, 50%, 70% and 90% percentile values are listed in Tables 1. and 2. respectively.

Thermo Labo II KES-FB7 is an instrument that is used to evaluate thermal conductivity and insulation in dry and wet conditions (simulating perspiration or no perspiration) of fabrics, and the warm/cool feeling when the fabric is briefly in direct contact with the skin.

Fig. 2. Thermo Labo II KES-FB7

Table 1. Reference values of the properties of single jersey knitted fabrics

Percentile	Thickness (mm)	Mass per unit area (g/m^2)	Air perme-ability	Thermal conduc-tivity	Q-max	Contact angle	WVTR
90%	0.780475	259.8803	160.3983	0.697562	0.127604	123.9107	0.055963
70%	0.713567	228.7349	117.0496	0.64433	0.119713	88.63974	0.052057
50%	0.667314	207.2043	87.08286	0.60753	0.114257	64.25714	0.049358
30%	0.621061	185.6737	57.11616	0.570731	0.108802	39.87455	0.046658
10%	0.554153	154.5283	13.76738	0.517498	0.10091	4.603544	0.042753

Notes:
Air permeability was measured according to ASTM D737-96. Thermal conductivity and Q-max were measured by Thermal Labo II KES-FB7. Contact angle was measured by ASTM D5727. Water vapour transmission rate (WVTR) was measured by ASTM E96-90,

Table 2. Reference values of the properties of interlock knitted fabrics

Percentile	Thickness (mm)	Mass per unit area angle (g/m^2)	Air perme-ability	Thermal conduc-tivity	Q-max	Contact angle	WVTR
90%	1.085118	239.0271	228.332	0.712801	0.120217	119.2669	0.055893
70%	0.926454	203.6248	192.5585	0.64456	0.111862	80.62629	0.052128
50%	0.816771	179.1514	167.8286	0.597386	0.106086	53.91429	0.049524
30%	0.707088	154.6781	143.0986	0.550211	0.10031	27.20229	0.046921
10%	0.548425	119.2758	107.3252	0.481971	0.091954	−11.4384	0.043155

Notes:
Air permeability was measured according to ASTM D737-96. Thermal conductivity and Q-max were measured by Thermal Labo II KES-FB7. Contact angle was measured by ASTM D5727. Water vapour transmission rate (WVTR) was measured by ASTM E96-90

Recent developments in knitted underwear fabrics

In recent years, new fabrics have been developed using engineered fibers and special constructions to achieve improved wicking properties, quick drying, lighter weights, improved durability and easy care. Here are some of the innovative fabrics on the global market today.

Nike® Dri-Fit

Nike® Dri-Fit - is a popular inner layer fabric which is claimed to carry the perspiration rapidly from the skin to the outside of a T-shirt, where it then evaporates. It is proposed that it should be worn next to the skin to keep the body dry. It is a high-performance, microfiber, polyester fabric that moves sweat away from the body and to the fabric surface, where it evaporates. As a result, Dri-Fit keeps athletes dry and comfortable.
Dri-FIT technology is used in a variety of Nike products, including shirts, socks, pants, shorts, sweatshirts, sleeves, hats, gloves and more

Fig. 3. Nike® Dri-Fit

Nike® Sphere Cool Fabric

Nike® Sphere Cool Fabric has developed many different functional materials for making undershirts and sportswear. Nike® Sphere Cool is one of their innovative technologies to increase heat loss in order to enhance air circulation. Nike Sphere is a high performance technical material that promotes thermal regulation without bulk by trapping air that gets warmed by the body. The fabric is designed to create a regulated, warm environment.
It is claimed that the mesh structure accelerates the evaporation of perspiration, so that the wearer feels cooler and more comfortable. Good moisture absorbency by the inner layer is also claimed to improve the thermal comfort of the wearer.The technology promotes warmth by minimizing contact points on the athlete so that body-heated air can move freely over the skin, insulating while breathing. Additionally, Sphere's microfibers pull sweat from the skin to the surface of the fabric so it can evaporate quickly.

Fig. 4. Nike® Sphere Cool Fabric

Coolmax® fabric

Coolmax® is another functional fabric that, it is claimed, can keep the wearer cooland comfortable in any situation. Four channel fibers in Coolmax® fabric canrapidly transport moisture and heat to the outer surface, which makes it a quickdrying and breathable fabric

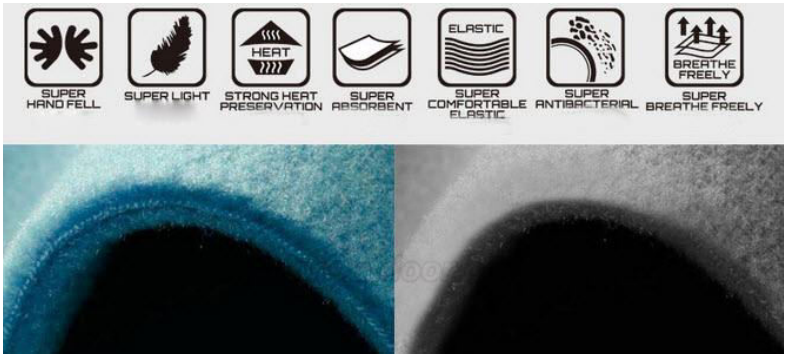

Fig. 5. COOLMAX® fabric

Akwatek® polyester fabric

Akwatek® polyester fabric is one of the performance fabrics that, it is claimed, can transport moisture and assist thermoregulation based on an electrochemical principle. Furthermore, it is also claimed that the chemicals cannot be removed by repeated laundering. The Akwatek® technology modifies the polyester fiber surface at the nano-particle level. With chemical treatment, Akwatek® Modifies the chemistry of polyester and releases hydrophilic groups at the molecular level. The modified polyester has an active surface layer with anionic end groups that transport water molecules and release them to the atmosphere before they can form into liquid water. Consequently, it is claimed that Akwatek® polyester fabric can enhance wearing comfort properties.

CONCLUSION

With this day and age, given the new and innovative knowledge of engineers threw out the world, there are many innovative fabrics emerging very often. Some with minor performance improvements others with exceptional improvements and capabilities. Many fabrics that are used for underwear production that are present on the market today are made of a blend of different fibers.

A number of studies have shown that by using appropriate yarn and fabric structures, clothes made from syntheticfibers can be as comfortable to wear as those made from natural fibers, especiallythe newly developed polyester fabrics. Many researchersstated that 100% cotton, or cotton-rich blends, weremore comfortable underwear materials as these were more effective to absorbwater vapor and perspiration than synthetic fibers.

It was found that fabric thickness had a direct effect on thermal transmittance, where the thicker the material, the lower the thermal transmittance. Knitted structure also affects some degree of dimensional deformation. Fabric structure is of high importance as well. Fabrics with more pores or bigger sizes of pore, potentially allow more airmovement through the fabric which results in a cooler feeling for the wearer. As the primary purpose of underwear is hygiene and comfort, everybody has an individual perception when it comes to choice of purchase.

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THE ANALYSIS OF YARN CONSUMPTION IN A LOOP OF RIB DAYED AND BLEACHED RIB KNITTWEAR

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Abstract: This paper analyzes the consumption of yarn in one loop. Six samples of knitwear were made for the test. The first samples is bleached and it is made of 100% cotton yarn fineness of 50 tex in 1x1 ribbed weave of different fineness knitting machine. The second sample is colored and has the same production characteristic like first one. The third sample bleached and it is made of yarn of the same composition but with different machine fineness. The forth sample is colored and has the same characteristic like third sample. Fifth sample is made on sam machine finesses like third and fourth sample but it is bleached and it is made form 96% cotton and 4% lycra. The sixt sample is colored and has the same composition like fifth one. From the results the differences in the consumption of yarn in a loop can be seen for all the samples. This work has shown that machine and fineness of weave types significantly affect the value of consumption of yarn in one loop.

Key words: *consumption of yarn in the loop, Dalidovičov model Weft knitted, knitting machines.*

INTRODUCTION

The main feature of knitted products is that they are more or less porous materials. Porosity is caused by free spaces that are between the loop - what specifically affects the density of knitwear. In addition, the characteristics and composition of the yarn of knits also made a significant impact. The twist of the yarn is particularly significant.

The structure of textile products, including knitwear, is determined by the size, shape and mutual arrangement of its main elements. The basic element of knitwear is yarn, which makes a loop formed by bending. In addition to the loop elements knitwear can be a trap or some other form of yarn that is different from the loop and traps.

Knitted fabrics are made in the knitting process so that they will merge basic elements in a predetermined order. Predetermined sequence connecting basic elements is called the interlacement knitwear. The type of weave largely depend on the basic characteristics of knitwear such as dimensional stability, extensibility, tearing mode, density, weight, etc.. because forms of the loops, which are characteristic for each interlacement have a significant impact on the above mentioned characteristics. The type of yarn used for knitting largely influences shape of the loop.

Connectivity and arrangement of loops in knitting depend on the type of weave. A variety of angles under which each elementary parts are knitted in its structure allow knitwear to have the following good features:

• Excellent resilience, because usually after action of external forces loops keep its original form that they had prior to the action of these forces,
• Has no closed areas, as opposed to fabric, but with a slight action of force stretching occurs on the loop in the direction of the action of the force,
• It is good insulator because the air that is located between the loops retains the heat, but knitwear allow air permeability at the same time, which gives a pleasant feeling when wearing knitted garments.

Knitting is a shaping process in which yarns are made into knitwear. Knitted fabrics are flat textile products resulting from the large number of interconnected loops. Loops are the main structural elements of knitwear and their shape and size depend on the appearance and properties of knitted products. The woven product loops are connected in different ways with each other and intersect at different angles. This position of the yarn in knitting knitwear seems to get excellent elasticity, porosity and ability to adapt to the shape of the body users. The layout and size of the loops enables it to obtain a large number of different weaves. Due to the exceptionally good properties of knits, as well as highly developed and economical production of knitted products on the market, today there are a lot of these products. In addition to making clothes these products have found their application in many other areas of human needs [1].

THE LENGHT OF YARN IN A LOOP

One of the most important parameters in the process of knitting is the length of yarn used for making loops. Length of the loop causes knitwear dimensions and its physical and chemical characteristics. This was observed already in 1914. by J. F. Tomkins's who understood the significance of the loop for quality and dimensional stability of knitted fabrics. The influence of the loop in 1956. was placed on a scientific basis by Doyle and Munden. Today, the most accepted view is that the analysis of knitwear is made through the length of the loop. If the length of the individual loops are more even this results in better quality knitwear. The length is usually expressed in millimeters, and depends on the width and height of the loop and the thickness of the used yarn.

When calculating the length of the yarn for the width of the loop the distance between the centers of two neighboring platinum head loop arcs is used. For the height of the loop the distance between the centers of the two loops that are located one above the other in the same row of knitwear is used. Parameters affecting the length of the loop are: the structure and properties of the yarn, the yarn thickness, uniformity of tension and hardness of yarn wound on the spool, the size of the yarn tension at the entrance to the knitting zone, the size of the friction between the yarn and the working elements of machines, weaving speed, speed of heat-tension knitwear etc..

The type of yarn that is used greatly influences the length of the loop and the weight per square meter of the knitwear. Loops of different lengths, if the same type of yarn is being used, give different weight per square meter knitwear. Thickness of the yarn, which also affects the length of the yarn in the loop, depends on the fineness and density of the yarn that is used. In determining the thickness of the yarn there are two different thicknesses: a theoretical thickness of the yarn (d /) that is characteristic of the tensioned yarn in which the tension of the space between fibers is reduced to a minimum and the actual thickness of the yarn (d), which depends on the fineness and twist level of yarn. The theoretical diameter of the yarn is determined by the equation:

$$d' = k' \cdot \sqrt{T_t}$$

the actual yarn diameter is determined by the equation:

$$d = k \cdot \sqrt{T_t}$$

k'-theoretical coefficient
k - coefficient of actual and
Tt yarn fineness used in [tex].
The values of the coefficients are shown in Table 1

Table 1: Values of the theoretical and the actual coefficient

yarn composition	theoretical coefficient k'	actual coefficient k
Raw Cotton	0,029	0,0393
Bleached cotton	0,029	0,0412
Wool	0,031	0,0430
Acetate	0,032	0,0430
Polyamide	0,033	0,0470
Polyacrylonitrile	0,033	0,0410
Textured polyester	0,030	0,0451

The equation to calculate the length of yarn in the loop has the following form:

$$l = xA + yB + zd$$

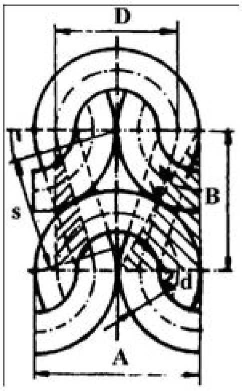
A - width of the loop, V - loop height, d-real yarn diameter and x, y, z - coefficients that depend on the *type of weave*

Previous equation is based on the assumption that all loops have regular geometrical shape. Variations in some cases the correct geometrical forms are taken into account, so the preceding equation changes its shape into a form that fits the case.
Calculating the length of yarn that is needed for the loop is not a simple process. Therefore, we set a large number of mathematical models that facilitate the calculations. Determination of this length is extremely important and a large number of science papers have shown when dealing with this issue. One of the first model, which is based on the observation of the loop in on an area, set by J. Peirce in a way that he assumed that the arcs of needle and platinum head are equal, round, that they touch each other and that they cross the arms tangentially. He took the diameter of the arc to be equal to the $D=3d$; trap height is equal to: $B=\sqrt{(4d)^2-(2d)^2}=2d\sqrt{3}$; width is equal to the traps $A=4d$. Labels correspond to labels in Pture 1 So he came to the following expression for the length of yarn in a trap:

$$l=16,66\ d$$

If the arcs head do not touch it the author establishes the following relations:

$$l=2B+A+5,95\cdot d$$



Picture 1: *The parameters of the length of the pitfalls of Peirce*

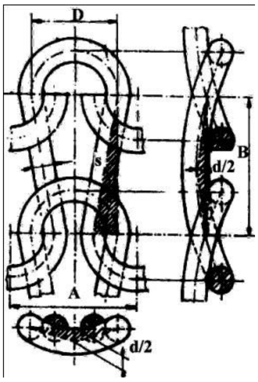
In the previous equation the other two researchers G.Fletcher -and M.Roberts have corrected the coefficient of 5.95, which multiplies the diameter of yarn for different cases. Their results show that the ratio ranges from 6.74 to 418.

Professor Dalidovič set his spatial model according to Picture 2. He assumed that the arcs of needled and platinum heads are equal and circular and in the leg cross by secants. This gives the relation:

$$l=\pi\cdot D+2s \quad \text{with } D=\frac{A}{2}+d.$$

If it is assumed that $s=B$, the result is:

$$l=1,57A+\pi\cdot d+2B$$



Picture 2: *Parameters length traps by Dalidoviču*

If we take $s = \sqrt{B^2 + d^2}$, then the result is:

$$l = 1{,}57A + \pi \cdot d + 2\sqrt{B^2 + d^2}$$

If instead of the A term we take 100/Dh then the previous expression to calculate the length of yarn needed for making traps has the following form:

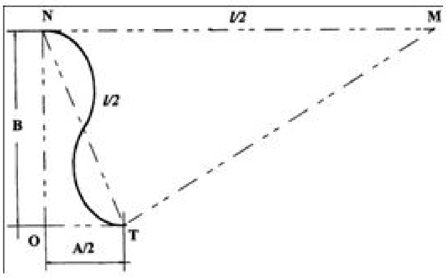
$$l = \frac{157}{D_h} + \pi \cdot d + 2 \cdot \sqrt{B^2 + d^2}$$

If we take into account the height of the loop V >> d then the previous equation can be written in the following form:

$$l = 1{,}57A + \pi d + 2B$$

If we include in the previous equation values of the ideal knitwear (assumed to be normally tight knitwear and the loop to occupy an ideal geometric shape, the value is: $A = 4d;\ C = \frac{D_h}{D_v} = 0{,}865$ i $B = 3{,}46d$, then the lenght of the loop will be equal to: $l = 16{,}34d$

The next way of determining the length of the loop takes into account its helical shape. Picture 3 shows the elements on which it is possible to determine the length of the loop.



Picture 3: *Helikoid model*

Picture 3: V - height of the loop; $l/2$ - half the length of the loop and $A/2$ - half step loop.
The advantage of this model is that it is three-dimensional. In Picture 3, one may notice two triangles ΔNOT and ΔNTM . Since these two triangles are similar, the following variations are exepted:

$$\frac{l/2}{NT} = \frac{NT}{A/2} \text{ i } NT^2 = B^2 + (A/2)^2$$

From the previous two equalities follow:

$(l/2) \cdot (A/2) = B^2 + (A/2)^2$, so the lenght of the loop is equal to:

$$l = 2 \cdot \frac{B^2 + (A/2)^2}{(A/2)}$$

In addition to these models there is also a geometric model and a number of ways to determine the length of the loop. The significance of this problem stems to come from the fact that the length of the yarn needed to create a loop significantly influences many features of the designed knitwear. Primarily this affects the length of the horizontal and vertical density of knitwear. Therefore, this length must be accurately determined because otherwise afflicted by distortion of the structure in the made knitwear.

In fact, this structure would be different from that previously projected. This calculation, which is related to the smooth right-left weft knitted fabric, generally depends on the type of weave that is used for knitting the knitwear. For specific interlacement, coefficients are precisely determined. However, if the geometric shape of the loop deviates from the usual, then the equations must be taken into account and corrected separately in the equation.

MATERIALS AND METHODS

Ribbed knitwear, that were used in this experiment, were made on a circular double needle knitting machine. Six samples of knitwear were made for the test. The first samples is bleached and it is made of 100% cotton yarn fineness of 50 tex in 1x1 ribbed weave and it is made on circular machines, fineness E15. The second sample is colored and has the same production characteristic like first one. The third sample is bleached and it is made of yarn of the same composition but with different machine fineness, E18. The forth sample is colored and has the same production characteristic like third sample. Fifth sample is made on same machine finesses like third and fourth sample but it is bleached and it is made from 96% cotton fineness 20texa and 4% Lycra fineness 44dtexa. The sixt sample is colored and has the same composition like fifth one. Basic characteristics of all 6 samples are shown in Table 2

Table 2. Basic characteristics of the ribbed knitwear samples

Sample	Interlacement, RIB	Material composition and the finnes if the yarn (tex)	Machine finesses	Finishing
Ia	1:1	cotton 100% tex 20/1	E15	bleached
Ib	1:1	cotton 100% tex 20/1	E15	colored
IIa	1:1	cotton 100% tex 20/1	E18	bleached
IIb	1:1	cotton 100% tex 20/1	E18	colored
IIIa	1:1	cotton 96% (tex 20/1) lykra 4% (dtex 44)	E18	bleached
IIIb	1:1	cotton 96% (tex 20/1) lykra 4% (dtex 44)	E18	colored

RESULTS AND DISCUSION

The main significance of knitwear is that they can be washed. To determine the consumption of the loop, a method was used for ripping the length of the thread. When the knitwear is ripped it stretches to the extent that the waved parts can straighten. Then the length is measured and the thread is let off of the pressure. Then the lengths of the loops are counted in a washed thread and the same numbers of threads are counted in the knitwear. For convenience in operation it is desirable that the number of loops from the ripped threads is a multiple of 10 Thus, mostly of 30, 40, 50, or 100 loops are ripped. One end of ripped thread is squeezed on the upper fixed forceps and the other end is pressured with 0.5 cN / tex. [9] In this case the 10 threads are ripped and on the basis of total length of ripped threads, consumption for forming a loop iscalculated.

$$l_{ei} = \left[\frac{\sum l_i}{(n \cdot n_p)} \right]$$

l_{e1}- consumption of yarn in one loop determined experimentally from ripped loops (mm)
l_i- the lenght of a single ripped thread
n - number of ripped threads
n_p - number od loops in a ripped thread

Table 3 Consumption of yarn in the loop of a ripped thread

	Ia			Ib			IIa			IIb			IIIa			IIIb		
n	n_p	l_i (mm)	l_{e1} (mm)	n_p	l_i (mm)	l_{e1} (mm)	n_p	l_i (mm)	l_{e1} (mm)	n_p	l_i (mm)	l_{e1} (mm)	n_p	l_i (mm)	l_{e1} (mm)	n_p	l_i (mm)	l_{e1} (mm)
1.	30	90	3,00	30	91	3,03	30	78	2,60	30	79	2,63	30	85	2,83	30	85	2,83
2.	30	92	3,06	30	90	3,06	30	76	2,53	30	77	2,56	30	83	2,76	30	84	2,80
3.	30	90	3,00	30	90	3,00	30	78	2,60	30	77	2,56	30	87	2,90	30	84	2,80
4.	30	90	3,03	30	92	3,06	30	77	2,56	30	78	2,60	30	85	2,83	30	84	2,80
5.	30	91	2,96	30	89	3.00	30	76	2,53	30	78	2,60	30	85	2,83	30	86	2,86
6.	30	89	2,93	30	88	2,93	30	76	2,53	30	78	2,60	30	84	2,80	30	83	2,76
7.	30	88	3,00	30	90	3,00	30	76	2,53	30	79	2,63	30	83	2,76	30	83	2,76
8.	30	90	3,00	30	90	3,03	30	78	2,60	30	76	2,53	30	86	2,86	30	85	2,83
9.	30	90	3,00	30	90	3,00	30	78	2,60	30	77	2,56	30	83	2,76	30	82	2,73
10	30	92	3,00	30	91	3,03	30	77	2,56	30	77	2,56	30	85	2,83	30	84	2,80
X			3,00			3,02			2,56			2,58			2,81			2,79

The results in Table 3 are visible differences in the consumption of yarn in a loop for all the samples. In preparing the Ia, Ib and IIa, IIb samples the same interlacement and the same composition was applied. The only difference was that these four samples were done on machines with different fineness. The results show that the length of the yarn consumption is greater in the Ia, Ib samples. In comparing IIa, IIb and IIIa and IIIb sample, the sameinterlacement but the different raw composition and the same fineness of the knitting machine was applied. The samples wich contain lycra shows that the lenght of the yarn consumption is greater then in the samples whitout lycra. Comparing the dayed samples and bleached smaples, the differences is minnor. This paper has shown that machine and fineness of weave types significantly affect the value of consumption of yarn in one loop.

CONCLUSION

One of the most important parameters in the process of knitting is the length of yarn used for making loops. Length of the loop causes knitwear dimensions and its physical and chemical characteristics. The importance of the consumption of yarn research in one loop is due to the fact that the length of the yarn needed to create a loop significantly influences many features designed knitwear. Primarily this affects the length of the horizontal and vertical density of knitwear. Therefore, this length must be accurately determined because otherwise it will be afflicted by distortion of the structure of the knitwear that is being made. In fact, this structure would be different from that previously projected. From the results you can see the differences in the consumption of yarn in a loop for all the samples.

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THE ADVENTAGES OF MODERN METHODS FOR ACHIEVING WATER REPELLENCY COMPARED TO CONVENTIONAL METHODS

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ABSTRACT: Due to increasingly strict environmental requirements that are set in the contemporary processes of textile technology, nowadays there is increased trend for using agents that are acceptable from an environmental point of view. The surface treatment with plasma, ozone, biopolymer, and similar technologies, which are nowadays investigated and applied for the purpose of modification of textile materials, in addition to being environmentally friendly, are energy cost-effective compared to conventional breeding methods. Development and commercialization of plasma technology in the design and manufacture of contemporary textile materials helps to reduce the use of chemicals, which gains importance - both from an environmental as well as from an economic point of view.

Key words: plasma, conventional finishing, apreture, water repellency

INTRODUCTION

The increased demand for highly functional textile materials is constantly growing. Two very important features which are of very great importance for many types of textile materials are the ability to repel water and oil. Conventional methods for achieving these properties include process with large energy consumption which goes to washing and drying. There is a high degree of chemical consumption, because the fabric must be impregnated with a solution containing the hydrophobic substance. Several compounds can be applied to textile materials in order to achieve the hydrophobicity, for example. waxes, silicones and silanes, which are usually not resistant to oil. Fluorocarbons are on the other side excellent in order to achieve water and oil repellency, because of its low surface energy [1]..

Reducing the amount of chemicals in the production lines will lead to cost-effectiveness and the environmental benefits. Plasma technology could have an answer to this problem.

WATER REPELLENCY

Hydrophobization is usual term for water repellency, oil repellency and stain repellency. In order to fully understand the phenomena of hydrophobization and stain repellency of textiles one must know the basic concepts of surface energy. To achieve a hydrophobic surface, the interactions between water and the surface should be inhibited. Such inhibition is achieved by minimizing the polar components of the surface energy , i.e.van der Waals forces, electrostatic interactions and hydrogen bonds.

CONVENTIONAL METHOD FOR HYDROPHOBIZATION

The conventional method of hydrophobization a textile involves a wet treatment step. The method usually consists of a pad-dry-cure sequence (Figure 1). This method is used because of its excellent ability to impregnate fabrics homogenously. In the padding step the fabric passes through a bath of an aqueous dispersion of hydrophobizing chemicals. The concentration of these chemicals is usually between 2-10 %. The bath is followed by squeezing of the saturated fabric between two rollers with a specific pressure, to ensure that the fabric obtains a certain pickup. Hence, the pickup is a measure of the amount of hydrophobizing chemicals that is absorbed by the fabric and is normally expressed by the following equation[2].:

$$Pickup\% = \frac{Rolled\ weight\ of\ the\ fabric - Dry\ weight\ of\ the\ fabric}{Dry\ weight\ of\ the\ fabric}$$

For diluted baths a modified version of Eq.3 can be used:

$$\frac{Mass\ Chemical\ [g]}{Mass\ Fabric\ [g]} = \frac{(Rolled\ weight\ fabric\ \ - Dry\ weight\ fabric) x\ Weight\ Chemical}{Total\ woight\ of\ chemical\ bath\ (Diluent + Chemical) x\ Dry\ weight\ fabric}$$

The padding and squeezing is followed by a drying step, to remove the excess water before curing it at a higher temperature. A high temperature is needed to fix the chemicals on the fabric surface[2]..

The pad-dry-cure technique makes the chemicals spread evenly in the fabric, but there are some downsides. The treatment consumes large quantities of water and chemicals. It also involves high energy costs due to the drying and curing of the fabric at high temperature. Plasma technology has great potential to substitute finishing processes like this, thus reducing the costs and the environmental impact [2].

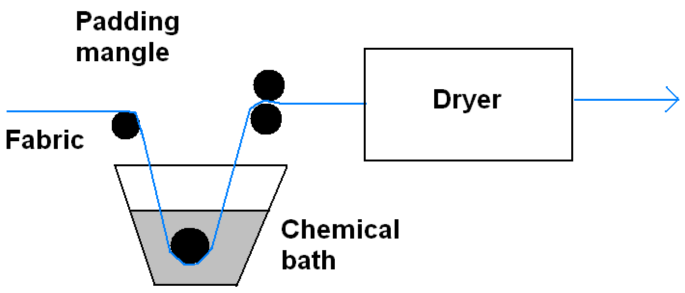

Figure 1: The pad-dry-cure sequence

PLAZMA TECHNOLOGY

Due to increasingly strict environmental requirements that are set in the contemporary processes of textile technology, nowadays there is increased trend for using agents that are acceptable from an environmental point of view. In this sense, there are more researches related to the application of plasma as an environmentally acceptable physical agents. Although it is known from earlier, special interest in the application of plasma technology in the field of textile is recorded in the last ten years, especially in the methods of pre-treatment and finishing of textile materials with the purpose of obtaining a more functional textile products. In this sense, the emphasis of modern treatment is aimed at obtaining favorable effects of surface modification of fibers that contribute to the overall quality of the fabric [2].

Plasma, also known as the fourth state of matter, is defined as ionized gas and consists of electrons, neutrons, ions, radicals, electronic excited particles and UV-radiation. It is created by introducing energy to a gas which causes a reorganization of the electronic structure of the atoms and molecules [1]. The energy source can either be thermal, consist of an electric current or electromagnetic radiation.

Plasmas can be divided into two broad categories:

- Thermal plasmas have high-energy densities and all of its constituents have the same relative temperatures. The sun is an example of a thermal plasma.
- Non-thermal plasmas have lower energy density and is characterized by a difference in temperature between electrons (which have energies that corresponds to several 1000 °C) and heavier elementary particles, which have a temperature just above room temperature [1]..

Common thermal plasmas are torches which consist of two electrodes generating a plasma arc sustained by means of an electric dc current flowing through the body of the discharge Thermal plasmas are often used in materials processing, since they have a high energy density, they are used to heat, melt or even vaporize materials.

Parameters relevant to the efficiency of the plasma treatment

In order to achieve the desired effects with plasma treatment, it is necessary to establish a good and optimize processing parameters such as the gas species, gas flow rate, the pressure of which is regulated by a vacuum pump (in the case of a low-pressure plasma) , the operating frequency of the device, the processing time and the distance between the electrodes and the substrate surface. For a clearer view of the meanings of certain parameters in Table 1 are given the different effects achieved by plasma depending on the area of operating frequency at which is conducted modification of the substrate[3].

Table 1. Operating frequency plasma reactor system and achieved effects

Operating frequency	Area of the operating frequency	Effect
10-50 kHz	Corona discarger	Activation adn modification of the surface
from 50-450 kHz	the low frequency region	activation of the surface, the lower degree of coating in the process of polymerization
13,56 or 27,12 MHz	area of radio waves	activation of the surface, a high degree of polymerization in the process of coating
915 MHz or 2,45 GHz	area of of microwave	macro-etching surface polymerization

COMPARISON BETWEEN PLASMA TREATMENT AND CONVENTIONAL METHODS

A comparison between plasma treatment and the conventional method used to hydrophobize a textile (Table 2) clearly show the benefits of the plasma treatment, where the major advantages being the low water and energy consumption. Other advantages of the plasma includes its versatility (any type of fabric can be treated), low consumption of chemicals and the optimization of the surface properties without affecting the bulk characteristics [2].

There are some disadvantages though; it is in most cases impossible to calculate the physical and chemical behavior of a plasma due to the huge amount of elementary reactions that occur. For this reason, the exact chemical composition of the surface is hard to predict, and it is also difficult to limit the type of functional groups formed, to a well defined set of species. [2].

Table 2.Comparision between plasma treatment and conventional methods

Parameter	**Plasma**	**Conventional method**
Solvent	None (gas phase)	Water
Energy	Electricity	Heat
Type of reaction	Complex	Simple
Deepness of the treatment	Very thin layer	Bulk of the fibers
Water and energy consumption	Low	High

CONCLUSION

The surface treatment with plasma, ozone, biopolymer, and similar technologies, which are nowadays investigated and applied for the purpose of modification of textile materials, in addition to being environmentally friendly, are energy cost-effective compared to conventional breeding methods. Development and commercialization of plasma technology in the design and manufacture of contemporary textile materials helps to reduce the use of chemicals, which gains importance - both from an environmental as well as from an economic point of view.

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TEXTILE FIBERS – STAGING TOOL OF TEXTILE INDUSTRY

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ABSTRACT: Main intention of this work is to example textile fibers, as starting resource of production in textile industry. Textile industry is on of the main economy branches which brings more then billion cash resources and represents a vital industry of last and current century.

Key words: *textile, textile fibers, textile industry, fashion*

INTRODUCTION

Phenomen of textile technology and science has never been more influental as today. There are two reasons for that, on one side the rise of consuming society that glorify dissipation and constant replacing of products, and on the other side, under the recent economical and energetic crises rebellion against the same consuming mentality, more society groups are rejecting hedonism and fake gloss of consolidating institutions.

In this works term of textile fabrics, their purpose and will in textile industry is being detaily analised, from their composition till their use in everyday life. Textile fibers if they are natural or chemical, represents starting thread of any further researching and production part in textile industry.

Fashion and textile industry are not just one of the most important social and economical phenomena; they are one of the most reliable arsine for measuring psychological, pshycoanalitical, technological and social-economical motivations of humanity. Therefore they are also one of the most sensitible indicators of special "taste of epohe" that makes a foundation of every esthetical and critical value of an historical epohe.

HISTORICAL REVIEW OF TEXTILE FIBERS

First foundations about usage of textile products have been found by archeologist that found textile trails from prehistoric period. Linen has been used by native Switzerland 8000 years B.C., where have been found linen fabric rest.

Data about silk dates from XI century from crusaders records, on their journey to Jerusalem, they passed through the great road of silk, which was the main market road between China and Mediterranean.

Cotton was used in India and Peru between 3500. and 3000. year B.C. In Europe, actually in Greece, cotton was brought from India in time of Alexander the Great in II century.

Wool probably comes from central Asia, around 2000. year B.C. domesticated sheeps were cultivated in Mesopotamia. Wool rugs were made also 500. years B.C. Wool clothes was used by ancient Greeks. Roman soldiers, when crusading today England, also wore clothes made of wool.

Herodet and Plinius, between 450. year B.C. and 80 year B.C., wrote in their records about fibers and products made of fibers, which processing was done by slaves. Handmade manufacturing of textiles was retained until the end of XVIII and start of XIX century. Then comes industrial revolution which, between foundation of steam machine, characterizes foundation of textile machine. First textile machines were build in England (Picture 1). They enabled easier processing of cotton fiber from plants and spinning machine significantly faster and larger production of clothes. From then cotton becomes on of the main raw materials of textile industry and remains until today.

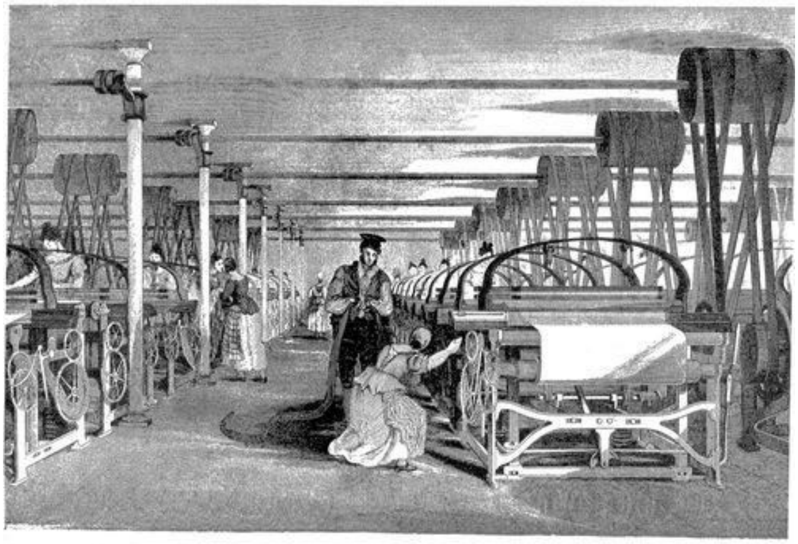
Industrial manufacturing of textile fibers started in France at the end of XIX century, when French scientist Chardon started to make chemical fibers from nitrocellulose. Chardon is considered as founder of chemical fiber manufacturing.

Manufacturing development of chemical fibers from cellulose (copper, viscose, acetate) lowers the manufacturing and use of fiber such as linen, hemp, sisal.

At the end of 30's in USA, firm "Du Pont" made first industrial polyamide fiber (Nylon), and then in Germany fiber from the same group (Perlon) was also made. Procedure of getting polyester fiber was found in Great Britain during the World War II, and in 50's industrial manufacturing of Terylen started.

With population growing in the world, and higher life standards, a need for increased manufacturing of chemical fibers was imposed not only for higher production then for improving their property. That's why basic types of sinthetic fibers were modified which brought improved property fibers (modified fibers).

Along with development of other sciences (electronic, robotic, communication) a need for fiber with totally new characteristics and needs arises. So today there are fiber from third, fourth, fifth generation, fiber of special usage, optical fibers.



Picture 1: First textile machines for yarn manufacturing from beginning of XIX century

TEXTILE FIBERS DIVISION BASED ON ORIGINS AND MANUFACTURED METHOD

Textile fiber diversity based on origins or manufacturing method, implemented a need for their classification apropos division. All textile fibers based on their origins and manufacturing method are dispart on natural and chemical or industrial fibers.

Natural fibers based on definition are fiber that are found in nature. By the origins they are dispart on plant or cellulose, animal or protein and mineral fibers. Plant and animal fibers have organic origin while mineral have inorganic origin.
Based on the title chemical or industrial fibers are defined as fabrics that are made in industry. Usually they are made from organic polymer, inasmuch these polymers are from nature (cellulose, proteins), so they are natural polymer fibers. Most organic polymers are being synthesized from non-polymeric compound; that's how synthesized fibers are being produced. Third ground of fiber is based on production from inorganic compound.

TEXTILE FIBERS USAGE

Until 40's in XX century, textile industry was only producing natural fibers (cotton, linen, wool, silk) and until the end of last century cellulose fibers were produced (copper, viscose).

Population growth was crucial for further manufacture and consumption of textile fibers. Natural textile fibers couldn't anymore settle the growing needs. That's why industrial production is being proceeded, engine were build all around the world. In period between 1900. until 1994. year production is increased ten times more. This was specific for textile fibers produced in industry. Growth of population had big impact on rise of textile fibers consumption. Based on data from 1980. year, every citizen from most developed countries spent yearly: 12 kg of cotton, 600 g of wool, 20 kg of chemical fibers and around 1 kg of other fibers. Based on familiar percents, textile fiber consumption is growing in the world.

In future, cotton will surely be on of the main raw materials in textile industry, while therefore will be changes in cultivating and processing. Present syntethic fibers will be modified (improving properties and expanding usage), there will be found new fibers accordingly to population needs in new millennium.

Today, as in past, basic fields of textile fiber use are production of clothes and household items.
Textile fibers are used for making of most different types of clothing – underwear, socks, glows. scarves. sweaters. costumes, suits, dresses, skirts, pants, shirts, blouses and other (Picture 2).
In household fibers are being used for making of bed sheets, covers, drapes, fabrics for furniture, rugs, floor compress, kitchen mops and other.

Picture 2: Clothing made of natural fibers

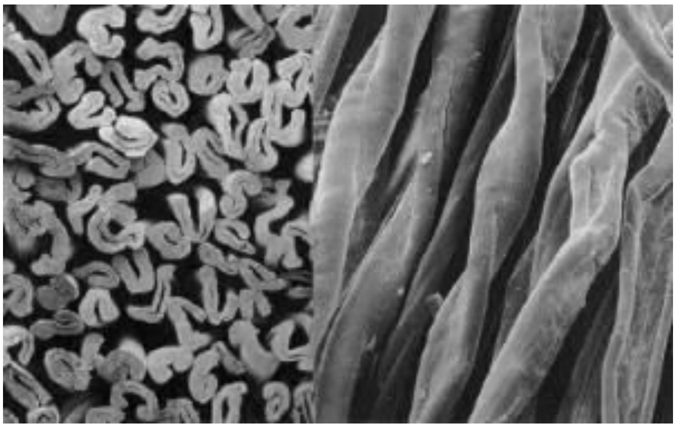
NATURAL TEXTILE FIBERS

There are my plants in nature whose parts of their tree, leaves, produce or grains contains fibers. But only few are being used for fiber getting.

In textile industry cotton is the most used one, whose fibers are being made from their grains (Picture 3). From the plant acon those fibers are also being made from the same way but they are not often used for fiber making.
More then 50 plants contains fibers in their tree (cortex), but in textile industry only few are being used – linen, hemp, burlap and ramie.
Its similar with fibers from leaves and produce. There are many plants that contains fibers in leaves, but only few are remarkable for textile industry. Those are: manila, sisal, ramie and others. Fibers made from leaves, like coco fibers, which are being made from coco palm produce, are being commonly called hard fibers.

Fibers made from grains (cotton, acon) are unicellular or elementary fibers. Most of the other plant fibers are multicellular.
Natural fibers of animal origins are hairs from sheep's body, whom are called wool, hair from the other animals (goats, camels, lamas, rabbits) and natural silk.

Common property of this group of fabric is protein texture. That's why these fibers are being called protein fibers. Albumin of wool and other hairs is called keratin, so this group is being called keratin fibers. Albumin of silk is called fibroin, so fibers that contains this substance are called fibroin fibers. Silk fiber contains two filaments that are connected with albumin of sericin (silk glue).

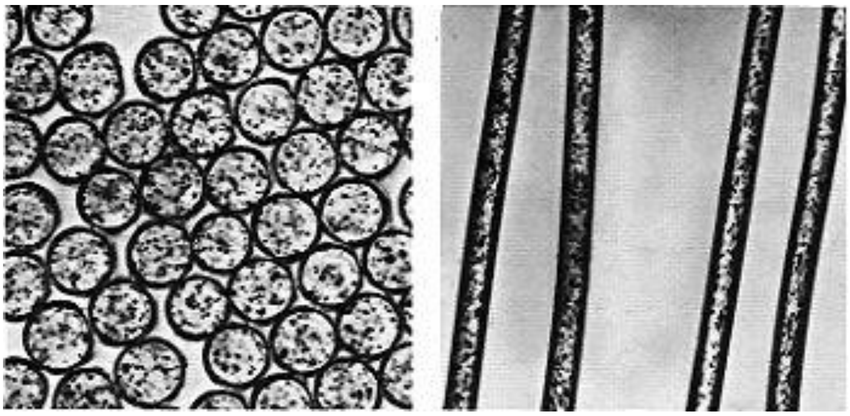


Picture 3:Microscopical view of cotton fibers

CHEMICAL TEXTILE FIBERS

Under the term of chemical fibers , fibers that are produced in chemical way are being purported. Most of these fibers are produced from organic polymers. Some polymers have natural origins, like cellulose and albumin (proteins), and are being used for making chemical cellulose and protein fibers (Picture 4). Most of organic polymers are made from in polymeric compound which are synthesized. That's how synthesized polymers were made, from whom synthesized fibers are made.

Chemical fibers of natural origins, are fibers made from cellulose and albumin raw material. Because of the properties, small stringent and bad smell, this fabrics are not used anymore in textile industry.
Chemical fibers of inorganic origins are glass fibers, called glass wool. This fibers have specific properties and usage. Glass fibers are mostly used in industry. They are very suitable for insulation material making, specifically for heat, sound and electrical filter which are exposed to temperature and chemical agent effect.



Picture 4: Chemical fibers structure

CONCLUSION

Pursuant to large appliance and usage we conclude that textile fibers are core of textile industry and they are essential element in any further advancement in this technology. Textile fibers are representing one of the main items in further scientifically researches in modern technology because of their multifunctional purpose and usage.

Fashion as research field that is constantly changing and demands new, innovative products and attempts anticipates from textile industry to carry on in further research of textile fibers.
Beside fashion, changes of living conditions and eco system alludes on textile fibers technology to move forward in troubleshooting that are coming in future, such as different humanity and climate changes, war, social systems and statuses problems.

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FASHION FORECASTING

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ABSTRACT: Long-term forecasting is the process of analyzing and evaluating trends that can be identified by scanning a variety of sources for information.**Fashion forecasting** is a global career that focuses on upcoming trends. A fashion forecaster predicts the colors, fabrics and styles that will be presented on the runway and in the stores for the upcoming seasons.Choosing the color of the product is one of the most important decisions that a designer has to make!Measure, mark and analyze complex indicators that predict the requirements so that customers can see what's selling, what's hot, what's happening and why.

Key words: forecasting, fashion, WGSN

WHAT IS LONG-TERM FORECASTING?

Long-term forecasting is the process of analyzing and evaluating trends that can be identified by scanning a variety of sources for information. Long-term forecasting seeks to identify: major changes in international and domestic demographics, shifts in the fashion industry along with market structures, consumer expectations, values, and impulsion to buy, new developments in technology and science, and shifts in the economic, political, and cultural alliances between certain countries. There are many specialized marketing consultants that focus on long-term forecasting and attend trade shows and other events that notify the industry on what is to come. Any changes in demographics and psychographics that are to affect the consumers needs and which will influence a company's business and particular [niche market] are determined.
Trend forecasting is a general term that focuses on other industries such as the car industry, medicine, literature, food and drink, not just mondojindustriji.Postoje special marketing consultants who focus on predicting long-term prognosis, and their task is to attend fairs and other events that present current and future proizvode.Važno to take into account all the social, demographic and economic changes that will significantly affect the business and manufacturing industry trends.

Larger companies such as Forever 21 have their own trend departments where they follow the styles, fabrics, and colors for the upcoming seasons. A company with its own trend department has a better advantage than those who do not because its developers are able to work together to create a unified look for their sales floor.

Product developers may offer anywhere from two to six seasonal collections per year, depending on the impact of fashion trends in a particular product category and price point. Women's wear companies are more sensitive to the whims of fashion and may produce four to six lines a year. For each season a collection is designed by the product developers and is based on a specific theme, which is linked to the story.color and material.

A merchandiser also plays a key role in the direction of upcoming trends. Different from developers, merchandisers have much more experience in buying and are knowledgeable in what consumers will be looking for. The designer takes the particular trends and then determines the styles, silhouettes and colors for the line and garments while creating an overall theme for the particular season.

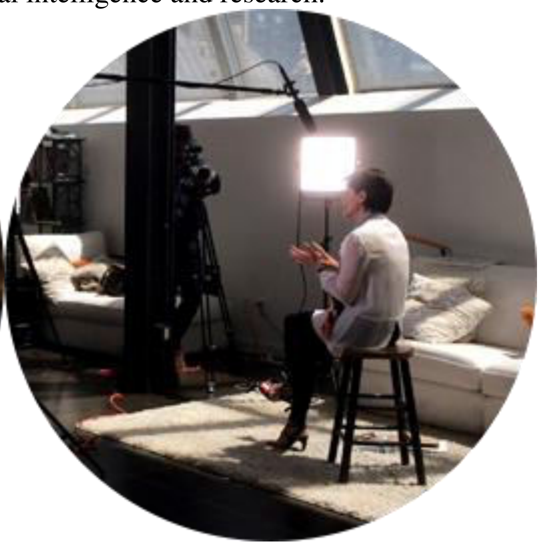
Individual bloggers also contribute to fashion forecasting and influence designers and product teams.

FASHION FORECASTING

Fashion forecasting is a global career that focuses on upcoming trends. A fashion forecaster predicts the colors, fabrics and styles that will be presented on the runway and in the stores for the upcoming seasons. The concept applies to not one, but all levels of the fashion industry including haute couture, ready-to-wear, mass market, and street wear. Trend forecasting is an overall process that focuses on other industries such as automobiles, medicine, food and beverages, literature, and home furnishings.[1] Fashion forecasters are responsible for attracting consumers and helping retail businesses and designers sell their brands. Today, fashion industry workers rely on the Internet to retrieve information on new looks, hot colors, celebrity wardrobes, and designer collections.

One of the best and most relevant websites for fashion forecasting is just WGSN. Engaged in providing accurate forecasts of global trends and styles of 1998. Is a world leading trend forecasting and analysis of past, present and future trends and fashion companies all over sveta.Takodje, WGSN has and research line that gives the user to be informed about all the upcoming fashion events, gatherings and shows.

WGSN is a reliable partner for many of the world's leading brands. It is composed of a team of industry experts who share their knowledge and experience with the trends, to assist in the development of fashion companies and kompanija.Takođe, has the largest global reach and access trends in the territory of Europe, Asia, Australia, North and South America. Represents products that are a combination of a large database of professional intelligence and research.



DESIGN AND INSPIRATION

One of the many merits of WGSN's is that it provides great inspiration and help to designers, creative teams and fashion companies. When you create a brand, you have a must-have product, or necessary, and most importantly producing their kolekcije.Never not forget the trend! When you start your season, WGSN guides you through the Top Trends, ie. The most current trends, silhouettes, materials and colors specific to your market. Make sure that you and your team have a clear direction and inspiration to create.

MARCETING ACTIVITY

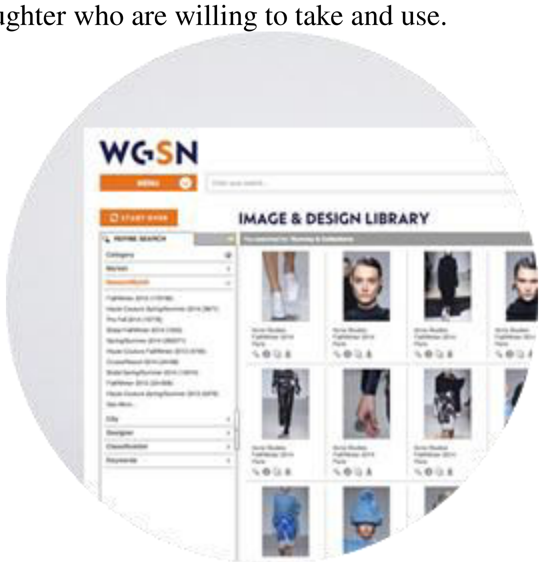
Provides the user the ability to increase its global visibility and expand competitive knowledge on WGSN tržištu.Važno to know your market. WGSN provides fresh, high on the daily reports that will keep you on track against its competitors.

PHOTOS ON WGSN

At WGSN-in you have access to over 10 million fashion photography, high quality, and it is the biggest archive of fashion photography collections, fashion shows and events, more than 400 exhibitions and activities.

DESIGN TOOLS

Allow the user to easily and quickly hits collection, build up the color palette, finding the subject of inspiration, and so on. WGSN provides high-quality, simple, and creative tools that are specifically designed for the design company to design teams for as little time as you create quality and unique product. Using these tools to stimulate the creativity and imagination of users and the development of design and artistic abilities and skills. Constant access to shows and fashion events gives the user exclusive access to the models and the events behind the scenes. Choosing the color of the product is one of the most important decisions that a designer has to make! Experts WGSN-followed timeliness of colors and with the latest dizajnerskub tools enabled users to use of all categories of colors and shades. Also, all users have access to the archive with more than 100 000 examples of printing, graphics, and clip a little daughter who are willing to take and use.



WHAT CAN YOU DO ON WGSN

WGSN group is working with a number of companies around the world by providing them with an insight into current trends, informs them of the retail and prouzvodnji and help them to follow the latest fashion events. On the basis of strategic intelligence, industry experience and creative knowledge, offers its customers not only the current, current trends, but also predstojećim.WGSN team is engaged in monitoring, interpreting and comparing the economic information, new technologies, business performance, and market dynamics. Helps its clients to build competitive advantage. Measure, mark and analyze complex indicators that predict the requirements so that customers can see what's selling, what's hot, what's happening and why. Store data and organize it to always be accessible klijentima.Takođe, WGSN team is engaged in studying the consumer with scientific precision, in order to discover not only what is needed but what will be needed and desired in the future. Identifies unmet needs is one of the main tasks of the WGSN team.

PERSONAL EXPERIENCE WITH WGSN-OM WHEN RESEARCH ON„ CHILDREN'S CLOTHES '

I decided that my main choice of data is WGSN because it offers the largest archive of images, data, reports and latest fashion show on current trends in children's odeće.Imala I have access to the latest developments in the area of Europe, Asia, North and South America and Australia. Also, I've met through the work of many young children's apparel makers whose creations slowly conquering the fashion world. Very helpful I was and what I could read reports from past fashion shows and also see that the colors, materials and the most current models. I met with trends such as Street-style where the emphasis given to children's clothing is almost identical to adult clothing, Vintage style, which is based on the creation of children's clothing similar models from the 50s and 60s of the last century, then one of the new styles Asian designers is to promote a combination of animal prints and bright colors, stylish and customized children, etc.. ... I would recommend to anyone who is interested in fashion, fashion trends and fashion research deals with the use of WGSN's

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TECHNIQUES FOR ACHIEVING THE WATER AND OIL REPILLENCY ON TEXTILE MATERIALS

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ABSTRACT: Products for textile water repellency can be classified into three groups. First group includes hydrophobic hydrocarbons which contain paraffin wax emulsions and reactive hydrophobic hydrocarbons fibers. Second and third group are silicones and fluor chemicals. A recently new technologies are introduced for achieving oil repellency and water repellency using plasma. This paper shows methods for obtaining water repellency acheved by conventional methods and with new plasma technology

Key Words: water repellency, conventional treatment, plasma treatment

INTRODUCTION

The future of the textile industry in the developed world is in the production of textile materials of superior quality. The interes of the multifunctional products with improved quality and utility properties are more expressed on the market. Customers are looking for products with high functionality which are both good dimensional stability and easy for maintening [1].

With some processes and treatments we can give textile some specific properties, such as high gloss, resistence to creasing, dimensional stability in use and washing, water and oil repellency [1].

Products for textile water repellency can be classified into three groups. First group includes hydrophobic hydrocarbons which contain paraffin wax emulsions and reactive hydrophobic hydrocarbons fibers. Second and third group are silicones and fluor chemicals. A recently new technologies are introduced for achieving oil repellency and water repellency using plasma [2].

HYDROPHOBIZATION

Hydrophobization is usual term for water repellency, oil repellency and stain repellency. In order to fully understand the phenomena of hydrophobization and stain repellency of textiles one must know the basic concepts of surface energy. To achieve a hydrophobic surface, the interactions between water and the surface should be inhibited. Such inhibition is achieved by minimizing the polar components of the surface energy , i.e.van der Waals forces, electrostatic interactions and hydrogen bonds [3].

SURFACE ENERGY

The surface energy is a concept that can be used to describe the ability of a liquid to wet a surface. All materials have a specific surface energy, which magnitude depends on the molecules making up the same (the molecules ability of the solid and liquid to interact with each other). A high interaction between these molecules results in a high surface energy and vice-versa for a low interaction. Hydrogen-bonds and induced dipoles create strong interactions between the surface and the liquid. Wetting is easier accomplished on surfaces with high surface energy since the solid is then more prone to interact with the liquid[4].

Scientist Fox and Zisman showed that wetting of a surface depended on the surface tension of the liquid. Water has a very high surface tension so it tends not to wet a surface,but rather forms spherical drops. Liquids of lower surface tension form flatter drops. The drops get progressively flatter until the liquid gives a contact angle of 0_. At this contact angle the drop is completely flattened and spreads over the surface. Thus the wettability of a surface can be measured by the surface tension of the liquid that can just wet the surface.

The surfaces that are hydrophobic or oleophobic are difficult to wetn and thay are called the surfaces with low surface energy [4].

Wetting is easily achievable to surfaces with a high surface energy, while the solid materials are more prone to interact with the liquid. Other important factors for wetting surface are surface structure, ie. porosity, roughness and chemical heterogeneity.

Young equation

The different surface forces involved in spreading of a liquid on a surface can be seen in Figure 1. This phenomenon of spreading is described by Young's equation, where is the surface free energy of the solid, interfacial tension between the solid and the liquid and is the surface tension of the liquid. The contact angle of the liquid on the surface also needs to be determined.

$$Y_{SG} = Y_{SL} + Y_{LG}{}^{cos\theta c}$$

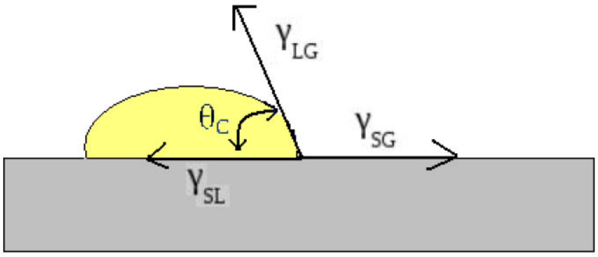


Figure 1. Surface forces in the contact moment of drop and surface

Another way of depicting the Young equation is by the use of a spreading coefficient, S where spreading occurs if S > 0.

For a surface to be considered hydrophobic the contact angle of the liquid should exceed 90 °. The contact angle of a drop can be measured directly by placing a drop horizontally on a substrate, also known as the sessile drop method, or by an adhering gas bubble captured at a solid-liquid interface [5].

$$S = \gamma_{SG} - \gamma_{SL} - \gamma_{LG}$$

The concept of critical surface tension can be used to determine the surface energy of a solid. The most straight forward way to do this is by a Zisman plot, which is done by measuring the contact angles of a series of liquids with decreasing surface tensions. Cosine of the contact angle is then plotted against the surface tension of the liquid and the critical surface tension is defined as the point where the plotted line intersects with the zero contact angle [6].

Methods for achieving water repellency

Water repellency and oil repellency could be achieved in two ways[1]:

- applying a water-resistant layer over the entire surface of the fabrics,
- impregnation fabrics i.e. treating the fabric with a hydrophobic substance which increases the angle of wetting between the water and fabrics.

Two important properties that are of high value for many types of textiles are their ability to repel water and soil. The conventional method of producing these features includes very energy-consuming processes i.e. washing and drying of the fabric. There is also a high consumption of chemicals involved, since the fabric needs to be impregnated by a solution of hydrophobizing agent. Several compounds can be applied to a textile in order to obtain hydrophobicity, e.g. waxes, silicones and silanes, they are however unsuccessful for soil- repellency. Fluorocarbons on the other hand are excellent in repelling water and oil, due to their low surface energy

PARAFIN WAX

Paraffin wax emulsions are the most economical water repellents for textile. They achieve good water repellency of the materials, however, they are not resistant to repeated washing.
Heretofore, the art of rendering textile or fibrous materials water repellent has commonly relied upon agents involving the chemical combination of certain metals and fatty acids to produce insoluble metallic soaps as stearates of metals such as aluminum.

These compounds while imparting more or less water repellent properties when applied to fibrous materials, as textiles, nevertheless are comparatively easily destroyed and removed in scouring operations employing soap and mild alkalies.

In an effort to remedy this condition, paraffin, which is relatively inert and does not saponify with weak alkalies has also been used in conjunction with aluminum acetate. When this mixture (usually in the form of an emulsion) is applied to fabric and dried, it provides a heterogeneous film which is little or not at all resistant to laundering[5].

A water repellent agent such as paraffin is effectively secured to the fibers of a fabric with suitably adsorptive binders in the form of adsorptive metal hydroxides formed in situ on the fabric or fibrous material. Hydroxides useful for this purpose are produced by impregnating the fabric with suitable metal salts, including those of zirconium, aluminum, magnesium, cerium, thorium, barium, chromium, nickel, lead or titanium, and forming the hydroxides on the fibers, as by heating or by treating with ammonium hydroxide solution and washing with waS ter to remove detrimental or useless substances such as the acid radicals of the salts used. The removal of the acid radicals either by heating or by washing after ammonia treatment appears to improve the adsorptive affinity of the hydroxide 10. for the water repellent material.

STEARIL - CHROM CHLORIDE TREATMENT

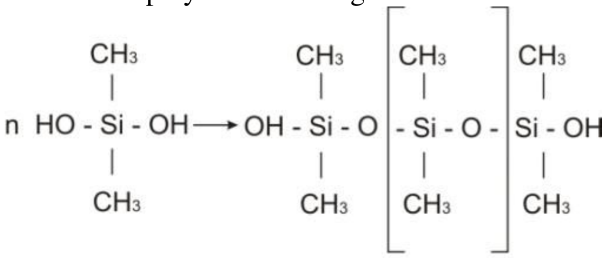
This kind of impregnation is convenient for wool products,but major disadvantage is that it leaves green mark on fabrics, so it is not suitable for processing of bright and white materials.In the case of cotton fabrics processing, it is necessary to add urotropin to the bath,because it is used like buffer. Namely, during the processing from stearyl-chromium-chloride compound, chloride (hydrochloric) acid is released and it could damage the fiber. During this processing, chromium is complexly linked to amino groups of wool or to hidroksil groups of cellulose. Since complex links are very strong, these compounds are highly resistant to washing and dry cleaning Due to fact that chrome from waste waters has very bad influence to ecology, this compounds are not used anymore. [1,5].

SILICONES

It has been known heretofore that silk, cotton, linen and other textile materials could be made resistant to water by coating the material with a water-repellent composition, for example, nrbber, metallic soaps, plasticized polyvinyl chloride, certain synthetic resins, etc. Generally, the process involved treating the material to be waterproofed with a solvent solution of the waterrepellent composition, for instance by passing it through a bath of the composition, and thereafter heating the coated and impregnated article to remove the solvent. The process involved considerable fire hazard.

Furthermore, articles waterproofed in this manner have not been entirely satisfactory for many applications, for example in the production of wearing apparel such as raincoats, raincapes, etc., due to the fact that the treated material, although it was resistant to penetration by water, was substantially nonporous and therefore did not permit the passage of moisture given off by the body of the wearer. As a result, waterproofed wearing apparel of this kind frequently was a source of discomfort to the wearer.

Silicone emulsions consist of silicone polymers resulting from the condensation of silandiol:



sulandiol polisiloksan

With water-repellent impregnation of the textile material it is necessary to pay attention to the fabric impregnation are hydrophilic, so that they can receive a lot of funding for impregnation.

FLUORCARBONS

Fluorocarbons have been used in the textile industry since the 1950s, thanks to their outstanding properties as repellants for water, oil and grease [3][10]. As stated previously, fluoropolymers owe their special properties to their low surface energy which means that they not only repel water but also oil-based substances. Fluoropolymers suited for textile finishing generally consists of a polymeric backbone, e.g. acrylate or polyurethane, with fluorinated side chains. Their effectiveness for each application varies with chain length, the shape of the chain and the type of end groups of the fluorinated side chains

PLASMA TECHNOLOGY

Due to increasingly strict environmental requirements that are set in the contemporary processes of textile technology,nowadays there is increased trend for using agents that are acceptable from an environmental point of view.In this sense, there are more researches related to the application of plasma as an environmentally acceptable physical agents. Although it is known from earlier, special interest in the application of plasma technology in the field of textile is recorded in the last ten years, especially in the methods of pre-treatment and finishing of textile materials with the purpose of obtaining a more functional textile products. In this sense, the emphasis of modern treatment is aimed at obtaining favorable effects of surface modification of fibers that contribute to the overall quality of the fabric. The surface treatment with plasma, ozone, biopolymer, and similar technologies,which are nowadays investigated and applied for the purpose of modification of textile materials, in addition to being environmentally friendly, are energy cost-effective compared to conventional breeding methods. Development and commercialization of plasma technology in the design and manufacture of contemporary textile materials helps to reduce the use of chemicals, which gains importance - both from an environmental as well as from an economic point of view.

Reactions and mechanisms of plasma treatment

For plasma creation, it is necessary to secure energy transmission from outer source, whereby elementary collisions between electrons can be described by reactions which are shown in table 7. Plasma affects chemically and physically onto the surface of the substrate, wherein the reactions between the plasma and the surface depend on the type of the gas and of their chemical properties. Textile materials exposed to such interpretations undergo chemical and physical transformations related to chemical changes in the surface layer, changes in the structure of the surface layer and the physical properties of the surface layer. Plasma creates large density of free radicals in the dissociation of molecules during collisions of electrons and photochemical processes. This causes destruction of chemical bonds in the polymer fiber surface that result in the creation of new chemical species. The effect of plasma on the surface of the fibers and the polymers results in the creation of new functional groups such as-OH,-C = O, COOH, which affect the improvement of fabric wettability (hydrophilic effect), and may be active sites for the graft-polymerization of different molecule [4].

Table.1 Reactions of plasma creation

Ekscitacija:	$A + e \rightarrow A^* + e$
Ionizacija:	$A + e \rightarrow A^+ + 2e$
Disocijacija:	$M + e \rightarrow M\cdot + \cdot M' + e$
Disocijativna ionizacija:	$M + e \rightarrow M\cdot + \cdot M'^+ + 2e$ $M + e \rightarrow M\cdot + \cdot M'$
Rekombinacija:	$M^+ + e + S \rightarrow M + S$
Disocijativna rekombinacija:	$M^+ + e \rightarrow M\cdot + \cdot M'$
Rekombinacija kao posljedica zračenja fotona:	$A^+ + e \rightarrow A + hv$

Thus the plasma is primarily used for the surface treatment of the material, because its actions only modify the surface properties of the layer thickness of a few tens of nanometers, thus the basic material properties remain almost unchanged. In this way, a selective modification of the properties of the fibers is achieved, for example, it can be affected on the ability of wetting and daying, adhesion characteristics, oil repellency and water repellency and others. This is difficult to achieve using classical chemica procedures without consequences to the fundamental properties of such treated fibers [4]. Generally the effect of plasma on the surface of textile materials can be roughly described by the four groups of processes[4]:
- plasma cleaning,
- plasma ablation or etching,
- activation, plasma modification,
- deposition, plasma polimerisation.

The mechanism of action of plasma is in the removal of a thin organic layer from the processed surface. Acting of the plasma during the cleaning and etching the surface of polymeric materials, leads to the breaking covalent links in the polymer chain. Such surface plasma treatment in the field of textiles is used for sterilization and sizing of textile products, especially by using atmospheric plasma. Application of atmospheric plasma is also possible in the methods of purification of waste water of textile industry.

The effects of plasma in terms of surface activation and modification are particularly interesting and encounter applications in medical technology, the automotive industry and the plastics processing industry, as well as in the field of textile [1, 7].This results in a reaction between the chemical groups on the substrate surface and the chemical particles in the plasma, where the leads to the formation of new functional groups on the surface of the substrate. Using this way of the application of plasma in the field of textiles it can be achieved improved wettability or hydrophilicity, and hydrophobicity of textile materials.

In the field of textile, application of plasma polymerization is used for surface modification in order to obtain textiles resistant to fire, reaching antimicrobial properties, and as dry and environmentally friendly technology shows some advantages over the appropriate treatment processes in the wet. Such processing can be efficiently carried out in atmospheric plasma and in low-pressure plasma, but it is still the most commonly used low-pressure plasma with a sealed reactor [1]. Implementation of the plasma treatment requires adequate reactors for continuous processing of fabrics and fibers, to which we must count as an investment.

CONCLUSION

This paper presents methods for achieving oil repellency and water repellency. Conventional and modern methods are shown and it can be concluded that modern methods (plasma) have the better effect on achieving water repellency and that are more efficient and productive, and that does not pollute the environment.

The results showed that it is possible to achieve the hydrophobicity of textiles using atmospheric pressure plasma. The results also show that the use of plasma provides better oil repellency than by using conventional methods.

Plasma technology has great potential to limit the impact of textile finishes on the environment; it is possible primarily due to lower consumption of energy and water than wet processing techniques. Also, the amount of potentially hazardous chemicals used in the impregnation of textiles can be reduced. As a result, plasma technology will greatly contribute to the sustainable development of the textile industry.

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PERFORMANCE EVALUATION OF KNITTED UNDERWEAR

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ABSTRACT: Underwear is a type of apparel worn next to the skin for reasons of hygiene andcomfort [1].It should provide comfort for the wearer, possess good sewability, retainits appearance during wear, be durable and have easy-care properties [2,3]. Thispaper considers the functional requirements of knitted underwear fabrics,describes the relevant standards and test methods for the performance evaluationof such fabrics, and reviews the recent developments in fabric engineering andproduct innovation. It serves to provide a reference for the product developmentand performance evaluation of knitted underwear fabrics.

Key words: comfort,sewability, durability, moisture, dimensional stability.

INTRODUCTION

A primary requirement of clothing is comfort. It can be categorized intoaesthetic comfort, thermal comfort, moisture comfort, tactile comfort and pressurecomfort [1]. Aesthetic comfort is the subjective perception of clothing by visualsensation, which is influenced by colour, style, garment fitting, fashioncompatibility, fabric construction and finish. [2]

THERMAL COMFORT

Thermal comfort is primarily related to the efficiency of heat dissipation froma clothed human body[6] and is viewed as the ‘neither too hot nor too cold feeling of the wearer [2]. The body is in a state of comfort when the core temperature of the body is maintained at 37˚C and the average skin temperature is approximately33˚C without the presence of sweat. One of the primary functions of underwear isto act as a buffer against environmental changes in order to maintain a thermalbalance between the heat generated by the body and the heat lost to the environmentwhile allowing the skin to remain free of liquid [2].

MOISTURE COMFORT

Moisture comfort depends on the feeling of dampness which isrecommended as a sensitive tool to evaluate the thermal function of garments tobalance the dampness of skin and clothing [3]. Although the human skin has nohumidity receptors, it can sense dampness, which determines the degree ofcomfort or discomfort [3]. The sensation of loss in comfort occurred when perspiration was present [4]. When morethan 50–65% of the body surface is wet, it feels uncomfortable [5].

Liquid transport properties

Wetting

ASTM D5725 [6] defines a test method to measure the contact angle of water incontact with a flat specimen of fabric under specific test conditions (figure 1.). Adrop of a specified volume of water is applied to a fabric surface using a liquiddelivery system. The rate of change of the contact angle is recorded by a videocamera and is used to determine the water absorbency of the fabric.

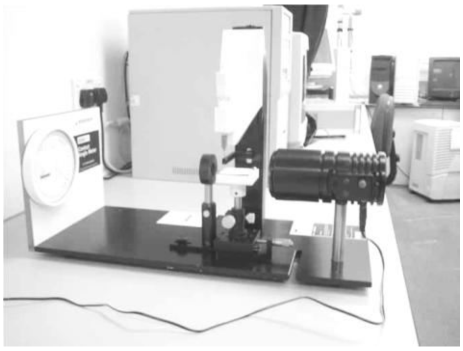

Figure 1. Contact angle tester

Wicking

Harnett and Mehta [6] have described two methods to measure the wicking propertiesof fabrics. They are the longitudinal wicking strip test and the transverse wickingplate test. For the longitudinal wicking strip test, a strip of fabric is suspendedvertically with its lower edge immersed in a reservoir of distilled water, as shownin Figure 2. It is recommended to add a dye to the water in order to track themovement of the water more easily. The measured height of rise in a given time isused to indicate the wickability of the test fabric. The water wicking performanceis highly dependent on the fabric structure and thickness and it is difficult tocompare the wicking performance of fabrics with extreme thicknesses or structures.

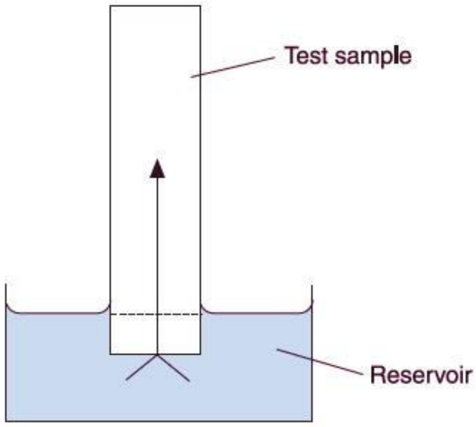

Figure 2. Longitudinal wicking strip test

The transverse wicking plate test is used to determine water transmissionaccording to fabric thickness, that is, perpendicular to the plane of the fabric. Itsimulates the mechanism of liquid perspiration moving from the skin through thefabric. The test fabric is placed between a weight and sintered glass plate as shownin Figure 3. The horizontal sintered glass plate is kept moist by a water supply ofwhich the height can be adjusted so as to keep the water level precisely at theupper surface of the plate. The fabric will draw water from the glass plate at a ratethat depends on its wickability. Given the diameter of the capillary tube, therecorded data is used to calculate the mass transfer rate of water into the fabric.

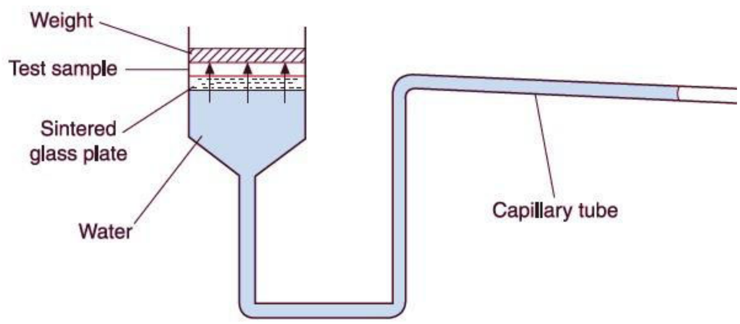

Figure 3. Transverse wicking plate test

TACTILE COMFORT

Fractional interaction between clothing materialand the human body[6] is related to tactile comfort, where physical/mechanical properties (surface structure,weight per unit area, thickness, bulk, compressibility, flexure, shear, elongationand frictional properties) of the fabric worn next to skin are thought to influencean individual's assessment of tactile comfort[10]. Some of the terms that havebeen used to describe the tactile sensations are clingy, sticky, scratchy, prickly,soft, stiff, heavy, light and hard [10]. Tactile discomfort may be caused by allergy,clinging to the skin, tickling, prickling, abrasion of the skin and coolness [7].The finishes, dyes, softening agents, washing powder used in laundering, thestructure and construction of the fibres and fabrics contribute to tactile discomfort.For example, if a fabric is hairy and rough to the touch, and tends to shed fibres,it may cause tickling and irritation, especially when the skin is damp withperspiration [11]. Ruckman and Green[12] also confirmed that skin irritation could becaused by breakage of the fibres and the fabric remaining wet during perspiration.Fabric hand is a generic term for the tactile sensations associated with fabrics thatinfluence consumer preferences [10]. To specify the fabric hand of underwear,Chen reported that the best hands for undershirts were rated as softest, slickest,smoothest, thinnest, lightest and coolest.
Ishtiaque suggested certain comfort requirements for general clothing, which
are also relevant to the comfort requirements of underwear [6].

Table 1. Functional requirements of clothing
• Maintains a comfortable microclimate in terms of temperature and humidity in the skin sensory zone
• Good moisture absorption and water vapour transmission
• Absence of unpleasant odour such as perspiration
• Compatibility with the skin
• Good extensibility without restricting mobility
• Good fit stability
• Low intrinsic weight (not impairing physical performance)
• Substantially water-repellent and dirt-repellent

Fabric low-stress mechanical properties

The handle and tactile comfort of knitted underwear are strongly related to thefabric's low stress mechanical properties. The Kawabata evaluation system(KES-F) is a set of sophisticated instruments for characterizing the fabric'slow-stress mechanical properties, which include tensile, shear, bending, compression and surface properties [5]. The specimens are cut into 20˚C ~ 20 cm2 samples and conditioned at 21˚C and 65% RH for at least 24 hours before taking the measurements. The instruments comprising the KESF system are shown in Pic. 8.–11.

Figure 4 KES-F1 shear and tensile tester

Figure 5 KES-F2 bending tester.

Figure 6. KES-F3 surface tester. Pic. 11. KES-F4 compression tester.

DURABILITY

Durability of knitted underwear is commonly characterized by bursting strengthand abrasion resistance, which are important attributes for the aesthetics andfunctional performance of underwear during use [6]. ASTM D4154 [5] and ASTMD4156 [1] state that the bursting strength of knitted underwear should exceed 222 N(50 lbf) for a durable garment based on the ball-burst testing method of ASTMD3786, where the test sample is cut into 375 mm (15 in.) along the selvedge.

Fabric bursting strength

As has been previously mentioned, the durability of underwear fabrics is verymuch related to their bursting strength. ASTM D3787 [10] defines a method thatmay be used to measure the bursting strength of knitted fabrics using a ball-burst strength tester (Figure 7). The instrument consists of a polished steel ball thathas a diameter of 25.4 ± 0.005 mm. The conditioned fabric specimen is placedtension-free in the ring clamp of the device. The polished steel ball is then pushedthrough the specimen until it ruptures. The bursting strength is determined as theforce applied to the ball at the instant of fabric rupture.

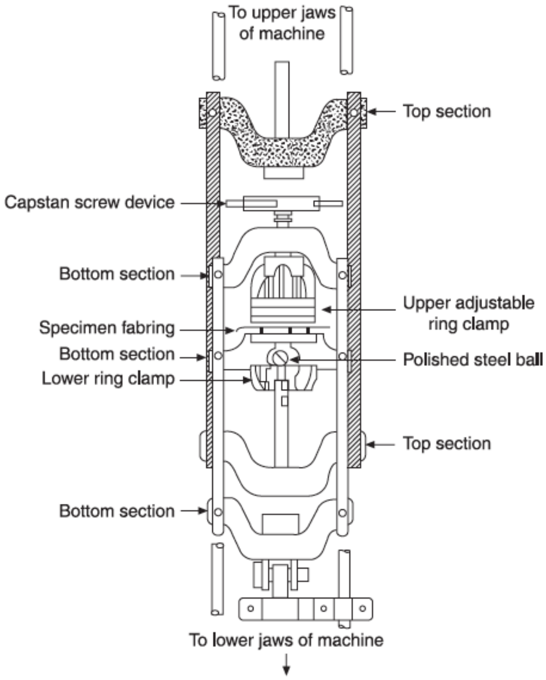

Figure 7. Ball burst attachment

Sewability

Underwear should be manufactured to a consistent quality free from defects. Oneof the major potential sewability problems of knitted underwear fabrics is sewingdamage (needle holes). This is a problem particularly for tighter, denser andlightweight knitted underwear fabrics. There are generally two types of sewingdamage derived from frictional forces in the fabrics, namely mechanical damageand needle heating damage. Mechanical damage is the cutting or breakage ofyarns in fabric caused by penetration of the needle during sewing. Needle heatingdamage is the fusing and melting of synthetic yarns in the fabric caused by thehigh needle temperature arising from the friction between the needle andthe fabric. The faults may be noticed only during wear or after being washed whenthe damaged holes are enlarged as a result of yarn laddering owing to the stresses during wear and laundering [2].
Sewing damage is related to the choice of needle (in terms of size, needle lengthand point shape) and sewing speed. Needle size determines the extent of thedeformation of the knitted loops within the fabric, and directly influences thestresses and strains imposed on the yarns. Moreover, shortpoint needles interactwith the fabrics more violently than long-point needles, and tend to produce moreyarn breakages. The use of bulged-eye needles, in which the diameter of theneedle at the eye is enlarged with respect to the diameter of the shaft, can contributeto reducing the sewing temperature effectively (about 15–30˚C). Furthermore,lower sewing speeds are effective in controlling the overheating problems ofneedles. At the same time, the number of yarn breakages is relatively reduced [8].
Therefore, finer needle size, bulged-eye needles and lower sewing speed can reduce sewing damage[15].

On the other hand, the ease of deflection depends not only on the needle, butalso on the ease of yarn movement, which is related to yarn friction. Withincreasing yarn friction, the level of each penetration force value will be greater,since the increased yarn friction will lead to a higher value of tension in the yarnaround the needle as it is pulled from the adjacent loops [3]. It is also known that thecondition under which sewing takes place can also cause sewing damage. It wasreported that the lower moisture content in winter of about 8% in cotton fabricsmake them brittle and thus susceptible to sewing damage [4]. Therefore knittedfabrics should not be sewn in an over-dry state. Applying appropriate lubricants tothe fabric can lower the frictional forces in the fabric to ease needle penetration.Heat generation and mechanical strains can also be reduced [0].

This can significantly improve sewing performance by the number of yarnbreakages being reduced. Cooling attachments can also decrease needle heating.A cooling air jet can be used to increase the convective heat losses from the needleand reduce its temperature. With the vapour spray, a coolant of light oil or similarsubstance is atomized and sprayed over the needle and onto the fabric so that the coolant can absorb heat [2].

L&M sewability test

This test measures the needle penetration force to predict the sewability of the fabric. The apparatus is called the L & M Sewability Tester. The fabric is fed forward by rollers beneath a needle that penetrates it. It can operate at a speed of 20 penetrations per minute, which means a test of 100 penetrations takes no longer than five minutes. The peak force of penetration is indicated on the meter and registered on a pen recorder. Penetration values that exceed a critical threshold value can be registered on the 'high reading' counter [3].

DIMENSIONAL STABILITY AND SKEWNESS STABILITY

AATCC TM 150 [3] describes a method to measure the dimensional change afterlaundering. Locations are marked as shown in Figure 8.by using a plastic ormetal tape graduated in millimeters after laundering. This testing method can beused to measure the shrinkage or extensibility at different positions of undershirtsafter laundering.

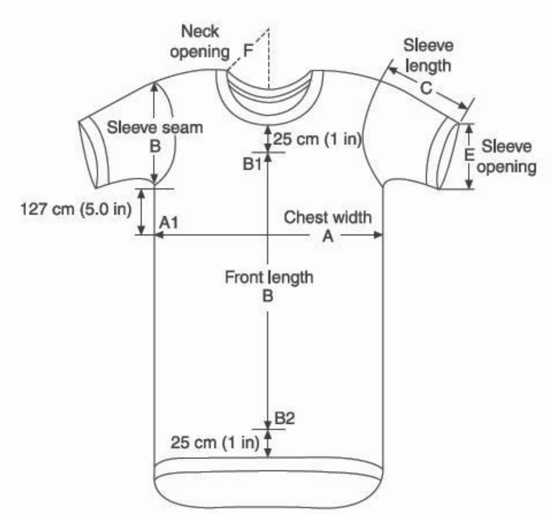

Figure 8. Dimensional change marking location [44]

For measuring the skewing stability of under-shirt fabrics, AATCC TM 179 [5] provides two methods to mark the positions on the garment or fabrics before laundering, as shown in Figure 9.and Figure 10.

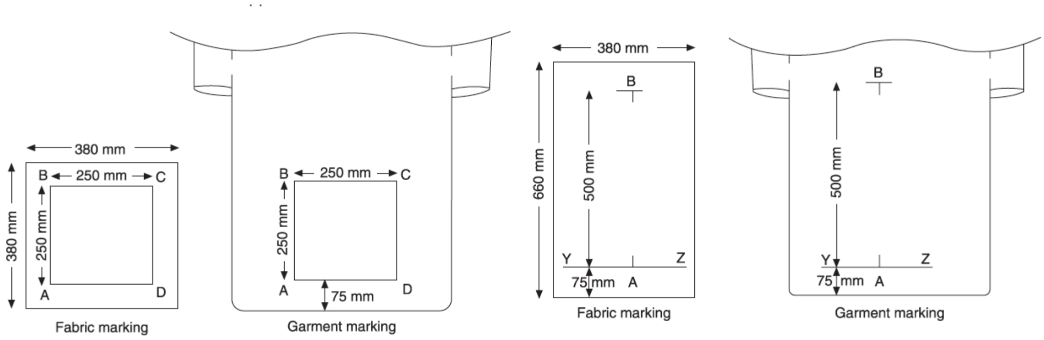

Figure 9 (left)Method 1 of AATCC TM179 skewness stability testing method: square marking
Figure 10. (right)Method 2 of AATCC TM179 testing method: inverted marking

There are three options to calculate the skewness changes in undershirt fabrics. For method 1, the percentage change in skewness to the nearest 0.1% can be calculated by the following two options:

• Option 1 (Figure 11): percentage change in skewness = 100 x [2 (AC – BD)/
(AC + BD)].
• Option 2 (Figure 12): percentage change in skewness = 100 x [(AA' + DD')/
(AB + CD)].
For method 2, change in skewness can be measured by calculating option 3.
• Option 3 (Figure 13): percentage change in skewness = 100 (AA' /AB).

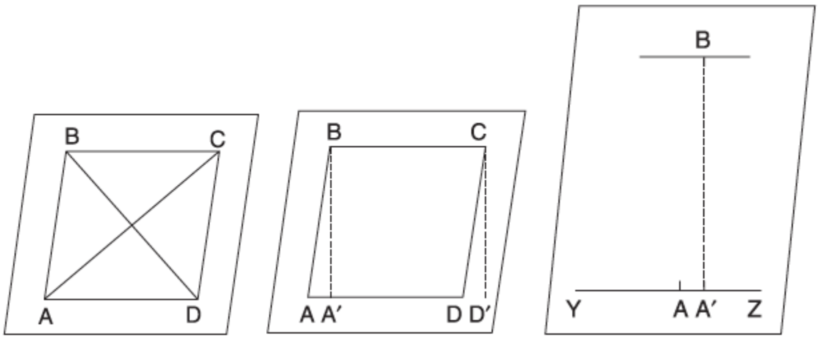

Figure 11 *Diagonal lines for option 1.*| Figure 12*Offset marks for option 2.*| Figure 13*Offset marks for option 3.*

WEARER TRIALS

Wearer trials are the ultimate test for the performance of knitted underwear,although the process tends to be expensive and time consuming and the resultstend to be less reproducible and consistent [15]. Wearer trials are especially necessaryfor assessing the subject sensations of the wearers, for example, comfort sensation.Wearers are often asked to judge the comfort of the garments after carrying out aseries of instructed activities. This method has been used for evaluating moisture, thermal, tactile and aesthetic comfort .Wearer trials can also bedesigned to obtain some objective sensory measurements under different wearing conditions, which are relevant to the behavior of the knitted underwear. Forexample, sensors such as copper-constantan thermocouples may be attached tothe wearers to measure skin temperature during a wearer trial.

CONCLUSION

Yarn type and structure affect the durability of underwear fabrics. Cotton is the most common material used to make underwear. It was found that cotton is associated with both physical and psychological comfort. The only disadvantage of cotton is that it is crushable. Cottoncould be more likely to cause skin irritation. On the other hand, other knittedunderwear materials, such as nylon and polyester were regarded as artificial, lowquality, unfashionable, clammy, sweaty, clingy, synthetic and causing itchiness.

A number of studies have shown that by using appropriate yarn and fabric structures, clothes made from synthetic fibers can be as comfortable to wear as those made from natural fibers, especially the newly developed polyester fabrics. Many researchers [7,16,57,58] stated that 100% cotton, or cotton-rich blends, weremore comfortable underwear materials as these were more effective to absorb water vapor and perspiration than synthetic fibers.

Fabric thickness is one of the most important factors determining thermal comfort [6]. It was found that fabric thickness had a direct effect on thermal transmittance, where the thicker the material, the lower the thermal transmittance. Knitted structure also affects some degree of dimensional deformation .Fabric structure also affects durability. It was reported [2] that plain knitted fabric,one of the popular knitted structures used for making underwear, had the worstabrasion resistance. It may be improved by knitting the structure to high areadensities.

Fabric structure is also an important factor affecting the comfort properties.Fabrics with more pores or bigger sizes of pore, potentially allow more airmovement through the fabric which results in a cooler feeling for the wearer [6]. Conversely, the tighter the fabrics, the smaller the spaces and the lower the airpermeability. So the tightness and area density of fabrics are importantconsiderations when designing underwear.

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