The results of thermogravimetric analysis (TGA) carried out in the area of 50°C to 800°C, with a temperature change of 10°C per minute confirm TGA curve of pure cellulose has two-steps mass loss characteristic of cotton cellulose degradation [4]. Cotton treated with combination of ammonium hydrogen phosphate and precursors (Ap2A and Ap2M) show the higher temperature needed for full degradation and more char residue then cotton treated with conventional flame retardant, only (Ap2).

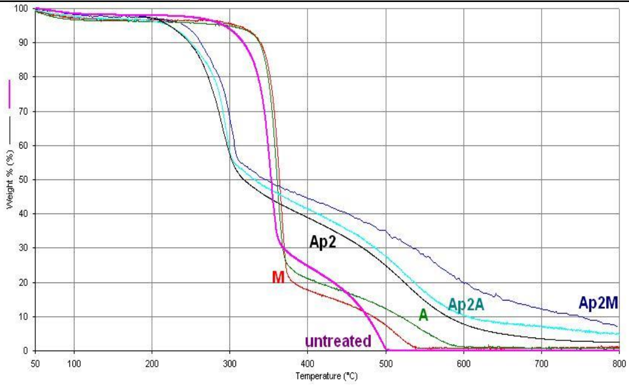

Figure 1. TGA curves of cotton fabrics recorded in air, heating rate 10 °C/min

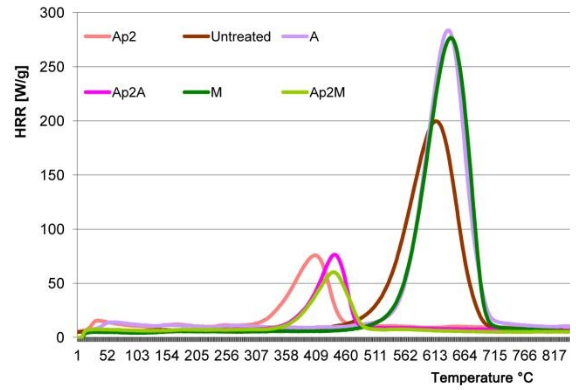

Figure 2. Cotton fabrics HRR curves

Micro combustion calorimeter (MCC) results presented in Figure 2 show that cotton material treated with ammonium hydrogen phosphate and precursors of silicon alkoxides (Ap2A, Ap2M) has much lower Heat Release Rate (HRR). This confirms the better thermal properties that are crucial in any material flame retardancy.

Precursors of silicon alkoxides visibly helped in cotton flame retardancy when conventional compound ammonium hydrogen is used.

Key Words: flame retardants, 3-Aminopropyltrietoxysilane, 3-Methacryloxypropyltrimethoxysilane, conventional flame retardants, LOI, TGA, MCC

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REFERENCES

[1] Horrocks, A. R., Thermal (heat and fire) protection, In Textiles for Protection, Woodhead Publ. Ltd, ISBN 978 1 85573 921, Cambridge, (2005), pp. 398-440.

[2] Macan, J ., Sol-gel process in preparation of organic-inorganic hybrid materials, Chemistry in industry.57(7-8) 355–361 (2008).

[3] Alongi, J., Ciobanu, M., Malucelli, G., Sol–gel treatments on cotton fabrics for improving thermal and flame stability:Effect of the structure of the alkoxysilane precursor, Carbohydrate Polymers 87 (2012) 627– 635

[4] Grancarić, A. M., Tarbuk, A., Botteri, L.: Silicone for Improvement of Cotton Flame Retardance, Program with Abstracts of 14th European meeting on Fire Retardancy and Protection of Materials. Lille 2013. (P24)-99.

FLAME RESISTANT PROTECTIVE FABRICS WOVEN WITH RING SPUN ARAMID AND FR PES YARNS

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Aramid fibres and FR PES fibres are widely used in different areas of protective textiles. The products which are made of aramid fibres provide protection against flames and high temperatures for car racing, high risk industries, the army, the paramilitary and forces of law and order. FR PES fibres are generally used for curtains, drapes, blinds, upholstery fabrics, tablecloth and bedding equipment.

Para-aramid fibres (with amide linkages in para position on aromatic ring) are commercially available as the basis material for protective clothing. The decomposition temperature is above 590 °C. The commercial products include Kevlar® by DuPont, Twaron by Acordis and Technora® by Teijin. The combination of high strength, non-flammability and high temperature resistance of the para-aramid fibre makes it suitable for thermal protective applications [1].

Meta-aramids have high temperature resistance, moderate tenacity, and low elasticity modulus but excellent resistance to heat; thermal degradation starts at 375°C. The most popular brand is Nomex® (Du Pont); other brands are Conex® (Teijin), Apyeil® (Unitika), Fenilon (former USSR), and Kermel® (Rhone-Poulene, now Rhodia Performance Fibers). M-aramids can resist up to 250 ° C for long periods.

FR (Flame retardant) PES fibres such as Trevira CS ®, are not treated with a surface flame-resistant chemical but rather the flame-resistant properties are permanently built into the molecular chain of the fibre and cannot be removed. The positive technical properties of the polyester fibre remain the same. The entire raw material is flame retardant, not just the surface, as is the case with the treated product.

The flame resistant fibres are typically blended to balance protection, comfort, durability, cost of the fabric based on intended end use. Para-aramids have been shown to be an excellent blending partner to reduce thermal shrinkage. This is also true of meta-aramid blends where para-aramid is used to offset the inherent thermal shrinkage of the meta-aramid fibre. They can also be blended with Lenzing FR, PBI, wool and modacrylic [2-12].

In this study, we used staple aramid fibres and FR PES fibres (Table 1.) to produce yarns and woven fabrics. Studies concerning the spinning of aramid fibres by using the technology of short-staple spinning is very few, hovewer, so we have examined the mechanical properties of spun yarns and woven fabrics.

To produce these fabrics (Table 2.), in the first part of the study aramid and FR PES yarns were spun on the ring frame with the same coefficient of twist (αe=3.5) and in the second stage fabrics were plain woven with the same weft and warp densities on the CCI® sample loom machine.

Table 1. Fibre properties

Fibres	Mean fibre length /Fineness
Para-aramid	40 mm/1.7 dtex
Meta-aramid	50 mm/2.2 dtex
FR PES	40 mm/1.2 dtex

Table 2. Fabric construction

Weft Yarns	Meta-aramid	Ne 10 Ne 20 Ne 30	15 ends/cm
	FR PES	Ne 10 Ne 20 Ne 30	15 ends/cm
Warp Yarn	Para-aramid	Ne 30/2	22 ends/cm

After the production of samples, measurements as listed below (Table 3) were carried out. To compare the mechanical properties of the fabrics, the effects of weft yarn count and fibre type were investigated statistically.

Table 3. The measured fabric properties

Performance Properties	**Related standard**
Tensile strength	TS 245 EN ISO 2062
Elongation	TS EN ISO 13934-1
Weight	TS EN 12127
Thickness (mm)	TS 7128 EN ISO 5084

REFERENCES

[1] Handbook of Fire Resistant Textiles (2013). Cambridge Woodhead Publishing Ltd

[2] Flambard , X., Bourbigot ,S., Ferreira , M., Vermeulen , B. and Poutch , F., Wool/para-aramid fibres blended in spun yarns as heat and fire resistant fabrics , Polymer Degradation and Stability , 77 (2), 279–284 (2002).

[3] Zhao, Shu-lin, and Hong-li Du. "Influence of blending ratio of Nomex/Lenzing Viscose FR on flame-retardant property of the fabric." Journal of Textile Research 27.12 (2006): 74.Publication No . 20100299817.

[4] Zhu , R., Guckert , D. and Lovasic , S.L. (2006), Modacrylic/Aramid Fiber Blends for Arc and Flame Protection , US Patent No. 7,065,950.

[5] Fahl N and Faile M. Polybenzimidazole Blends in Protective Apparel. Acs Sym Ser. 1991; 457: 238-47.

[6] Arrieta C, David E, Dolez P and Vu-Khanh T. Thermal Aging of a Blend of High-Performance Fibers. J Appl Polym Sci. 2010; 115: 3031-9.

[7] Sinnppoo K, Arnold L and Padhye R. Application of Wool in High-velocity Ballistic Protective Fabrics. Textile Research Journal. 2010; 80: 1083-92.

[8] Flambard X, Bourbigot S, Ferreira M, Vermeulen B and Poutch F. Wool/para-aramid fibres blended in spun yarns as heat and fire resistant fabrics. Polym Degrad Stabil. 2002; 77: 279-84.

[9] Gehrmann W. Viscose Fr/Aramid - Non-Flammable Mixed Textiles for Protective Clothing. Melliand Textil Int. 1984; 65: 795-.

[10] Geshury AJ, Barker RL and Behnke WP. Measuring the Effects of Intense Heat and Dynamic Mechanical Forces on Thermal Protective Fabrics. Acs Sym Ser. 1991; 457: 277-92.

[11] Flambard X, Bourbigot S, Kozlowski R, et al. Progress in safety, flame retardant textiles and flexible fire barriers for seats in transportation. Polym Degrad Stabil. 2005; 88: 98-105.

[12] Mettananda CVR, Torvi DA and Crown EM. Characterization of the Combustion Process of Flame Resistant Thermal Protective Textiles in the Presence of Oily Contaminants: Effects of Contamination and Decontamination. Textile Research Journal. 2010; 80: 917-34.

UNCONVENTIONAL METHODS TO STUDY THERMODYNAMICS OF AEROGEL TREATED FABRICS

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Aerogel, with its nanoporous structure and mass, is very suitable to be used as super insulating material. Due to its high porosity and specific surface, it has very low density and thermal conductivity. Heat transfer phenomena in silica aerogel is closely associated with its complex nano-porous structure [1,2]. Thermal properties are among the most important features of textiles and most studies carried out until now were focused at measurements of static properties such as conductivity, resistance and diffusion. Thermal insulation is an important factor for estimating apparel comfort for the user. These properties are determined by the physical parameters of fabrics as well as the structural parameters [5]. In winter clothing, the role of the middle layer is to protect the human body against chilling. Different kinds of textile materials are used as the middle insulating layer of multilayer clothing, such as traditional nonwovens. Highly advanced insulating materials like aerogel is used to treat nonwoven fabrics. These are characterised by excellent insulation. In the trade, we can still observe the use of the traditional lining combined with the outer fabric. These characteristics of standard thermal insulation materials are not commonly known [4]. The research reported here discusses the influence of aerogel on the thermal conductivity, resistance and effusivity at low temperatures. Vector and scalar maps of the fluid flow developed by the heat convection above the textile sample for different temperature gradients were studied.

PARTICLE IMAGE VELOCIMETRY

The Particle Image Velocimetry (PIV) belongs to the family of methods for fluid flow measurement and visualization. The PIV technique allows providing the measurement in the wide range of flow speeds. The basic condition for the successful measurements deals with the property of the examined medium. The basic building block of the measuring system is a laser PIV system Dantec Dynamics. The PIV measurement technique allows obtaining information about the current distribution of velocities in two-dimensional array in a flowing fluid. The motion of the fluid is visualized due the seeding particles that are usually added to the flow. The system displays and analyzes the particles movement in selected planar light cut. Conveniently placed light plane is generated with a powerful laser and optical system components. The positions of particles in the plane of light section are recorded in the medium sensitive to light, such as photographic film or a CCD camera detector. Evaluation is based on the fundamental equation expressing the relationship between speed, distance and time, where distance represents the displacement of particles entrained fluid flowing in a defined time interval between two laser pulses.

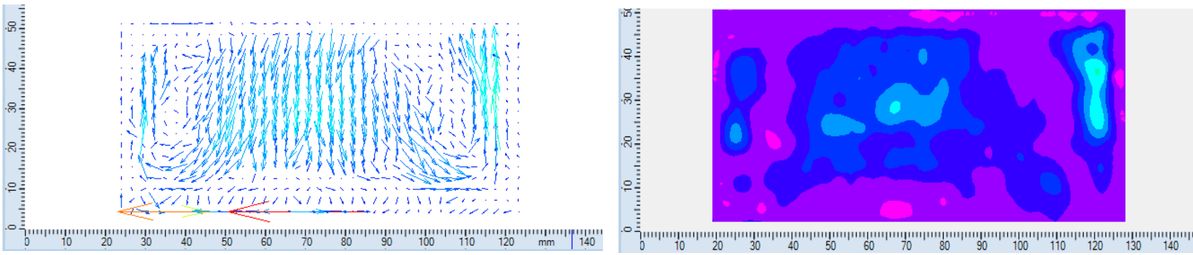

Figure 1. Vector and scalar maps for temperature gradient 21.5°C

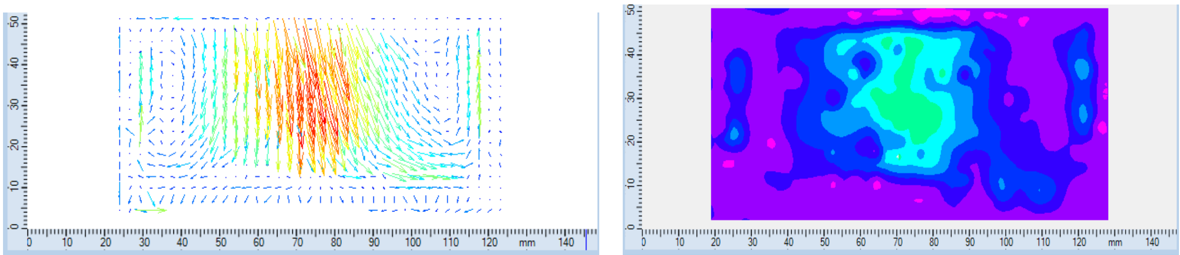

Figure 2. Vector and scalar maps for temperature gradient 23.8°C

CONCLUSION

The thermal properties of Polyetser/polyethylene bicomponent nonwoven thermal wraps of varying thicknesses treated with aerogel were compared. The SEM images were also taken to compare the physical structure of the fabrics. Specific thermal properties like thermal conductivity, resistance and effusivity were measured using C-Therm TCi anlayzer. Heat transfer caused by conductivity of the thermal wraps was measured by Particle image velocimetry (PIV) measurement technique, which allows obtaining information about the current distribution of velocities in two-dimensional array in a flowing fluid. Vector and scalar maps of the fluid flow developed by the thermal convection above the textile sample for different temperature gradients was also studied. These tests were conducted to understand behavior of aerogel treated nonwoven fabrics treated with amorphous silica aerogel. The results of the experiments were statistically analyzed and found to be significant.

Key Words: Particle image velocimetry (PIV), thermal conductivity analyser, heat convection, conductivity

REFERENCES

[1] S.S. Kistler., Coherent expanded-aerogels J. Phys. Chem., 36 (1) (1931), pp. 52–64 (1931)

[2] Tao Xie, Ya-Ling He, Zi-Jun Hu., Theoretical study on thermal conductivities of silica aerogel composite insulating material International Volume 58, Issues 1–2, March 2013, Pages 540–552 (2013)

[3] Giorgio Mazzuchetti, Giuseppina Lopardo and Roberto Demichelis., Influence of Nonwoven Fabrics' Physical Parameters on Thermal and Water Vapor Resistance., J.Ind.Text.,Vol. 36, No. 3—January 2007 (2007)

[4] Małgorzata Matusiak., Investigation Of The Thermal Insulation Properties Of Multilayer FIBRES & TEXTILES In Eastern Europe January / December 2006, Vol. 14, No. 5 (59) (2006)

[5] Frydrych, G. Dziworska and J. Bilska., Comparative Analysis of the Thermal Insulation Properties of fabrics Made of Natural and Man-Made Cellulose Fibres., FIBRES & TEXTILES in Eastern Europe October/December 2002 (2002)

USAGE OF CLAY/CHITOSAN BIOCOMPOSITES AS ANTIBACTERIAL AGENTS FOR COTTON FABRICS

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Over the last 10–15 years research interest has increased in the area of polymer/clay nanocomposites due to their excellent properties. This new type of material, based on clays, usually shows many properties through ionic exchange of the sodium interlayer cation with an onium cation [1-2].

Clay particle is commonly any of group of important hydrous aluminum silicates with a layer (sheet) structure and very small size, as for example montmorillonite, which are often organically modified to render them organophilic and to enable their dispersion into a polymer. The result of such dispersion is a nano composite comprised of nanoscale clay particles and a surrounding polymer. Important clay particles are Kaolinite, Illite, Bentonite, Chlorite and Montmorillonite [3]. The typical clay of choice for composites is montmorillonite. Montmorillonite clay has a large surface area providing sufficient interfacial regions in the nanocomposite, allowing for an enhancement of thermal and tensile properties at low percentages of incorporation into the polymer matrix. The montmorillonite clay has an average length of 2000 Å and width of 10 Å [1].

Chitosan has been extensively investigated for several decades for molecular separation, food packaging film, artificial skin, bone substitutes, water engineering, to immobilize biomolecules on solid substrates and in biomedical applications as anticoagulant or wound-healing accelerator. The reason is that chitosan has good mechanical properties, biocompatibility, biodegradability, nontoxicity, bioactivity, multiple functional groups as well as solubility in aqueous medium [6-7]. However, its properties, such as thermal stability, hardness and gas barrier properties are frequently not good enough to meet those wide ranges of applications [6].

The cationic biopolymer chitosan can be intercalated in Na+-montmorillonite through cationic exchange and hydrogen bonding processes, the resulting bionanocomposites showing interesting structural and functional properties [7].

The development of materials with the ability to inhibit bacterial growth have been of great interest in recent years due to their potential use in everyday products like paints, kitchenware, school and hospital utensils, etc [4]. The growth of microorganisms on textiles inflicts a range of unwanted effects not only on the textile itself but also on the wearer. These effects include the generation of unpleasant odor, stains and discoloration in the fabric, reduction in fabric mechanical strength and an increased likelihood of contamination. For these reasons, it is highly desirable that the growth of microorganisms on textiles be minimized during their use and storage [8].
The aim of this study is to obtain antibacterial activity via applying high-performance clay/chitosan bionanocomposite on cotton fabrics. The effect of clay/chitosan

bionanocomposite on the antibacterial activity, morphology, thermal stability and mechanical properties of the fabrics has been investigated. According to the results, the samples showed antibacterial activity against both gram positive and negative bacteria.

Key Words: Clay, chitosan, cotton, antibacterial activity

THE EFFECTS OF ATMOSPHERIC PLASMA TREATMENTS ON SURFACE ENERGY OF COTTON FABRICS

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Wetting performance of textile materials is the key parameter for both dyeing-finishing processes and wear comfort. In addition, wettability affects interaction of fibers with liquids and surfactants, and their adhesion with polymers. Research on the effect of plasma treatments on surface modification and hydrophilic characteristics of textile materials have been gaining importance due to being environmentally benign process. Controlling the plasma variables, such as the nature of gas, discharge power and exposure time; modification of fiber surface is obtained without altering bulk characteristics. Studies on the effects of plasma process are mostly focused on improving wettability, dyeability and printability properties of the fibers. The clear way to determine the improvements in wetting performance of a surface is to measure the contact angle by sessile drop method. However heterogeneous surface structure of fibers and porosity of the fabrics make this method improper for textile materials. Therefore drop dissipation time and capillary rise methods have been mostly preferred in the previous studies.

In this paper, evaluation of the wetting performance of plasma treated fabrics are investigated in terms of understanding the interactions at the textile material-liquid interface by calculation the contact angle and surface free energy by Washburn equation and Owens-Wendt method. Grey woven cotton fabrics are treated by plasma system operating under atmospheric conditions.

The results showed that the hydrophobic surface of grey fabric became hydrophilic and the drops were disappeared in seconds according to the drop dissipation time measurements. While the contact angle of water on grey fabric was higher than 90°, the plasma treated ones had 80°. The surface free energy of cotton fabrics were increased over than fifty percent of grey cotton fabric.

Key Words: Cotton fabric, atmospheric plasma, contact angle, surface free energy, wettability

April 04, 2014

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ANALYSIS OF THE EFFECT OF SEWING MACHINE NEEDLE NUMBER TO THE NEEDLE HEATING

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The sewing process is the basic process of clothing production process. The sewing process is the most important factor that determines the quality and durability of the clothing production. The sewing process is the process of passing the sewing thread through sewn materials with the help of a needle for decoration, merge or consolidate. This is the most important phase of the production process. Realization of this process desired manner will have an effect on more efficient evaluation of the production resources and time used in the production process and to ensure the expected level of quality on final product.

Sewing process must be performed by machine needles. Features, shapes, sizes, and proper installation of the needles directly affect the quality of sewing [1]. Sewing needle plays an important role during the creation of optimum stitch. Sewing needles help passing the sewing thread through fabric and formation of loop by keeping the upper thread [2].

There are over 100 different types of industrial sewing needle in the market. These have different lengths, thicknesses, shapes and points. Typical industrial sewing needle consists of 15 parameters. These are; needle shape, point, number, eye etc. Each of these parameters affects heating of the needle at different degrees [3], [4], [5].

Clothing production continues to be labour-intensive despite the increasing automation. Therefore large amounts of both human, machine and process related errors can occur. Failure to timely detection of these errors can lead to large losses in production [6]. The heating of the needle, causes various problems that affect the sewing operation. Needle temperature is desirable below the 140^0C [7].

A high degree of heat is formed during the sewing process from friction of the sewing machine needle, the sewing thread and fabric. Sewing speed, fabric thickness and the needle number acts on the amount of this heat [8].

In this study examined how needle number affects the heating of the needle during the sewing process. For this purpose an application will be performed with the conditions and materials described below.

Fabric: Twill Woven Fabric

Sewing Machine: Juki DDL 9000A-SS Lock Stitch Sewing Machine

Stitch Type: Lock Stitch with 302 Code Number.

Sewing Machine Motor Speed: 3500 r/min

Needle: 10, 12, 14, 16, 18, 20 No Needles - Normal Form Point

Sewing Frequency: 5 stitches / cm

Pyrometer Used for Temperature Measurement on Needle: Optris CT3M.

Key Words: Sewing machine needle, woven fabric, needle temperature

REFERENCES

[1] Komisyon: “Temel Dikiş Makineleri”, Millî Eğitim Basım Evi, Ankara, Türkiye, (2008)
[2] Komisyon: “Makine Bilgisi”; Milli Eğitim Basım Evi, Ankara, Türkiye, (1999)
[3] Li, Q.; Liasi, E.; Simon, D.; Du, R.:”A Study on the Needle Heating in Heavy Industrial Sewing: Part 1:Analytical models” International Journal of Clothing Science and Technology; Vol.13, No 2, (2001) pp87-105
[4] Li, Q.; Liasi, E.; Simon, D.; Du, R.:”A Study on the Needle Heating in Heavy Industrial Sewing: Part 2: Finite Element Analysis and Experiment Verification” International Journal of Clothing Science and Technology; Vol.13, No,5, (2001) pp 351-367
[5] Zouharová, J., “Influence of Surface Treatments Mechanical Sewing Needles on Quality of the Stitches”, Metal, 22. – 24. 5. 2007 Hradec nad Moravicí
[6] Yücel, Ö.: “Dikiş İpliği ve Kumaş Özelliklerinin Dikiş Randımanına Etkisi”; KSÜ Fen ve Mühendislik Dergisi, 10(1), (2007),36-41
[7] Gürarda, A.; Kaplangiray, B.; Kanık, M.:”Yağlama İşleminin Dikiş İpliklerinin Özellikleri ve Dikiş performansı Üzerine Etkileri”; The Journal of Textiles and Engineer;Vol:18, No:82; (2011) 19-25
[8] KALOĞLU, F., “Dikim İşlemi Sırasında Sürtünme Isısına Etki Eden Malzeme Değişkenlerinin İncelenmesi”, İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi , 1992, Syf 22.

EFFECT OF MOLECULAR WEIGHT ON THE MORPHOLOGY OF ELECTROSPUN POLY(VINYL ALCOHOL) NANOFIBERS

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PVA has the largest volume within the water-soluble polymer production of the world [1] and it is semi-crystalline, hydrophilic polymer with good chemical and thermal stability [2]. Due to biocompatibility, nontoxicity, hydrophilicity and ease of processability of PVA, electrospun PVA nanofibers have been one of the most extensively studied topics [3,4] and they are considered as a potential polymer for biotechnological applications [5-7]

Although PVA have advantageous properties, higher solubility in water results in stability problems thereby limiting its applications [8]. Therefore, crosslinking of PVA nanofiber web [9] is carried out to produce nanowebs with poorer solubility characteristics in which polymer chains are joined together to form three-dimensional network structure and improve mechanical properties. Crosslinking of PVA nanofibres can be carried out by two methods, including chemical and physical crosslinking techniques. The principle of chemical crosslinking is to create permanent and irreversible covalent bonds between the polymer chains [10, 11] while physical crosslinking is mainly based on the increase in crystallinity of resultant fibers.

Furthermore, PVA based nanofibers and nanofiber composites have been considered as an attractive choice in tissue scaffolding [6,12], filtration materials [13, 14], protective clothing, wound dressing [15], drug release [16], medical [17,18] and biosensor applications [19], and so on.

In this paper, morphological characteristics of electrospun PVA nanofibers were investigated in terms of polymer molecular weight. The change in the morphology depending on the polymer concentration of electrospinning solution and the applied voltage were also addressed.

Key Words: Electrospinning, PVA, nanofiber, stabilization, applications.

REFERENCES

[1] MARTEN, F., Vol.8:Vinyl Alcohol Polymers, In Encyclopedia Of Polymer Science and Technology, Edited by MARK, H.F., John Wiley & Sons, 2004, ISBN: 978-0-471-27507-7.
[2] SHAO, C., KIM, H., GONG, J., LEE, D., and PARK, S., Fiber mats of poly(vinyl alcohol)/silica composite via electrospinning, Materials Letters,2003, vol. 57, pp. 1579-1584.
[3] KOSKI, A., YIM, K. and SHIVKUMAR, S., Effect of molecular weight on fibrous PVA produced by electrospinning, Materials Letters, 2004, vol. 58, pp 493–497.
[4] LEE, J.S., CHOI, K.H., GHIM, H.D., KIM, S.S., CHUN, D.H., KIM, H.Y. and LYOO,W.S., Role of Molecular Weight of Atactic Poly(vinyl alcohol) (PVA) in the Structure and Properties of PVA Nanofabric Prepared by Electrospinning, Journal of Applied Polymer Science, 2003, vol. 93, pp.1638–1646.

[5] TANG, X. and ALAVI, S., Recent advances in starch, polyvinyl alcohol based polymer blends, nanocomposites and their biodegradability, Carbohydrate Polymers,2011, vol. 85, no.1, pp. 7-16.
[6] LINH, N.T.B. and LEE, B., Electrospinning of polyvinyl alcohol/gelatin nanofiber composites and cross-linking for bone tissue engineering application, Journal of Biomaterials Applications, 2012, vol. 27 no.3, pp. 255-266.
[7] RAHMAN, W.A.W.A., SIN, L.T., RAHMAT, A.R. and SAMAD, A.A., Thermal behaviour and interactions of cassava starch filled with glycerol plasticized polyvinyl alcohol blends. Carbohydrate Polymers,2010, vol. 81, no.4, pp. 805-810.
[8] COOK J.G., Handbook of textile fibre-II manmade fibres, Merrow publishing co. ltd.1984
[9] CAY, A. and MIRAFTAB, M., Properties of Electrospun Poly(vinyl alcohol) Hydrogel Nanofibers Crosslinked with 1,2,3,4-Butanetetracarboxylic Acid, Journal of Applied Polymer Science, 2013, vol.129, no.6, 3140-3149
[10] RATANAVARAPORN, J., RANGKUPAN, R., JEERATAWATCHAI, H., KANOKPANONT, S. and DAMRONGSAKKUL, S., Influences of physical and chemical crosslinking techniques on electrospun type A and B gelatin fiber mats, International journal of biological macromolecules, 2010, vol.47, no.4, pp. 431-438.
[11] HOFFMAN, A.S., Hydrogels for biomedical applications, Advanced Drug Delivery Reviews, 2002, vol. 54, no.1, pp. 3-12.
[12] DRURY, J.L. and MOONEY, D.J., Hydrogels for tissue engineering: scaffold design variables and applications, Biomaterials, 2003, vol.24, no.24, pp. 4337–4351.
[13] QIN, X. and WANG, S., Filtration properties of electrospinning nanofibers, Journal of Applied Polymer Science, 2006, vol. 102, no.2, pp.1285-1290
[14] LIU, Y., WANG, R:, MA, H., HSIAO, B.S. and CHU, B., High-flux microfiltration filters based on electrospun polyvinylalcohol nanofibrous membranes, Polymer, 2013, vol.54, pp. 548-556.
[15] HONG, K.H., PARK, J.Y., SUL, I.H.,YOUK, J.H. and KANG, T.J., Preparation of Antimicrobial Poly(vinyl alcohol) Nanofibers Containing Silver Nanoparticles Journal of Polymer Science: Part B: Polymer Physics, 2006, vol. 44, pp. 2468–2474.
[16] KENAWY, E., ABDEL-HAY, F.I., EL-NEWEHY, M.H. and WNEK, G.E., Controlled release of ketoprofen from electrospun poly(vinyl alcohol) nanofibers, Materials Science and Engineering, 2007, vol. 459, pp. 390–396
[17] MIKOLAJCZYK, T., RABIEJ, S., BOGUN, M., SZPARAGA, G. and DRACZYNSKI, Z., Nanocomposite polyvinyl alcohol fibers for medical applications, Journal of Applied Polymer Science, 2011, vol. 120, no.2, pp.1234-1244.
[18] JIA, Y., GONG, J., GU, X., KIM, H., DONG, J. and SHEN, X., Fabrication and characterization of poly (vinyl alcohol)/chitosan blend nanofibers produced by electrospinning method, Carbohydrate Polymers, 2007, vol. 67, pp. 403-409.
[19] REN, G., XU, X., LIU, Q., CHENG, J., YUAN, X. and WAN, L.W.Y., Electrospun poly(vinyl alcohol)/glucose oxidase biocomposite membranes for biosensor applications, Reactive & Functional Polymers, 2006, vol. 66, pp. 1559–1564.

RELEASE CHARACTERISTICS OF NAPROXEN LOADED ELECTROSPUN THERMOPLASTIC POLYURETHANE NANOFIBERS

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ABSTRACT

Combination of biocompatibility, non-toxicity, toughness and functionality of thermoplastic polyurethanes (TPU) has led their widespread use in medical applications [1-3]. Electrospinning of thermoplastic polyurethane nanofibers have been reported to have a potential use for the preparation of drug loaded non-biodegradable membranes for topical drug administration [4]. In the present study, ultra-fine fiber mats of TPU containing naproxen was successfully prepared by electrospinning from 8%w/w TPU solutions in dimethylformamid (DMF). The amount of naproxen in the solutions was 10 and 20 % based on the weight of TPU granules. The drug-loaded electrospun TPU fibers collection period was changed to 5, 10 and 20 h. The morphology of the 10 and 20% naproxen loaded electrospun TPU fiber mats was smooth and the average diameters of these fibers were 527 and 537 nm respectively. The release characteristics of the naproxen loaded TPU fiber mats were carried out by the total immersion method in the phosphate buffer solution at 37±0.5^{o}C.

Average thickness, average weight and theoretical naproxen content of the 10 and 20% naproxen loaded 8% TPU mats were given in Table 1.

Table 1. The thickness, average weights and theoretical naproxen contents of naproxen loaded 8% TPU mats according to collection period

	Average thickness (mm) ±SE	*Average weight (mg) ±SE*	*Theoretical naproxen weight (mg) ±SE*
8% TPU/10% Nap 5 hours collection	0.03 ±*0.028*	29.40 ±*2,54*	2.67 ±*0,23*
8% TPU/10% Nap 10 hours collection	0.09 ±*0.038*	57.70 ±*2,54*	5.25 ±*0,23*
8% TPU/10% Nap 20 hours collection	0.30 ±*0.015*	169.87 ±*11,90*	15.44 ±*1,08*
8% TPU/20% Nap 5 hours collection	0.02 ±*0.026*	21.90 ±*1,76*	3.65 ±*0,29*
8% TPU/20% Nap 10 hours collection	0.07 ±*0.004*	46.40 ±*3,52*	7.73 ±*0,59*
8% TPU/20% Nap 20 hours collection	0.22 ±*0.011*	127.37 ±*9,09*	21.23 ±*1,51*

Electrospun polyurethane nanofibers containing naproxen was developed and their release characteristics were investigated. It was seen that, the thickness of the mats, the collection time and drug content played an important role on release rate.

Key Words: Nanofibers, Electrospinning, Thermoplastic polyurethane, Naproxen, Release rate

REFERENCES

[1] WANG, B.; WANG, Y.; YIN, T. & YU, Q: Applications of electropsinning technique in Drug Delivery, Chemical Engineering Communications, 197:10, 2010, pp. 1315-1338

[2] SILL, T.J., & RECUM, H.A.v.: Electrospinning: Applications in drug delivery and tissue engineering, Biomaterials, 2008, Vol.29, pp. 1989-2006

[3] HUYNH,T.T.N.Y.; PADOIS, K.; SONVICO, F.; ROSSI, A.; ZANI, F.; PIROT,F.; DOURY, J.; & FALSON, F.: Characterization of a polyurethane-based controlled release system for local delivery of chlorhexidine diacetate, European Journal of Pharmaceutics and Biopharmaceutics, 2010, Vol. 74, pp. 255–264

[4] ZDRAHALA, R.J. & ZDRAHALA, I.J.: Biomedical Applications of Polyurethanes: A Review of Past Promises, Present Realities, and a Vibrant Future, J Biomater Appl,1999, 14: 67

INVESTIGATION OF THE USAGE POSSIBILITY OF ENZYMATIC PRETREATMENT FOR LOW TEMPERATURE DYEING OF POLYESTER FIBERS

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1. INTRODUCTION

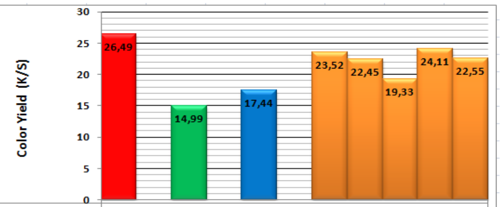
In recent years, using of enzymes in a variety of finishing processes of textiles is increasing. The reason for this increase is enzymatic finishing process does not lead to environmental pollution [1]. Some of the enzymes that can potentially be applied to PET fabric hydrolysis include lipase, esterase and cutinase. Hydrolysis on ester linkage by these enzymes cause producing hydroxyl and carboxyl groups on the surface of the fibers, so surface hydrophilicity of PET fabrics could be improved. When the PET fibers are treated such kind of enzymes, their stain resistance, wettability and dyeing properties would improve [2]. Generally, as well as there are some studies about enzymatic modification of PET fibers [2, 3, 4], there isn't any study that enzymatic treatment was used in order to dye these fibers at lower temperatures. The aim of this study is to loosen the firm structure of PET fibers by applying enzymatic treatment prior to dyeing and hence to make possible to dye these fibers at lower temperature without causing any decrease in color yield.

2. MATERIAL-METHOD

In this study, firstly PET fibers (19 micronaire) were pretreated with lipase enzyme. Enzymatic treatments were carried out in five different concentrations (0,5-1-2-4-8%) for 30 min. at optimum pH value (pH 8) and optimum temperature (40°C) that enzyme has maximum activity. Then treated and untreated samples were dyed with Bemacron Navy S2GL dye at color depth of 3%. Remission (R%) values of dyed samples were measured with Data Color Spectraflash SF600 (D 65/10°) and color yields (K/S) of dyed samples were calculated. Afterwards, washing, rubbing and light fastness tests of samples were assessed according to ISO 105 C06-A1S, ISO 105-X12 and ISO 105-B02 standards respectively. Besides, breaking strength test was carried out for untreated and treated samples with Prowhite Single Fiber Strength Tester.

3. RESULTS AND DISCUSSION

Color yield values of untreated and enzymatic treated (with lipase) samples dyed with disperse dye are given in Fig. 1. As can be seen in Fig. 1, enzymatic treated samples were dyed darker than the untreated samples, which means dyeability of enzymatic treated PET fibers were developed. As generally known, lipase enzymes are biocatalysts which hydrolyze ester bonds. Breakage of ester bonds in PET fiber structure by the effect of lipase enzymes, loosen the fiber structure and hence facilitate diffusion of dye molecules into the fiber.



K/S		26,49	14,99	17,44	23,52	22,45	19,33	24,11	22,55
Enzymatic Treated	Concentration (%)				0,5	1	2	4	8
	Time (min.)			30	30	30	30	30	30
	Temperature(°C)			40	40	40	40	40	40
	pH			8	8	8	8	8	8
Dyeing Temperature(°C)		130	115	115	115	115	115	115	115

Figure 1. Color yield results of untreated and enzymatic treated samples

After determination of enzymatic treatment on color, also fastness tests were carried out. It was observed that there is not any important change both in washing, rubbing and light fastness values of sample dyed at 115°C after enzymatic treatment and untreated sample dyed at 130°C. Furthermore in order to determine the effect of enzymatic treatment on fiber strength, breaking strength test was done and change in strength was found to be unimportant.

4. CONCLUSION

In this study, which was carried out in order to determine the usage possibility of enzymatic modification method for dyeing of polyester fibers at lower temperatures (115°C) rather than HT conditions without causing any decrease in color yield, it was observed that dyeability of enzymatic treated fibers were improved. The optimum concentration of enzymatic treatment was found to be 0.5%. Although color yield value of enzymatic treated sample dyed at 115°C was not completely equal to untreated sample dyed at 130°C, it is quite similar. According to these results, it can be said that if small amount of diffusion accelerator is also used, enzymatic treated fibers may be dyed at 115°C without causing any decrease in color yield. In this case, beyond the energy saving, fiber properties will be conserved due to dyeing at lower temperature. Furthermore as generally known, the main reason of olygomer problem faced most frequently in polyester dyeing is olygomers to get out due to the loosening of fiber pores during dyeing treatments carried out at high temperatures. The most effective method for the solution of this problem is dyeing of fibers at lower temperatures. This study presents promising results in terms of dyeability of polyester fibers at lower temperature.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

[1] YILDIRIM, F., Selülozik Liflerin Terbiyesinde Kullanılan Çevre Dostu Enzimler, *SAGEM*, Ekim/Aralık 1998, 15-23.
[2] LEE, S. and SONG, W., Surface Modification of Polyester Fabrics by Enzyme Treatment, *Fibers and Polymers*, 2010, 11/1, 54-59.
[3] DJORDJEVIC, M., PETRONIJEVIC, Z., CVETKOVIC, D., Polyester Fabric Modification by Some Lipases. *Chemical Industry and Chemical Engineering Quarterly*, 2005, 11/4, 183-188.
[4] HSIEH, Y. L., and CRAM, L. A., Enzymatic Hydrolysis to Improve Wetting and Absorbency of Polyester Fabrics, *Textile Research Journal*, May 1998, 68, 311-319.

APPLICATION FOR BLENDS OF CHITOSAN, LYOCELL FIBER TO CONTROL BACTERIAL GROWTH

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Developing technology makes people have expectations for the high performance and comfortable products which provide protection against internal and external factors. Anti-bacterial products are leading improved textile products through their improved functional properties of protection of health, personal hygiene and comfort [1].

Antibacterial products can avoid odor by micro-organisms along with advantages like preventing growth of bacteria and fungi, providing hygiene. For obtaining high level anti-bacterial feature seacell, chitosan, sochi, bamboo, tencel can be used [1].

Within this study, anti-bacterial knitted fabrics will be developed by using chitosan fibers produced from natural polymers and their blends with cotton and tencel.

Chitosan can behave as an antimicrobial fiber against fungi and bacteria because of its polycationic structure [2].

Tencel is a low cost fiber because of its raw material and process. It is eco-friendly. Besides look like cotton molecules, have better strength than cotton, high water absorption, bright view and soft handle are the other important properties [3].

In the scope of this project, the final products have been tested according to the standard AATCC 100:2004.

Table 1. Anti-bacterial test results of different yarn types

FIBER TYPE (%)			COMBINATION RATIO (%)	BACTERIAL REDUCTION (%)
COTTON	TENCEL	CHITOSAN		
100			100	**-**
	100		100	**92.38**
		100	100	**99.99**
85		15	100	**90.48**
	85	15	100	**99.99**

As seen in the Table 1, %100 cotton fabrics do not have antibacterial activity. On the contrary of cotton, the results show us fabrics produced by %100 tencel and chitosan indicate effective antibacterial activity. To increase antibacterial efficiency of cotton and to decrease cost of %100 chitosan and tencel, cotton fibers were blend with chitosan and tencel. As a result of these trials, it can be seen that fabrics from blended fibers can be used to achieve antibacterial fabric.

Key Words: Chitosan, cotton, tencel, anti-bacterial

REFERENCES

[1] DURAN, K., ALAY, E., 2011, "Biobozunur Antibakteriyel Koku Tutmayan Orme Kumaş Geliştirilmesi", San-Tez Project
[2] TAVARIA, F., 'Application of Chitosan in the Textile Industry to Control Microbial Growth'
[3] GUNAYDIN, N., 2009, "Rejenere Selülozik Lifler Karakteristik Ozellikleri ve Tekstilde Kullanım Alanları", Tekstil ve Mühendis Dergisi, p.18.

COPTIC FABRICS FROM NATIONAL MUSEUM OF SLOVENIA

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Coptic fabrics (50 artefacts) held by the National Museum of Slovenia in Ljubljana have been manufactured in Egypt between the 3rd and 10th centuries AD. These textiles have both historical and archaeological value, as they have been preserved in graves over the centuries. This was largely due to the dry climate and other favourable conditions. The analysed artefacts were once part of larger textiles: tunics, covers, headgear, curtains, scarves and cushions. They represent part of the belongings that Copts were buried with. In addition to the damage caused by old age, the fabrics were exposed to further destructive factors after they were excavated. This additionally affected their state today. As part of this study, we wanted to establish the level of the damage caused and the current state of the textiles. The results we obtained allowed us to determine which conservation and restoration processes should be applied.

Early in the experimental part, we found that the Coptic fabrics were in a worse condition than initially assumed, with fibres markedly damaged and fragile. As the textiles were found to be so delicate and due to their historic significance, we decided to use only reversible, non-destructive research methods. We first examined the composition of the artefacts using optical microscopy and found that the fabrics have mostly been woven with linen and woollen threads. Thread density, yarn twist direction and yarn diameter were established using a monocular magnifier. To understand the different weaving techniques, we used the NOVEX stereomicroscope with a digital camera CMEX-5000.

By studying the texture and structure of the Coptic textile we can get important insights on the techniques of weaving and skills of that time. These textiles were woven in all-linen warp, and linen was also used for the plain weave in the so called basic fabric (plain areas between ornaments). The ornaments (colour patterns) were woven in dyed wool yarn, which were tightly wrapped around linen warp in tapestry (resembles of gobelin technique) and completely cover the warp. The appearance of patterns looks like the rip weave. This technique required very skilled weavers as they produced many tiny patterns from a large number of colored threads. In doing so, they have developed a variety of techniques that result in differently shaped and constructed patterns. These include design patterns interspersed with weft, making slots, design pattern with cutting and adding warp and weft thread, "lazy" lines, weaving loops and Sumak technique. It is necessary to highlight the weaving technique of decorating with a flying needle, which is unique.

Key Words: Coptic textile, linen fabric, rips, woolen pattern, flying needle

THE INFLUENCE OF INCREASED ELASTICITY ON RESISTANCE OF COTTON FABRICS

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The research focuses on the influence of elastane (Spandex) incorporation in the weft direction of cotton fabrics and the structural properties (fabric density, type of weave) on the thermal and water vapor resistance level.

With the research, the two different yarns were chosen, 100 % Cotton rotor or OE-yarn, fineness 20 tex and Cotton/Elastane core-spun yarn with 6.2 % of elastane multifilament yarn, fineness 44 dtex in the core. Woven fabrics were produced on Picanol OMNI looms with yarn density in the warp direction 22 yarns/cm and width 160 cm and two different densities in the weft direction 17 and 20 yarns/cm. The first group of fabric is waved from 100 % Cotton, OE-yarn (in the both directions), the second group of fabrics is waved from 100 % Cotton, OE-yarn in the warp direction, while the raw material for weft yarn is Cotton/Elastane core-spun yarn. Woven fabrics were produced in two basic weaves, the plain weave P 1/1 and twill weave T 3/1 S.
Thermal and water vapor resistance are determined with two novel methods, which were compared with the well-known Permetest method. The thermal resistance is calculated according to the thermal conductivity method which was established by the faculty research laboratory and with the Permetest, while the water vapor resistance is measured with the water cup method (developed by professor Jaksic, D.) and with the Permetest.

The research results indicate that cotton fabrics in twill weave with elastane in the weft direction have higher thermal and water vapor resistance compared to conventional cotton fabrics. The reason lies in higher yarn density of fabrics with elastane in the weft direction in twill weave (from 24 to 29–31 yarns/cm in the warp direction) than in plain weave (from 24 to 28 yarns/cm in the warp direction).

Key Words: Thermal resistance, water vapor resistance, elastic and conventional fabrics

ANALYSIS OF MECHANICAL PROPERTIES OF TEXTILE FABRIC PACKAGES CONTAINING BASALT FABRICS

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Abstract: Nowadays increasingly more attention is devoted to the basalt fibres as alternative solutions used in protective clothing. Literature reports included basalt fibres to ultra-high heat resistance fibres. The current production of protective clothing against heat radiation using aluminized glass fabric. Aluminized fabric basalt due to the high heat radiation can successfully replace aluminized glass fabric. In this paper was performed strength adhesion of aluminized basalt fabrics. These fabrics differed in terms of: weave, type of adhesive and the way of bonding process. Connections of protective clothing layers is a important issue because of the potential destruction of the connections under the influence of high temperature.

Key Words: Basalt fabrics, aluminization, glue joints, adhesion

1. INTRODUCTION

Basalt fibres belongs to the heat radiation fiber group, a subgroup of fibres characterized by ultra-high temperature resistance. Basalt fibres and products made from them have a low moisture absorption, low thermal conductivity, good thermal stability and low values of extension of break. Properties of basalt fiber may constitute great alternative to currently used glass fiber in the protective clothing production.

It has been reported that basalt fabrics using without coated can occur the skin irritation. Therefore for research were used laminated basalt fabric with aluminum foil. Aluminum foil was glued to the fabric basalt appropriate glue (table 1). Execution of foil was effected by applying a evenly layer of a few microns of aluminum on both sides of backing polyester film. The thickness of layer aluminum foil with a backing was 12 μm. Double-sided foil dusting method has no effect on flexibility of the fabric and additionally provides adequate protective properties and sensory comfort [1].

Bonatex PU85 is the dispersive glue, based on aqueous dispersions of synthetic resins and polyurethanes. This glue is not consists of a mixture any organic solvents [2]. Whereas the Butacoll A+ glue its insolubility in water. It is based on a mixture of epoxy resins consists of a mixture toluene, acetone, 4-tert-butylphenol [3].

2. OBJECT OF EXAMINATION

Feature of a laminate is the presence of glue (binder) between the surfaces of joined materials. The discontinuous structure of the fabric abutment surface makes a connection between the glue and the fibres. The glue penetrates the fine pores, irregularities on the surface of the aluminum foil. Depending on the degree of penetration of glue inside the material, the resulting combination may have a different resistance. Destruction laminate takes place especially when it occurs of the frequent action, variable forces deformation and variable temperature. A particularly important feature of the usefulness of a laminate is delaminating strength, often called the adhesion. It is a very challenging test of the strength properties of the glue connection. Verification of the adhesion strength were carried out for the aluminized basalt fabric (table 1). Up to two fabrics were introduced steel wire (a diameter: 0.1 mm), which increases the strength of the material. Carrying out studies were designed to determine how the introduction of the steel wire in fabric structure affects to the adhesion [4].

Table 1. Characteristics of aluminized basalt fabric

Symbol of sample	Wave	Mass per square, g/m^2	Thickness, mm	Type of glue
T1	plain	329	0.28	Butacoll A+
T2	twill	443	0.51	Bonatex PU85
T3	plain reinforced with a wire	380	0.47	Butacoll A+
T4	twill reinforced with a wire	388	0.52	Bonatex PU85

3. RESULTS AND SUMMARY

The assessment of the adhesion strength of laminates were carried out at a testing machine Hounsfield (Tinius Olsen) with installed the head of 100N.

Table 2. Average values

Direction of the delamination	T1		T2		T3		T4	
	P daN/cm	v %	P daN/cm	V %	P daN/cm	v %	P daN/cm	v %
warp	0,150	74,56	0,360	73,01	0,415	21,33	0,685	30,81
weft	0,150	172,52	0,690	41,66	1,105	29,24	nroz	

The tested materials were characterized by high inhomogeneity- of lamination. It seems that the laminating process is not fully controlled, resulting in differences in the character samples delaminating – from the delaminating fabric the aluminum foil stick out itself or with glue layer. On the some laminates glue, penetrating the fabric, passing through to the outer surface of the material.

For all tested laminates were stated the strength asymmetry of glue bonded. Delaminating strength in the direction of weft is greater than in the warp direction.

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REFERENCES
[1] Gilewicz P, Dominiak J, Cichocka A, Frydrych I. Change in Structural and Thermal Properties of Textile Fabric Packages Containing Basalt Fibres after Fatigue Bending Loading FIBRES & TEXTILES in Eastern Europe 2013; 21, 5(101): 80-84.
[2] http://www.bochemia.com.pl.
[3] http://www.aned.biz.pl/pliki_inne/153.pdf.
[4] Więźlak Wł., Elmrych-Bocheńska J., Zieliński J., Odzież. Budowa, własności i produkcja. Instytut Technologii Eksploatacji – Państwowy Instytut Badawczy, Radom 2009.

USING AN APPLICATION FOR THE PRODUCTION OF WORKWEARS AND ASSESSMENT ACCORDING TO DIN 53814:2007

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Workwears are great important because of difficult working conditions. The people who work at least eight days spend time with the same clothes. For this reason, protective clothing wears must be healthy and safety, convenient, easy to use and also these clothes must be in accordance with body specifications. Because of these reasons, in this study we chose the TENCEL/PES pique and single jersey fabrics and to be resistant to standard of DIN EN ISO 15797: 2002, we tried some resin process.

Through this process, pilling (martindale 5000- 7000), fastness properties (washing fastness, water fastness, acidic perspiration fastness, alkaline perspiration fastness, crock fastness) and surface appearance of fabric after 25 times industrial washing is excellent.

SLUNJSKI and et all (2006), Resin processes are based on ionic exchange resins, i.e. insoluble organic substances able to exchange their ions with other ions having the same load and contained in the solution in which they are immersed [1].

Greeson and et all(2005), for %100 cotton fabric, achieving the best performance from durable press (DP) product is a balancing act. Since crosslinking to obtain durable press properties weakens the fiber, construction and finishing details must be optimized to provide the best balance of physical properties. They tested abrasion resistance, tensile strength, surface appearance of fabrics after 50 launderings [2].

In this study, the following tests were performed to measure the degree of success of the resin process;

- Martindale pilling (5000-7000 revolutıon)
- Fastness properties of fabrics
- Household and industrial washing resistance (25 washer-DIN EN ISO 15797: 2002)
- And To measure the success of the resin process, DIN 53814:2007 standard is used.

Table 1. Test results of TENCEL/PES fabric before resin and after resin process

Fabric Quality		Washing Fastness	Water Fastness	Acidic Perspiration Fastness	Alkali Perspiration Fastness	Washing Fastness	Water Fastness	Acidic Perspiration Fastness	Alkali Perspiration Fastness
20/1 50/50 Vortex Tencel Resin	**Acetate**	**5**	**5**	**5**	**5**	**5**	**4/5**	**4/5**	**5**
	Cotton	**4/5**	**4/5**	**4/5**	**5**	**4/5**	**5**	**5**	**4/5**
	Nylon	**4**	**4/5**	**4/5**	**4/5**	**4/5**	**4/5**	**4/5**	**4/5**
	Polyester	**4/5**	**4/5**	**4/5**	**4/5**	**5**	**4/5**	**4/5**	**5**
	Acrylic	**5**	**4/5**	**5**	**5**	**5**	**5**	**4/5**	**5**
	Wool	**4/5**	**4/5**	**4/5**	**4/5**	**4/5**	**4/5**	**5**	**4/5**

Fabric Quality		Before Resin	After Resin	Burst Strength	Before Resin	After Resin	Piling Test(Martındale)		
20/1 50/50 Vortex Tencel Resin	Crock fastness (dry)	4/5	4/5	kpa	302.3	515.4		5000	7000
	Crock fastness (wet)	4	4	mm	39.4	44	Bfr. Resin	4/5	4/5
	Hypochlorite Fastness	4	4/5	sn	20.3	22	Aft. Resin	4/5	4/5
					($50cm^2$)				

FABRIC QUALTY	PROCESS	Swelling Index (%)			
		T	M	D	%
20/1 Tencel/PES Pique	Before Resin	7.08	7.95	7.63	58.2
20/1 Tencel/PES Pique	After Resin	7.08	7.65	7.57	16.3

Key Words: Resin, Tencel/PES, industrial washing, swelling index

REFERENCES

[1]Slunjski, M., K., Cadee, J. Tattersall, ‘Mıex® Resın Water Treatment Process’, 2006.
[2]Greeson, H., K., Philips, N., Cary, j., Turner, Cotton Incorporate, ‘Tough Cotton: A novel Approach to Durable Press Finishing’, page 13-16, 2005.

DYEING OF COTTON FABRICS USING NATURAL DYES OBTAINED BY SPRAY DRYER METHOD

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Natural dyes obtained from plant and animal materials and they use for coloring of different materials. Until 1876, unless and until synthetic dyes, all of dyeing was made with natural dyes. Many synthetic dyes are used nowadays. However in recent times again due to the increase in interest in natural products, natural dye has been raised again. In this study, natural dyes are made powder natural dyes by using Spray Dryer.

Tutak ve Korkmaz (2012), in their study, organic cotton fabrics were dyed with different natural dye sources (madder root, walnut shell, henna, horse chestnut, pomegranate peel, berberis vulgaris root, thyme, and sage tea). The dyeing was carried out with different mordants (copper sulphate, potassium aluminum sulphate, potassium tartrate, and citric acid), using pre-mordanting dyeing methods. The color of the fabrics was investigated in terms of color strength (K/S) and fastness properties against light, washing, rubbing, and perspiration. The color and fastness properties obtained from the dyed organic cotton fabrics were between good to excellent [1].

Vankar et al (2009), in their study using onion skins and metal mordants for dyeing cotton, wool and silk fabrics. The resulting color is the color dyeing of high spectral efficiency, measured with a photometer. The fastness values of fabrics were good [2].

Tutak ve Benli (2008), some fruits and plants obtained from natural dyes can dye on wool fiber good in a way different tone. In this study, with five different natural colorant in the form of yarns produced from 100% wool fiber for textile products, has been painted with three different mordants. After dyeing with the color measurement of work has been done. Gathered colors, washing, rubbing, perspiration and light fastness have in terms of consumers that can be used with natural dyes on wool fabric [3].

When we investigate other studies, there isn't any study about Spray Dryer method in natural dyeing. So, this study will be first for textile sector in Turkey. In this study, Natural dyes which is extracted with some solvents such as ethanol and then extractions has been made powder by using the Spray Dryer in the laboratory. After that obtaining natural powder dyes, dyeing are made with natural dyes.

100% cotton jersey and rib fabric samples were used in study and for dyeing process pre-mordant is prefer because of the better than other methods. 60 C and 96 C temperatures were used for color efficiency

Figure 1. Juglans regia was dyed with three different mordants

Figure 2. Pinus brutia was dyed with three different mordants

Key Words: Spray dryer, dyeing, powder, natural dyes

REFERENCES

[1] TUTAK, M., E., KORKMAZ, 'Environmentally Friendly Natural Dyeing of Organic Cotton', Journal of Natural fibers, 9:1, 51-59.
[2] VANKAR, P., R., SHANKER, S., WİJAYAPALA, 'Dyeing of cotton, wool and silk with extract of Allium Cepa', Pigment and Resin Technology, Vol. 38 Iss: 4 pp. 242 – 247.
[3] TUTAK, M., H., BENLİ, 'Bazı Bitkilerden Elde Edilen Doğal Boyar Maddelerin Yünü Boyama Özelliğinin Incelenmesi', Erciyes University, Faculty of Engineering, Department of Textile Engineering, Mustafa Çıkrıkçıoğlu, Vocational High School, Kayseri, 2008.

PACKAGING TEXTILES AND THEIR APPLICATION AREAS

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Packaging textiles include all textile packing material for industrial, agricultural and other goods [1]. The demand for packing material is directly proportional to economic growth, industrial production and trade as goods are produced and then distributed both locally and internationally. The growing (environmental) need for reusable packages and containers is opening new opportunities for textile products in this market.

Sacks and bags made of traditional jute, cotton or natural fibre are gradually casting way for modern synthetic fibres. These technical textiles, used in packaging and subsequent transportation are called “Packtech”.

It is well known that these fabrics are ideal for many kinds of packaging. At one end, Packtech includes heavyweight, dense woven fabrics (used for bags, sacks, flexible intermediate bulk carriers and wrappings for textile bales and carpets) and on the other end, it includes lightweight nonwovens used as durable papers, tea bags and other food and industrial product wrappings.

The use of textile materials in consumer packaging is exhibited in the following products [2]:

- FIBC big bags (Flexible Intermediate Bulk Containers),for powdered and granular materials
- Laundry bags and other bulk packaging products
- Sacks for storage etc
- Twine and string for tying packages, etc (excludes agricultural applications)
- Non-paper tea bags and coffee filters
- Food soaker pads
- Net packaging for storing, packing, transporting, retailing foodstuffs, toys,
- Woven fiber strapping, lightweight mailbags.
- Soft luggage

Key Words: Packaging, technical textiles, protection, indusrial textiles

REFERENCES

[1] http://www.technicaltextile.net/packaging-textiles/
[2]http://www.bch.in/index.html

MELTBLOWN NONWOVEN TEXTILE FILTERS

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One of the fastest growing segments in the nonwovens industry, filtration is characterised by dozens of end use areas and applications. Nonwovens can be engineered very precisely to meet exacting specifications and stringent regulatory requirements for the filtration of air, liquid, bacteria, dust, gas and a myriad of other areas. Nonwovens have evolved from simply replacing other forms of media, such as paper, cloth, glass and carbon to becoming the media of choice for filtration [1].

Alone or in combination with other methods, meltblowing is a widely used technology for the production of nonwoven filters.

Melt blowing is a kind of microfiber nonwoven production process which uses thermoplastic polymers to attenuate the melt filaments with the aid of high-velocity air. Polypropylene (PP) is the most widely used polymer for this process, since it is relatively inexpensive and versatile enough to produce a wide range of products. Other polymers such as polyethylene (PE), poly(ethylene terephthalate) (PET), poly(butylene terephthalate) (PBT), polystyrene, polyurethane (PUR), and polyamide (PA) can also be used for the production of melt blown nonwovens [2,3,4,5].

Meltblown microfibers generally have diameters in the range of 2 to 4 μm, although they may be as small as 0.1 μm and as large as 10 to 15 μm. Differences between meltblown nonwoven fabrics and other nonwoven fabrics, such as degree of softness, cover or opacity, and porosity can generally be traced to differences in filament size [5,6,7].

Melt blowing has become an important industrial technique in nonwovens because of its ability to produce materials suitable for filtration media, thermal insulators, battery separators, oil absorbents, medical area, miscellaneous applications, apparel area, wipes, and many laminate applications. [2,3,5].

Nonwoven filters can be used in various applications such as surgical face mask filter media, automotive filters, liquid and gaseous filtration, clean room filters and others [8].

The aim of this study is to make an overwiev of meltblown nonwoven filters; materials used, effects of some production parameters on filtration efficiency, application areas and basing on the results of previous research emphasize the effects of various production parameters, such as die-to-collector distance (DCD), collector drum speed, collector vacuum, die air pressure, extruder pressure and extruder speed on the filtration efficiency of meltblown nonwovens.
The results have shown that production parameters have significant effects on physical properties and thus the filtration efficiencies of meltblown nonwoven filters.

Key Words: Meltblown nonwovens, filtration, microfiber nonwovens, textile filters

REFERENCES

[1] http://www.edana.org/discover-nonwovens/products-applications/filtration.
[2] Kathryn C. Dutton, Overview and Analysis of the Meltblown Process and Parameters, Journal of Textile and Apparel, Technology and Management (JTATM), Vol. 6, Issue 1, Fall 2008.
[3] Duran, D., Perincek, S., The Effect of Various Production Parameters on the Physical Properties of Polypropylene Meltblown Nonwovens, Industria Textila, Vol.61, Nr.3, 117-123, 2010.
[3] http://www.edana.org/discover-nonwovens/what-are-nonwovens-
[4] Dong Zhang, Christine Sun, John Beard, Houston Brown, Ian Carson, Charles Hwo, Development and Characterization of Poly(trimethylene terephthalate)-Based Bicomponent Meltblown Nonwovens, Journal of Applied Polymer Science, Vol. 83, 2002, 1280–1287.
[5] Duran, D., Duran, K., Meltblown Nonwovens: Effect of Production Parameters on Physical Properties, 14th National & 1st International Textile Technology and Chemistry Symposium, May 8-10 2013, Bursa, ISBN:978-605-63112-2-2.
[6] One Lee, B.; Anko, J.& Won Han, S.(2010). Characteristics of PP/PET Bicomponent Meltblown Nonwovens as Sound Absorbing Material, *Advanced Materials Research*, Vols. 123-125, August 2010, pp. 935-938.
[7] Duran, D., Investigation of the Physical Characteristics of Polypropylene Meltblown Nonwovens Under Varying Production Parameters, Elastomeric Polymers, Chapter 12, pp: 243-264.
[8] Duran, D., Investigation of the Physical Characteristics of Polypropylene Meltblown Nonwovens Under Varying Production Parameters, Elastomeric Polymers, Chapter 12, pp: 243-264.

USAGE OF ARTIFICIAL TURF WASTES IN FIBER REINFORCED BITUMEN/ASPHALT PRODUCTION

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Number of researches and applications on production and usage of fiber-reinforced structures has been increasing during the recent years. Especially, carbon glass, and aramid fibers have been widely used for this purpose. Various fibers can be also used to improve the properties of bitumen. Recycled or recyclable fibrous materials started to attract the attention of researchers working in this field. In this project proposal, it is planned to use the artificial turf wastes as a reinforcement material in bitumen. By this way both decreasing the production costs and increasing the product quality/standard can be achieved.

Polypropylene (PP) or polyethylene (PE) fiber wastes, which can be obtained during production and installation process of artificial turf, are going to be used as a material of project. These fiber wastes are going to be used as a reinforcement material in bitumen. At first composite bitumen samples having different waste fiber weight ratios will be produced and then structural and physical properties of these samples will be tested within the context of project. The results are also going to be compared with classical bitumen.

In conclusion, both technical and economic benefit is expecting by using waste fibers as reinforcement material in the project. The technical development is going to be achieved by improving the mechanical properties of bitumen, and the economic benefit can be achieved by increasing the usage life of bitumen and by re-using of fibers or providing sustainability of fibers.

Key words: Waste fiber, artificial turf, recycling, bitumen reinforcement, composites.

PERFORMANCE AND THERMAL COMFORT PROPERTIES OF KNITTED FABRICS PRODUCED BY COTTON, ACRYLIC AND MIYABI YARNS

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Due to stretchability, freedom of movement, good handle and comfort properties, knitted fabrics are commonly preferred for sportswear, casual wear, underwear and socks. Socks are critical for maintaining foot climate because it wicks sweat from the foot to the shoe upper for evaporation. The thermo-regulation of foot climate can be explained optimum heat, damp and air passing properties so called thermal comfort properties of socks. The expectations from socks are not only thermo-regulation of foot climate but also resistance against abrasion, elasticity and dimensional stability after several washing cycles are required.

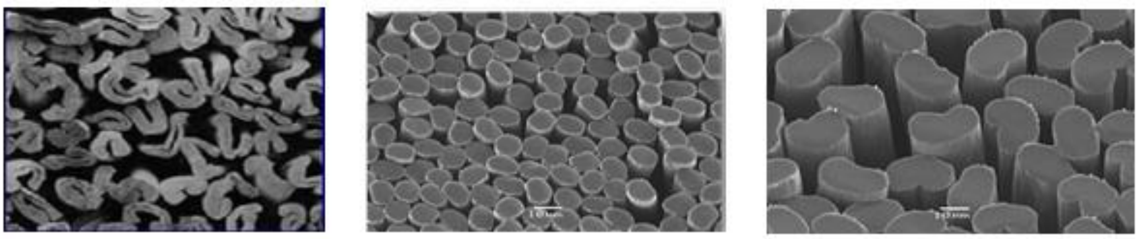
The performance characteristic of socks can vary depending on many factors such as yarn type, knitting process and finishing method etc. Cotton, acrylic, wool, viscose, polyester, nylon, elastomeric yarns and their blends are commonly used in sock production. Synthetic fibers with better moisture transport properties such as acrylic and polyester have replaced cotton fibers in most sock models. Cotton fibers are less conductive to moisture transport and have longer drying times.

This research is focused on the comparative analysis between the most commonly used yarns in sock production (cotton and acrylic) and a new yarn type (miyabi) and the evaluation of physical and thermal comfort properties.

Cotton remains by far the most important natural fibre due to good water vapor, air permeability, softness and hygienic properties, despite all of the disadvantages listed above.

Acrylic fiber has a warm and soft handle like wool. It is about 30% bulkier than wool. It is also lightweight and highly resistant to sunlight; has high resilience and elastic recovery characteristic [1].

Miyabi fiber is a micro-fine acrylic yarn developed by Mitsubishi Rayon. It offers smoothness more superior to modal, viscose and silk. It is thinner, lighter and warmer as compared with wool and modal and is extremely comfortable to wear [2]. The cross sectional views of the fibres are given in Figure 1.



(a) (b) (c)

Figure 1. The cross sectional views of (a) Cotton, (b) Miyabi, (c) Acrylic fibers [3]

Single jersey fabrics were knitted using 100 % Cotton, Acrylic, Miyabi yarns in the same yarn count (36 Ne) and with the same twist coefficient (αe= 3,8) and same tightness values. Some physical properties (weight, thickness, stitch density, abrasion and bursting strength) and comfort properties (thermal conductivity, thermal resistance, thermal absorptivity, relative water vapor permeability, air permeability) of the fabrics were measured. The results were evaluated statistically.

Key words: Miyabi, acrylic, cotton, socks, knitted fabrics, physical and thermal comfort properties

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REFERENCES

[1] http://www.aksa.com/en-US/OurProducts/Pages/WhatIsAcrylicFiber.aspx
[2] http://www.mrchk.com.hk/en/product_c_04.php
[3] EDİS, E.T., 2010, Miyabi Mikroakrilik Lifleri, Çorapland Dergisi, Mayıs- Haziran, 52-53s.

ECOLOGICAL AND ECONOMIC FOULARD DESIGN FOR TEXTILE INDUSTRY

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For needs of the human population of the world increases, increases in parallel When we meet these needs, of course, necessary , but how to do it so important for future generations .Textile Finishing - dyeing production process, dyestuff, chemicals and water are first elements of process . But more importantly, they are not available in the amount of use and the operating cost channel transmitted by the process liquor (dyed or chemically mixed with water), the amount and the content is just as important. We were immediately placed foulard (padder) in front of each dyeing-finishing mill stenter, stenter foulard used in the dyeing and finishing companies that we noticed things about the layout of the environment and in terms of the cost of the foulard you think would benefit a lot about the design of our observations and interviews after a long time;

1) Ergonomically designed to be filled foulard immersion cylinder and is connected to the mechanism currently less than those of all enterprises with liquor at least the duration of the interaction will be achieved with 10-15 liter liquor. Such a practice can also be applied so that the current foulard filling with too much liquor can be avoided. In addition, new production is seen as the most ergonomic triangle shape foulard. Blue region in the figure 3 with immersion cylinder create additional volume and low liquor distracted by moving towards the foulard fill empty. Thus, with less liquor that has minimal impact on the system will be provided a new foulard .

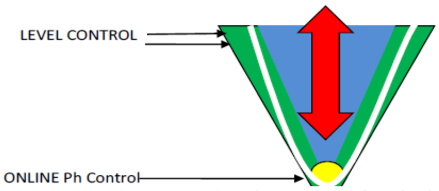

Figure 3. Designed New Type of Foulard

2) There are currently many companies pick-up a certain part of the fabric float (the amount of liquid to be absorbed onto the fabric due to hydrofility) is the amount of pick-up with eye . This is due to the fall in the level of the fabric from time to time in various points leads to the formation of different grades. We designed it with a new system -level control sensors continuously between minimum and maximum levels (on-line) by following the fluctuations in quality will not be permitted.

3) There are currently many companies, in foulard liquor pH adjusted initially and then not followed. However, the fabric float, set pH value of the chemical work that we have done, destroys the system deteriorates over time. Which is available in the markets we currently applique foulard by on-line pH control systems, our range of pH as determined at run-time (range) change to send a beep will alert the operator by the system aimed to establish . Thus pH fluctuation on the fabric will not be so.

PROPERTY ANALYSIS OF SKIRTS MADE FOR READY-TO-WEAR COLLECTION. PART I: TENSILE TESTING OF SEWING THREADS AND WOVEN FABRICS

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This study aims to emphasize several concerns regarding women's skirts design, named as the connections between special types of sewing threads delivered by the supplier for the garment manufacture and fabrics' selection for specific destination.

At the beggining, the cause- effect analysis referring to the most important properties required by the designed garment was achieved.

Testing methodology was based on the actual standards for evaluation of the tensile properties for yarns and woven fabrics. Experiments have carried out for tensile testing of the sewing threads (with different ticket number) and, tensile testing of the textile materials (with different structure and fiber composition), all by using advanced tensile systems.

The outcome of this paper was that the sewing threads and woven fabrics are once again, important parameters which have an effect on skirts design owing to their properties in the overall, for a quality profile expected at wear.

Key Words: Sewing threads, woven fabrics, cause- effect analysis, tensile testing, skirts

REFERENCES

[1] AMANN & Soehne GmbH & Co. KG, Sewing and Embroidery Threads. Basics, volume l, (2008), Available from: www.amann.com.
[2] Oakland, J.S., Statistical Process Control, Butteworth-Heinemann, Edition 5, Oxford, (2003).
[3] Gurarda, A.: Investigation of the Seam Performance of PET/Nylon-Elastane Woven Fabrics, Textile Research Journal, Vol. 78, No.1, pp.21-27, ISSN:0040-5175, (2008).
[4] Pavlinic, D.Z. et al:Predicting seam appearance quality, Textile Research Journal, Vol. 76, No. 3, pp 235-242, ISSN:0040-5175, (2006).
[5] Mandal, S.; Nandita, A.: An Overview of Sewing Threads Mechanical Properties on Seam Quality, Pakistan Textile Journal, Vol.1, pp.40-43, Available from: http:// www.ptj.com.pk , (2010), Accessed: 2010-04-06.
[6] Harpa, R., Quality Garment By Means Of Quality Seam, Proceedings of The 7th International Conference Management of Technological Changes – MTC 2011, Book 1,pp.21-25, ISBN :978-960-99486-2-3, September 1st – 3rd, Alexandroupolis, Greece, (2011).
[7] Morari, A.S., Seam Quality- Durability's Factors, Masters Thesis (Directed by Assoc. Prof. Dr. Ing. Rodica Harpa), (2012).
[8] SR ISO 5081:1991Textiles.Woven Fabrics.Determination of Breaking Strength and Elongation. Strip Method.
[9] SR ISO 5082:1992 Textiles. Woven fabrics. Determination of Breaking Strength. Grab Method
[10] SR EN ISO 2062:2010 Textiles. Yarns from Packages. Determination of Single-End Breaking Force and Elongation at Break Using Constant Rate of Extension (CRE) Tester.

PROPERTY ANALYSIS OF SKIRTS MADE FOR READY-TO-WEAR COLLECTION. PART II: TENSILE TESTING FOR PROPER SEWABILITY

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The second part of the study regards the seam involvement to the skirts design and, to the overall quality profile expected at wear.

Taken as a whole, the durability of sewing is provided by means of sewing threads, sewn materials and the sewing technology.

Experiments have carried out for the tensile testing of the seam, according to the actual standard, by using advanced tensile systems. Investigation regarding the smoothness of seams in fabrics, complete the study idea.

The outcome of this paper was that the particular knowledge about tensile features of the materials as layers and the sewing threads, could allow achieving proper sewability according to the designed garments, which were skirts, ready-to-wear collection.

Key Words: Sewing threads, fabrics, seam, tensile testing, smoothness, sewability, skirts

REFERENCES

[1] AMANN & Soehne GmbH & Co. KG, Sewing and Embroidery Threads. Basics, volume l, (2008), Available from: www.amann.com.
[2]AATCC Test Method 88B-2011 Smoothness of Seams in Fabrics after Repeated Home Laundering.
[3] Mandal, S.; Nandita, A.: An Overview of Sewing Threads Mechanical Properties on Seam Quality, Pakistan Textile Journal, Vol.1, pp.40-43, (2010), Available from: http://www.ptj.com.pk/ , Accessed: 2010-04-06.
[4] Backauskaite, D., Daukantiene, V., Tensional Behaviour of Seamed Linning Fabrics, ITC&DC: 4th International Textile Clothing & Design Conference - Magic World Of Textiles, October 5th–8th 2008, Dubrovnik, Croatia, Book Of Proceedings, pp.519-524, ISBN:978-953-7105-26-6, (2008).
[5] Harpa, R., Quality Garment By Means Of Quality Seam, Proceedings of the 7th International Conference Management of Technological Changes– MTC 2011, Book 1,pp.21-25, ISBN :978-960-99486-2-3, September 1st – 3rd, Alexandroupolis, Greece, (2011).
[6] Morari, A.S., Seam's Quality - Factors of Durability, Masters Thesis (Directed by Assoc. Prof. Dr. Ing. Rodica Harpa), (2012).
[7] SR EN ISO 13936-2:2004 Textiles - Determination of the Slippage Resistance of Yarns at a Seam in Woven Fabrics - Part 2: Fixed Load Method.

HEIJUNKA TECHNIQUE FROM LEAN PRODUCTION TOOLS AND ITS APPAREL APPLICATIONS

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Lean manufacturing is a production philosophy which considers any resource expenditure for any goal other than the creation of value for the end customer to be wasteful and thus a target for elimination. Lean production thus defined calls for high capacity utilization combined with relatively low inventories, requiring that system variability (concerning both arrival and service rates) be minimized. There are two general approaches to appreciating the lean concept: waste and smoothness. Lean can be considered as the set of Toyota Production System "tools" that assist in the identification and steady elimination of waste (muda) by improving quality while reducing production time and cost[1].

Many tools are used while applying lean production. Some of these are cellular layouts, single minute exchange of die (SMED), andon boards, jidoka, heijunka, six-sigma, kanban systems and poka-yoke (Figure 1). Using these concepts, aids in bridging the gap between the empirical and conceptual worlds[2].

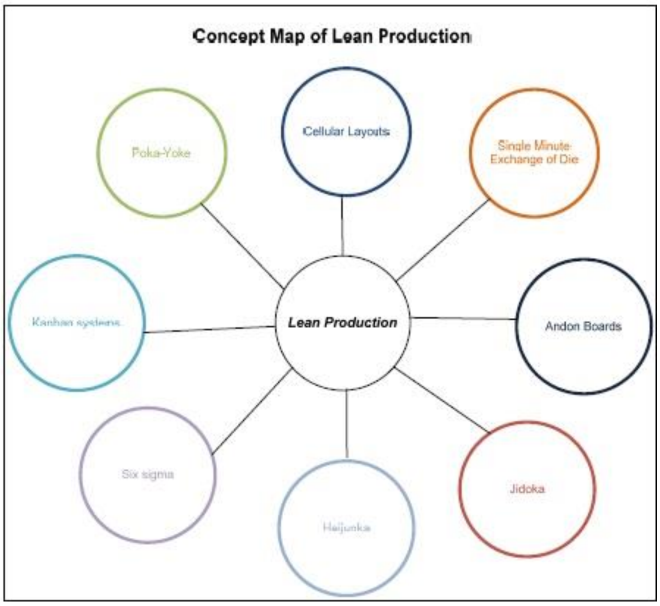

Figure 1. Concept map of lean production

Heijunka is one of lean manufacturing tools and calls for distributing the jobs requiring more labor in put through out the production schedule to permit higher average utilization assuming that the cycle time is held constant over time[3]. Production lines or resources require to be arranged in comply with changes in demand so that various types of products can be produced at small amounts. Balanced production, also called mix loading and production smoothing is a method for producing the models or products different from each other in the same recent assembly line respectively.

In addition to the competitive conditions of the clothing sector changing in recent times, the order understanding based on less items and more models has been adopted. Enterprises produce more than one order for more than one customer at the same time. These competitive conditions make enterprises reduce waste in production, increase their efficiency and have a balanced production. In this study the heijunka from lean manufacturing tools is informed and the applications of clothing production are explained as well.

Keywords: Lean manufacturing, apparel, heijunka, balanced production

REFERENCES

[1] BUCOURT M., BUSSE R., GÜTTLER F., WINTZER C., COLLETTINI F., KLOETERS C., HAMM B., TEICHGRÄBER U. F., Lean manufacturing and Toyota Production System terminology applied to the procurement of vascular stents in interventional radiology, Insights Imaging (2011) 2:415–423.

[2] MCLEOD A., Conceptual Development of an Introductory Lean Manufacturing Course for Freshmen and Sophomore Level Students in Industrial Technology, the Technology Interface Journal/Fall 2009, Vol. 10, No: 1.

[3] HÜTTMEIR A., TREVILLE S., ACKERE A., MONNIER L., PRENNINGER J., Trading off between heijunka and just-in-sequence, Int. J. Production Economics 118 (2009) 501–507.

IMPLEMENTATION POSSIBILITIES OF REVERSE LOGISTICS IN TURKISH TEXTILE AND CLOTHING SECTOR

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Reverse logistics is the process of planning, implementing and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal [1]. Reverse logistics can also be defined as the process of collecting used products and materials from first customers in order that they may be reused, recycled or upcycled into other products. Reverse logistics treats these materials as valuable industrial nutrients rather than trash [2].

A typical reverse logistics process is as follows: once returns are accepted, the firm issues a return merchandise authorization or return material authorization to begin all reverse logistics activities. Returned products with less damage are processed to put back to finished goods inventory with some test and repair, to be sold to customers. The rest with more damage is returned to suppliers, sold to secondary markets, dismantled to harvest components or landfilled [1].

Reverse logistics implementations in textile sector include the recycling and upcycling processes of unusable yarns, fabrics, production waste, husks and clippings. On the other hand reverse logistics implementations in clothing sector include the recycling, upcycling and reuse processes of used garments and clippings which are composed after cutting fabrics.

Unfortunately, reverse logistics implementations in Turkish textile and clothing sector, which has an approximate economic size of 50 billion dollar and which is the sixth biggest textile exporter and fifth biggest clothing exporter in the world by 2012, are much lower than expected. The evaluation of husks and clippings becomes widespread in textile sector. However, the garments are gone to waste after usage or they are delivered to the establishments which collect garments. The establishments (Kızılay, municipalities, social institutions etc.), which collect garments, convey them to destitute people. Thus, the garments are reused. However, if the garments are well-worn they are usually gone to waste. Turkish clothing enterprises, which own brands, don't collect used garments from their customers for evaluation like their rivals throughout the world. Most of the clothing enterprises throughout the world collect used garments from their customers and in return they give discount checks. They have the garments dry-cleaned and deliver them to destitute people and send the unusable ones to recycling.

Önal Elyaf, which operates in Uşak and Çerkezköy factories, is one of the biggest recycled fiber producers of Turkey. It buys all kind of textile waste from their sources, separates them according to their fabric properties and colors and gets them through processes which are necessary for fiber production. It produces 13.000 tons of recycled fibers from textile wastes (cotton producer without a cotton field) per year. All of its products are 100% recycled. The recycling ratio of textile wastes in Turkey is 67% by 2011 [3].

The inventory deficiency in Turkish textile and clothing sector stands in our way for getting accurate information about reverse logistics implementations. However, the general profile of recycling possibilities and textile and clothing wastes in Turkey can be obtained from a project which is carried out in 2010.

According to the project report the annual economical value of textile husks, which are gone to waste, in Turkey is over 100 million TL. 62% of the enterprises, which take place in the research, sell their husks, 17% evaluates in its own production line and 16% dumps. Within the context of project, capacities, product and production types of the waste treatment enterprises in Turkish textile and clothing sector are determined. 82% of 60 enterprises are situated in Uşak province which becomes the recycling center. 18.050 tons husks are reevaluated per month. The enterprises recycle fibers, yarns, fabrics and fabric clippings. The enterprises use the husks for reproducing yarns, acquiring laps, acquiring nonwovens-felts, obtaining granules. The recycled fibers are cotton, polyester, acrylic, wool, viscose, nylon, polypropylene and linen. The husks are obtained from domestic and international (Romania, Bangladesh, Pakistan, India etc.) markets. The products, which are obtained from husks, are used in the production of felts, blankets, knitwear, woven fabrics, yarns, socks, rugs, quilts, carpets and furniture [4].

In order to achieve an increase at reverse logistics implementations in textile and clothing sector, both the enterprises and consumers must become conscious. Reverse logistics increases the recycling and provides the reuse of worn products or upcyling. The requirement for environment protection and sustainability increases day by day. At this point, the raw materials must be reused and minimum waste must left to environment. Therefore, the upcyling and recycling of textile and clothing products are vital. Thus, the sustainability ratio will increase and an economic contribution will be made.

Key Words: Reverse logistics, Turkish textile and clothing sector, recycling, reuse, upcycling

REFERENCES

[1] Olorunniwo F.O. and Li X., 2010, Information sharing and collaboration practices in reverse logistics, Supply Chain Management: An International Journal, V:15, No:6, p:454-462.
[2] Abraham N., 2011, The apparel aftermarket in India- a case study focusing on reverse logistics, Journal of Fashion Marketing and Management, V:15, N:2, p:211-227.
[3] http://www.onalelyaf.com.tr.
[4] Altun Ş., 2010, Obtaining the general profile of recycling possibilities and textile and clothing wastes in Turkey, 109Y008 Numbered Tübitak Project Report (in Turkish).

DEVELOPMENT OF ENERGY SAVING MULTIFUNCTIONAL BLACK-OUT CURTAIN FABRICS

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ABSTRACT

Black-out curtains mainly block the light, and they are used in various fields to protect from light and UV radiation and personal privacy. As well as their light resistance (opacity), it is claimed that this curtains provide heat and sound insulation to a certain degree. In fact, heat and sound insulation properties of the regular black-out curtains are not so effective. Because, in black-out fabric production with coating, generally TiO_2, $CaCO_3$ and carbon black are used as fillers which are high thermal conductivity materials (i.e. lower heat insulation).

Black-out draperies are usually produced three-layered foam-coating technique which is a long and costly production procedure. Through this project, it is planning to develop high value-added black-out draperies with advanced functional properties without considerable increase in production cost.

By the use of alternative fillers which are lower thermal conductivity (preferably < 0.065 W/mK) as an alternative to the white pigments used in the coating (i.e. TiO_2 and $CaCO_3$), thermal insulation properties of these curtains can be improved to a pretty good level. On the other hand, it is possible to obtain electromagnetic shielding (EMI) property on the black-out curtain with the use of suitable metal powders besides carbon-black. Further, the use of highly reflective powders such as metal, silica, glass etc. in the top coat of the black-out curtains will also provide sun blocking property along with EMI property. That means energy saving from the AC in the summer. It is also possible to improve the sound insulation properties by selecting the fiber material/fabric construction and/or by a top coating with porous surface.

In short, the project aims to develop black-out draperies with advanced functional properties by using suitable fillers in right concentrations without changing the conventional production method. It features:

- Light and UV resistant (black-out)
- Thermal insulation and energy saving
- Protective effect against electromagnetic waves (EMI)
- Noise (sound) insulation

It will also possible to obtain conventional finishing functions such as flame retardancy, soil-release and dirt repellency as well as these advanced functions, when desired.

Key Words: Black-out curtain, energy saving, thermal insulation, sound insulation, electromagnetic shielding

REFERENCES

[1] ARICI, M. et al., Çift Camlı Pencerelerde Isı Geçişinin İncelenmesi, 4th Ege Energy Symposium, 21-23 May 2008, İzmir.
[2] ATMACA, E. and PEKER, İ., 1999, Sivas'ta Trafik Gürültüsü, Çevkor, 30, 3-8.
[3] Emfields, http://www.emfields.org/shielding/naturell.asp [31.01.2013].
[4] FUNG, W., 2000, Coated and Laminated Textiles, Woodhead Publ. Ltd., Cambridge, 1855735768.
[5] NEGRU, D. et al., 2012, Electrical Conductivity of Woven Fabrics Coated with Carbon Black Particles, Fibres & Textiles in Eastern Europe, 20, 53-56.
[6] ÖZMETE, Ö. 2009. Kronik Özofagial Striktür Gelişen Çocuklarda Oral Midazolam Deksmedetomidin ve Melatonin Premedikasyonunun Karşılaştırılması. Expertise Thesis, Çukurova University.
[7] ZOU, F. 2007, Energy Saving Curtains, Thesis (MSc), Gavle University.
[8] Ultra Sound, http://www.ultrasound-blinds.co.uk/blackout-roller-blinds.htm [15.02.2013].
[9] Wisegeek, http://www.wisegeek.com/what-are-blackout-curtains.htmblinds.htm [14.02 2013].

WOVEN YARN AND FABRIC FAULTS CAUSED DURING THE WEAVING PROCESS

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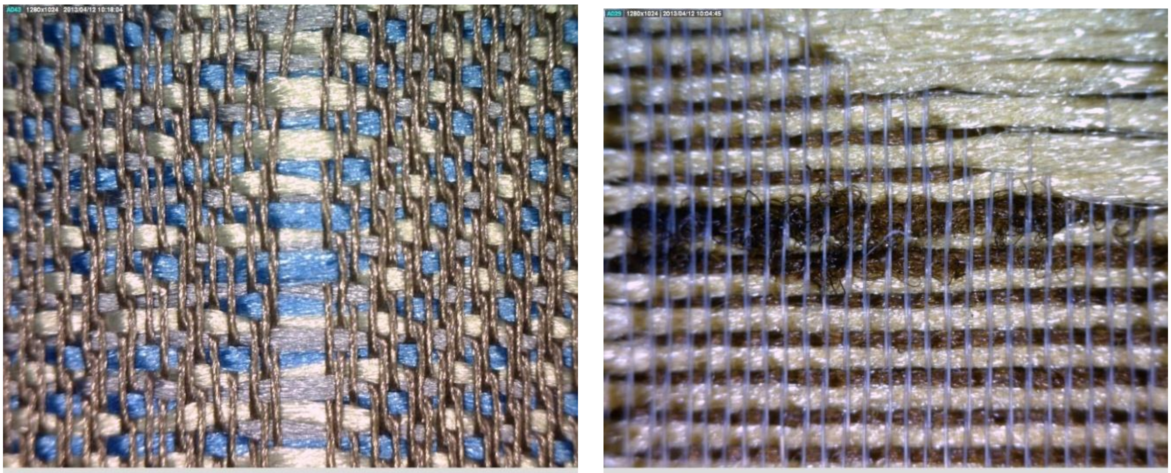
Fabric faults reduce fabric quality. This is the reason why such fabrics are only partially used for the purpose for which it has been woven. Due to high demands on material quality, it is necessary to separate them during cutting which is the reason for making the production more expensive. They are often the cause of quality reduction; therefore, they are considered more and more unusable or as waste material [1-6].

The conceptual framework of the research of this paper was the analysis of unusable fabrics caused by a fault during weaving. In order to protect environment and because of difficulties in waste disposal, recycling of fabrics made of various raw materials, the cause of fault formation in the fabric during the technological process and the way how to avoid them was investigated. A part of unusable fabrics came from the industry and it was impossible to make use of them or to recycle [7-9].

The most frequent faults during weaving were investigated in this work. Yarn faults and technical errors were investigated as well as the cause of formation and consequences. Work procedure and control were proposed in order to prevent their emergence and to reduce their frequency.



a) b)

Figure 1. Fabric faults a) In the warp b) In the weft

Key Words: Fabric quality, fabric fault, types of faults, fault systematization, waste textiles

REFERENCES

[1] PEACOCK J.: The Complete Fashion Sourcebook, London: Thames & Hudson Ltd, ISBN-13: 978-0-500-51276-0; ISBN-10: 0-500-51276-0 (2005).
[2] ROTHSTEIN N.: 400 Years of Fashion, London: V & A Publishing, ISBN 978 1 85177 3015 (2010).
[3] BOUCHER F.: A history of costume in the West, London: Thames & Hudson Ltd, ISBN 0-500-01416-7 (1996).
[4] LAVER J.: Costume and fashion a concise history, London: Thames & Hudson Ltd, ISBN 0-500-20348-2 (2002).
[5] KOVAČEVIĆ S., FRANULIĆ ŠARIĆ D.: The Influence of Weave and Shed Geometry on Tension and Deformation of Warp Threads, "1st International Textile, Clothing & Design Conference - Magic World of Textiles", Magic World of Textiles, Dragčević Z. (ur.), Zagreb, Faculty of Textile Technology, University of Zagreb, 2002. 199-204.
[6] SCHWARZ I., ŠABARIĆ I., KOVAČEVIĆ S., VINKOVIĆ M.: Traditional Slavonian Folk Costume in Contemporary Fashion Trends and in Haute Couture, Book of Proceedings of the 4th International Textile, Clothing & Design Conference - Magic World of Textiles, Dragčević, Zvonko (ur.), Zagreb: Faculty of Textile Technology, University of Zagreb, Zagreb, Croatia, 2008. (ISBN: 978-953-7105-26-6) 1012-1017.
[7] ŠABARIĆ I., BRNADA S., KOVAČEVIĆ S.: Designer solutions of weft distortion in striped fabrics, book of proceedings, of the 5th International Textile, Clothing & Design Conference, Dragčević, Zvonko (ur.), Zagreb, Faculty of Textile Technology, University of Zagreb, Zagreb, Croatia, 2010. 896-900.
[8] JEMO D., KOVAČEVIĆ S.: Textile technological analysis of the old fabric of large and complex patterns, Tekstil 60 (2011) 5, 265-270.
[9] ŠABARIĆ I., KOVAČEVIĆ S., BRNADA S.: Analyses of Work Study in Dawing-in in Warp Preparation of Weaving Process, Ergonomics 2013., Budimir Mijović (ur.) Zagreb, 2013. 133-138.

CHARACTERISTICS OF ATHLETIC APPAREL PRODUCTS

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Athletics is a term encompassing the human competitive sports and games requiring physical skill, and the systems of training that prepare athletes for competition performance. Athletic sports or contests are competitions which are primarily based on human, physical competition, demanding the qualities of stamina, fitness ad skill[1]. At this stage, the clothing comfort comes to the fore.

Slater defined comfort as "a pleasant state of physiological, psychological and physical harmony between a human being and the environment"[2]. The clothing comfort of sportswear is an important quality criterion. It affects not only the well-being of the wearer but also their performance and efficiency[3]. Sports apparel, driven by innovation in fibres, fabrics and garment manufacturing techniques, enables the athlete to `feel good' which, in turn, promotes better performance[4].

There are many factors to consider when selecting athletic apparel products. For the best athletic performance, the garments should neither physically restrict the athlete nor psychologically detract from the player's performance due to the concerns about how he/she looks. Aesthetic factors such as school colors, garment style, and uniform size and fit must be considered[5]. Additionally, athletics apparel products should be assisting the body natural ability to regulate temperature when running in a variety of conditions. The products keep runners comfortable, protected, fit and focused on performing at their best.

In this study, primarily the environmental conditions for athletes were examined. The characteristics of athletes' clothing were investigated by considering fabric properties, harmony of the body, garment pattern, manufacturing techniques and model.

Keywords: Athletics, clothing comfort, athletic garments, athletic garment manufacturing

REFERENCES

[1] http://en.wikipedia.org/wiki/Athletics_(U.S.)
[2] Cureklibatır Encan B., Temel C., Tama D., Öndoğan Z., Yurdakul B., Evaluation of certain fabrics' thermal comfort properties and a design suggestion for active sports, The International Istanbul Textile Congress, 2013, Istanbul, Turkey.
[3] Bartels V. T., 2005, Textiles in Sport, Chapter 9: Physiological comfort of sportswear The Textile Institute, Woodhead Publishing Limited, England, 364 p.
[4] McCann J., 2005, Textiles in Sport, Chapter 4: Material requirements for the design of performance sportswear, The Textile Institute, Woodhead Publishing Limited, England, 364 p.
[5] Wheat L.K., and Dickson M.A., 1999, Uniforms for Collegiate Female Golfers: Cause for Dissatisfaction and Role Conflict?, Clothing and Textiles Research Journal, 17:1, 1-10pp.

INVESTIGATION ON FLAMMABILITY AND COMFORTABILITY OF KNITS FOR HELMET LINERS

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INTRODUCTION

The most direct way to improve the safety of the fire-fighters is the creation of protective clothing with two functions: be flame-resistant, form a heat barrier and be comfortable. The overall function is to provide the fire-fighter with adequate protection from heat, flames, and other hazardous environments. However, this protection is often achieved at the outlay on the body heat balance. Knitted fabrics provide outstanding comfort qualities, and for long time have been preferred in many types of clothing. Designing a new fabric requires to predict its behaviour before the production of fabric. Therefore the investigation on the influence of various parameters of fabric properties and creation of a fabric design in accordance with the characteristic of relationships determined is very topical [1–3].

The goal of our research was to investigate the possibility to manufacture garment from knitted fabrics with lower flammability and also higher comfortability changing only construction of knit, i.e. number of yarns in the loop.

EXPERIMENTAL

The knitted fabrics from Nomex Delta TA 18 tex×2 yarns have been used for investigations. The knits where manufactured on the circular one bed 14E gauge machine with the same kind of pattern (single jersey) and with the same set of knitting machine (loop length in all variants was 5.1 mm). Four variants of knits where manufactured: I variant from single yarns, II variant from two folded single yarns, III variant from three folded single yarns and IV variant from four folded single yarns.

The 4 combinations of pockets from I variant (single fabric, two layers of single fabric, three layers of single fabric and four layers of single fabrics), 2 combinations from II variant (single fabric and two layers of single fabric), single layer of III variant and single layer of IV variant have been used in the investigations. The horizontal flammability test was used and the burning time up to the start until fabric or upper layer of pocket break-up has been measured.

RESULTS AND DISCUSSION

The number of yarns in the loop as well as the number of layers linear increased the burning time of knits. The number of yarns in the loop influences on flammability more than number of layers. Usage of four yarns in the loop increases flammability till 5.2 times (from 59.4 s of knit from single yarn till 310 s of knit from four folded single yarns) while usage of multilayer pocket increases flammability only 3.8 times (from 59.4 s of single knit till 226.8 s of pocket from four knits from single yarns).

The burning time has a medium correlation with air permeability and surface density. However, two areas with the similar burning time and with very different values of air permeability or surface density were found. Here the same flammability properties are possible to achieve with very high difference of air permeability and surface density values. The implication is that prediction and designing of clothing flammability in accordance with air permeability or surface density is impossible. It means, it is possible to increase comfortability of clothing do not decreasing burning time - to design clothing with higher air permeability or/and lower surface density.

All results were analysed in comparing that the same or similar surface density of knit is possible to design using different number of folded yarns in the loop, using the same number of knits layers from single yarns in pocket or changing both characteristics. It was found that the much higher burning time is possible to achieve using folded yarns than using the same number of layers in the pocket, especially when more than two layers of knits or folded yarns are used. The burning time of two layers pocket knitted from single yarns is lower only in 5.5 % than burning time of knit from folded two single yarns, while the same difference of burning times of three layers and four layers is in 25÷30 %. The burning time of two layer pocket is 2.6 time higher than single layer, while three and four layer pocket approximately is only 12 % higher than pocket with two and tree respectively. In addition, it is necessary to note, that in the case of two layers pocket it will be achieved the similar flammability as using two yarns in the loop.

CONCLUSION

Higher number of yarns in the loop as well as higher number of knits in multilayer pocket linear increase burning time of garment. Using different number of yarns in the loop it is possible to increase burning time of knit more than using the same number of knits in the pocket. On the other hand, such knit will have lower air permeability and higher rigidity. For garments where the rigidity is not very important property, it is better to use higher number of yarns in the loop than multilayer pocket. Such way also has some economical aspect – manufacture of one knit with higher number of yarns in the loop is cheaper than manufacture of multilayer pocket of knits from single yarns.

Key Words: Flammability, comfortability, knits

REFERENCES

[1] HOLMER, I,., Industrial Health 44 (2006) 404-413.
[2] SUN, G. et al., Textile Research Journal 7 (2000) 567-573.
[3] MIKUCIONIENE, D. et al., Fibres&Textiles in Eastern Europe 6 (2011) 71–74.

PHYSICAL AND MECHANICAL PROPERTIES OF CORONA DISCHARGE TREATED POLYESTER FABRIC

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INTRODUCTION

The Plasma and corona discharges are the eco friendly methods for treatment of the polymeric surfaces. These methods improve the surface with changing the bulk properties in a dry system without chemicals and water. The attention has been paid to improve the wettability, friction, adhesion, reflection of light, water repellency, soil release, printing, dyeing and other finishing process of textile fibres and fabrics by using plasma and corona technology [1].

The corona discharge occurs when a high voltage is applied between two electrodes. The electrons that are produces by this electrode are accelerated towards the isolator by a high voltage. The electrons collide with air particles, producing ozone and reach the substrate can split chemical bonds, and produces radicals on the surface of the substrate [2].

In this study the polyester fabric was exposed to corona discharge under different powers and number of passages. Some properties of corona discharge treated polyester fabrics were investigated. The wetting time, air permeability, strength, pilling, weight reduction, thickness, surface morphology properties of the fabrics were the selected properties for the experiments.

METHODS

The knitted polyester fabric was exposed to corona discharge under different powers and number of passages (500 & 1000 w , 30, 50 & 70).The thickness of the untreated and corona treated fabrics were investigated by the BS 2544-1987 standard test method and the instrument was SDL thickness tester made by UK. The pilling test was carried out according to the ISO 12945-2 test method by Martindale made by Nasj Sanj from Iran. The loss weight of the corona treated fabrics was determined by weighting the samples before and after corona treatment.

The wetting time of the fabrics were obtained by using the BS 4554 standard test method. Drop of distilled water was poured on the surface of the fabric by burette then wetting time of a drop was reported. The tensile strength test was carried out using the Testometric M500 25 CT and the air permeability was done regarding the ASTM D737:2004 test method. The surface morphology of the untreated and corona treated polyester fabrics was investigated by scanning electron microscope (KYKY, model: EM 3200, made by china) with the accelerated voltage of 25kv and the magnification of 2000.

RESULTS

The thickness results in Table 1 show a minor decrease in the thickness of corona treated polyester fabrics that might be because of the removing of the fleece from the fiber surface.

We can see this property in the results of the pilling tests, since the pilling rate decreased by corona discharge treatment. Corona discharge treatment reduced the weight of the treated fabrics as we can see the 3.7 % of reduction at 500w & 30 passages and it reached to 4.01 for high power and passages of the corona treatment (1000w, 70 passages). The etching effect caused by corona discharge and by removing the etched particles the weight reduced. In table 1 we can see the decrease in wetting time of corona discharge treated polyester fabric and wettability increased by the treatment.

Table 1. The results of thickness, pilling and loss weight of untreated and corona treated polyester fabrics

	untreated	500 W			1000W		
		30 P	50 P	70 P	30P	50P	70P
Thickness (mm)	0.52	0.5	0.51	0.49	0.49	0.47	0.46
Pilling	3	2-3	2-3	3	2-3	3	2-3
Loss weight (%)	-	3.7	3.81	3.85	3.89	3.91	4.01
Air permeability(ml/cm^2)	38.71	39.21	39.33	39.3	39.67	39.76	39.32
Wetting time (s)	16.7	12.9	12	10.7	10.2	9.5	8.3

Figure 1 shows the tensile strength and elongation at break for untreated and corona discharge treated polyester fabrics. The corona discharge treatment and increase of the corona passages increased the tensile strength and reduced elongation at break. The high energy electrons can etched the surface of the fiber so that changed the tensile strength and elongation.

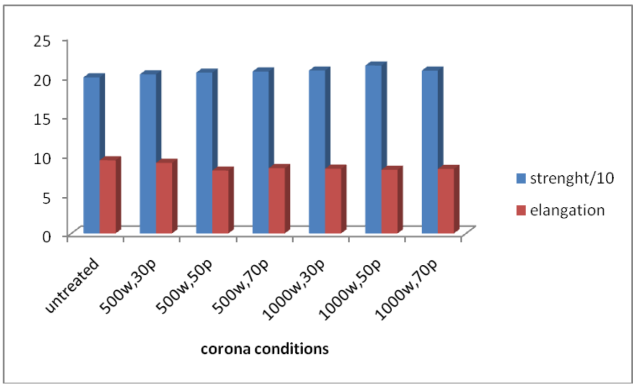

Figure 1. Tensile strength (N/10) and elongation at break (mm) for untreated and corona treated cotton fabrics

REFERENCES

[1] Nourbakhsh S, Ebrahimi I.: Different Surface Modification of Poly (Ethylene Terephthalate) and Polyamide 66 Fibers by Atmospheric Air Plasma Discharge and Laser Treatment: Surface Morphology and Soil Release Behavior , J Textile Sci Engg , 2. (2012) ,pp. 109.
[2] Rouette HK.: Encyclopedia of Textile Finishing , Springer, Germany, (2001), 429.

DIVING SUITS; AREAS OF USE AND PROPERTIES

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A diving suit is a garment or device designed to protect a diver from the underwater environment. There are five main types of diving suits. These are [1]:

- dive skins
- wetsuits
- semi-dry suits
- drysuits
- hot water suits

Dive skins are used when diving in water temperatures above 25 °C (77 °F). They are made from spandex or Lycra and provide little thermal protection, but do protect the skin from jellyfish stings, abrasion and sunburn.

Wetsuits are relatively inexpensive, simple, Neoprene suits that are typically used where the water temperature is between 10 and 25 °C (50 and 77 °F). The foamed neoprene of the suit thermally insulates the wearer [2,3].

Semi-dry suits are effectively a thick wetsuit with better-than-usual seals at wrist, neck and ankles. They are used typically where the water temperature is between 10 and 20 °C (50 and 68 °F).

Drysuit are used typically where the water temperature is between −2 and 15 °C (28 and 59 °F). Water is prevented from entering the suit by seals at the neck and wrists; also, the means of getting the suit on and off (typically a zipper) is waterproof.

Hot water suits are used in cold water [4]. An insulated pipe in the umbilical line, which links the diver to the surface support, carries the hot water from a heater on the surface down to the suit.

Diving suits make different materials; these are usually rubber, neoprene, polyurethane.

In this study, diving suits, their properties, areas of use, their accessories, materials that are used have been investigated.

Key Words: Diving suits, drysuits, wetsuits, neoprene

REFERENCES

[1] http://en.wikipedia.org/wiki/Diving_suit
[2] US Navy Diving Manual, 6th revision. United States: US Naval Sea Systems Command. 2006. Retrieved 2008-04-24.
[3] Jump up Fulton, HT; Welham, W; Dwyer, JV; Dobbins, RF (1952). "Preliminary Report on Protection Against Cold Water". US Naval Experimental Diving Unit Technical Report. NEDU-RR-5-52. Retrieved 2008-04-25.
[4] Mekjavić B, Golden FS, Eglin M, Tipton MJ (2001). "Thermal status of saturation divers during operational dives in the North Sea". Undersea Hyperb Med **28** (3): 149–55. PMID 12067151. Retrieved 2008-05-05.

DETERMINATION OF THE PROPERTIES OF FOAM AND BACKING FABRIC TO PROVIDE HIGH THERMAL COMFORT FOR CAR SEATS

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Car seat upholstery generally consists of three components. (Figure 1) The top is surface fabric, the bottom is backing fabric and foam is located in between these two materials. Choice of foam and backing fabric material is as important as choice of surface fabric for car seat upholstery fabric that improved thermal comfort properties. For this purpose in the study carried, woven and knitted fabric as surface fabric, two different foam materials and four distinct backing fabrics were used.

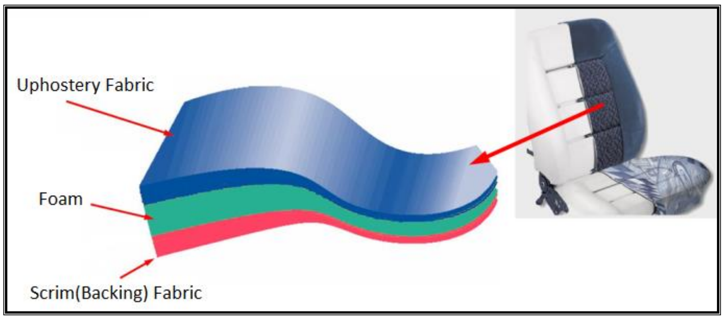

Figure 1: Automotive seat upholstery fabric components (Armakan vd.,2010)

Backing fabric structure selection is changing depends on the surface fabric structure that is used on top of the upholstery fabric. Circular or warp knitted backing fabrics are preferred for this purpose. Rarely, woven or nonwoven fabrics are also used. When woven fabric that has high dimensional stability used as a surface, circular knitted backing fabric that has high elasticity is preferred, in order to improve balanced elongation for upholstery fabric. When knitted fabric that has relatively high elasticity used on the top, warp knitted backing fabric is selected, to obtain balanced elongation. Generally backing fabric has 30 g/m^2-150 g/m^2 weight ranging is used in the market.

The aim of this study, to determine appropriate foam and backing fabric material for lamination of woven and knitted surface fabric that used as a car seat upholstery providing high thermal comfort.

For this purpose; circular knitted backing fabrics which weight are 30 and 50 gr/m^2 are used for lamination of woven surface fabrics and warp knitted backing fabrics which weight are 50 and 60 gr/m^2 are used for lamination of circular knitted surface fabrics. Woven and knitted fabric used as a surface fabric has respectively panama and interlock structure which is commonly used in automotive industry. These fabrics are produced from %100 polyester yarn.

Keywords: automobile upholstery fabric, thermal comfort, foam, backing fabric

A NEW METHOD FOR MANUFACTURING OF FANCY YARN: FANCY YARN PRODUCTION WITH FLOCKING TECHNIQUE

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In recent years, the products with unusual effects have been used more frequently rather than standard (i.e. usual, regular) products in the development of the high value-added textile products and fashion trends. Fancy yarns have taken a special place in this kind of designs. As a result of this, the importance of fancy yarns has increased compared to the past. Developing new fancy yarn effects besides known fancy yarn effects will make a good contribution to the designing of the high value-added new textile products.

Fancy yarns have been produced for long years using direct and indirect production technologies. The improvement of new production technologies plays a crucial role in the development of new yarn structures and effects. The project team has started to study on a new project aiming at “manufacturing of fancy yarn by means of flocking technic”, with the helping of the experiences gained from developing the production technology of the standard flock yarn. Preliminary studies have shown that many different kinds of fancy yarn effects which have not been produced so far can be obtained using this technic.

Regular flock yarns have been produced from standard yarns covered with short flock fibres by electrostatic flocking methods. The project team has completed a SAN-TEZ project titled “Prototype Flocking Machine Design and Manufacturing, and Flock Yarn Manufacturing” in previous years”. At the end of the project, a flock yarn manufacturing machine with small capacity has been developed and flock yarns have been successfully manufactured on this machine for the first time in Turkey. Two different patents (Patent No: TR 2008 08141 B and TR 2010 04301 B), knowledge and experiences obtained from this project are expected to make a contribution to the realization of this new project.

The most important part of this project consists of a new "adhesive application unit" which has already been designed to produce fancy flocking effects. This unit and a software to be developed will be set up on the conventional flock yarn machine in this project. After that, fancy yarn effects can be produced on standard yarns, flocked yarns (flock- on- flock), chenille yarns and some other special yarn kinds using this system.

In this system, at the same time, standard yarns can be covered with silver and gold and so on. Besides; the project includes the followings;

- Obtaining fancy yarns using different flock fibres (fibre material, length, thickness, colour etc.), and other special effect materials such as silver and gold powder.
- Obtaining fancy yarns by changing the voltage applied on the electrostatic systems (on/off)

In conclusion, new flocked fancy yarns with the effects which have not been produced so far in the world can be produced using the new systems, software and methods which are to be developed within this project.

This project will allow to develop the prototype system and different methods for the production of the flocked fancy yarns for the first time in the world. The new fancy yarn effects to be produced by means of these systems will contribute to the textile industry to obtain and design the high value-added special fabrics.

REFERENCES

[1] Özdemir, Ö.,2012, "Fancy Yarn Technology" Course notes, Uludağ Üniversity, Engineering Faculty,Textile Engineering Department.
[2] Gong, R. H., Wright R. M.,2002, "Fancy Yarns, Their Manufacture and Application," Woodhead Publishing Limited, Cambridge, U.K, 150 p.
[3] Orhaneddin, B., 2010, "Prototip Floklama Makinesi Tasarımı, İmalatı ve Flok İplik Üretimi" Master Thesis, Uludağ Üniversity, The Institute of science Fen Bilimleri Enstitüsü.
[4] Kanık, M., 2008, Special printing methods, Course notes, Uludağ Üniversity, Engineering Faculty, Textile Engineering Department.
[5] Anonim, 2008, Rallytex, Flockgarn Kataloğu.
[6] www.flock.de
[7] www.flock.ru
[8] www.swicofil.com
[9] http://flocking.org
[10] www.flockcan.com.tr
[11] Goerens, R. L. 1988. Flocked Yarn, Patent. No EP 0179340 B1
[12] Seeling, O. N., Hills, W. and Seeling, G. K, 1968, Covered Elastomeric Yarns, Patent no US 3382662 A

FABRIC HANDLE: EFFECT OF SILICONE BASED SOFTENING AGENTS

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Handle is one of the main parameters that effect the consumer admiration and the value of the products. There are many studies in the literature that deal with the handle behaviour of the fabrics, aiming better tactile properties by using different textile finishes. Softening treatment, which can be applied by numerous chemical agents, is carried out to improve the handling characteristics of the fabric. Silicones, one of the widely used one, are the organo metallic polymers derived from the abundant raw material on earth, sand. A variety of silicone technologies have application in the textile industry for this purpose. They provide softening by reducing the coefficient of friction without reducing wet or dry strength of the material. They turn a hard and a brittle fabric into a soft pleasant textile. In this study, five different silicone based softening agents were applied to the knitted fabrics produced from viscose/polyester fibres. Afterwards, handle characteristics such as drapebility, bending behaviour, roughness, thickness, compressibility and elastic recovery properties were measured. The results were analysed by using statistical methods.

Key Words: Fabric handle, tactile properties, softening, drapebility, bending, surface roughness, elastic recovery

REFERENCES

[1] Valatkienė, L., Strazdienė, E., Accuracy and Reliability of Fabric's Hand Subjective Evaluation, ISSN 1392–1320 Materials Science (Medžiagotyra). Vol. 12, No. 3. 2006
[2] Mäkinen, M., Meinander, H., Luible, C., Magnenat-Thalmann, N., Influence of Physical Parameters on Fabric Hand, Proc. of the Workshop on Haptic and Tactile Perception of Deformable Objects, Hanover (HAPTEX'05), pp. 8-16, December 2005
[3] Juodsnukytė, D., Gutauskas, M., Kraulėdas, S. Influence of Fabric Softeners on Performance Stability of the Textile Materials, Materials Science (Medžiagotyra) 11 (2) 2005, pp. 179 – 182.
[4] Tickel, A.R., The Evaluation of Three Types of Fabric Softener, A Thesis in Clothing and Textiles, Texas Tech University, Master of Science in Home Economics, August, 1974
[5] Manickam, M.M., Silicone chemistry for fabric care, Colourage, vol 56, issue 22, p86, Nov., 2009
[6] Nostadt, K., Zyschka, R., Softeners in the Textile Finishing Industry, Colourage, January 1997, pp. 53-58
[7] Schindler, W.D., Hauser, P.J., Chemical finishing of textiles, Woodhead Publishing Series in Textiles No. 32 (2004)
[8] Andriot, M., Chao, S.H., Colas, A.R., Cray, S.E., deBuyl, F., DeGroot, J.V., Dupont, A., Easton, T., Garaud, J.L., Gerlach, E., Gubbels, F., Jungk, M., Leadley, S.R., Lecomte, J.P., Lenoble, B., Meeks, R.G., Mountney, A.W., Shearer, G.N., Stassen, S., Stevens, C., Thomas, X., and Wolf, A.T., "Silicones in Industrial Applications" In: Silicon-Based Inorganic Polymers, De Jaeger, R. and Gleria, M., (Eds.), Nova Science Publishers, New York, 84, 2009.
[9] http://www.tx.ncsu.edu/texlabs/equipment-detail.cfm?labid=1&equipmentid=114
[10] http://www.textileweb.com/doc/pneumatic-fabric-stiffness-tester-0001
[11] http://aeipro.com/files/congresos/2009badajoz/ciip09_1728_1836.2716.pdf

WRINKLE RECOVERY BEHAVIOUR OF THE FABRICS CONSTRUCTED WITH PLIED YARNS

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The appearance of the garments is significant to fulfill the requirements of the consumers. Therefore, it is important to achieve desirable appearance and quality parameters on the structure and to avoid undesirable defects. Crease is mostly an undesirable property for the textile fabrics. Wrinkle or crease recovery is defined as the property of a fabric that enables it to recover from folding deformations. When fabrics are crumpled and then allowed to recover, the degree of recovery will depend on the morphology, inherent structure of the fiber and fabric construction. Wrinkles can occur in fabrics during the production; however they more often appear in textile end products when the fabrics are subject to creasing, shearing, compressing, bending, bulging, or washing in use and care. In this paper, fabrics, which were produced from plied yarns spun in 3 different twist level and woven in 3 different weft densities were tested for their crease recovery angles. Thereafter, the results were compared and evaluated.

Key Words: Wrinkle recovery, crease recovery, crease recovery angle, woven fabrics, plied yarns.

REFERENCES

[1] Shi, F., Wang, Y., Modelling crease recovery behaviour of woven fabrics, The Journal of The Textile Institute, Vol. 100, No. 3, 218–222, April, 2009
[2] Bilgen, M., Wrinkle Recovery for Cellulosic Fabric by Means of Ionic Crosslinking, North Carolina State University, Degree of Master of Science, 2005
[3] http://www.tikp.co.uk/knowledge/material-functionality/crease-and-wrinkle-resistance/basic-principles/?print=true
[4] http://www.sdlatlas.com/product/46/Crease-Recovery-Tester-+-Loading-Device
[5] http://textile-test-equipment.com/product/Shirley-Crease-Recovery-Tester-114.html
[6] Srikrishnan, M.R., Vellingiri, K., A Novel Approach of Synthesis of Polycarboxylic Acid and Dimethylene Urea for Improving Dimensional Stability of Cotton and Silk Fabrics, Int. J. Chem. Res., (10-32), June-May (2012)
[7] http://nptel.ac.in/courses/116102029/62
[8] Hussain, T., Ali, S., Qaiser, F., Predicting the Crease Recovery Performance and Tear Strength of Cotton Fabric Treated with Modified N-Methylol Dihydroxyethylene Urea and Polyethylene Softener, Color. Technol., 126, 256–260, 2010
[9] http://www.james-heal.co.uk/en/other-instruments

MODIFICATION OF COTTON FABRIC HYDROPHOBICITY BY FUNCTIONALIZED POLYSILOXANE

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In recent years, interest in the investigation and production of highly hydrophobic natural textiles has increased considerably. Waterproof properties are important for different purposes, such as protective clothing, stain-resistant fabric, and clothing for medical personnel. Several challenges must be addressed when developing waterproof coatings: the texture, mechanical properties, density, flexibility and coloring of the basic fabric must all be retained, and the coating must survive the washing process. There are currently many methods for textile modification that impart hydrophobicity, but many of them have disadvantages.

We investigated the influence of fluorinated polysiloxanes on the hydrophobicity of cotton textiles.

To obtain water repellent fabric, two types of difunctional polysiloxanes with different ratios of functional groups, were used.

- poly[dimethyl-co-(octafluoropentyloxypropyl)methyl-co-(trimethoxysililethyl) methyl]siloxane 9:9
- poly[dimethyl-co-(octafluoropentyloxypropyl)methyl-co-(trimethoxysililethyl) methyl]siloxane 12:6

The fluorinated groups are responsible for the hydrophobic effect and lowering of the surface's free energy. The presence of the alkoxy groups enable polysiloxanes to covalently bond to the modified surface. Polysiloxane forms a silica layer on the surface of textile which further increases hydrophobicity.

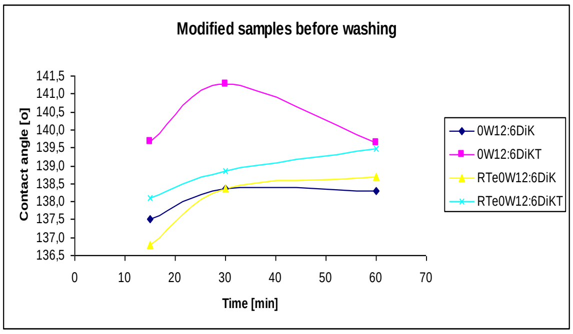
A cotton fabric was bleached using the pad-batch process. The modification was performed by either a one or two step process. In both processes polysiloxane was hydrolysed in aqueous isopropanol over one hour and the cotton samples were immersed in a siloxane solution by a dip coating method. Coating was carried out for 15, 30 or 60 minutes at room temperature or 80ºC. All samples were then dried at 80ºC and cured at 130ºC. In the two step process, pure silica phases were synthesized on the cotton fabric by a sol-gel method before the hydrolysis and dip coating step. The silica sol was produced by stirring tetraethylorthosillicate aqueous acetic acid for 16 hours and then the fabric was immersed for 40 minutes.

The durability of the modification was assessed by washing the samples with distilled water at 60º0C for 1 hour.

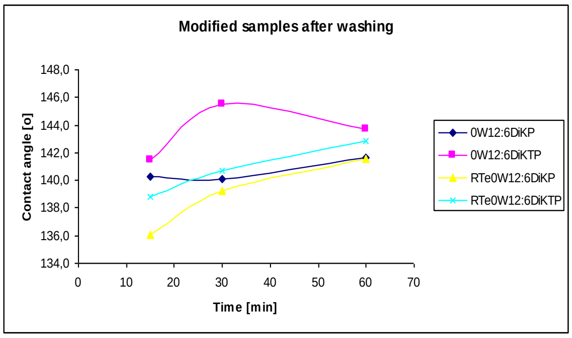
Water contact angle measurements were used to characterize the ability of fluorinated polysiloxane to modify the wettability of cotton textiles.

The effect of modification time on the water contact angle (WCA) of cotton fabrics before (a) and after (b) washing.

a)



b)



RTe – two step process (sol-gel + chemical modification), **OW12:6-** poly[dimethyl-co-(octafluoropentyloxypropyl)methyl-co-(trimethoxysililethyl) methyl]siloxane 12:6, **DiK** – dip coating process, **T** – reaction at 80^0C, **P** – washing process

Analysis of the wetting angles showed that all methods of modification increased the hydrophobic character of cotton fabric. One step modification at 80ºC gave the best results with a dip coating period of 30 minutes (WTA 145^0). For the two step modification, we can clearly see that the wetting angle grows as the time of modification increases.
It should be noted that the wetting angles after the washing period did not diminish, which demonstrates the strength of impregnation and formation of covalent bonds between hydroxyl groups of the fabric and the modifying agent.
After the modification process, the fabric remained elastic, with the same texture and color.

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REFERENCES

[1] N.A. Ivanova, A.K. Zaretskaya *Protection of Metals and Physical Chemistry of Surfaces*,2011, Vol 47, 361-371.
[2] K. Dopierała, H. Maciejewski, J. Karasiewicz, K. Prochalska *Applied Suface Science,* 2013, Vol 283, 453-459.
[3] Li H, Tabil L.G., .; Panigrahi S, *Journal of Polymers and the Environment* 2007, Vol 15, 25-33 .
[4] Xu Q.F., Wang J.N., Sanderson K.D., *Journal of Material Chemistry* 2010, Vol 20, 5961-5966.
[5] Erasmus A., Barkhuysen F.A., *Indian Journal of Fibre & Textile Research* 2009, Vol 34;377-379.
[6] Bae G.Y., Min B.G., *Journal of Colloid and Interface Science* 2009, Vol 337;170-175.

TAILORING IN THE OTTOMANS IN THE PROCESS OF MODERNISING AND THE FIRST EFFORTS IN SARTORIAL TRAINING FOR TAILORING

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Modernization fact was gratefull for its existence and progress which depends on technological innovations, developments, enterprises and newnesses. Tanzimat period had been found an application area in political and social life to put them in order. Garmentchanges was the most important force for re- shaping of the Ottoman women and men. We can understand the importance of the changes when we consider that in Ottoman there was almost no changes for man and woman garments for centuries which had similar formal elements.

European countries had been lived similar process and with technological developments they used the newnesses which had been created for garments, for the production and sewing of garment models and patterns and they transformed their knowledge into theoretical publications. They transformed the inventions especially in this subject to books which were completed with theoretical knowledge and sold to Tailor Schools and Academies.

In Ottoman, producing and selling of the modern wearing which had been accepted by director group, were provided from the shops “Bon Marché”. Almost all of these shop owners were foreigners. These garments had been sewed in Europe and looks like todays clothes. They were produced as ready to wear and we could meet dominance of the shops which sold garments to women, men, officers, officials, children and almost all people.

When we started to study of changes of man garment in Ottoman, we have to study Ottoman tailors, first publications and articles which used for teaching the garment knowledge to our women. Until to the first years of constitutional monarchy, we could see nonmuslim tailor masters whose learned tailor knowledge from Istanbul to Paris, London, Berlin etc. because of difficulty of finding muslim tailors. They had great prestige in the garment market for very long years as modern garment producers.

Later, most of Ottoman tailors learned the clues of the profession from “Tailor Schools and Academies” in their country and taught to others. There were many valuable Ottoman tailors like Mustafa Refik, Osman Zeki Bey and Behire Hakkı which were the leaders of the tailor activities; their publications inform us for the circumstances, difficulties and achievements in their period.

Key Words: Tailoring, fashion, ottoman, pattern, tailoring education

FORMS OF CHITOSAN BIOPOLYMER AND THEIR TEXTILE APPLICATIONS

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Chitosan is prepared from chitin, the second most abundant natural polymer in the world. It is primarily composed of glucosamine and N-acetyl glucosamine residues with a 1,4-β-linkage. It can be obtained by deacetylation of chitin, which is produced from shells of crustaceans, insects [1].

The first discovery of chitin was in mushrooms by Henri Bracannot (1811), a French botanist and director of botanical gardens at the academy of science in Nancy. In 1823, chitin was isolated from insects and was got its name when another French scientist, A. Odier named it "chitine" which simply means "tunic" or "coverage" in Greek. In 1859, C. Roughet a chemist discovered that chitin could be transferred into water soluble form through some chemical reactions. After that in 1870, this modified chitin was named chitosan [2]. In spite of early descovery of chitin and chitosan, a number of researchers have investigated wide range of uses of chitosan in recent years.

The applications of chitosan include uses in a variety of areas, such as pharmaceutical and medical applications, paper production, textiles, wastewater treatment, biotechnology, cosmetics, food processing and agriculture. The unique properties of chitosan including availability, biodegradability, biocompatibility, bioactivity, non-toxicity as well as good adhesion and sorption are the major reasons for its multiple applications. Another main reason for this increasing interest of chitosan is its wide range of physical forms which can be obtained by using an appropriate technological process. Chitosan and its blends exist in various physical forms including resins, microspheres, hydrogels, membranes and fibers. The selection of one particular physical form depends mainly on application area [3,4].

Due to the significance of the physical forms of chitosan in various fields of science and technology, this study were compiled physical forms of chitosans as well as its textile applications.

Key Words: biopolymer, chitosan, chitosan forms, hydrogel, fiber.

REFERENCES

[1] HONANKAR, H. and BARIKANI, M., 2009, *Applications of biopolymers I: chitosan*, Monatsh Chem, 140:1403–1420.
[2] CHEBA, E.A., 2011, *Chitin and Chitosan: Marine Biopolymers with Unique Properties and Versatile Applications*, Global Journal of Biotechnology & Biochemistry 6 (3): 149-153
[3] EL-HEFIAN, E.A., NASEF, M.M. and YAHAYA, A.H., 2011, *Chitosan Physical Forms: A Short Review*, Australian Journal of Basic and Applied Sciences, 5(5): 670-677.
[4] LIM, S.H. and HUDSON, S.M., 2003, *Review of Chitosan and Its Derivatives as Antimicrobial Agents and Their Uses as Textile Chemicals*, Journal of Macromolecular Science Part C—Polymer Reviews, Vol. C43,No. 2,pp. 223–269.

OPTIMIZATION FOR NUMBERING OF CUT FABRIC LAYERS IN APPAREL INDUSTRY

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Productivity and costs become important as competitive pressure on the companies in apparel sector-which is an important sector for our country. Apparel industry needs high number of employee, so in order to increase productivity, studies for optimization in terms of time, labor, cost, quality, increasing automation and for reducing dependency to employee continues. Automation cannot be to applied fully, because the material used in apparel is not rigid. One of employee dependent operations is the first step in regulation section that meto label gumming process applied to all fabric layers. Labelling process became obligatory for preventing colour tone difference in serial production. Thus parts are brought together with the same number and precluded from sewing /processing the wrong parts. In general, more than one employee work with meto label gun.

In this study, it was targeted to investigate and optimize labelling process in the production processes of apparel sector. Labels attached might pose problems during and after sewing process. In some cases, removal of numbers could be forgotten. As a consequence of that, images are distorted especially in light coloured and fine clothes and the products are classified into second quality products. Sometimes to find label while sewing or removal of label from surface takes unnecessarily long time. In order to prevent these problems, labelling of cloth patterns should be applied via considering sewing positions. Removal of label at the beginning of sewing operation will be easier, since; label on pattern would catch attention of the sewer. In this study, positioning of labels on patterns will be explained in accordance with an appropriate process flow via considering all types of clothing patterns.

Key Words: Meto labelling, tone diversity, optimization, efficiency.

CLOTHING PROBLEMS WITH MATERNITY GARMENTS

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Pregnancy takes forty weeks, tree trimesters, nine calendar months or ten lunar months. A body starts to change after impregnation immediately [1]. The changes in core stability during pregnancy are determined by both mechanical and hormonal factors. During the growth and development of uterus where the fetus is developing, the abdominal wall is gradually stretching and by the end of pregnancy the abdominal muscles are stretched reaching the limits of their elasticity [2].

Figure 1. Dimensional change of body during pregnancy

In pregnancy period the changes of proportion are in regions: thoracic area, abdominal area, gluteal area, femoral area and arm area. The biggest change is in abdominal region (Figure 1) [1]. Pregnancy places a woman's body in a continual physiological and psychological adaptive state. It was therefore anticipated that these changes during pregnancy would have an effect on women's clothing preferences and wearing behaviors [3].

Maternity wear is a garment which is specifically designed for pregnancy stage of a woman's life [4]. Maternity wear was aimed at disguising the pregnant form. Women are expected to be on interiority rather than exteriority. Women are expected to collect goods and shop for the coming baby but not to spend huge amounts of time and money on adorning their own bodies [5].

The aim of this study is to determine the problems of maternity garments on fit and to reveal the difficulties during buying maternity clothes. The data was collected by questionnaire applied on 100 pregnant women, who live in Izmir. The obtained data analyzed by using statistical analysis software. In the result of the research, it was determined that the use of maternity clothes remained after fifth month of pregnancy. It has seen that, pregnant women commonly encounter problems in maternity pants.

Key Words: Pregnancy, maternity clothes, clothing comfort, satisfaction about maternity clothes

REFERENCES

[1] Komarkova P. and Musilova B., Pattern constructions of maternity wear, 7th International Conference – TEXSCI, 2010, Czech Republic.
[2] Zachovajevas P., Zachovajevienė B., Banionytė J., Siaurodinas A., Physical therapy and maternity support garment: influence on core stability and low back pain during pregnancy and after delivery, 4th International Conference – Physical Activity and Sport at University 2012, Lihuania.
[3] Sin Man S. H., Maternity garment treatment for the relief of low back pain, PhD thesis, The Hong Kong Polytechnic University, 2008, Hong Kong.
[4] Anand N., “Smart maternity wear”: an answer to longevity problem of maternity wear, Journal of Textile and Apparel, Technology and Management, 2012, Vol. 7 (3).
[5] Longhurst R., (Ad)dressing Pregnant Bodies in New Zealand: Clothing,fashion, subjectivities and spatialities, Gender, Place and Culture, 2005, Vol. 12, No. 4, pp. 433–446.

FUTURE SKILLS OF CAD SYSTEMS IN APPAREL INDUSTRY

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Recently, apparel enterprises began to accept the Mass Customization strategy to satisfy the customers' individual requirements with low costs and a high efficiency of mass production. This strategy is aimed at a market segment of some similar customers and focuses on satisfying the requirements of a group of similar people [1]. Mass customization and automated custom clothing is promising ways by which apparel manufacturers and retailers can create well-fitting clothing for their consumers [2]. Therefore, using Computer Aided Design (CAD) Systems become an inevitable factor for apparel industry.

Computer Aided Design (CAD) systems have been widely used in clothing enterprises and they have improved the efficiency of production greatly during the past thirty years [3]. In today's rapidly changing business environment CAD technology speeds up the product development process and shortens the time to market of fashion products [4].

Three-dimensional (3D) garment design is more intuitive and easy to generate a fitted garment. With the development of 3D laser scan and computer graphics, there is a tendency for the garment CAD to turn from two-dimensional (2D) to 3D [1]. Cloth simulation techniques provide a way of testing patterns by assembling 2D patterns in a computer system and draping them on a virtual human body [5].

Two-dimensional (2D) apparel patterns are created, imported into a three-dimensional (3D) simulation program and converted to a polygonal mesh that can be positioned around a 3D form representative of a human body. The ‘‘virtual fit’’ of the patterns formed to the body can be evaluated and modified to improve the fit of the simulated garment and the simulation can be changed accordingly for re-evaluation [6]. Garment shapes are accurately predicted by including material properties and external interactions [7].

CAD systems, which ease and speed up the processes, are widely spreading in textile and apparel industries. Therefore, it is crucial to track the improvements in these systems in order to keep up with today's harsh rivalry. In this study latest developments in 3D CAD systems will be researched.

Key Words: Computer Aided Design (CAD) Systems, 2D garment patterns, 3D virtual clothing, garment fit

REFERENCES

[1] Wang J., Lu G., Chen L., Geng Y., Deng W., Customer participating 3D garment design for mass personalization, Textile Research Journal, 2011, 81(2) 187–204.
[2] Song H. K. and Ashdown S. P., Development of Automated Custom-Made Pants Driven by Body Shape, Clothing and Textiles Research Journal, 2012, 30(4) 315-329.
[3] Liu Y. and Geng Z. F., Three-dimensional Garment Computer Aided Intelligent Design, Journal Of Industrial Textiles, 2003, Vol. 33 (1).
[4] Meng, Y., Mok, P.Y. and Jin, X., 2010, Interactive virtual try-on clothing design systems, Computer-Aided Design, 42, 310-321.
[5] Wang, C.C.L., Wang, Y. and Yuen, M.M.F., 2005, Design automation for customized apparel products, Computer-Aided Design, 37, 675-691.
[6] Kim D. E. and LaBat K., An exploratory study of users' evaluations of the accuracy and fidelity of a three dimensional garment simulation, Textile Research Journal, 2013, 83(2) 171–184.
[7] Fontana, M., Rizzi, C. and Cugini, U., 2005, 3D virtual apparel design for industrial applications, Computer-Aided Design, 37, 609-622.

RETROREFLECTION PROPERTY CHANGE AFTER VARIOUS EXPOSURES

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ABSTRACT

Retroreflective properties of safety garments increase worker safety under low-light level conditions. The retroreflection quality parameters of the safety garments have to fulfil the minimum requirements not only the first time you wear them. After washing and wearing the garment for a long time, the quality of the reflective tape could reduce, thus it vitally effects the safety of the garment. It must have sufficient retroreflective properties, after various exposures and under different environmental conditions. For this purpose retroreflective sheeting, which was used in the safety vests was supplied and this sample (original sample) was subjected to various operations such as, abrasion, flexing, folding at cold temperatures, temperature variation, washing, dry cleaning and influence of rainfall. The coefficients of retroreflection values of retroreflective sheeting were measured. The results were compared by using statistical methods.

Retroreflective materials must have sufficient retroreflective properties and must provide complete protection of visibility in the dark operation conditions. Since these materials were used in different environmental conditions, their performance could change according to the applied exposure. Therefore, in order to measure the effect of exposures on retroreflective properties of materials, 7 different types of deformation were conducted and coefficient of retroreflection values after these deformations were measured.

The non-deformed (original) retroreflective material must provide the illumination amount of over 330 cd/lx.m^2 according to the standard BS EN 471:2003. And considering the test result, the non-deformed retroreflective sample shows 527,4 cd/lx.m^2 retroreflective value, which indicates that it has a sufficient performance.

For supplying the safe working conditions to the workers, the retroreflective properties must exceed the 15 cd/lx.m^2 under the rainfall according to the same standard BS EN 471:2003. The test results show that retroreflective material fulfils 60 cd/lx.m^2 luminance performance successfully.

Under different environmental conditions and after the processes like washing and dry cleaning, retroreflective sheetings fulfil the required retroreflective characteristics. According to the standard BS EN 471:2003 after the exposures (abrasion, flexing, folding at cold temperatures, temperature variation, washing, dry cleaning), the retroreflective material must exceed 100 cd/lx.m^2 illumination performance. Test results show that, after all these deformations retroreflective materials show great luminance characteristics.

The results of original sample and the samples which were under the exposure of abrasion, washing, folding and temperature variation were not found statistically different.

However, dry cleaning and flexing deformations and rainfall reduce the retroreflective properties significantly. Influence of rainfall has the highest effect on retroreflection property. Therefore, the measured value under the influence of rainfall is the lowest.

Keywords: Retroreflection, safety garments, warning clothing, sign luminance.

REFERENCES

[1] Reflective material on road vehicles, Information Sheet, October 2010, Department for Transport, (web: http://assets.dft.gov.uk/publications/dft-information-sheets/reflective-material-on-road-vehicles.pdf)

[2] Reflexite® EN471 Technical Brochure (web: http://www.fashionsystems.net/downloads/EN471%20technical%20brochure%20EN_lowress.pdf)

[3] **Health and Safety Executive** (2011), High-visibility clothing, WPT11 08/11, Published by the Health and Safety Executive.

[4] http://www.cvam.info/index.php?page=articles.night_riding

[5] Delta RetroSign® Retroreflectometer Technical Manual

[6] **Lloyd, J.** (2008) A Brief History of Retroreflective Sign Face Sheet Materials, Understanding Retroreflectivity

[7] **Paulus, S. C.** (2010) A Retroreflective Sheeting Selection Technique For Nighttime Drivers' Needs, Master of Science Thesis, Texas A&M University

[8] Zehntner Testing Instruments, Basic Principles Retroreflection RL (night visibility) of road markings caused by Glass Beads: Version 1.4 dated 13 May 2008

[9] BS EN 471:2003

[10] ASTM E1709 – 09

USING GAMES AS TEACHING AND LEARNING TOOLS IN ENGINEERING EDUCATION – A CASE STUDY

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In engineering education the learning methods must be adapted to the actual learning requirements that are focused more on the skills and abilities than on quantity of knowledge acquisition. An active participation and involvement of students in the process of their learning can be stimulated through the use of serious games.

The purpose of this paper is to describe how the game-based learning is working in academic context, how we have used it and what kind of experiences we have got of it. One of the objectives of using serious games for formative purposes is to help students to improve their learning and thinking skills.

According to Wikipedia [1], "*Game based learning (GBL) is a type of game play that has defined learning outcomes*". In case of using games for learning, the educational value is not diminished by fun. On the contrary, they are designed to help achieving a balance between both of them [2]. The use of games for education of students in engineering has proven its success in many universities [3, 4, 5] and its advantages was taken into consideration by the authors.

This paper presents how a practical laboratory within the curricula of "Knitting and Clothing Technology" BSc program at the Faculty of Textiles, Leather and Industrial Management from Iaşi, Romania, have been taught experimentally through the game-based learning method.

The presented case study refers to "Loop forming process" unit of the laboratory activities of the "Basics of Knitting Technology" course that was adapted to game-based learning in terms of content and procedures.

In the presented case study, the game named "Loop forming" has the features that can be found in literature for those used for learning purposes [6]: players, story, rules, goals, outcomes, feedback, score, rewards.

The game was designed in php and html programs. The user interface allows the player (student) to interact with game elements, for example: play, load/save, end game, options buttons, and exit. The interface also includes some built-in information: game name, variance, rules. At the end of game, the score and time consumed are given. The game was designed so that it can be used both for learning and for assessment.

The new learning method was applied with two groups of twelve students each. Other two groups of students (considered as control groups) have studied using the usual method. The level of understanding through the acquisition of knowledge and abilities revealed the effects of the applied method.

The results of the research derive from the comparison between the performances of the students who were instructed in the two approaches. The students' performances were assessed by grading both the practical results given by the applied game and their knowledge about the subject by an individually taken quiz. The individual quiz was made of 18 multiple-choice questions. The results demonstrate better learning outcomes when using the game-based method, thus encouraging the teaching staff to pursue this further.

The paper gives an idea about teaching certain concepts and processes like those in knitting technology in the form of a game. Among the benefits from using games in learning that one can take into consideration are the followings:

- the students were more interested and involved in their learning when playing the game than when were just sitting and listening.
- the small-scale experiment may be replicated or adapted to other units within Knitting and Clothing Technology curricula which aim to equip students with clear understanding of technological processes.

In conclusion, the use of gaming as an additional learning tool has demonstrated its advantages and can be taken into consideration for making students learning more effective.

Key Words: game based learning, serious games, student centered learning, collaborative learning

REFERENCES

[1] Educational game, http://en.wikipedia.org/wiki/Game_based_learning, Accessed: nov. 2013.
[2] Zyda, M., 2005, From visual simulation to virtual reality to games, IEEE computer, 38(9), p.30-34.
[3] Teschler, L., 2013, Could gaming revitalize engineering education? http://machinedesign.com/engineering-education/could-gaming-revitalize-engineering-education, Accessed: nov.2013.
[4] Morsi, R., Jackson, E., 2007, Playing and Learning? Educational Gaming for Engineering Education, Proceedings of the 37th ASEE/IEEE Frontiers in Education Conference, Milwaukee, Wisconsin, USA, October 10 - 13, 2007**.** Page(s):F2H-1 - F2H-6, E-ISBN : 978-1-4244-1084-2 .
[5] Baalsrud Hauge, J.M., Pourabdollahian, B., Riedel, J.C.K.H, 2013, The use of serious games in the education of engineers, Advances in Production Management Systems. Competitive Manufacturing for Innovative Products and Services, IFIP Advances in IC T, Vol. 397, pp 622-629, ISBN 978-3-642-40352-1 (Online).
[6] Apostol, S., Zaharescu, L., Alexe, I., 2013, Gamification of learning and educational games, Proceedings of eLSE'2013 conference, April, 25-26, Bucharest, p.67-72, ISSN: 2066 - 026X (print) 2066 - 8821 (online).

ELECTRICAL PROPERTIES OF POLYANILINE/CARBON BLACK DEPOSITED POLYESTER FABRICS

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ABSTRACT

Conductive textiles have gained a great interest in last decades. Making a textile surface conductive can be carried out by adding conductive materials into textile substrate [1] or by depositing conductive polymers onto textile surface[2, 3]. Considering conductive polymer usage in this issue, polypyrrole and polyaniline are the most widely used conductive polymers in literature. Some studies have been done by using both conductive material and polymer at the same surface. For instance, Kim et al. have been coated nylon Lycra® woven fabric with electroless nickel/polypyrrole combination to produce flexible and electrically conductive textiles [4]. In another research, core-shell polyaniline/carbon black composite was produced followed by the deposition of platinum particles in order to improve the carbon mono oxide antipoisoning ability and catalytic efficiency of the platinum catalyst [5].

In this study, it was aimed to produce conductive polyester fabrics by deposition of carbon black (CB) and polyaniline. CB particles were pre-treated with nitric acid (HNO_3) in order to add carboxyl groups. By changing the oxidant ratio in aniline polymerization, fabric samples were deposited by CB/PANI. The deposited CB/PANI substrate has been characterized by Fourier Transform Infrared (FTIR) spectroscopy and Scanning Electron Microscopy (SEM) analysis. Samples then evaluated in terms of surface resistivity and weight increment respectively.

Key Words: Carbon black, polyaniline, polyester fabric, conductive textile

EXPERIMENTAL

Reagent grade aniline monomer was purchased from Sigma-Aldrich. Ammonium peroxodisulfate (APS) extra pure was purchased from Merck and used as dopant. As textile material 118 g/m^2 plain weaved polyester fabric (34 warp/cm, 32 weft/cm) was used. Carbon black particles (Vulcan XC72R, 10-20 nm in diameter) were purchased from Cabot Corporation, USA. CB particles were pretreated by boiling 4 mol/L HNO_3 solution for 4 h then washed with distilled water several times until pH 7, finally dried in an oven. The carboxyl groups of the pretreated CB particles were characterized by FTIR spectroscopy (FTIR; Perkin Elmer Spectrum, 100 ATR-FTIR). The pretreated CB particles were added to the 1 mol/L H_2SO_4 solution and ultrasonicated for 1 h just before used. 20 mL 0.2 M aniline solution and 20 mL CB/H_2SO_4 solution were used in all samples. After mixing the monomer and CB solutions, 10x10 cm dimension fabric sample was added to the solution and mixed by magnetic stirrer in an ice bath (0-5 ^oC). After 30 min APS solution in various molar amounts was added slowly to the system. Polymerization reaction was completed in 4 hours until green polyaniline particles were observed on the fabric surface. The polyaniline deposition on fabric surface was proved by weight increment, SEM images (SEM; JEOL Ltd, JSM-5910LV) and surface electrical resistivity (Keithley 6517A Electrometer/High Resistance Meter) measurement respectively.

RESULTS AND DISCUSSION

The FTIR spectrum of pure and acid treated CB particles was seen in Fig. 1. Accordingly, the densities of the carbonyl and hydroxyl peaks were increased after acid modification. The carbonyl peak was formed at 1720 cm-1 after acid treatment.

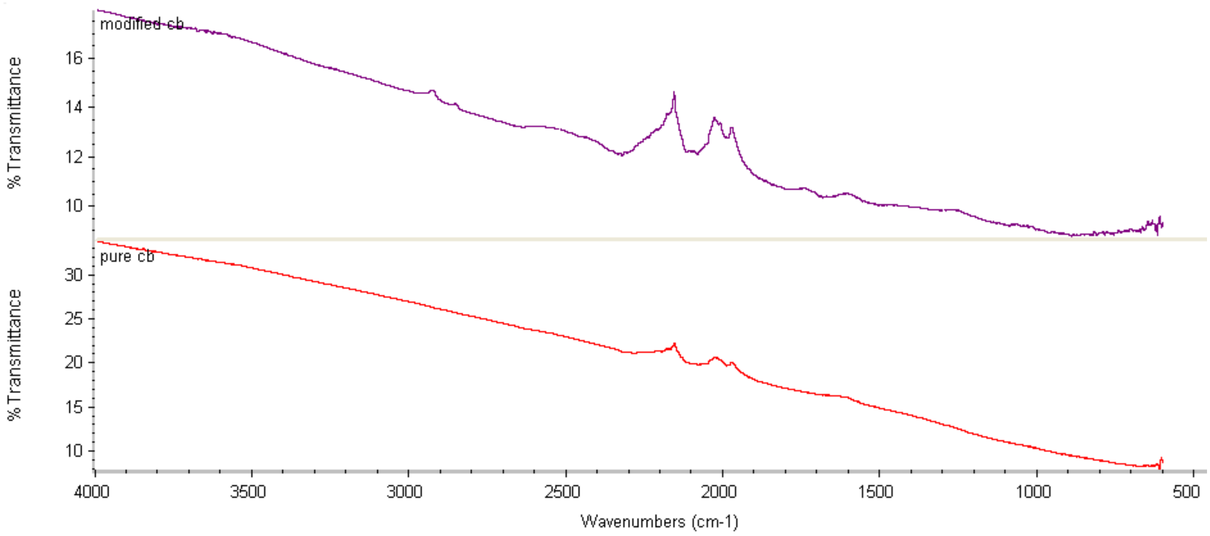

Figure 1. FTIR spectra of pure and modified CB particles

Table 1 shows the surface resistivity and weight increment values of the CB/PANI deposited polyester fabric samples at various dopant concentrations. In order to see the CB affect to the electrical conductivity, the best APS concentration was repeated without CB addition to the polymerization process. According to the results, the best conductivity value and the highest weight increment were observed at 0.2 M APS concentration without CB addition.

Table 1. The surface resistivity and weight increment values of the CB/PANI deposited polyester fabrics at various dopant concentrations (at 1 V, 20 mA)

APS Molar Ratio (M)	Surface Resistivity (Ω/sq)	Weight Increment (g)
Raw Fabric	$8.60x10^{7}$	-
0.1	$3.11x10^{5}$	0.035
0.2	$2.19x10^{5}$	0.046
0.2 (without CB)	$1.35x10^{5}$	0.061
0.3	$2.31x10^{5}$	0.033
0.4	$8.49x10^{6}$	0.008

REFERENCES

[1] Cheng KB, Ramakrishna S and Lee KC. Electromagnetic shielding effectiveness of copper/glass fiber knitted fabric reinforced polypropylene composites. Composites Part A: Applied Science and Manufacturing. 2000; 31: 1039-45.

[2] Opwis K, Knittel D and Gutmann JS. Oxidative in situ deposition of conductive PEDOT:PTSA on textile substrates and their application as textile heating element. Synthetic Metals. 2012; 162: 1912-8.

[3] Åkerfeldt M, Strååt M and Walkenström P. Electrically conductive textile coating with a PEDOT-PSS dispersion and a polyurethane binder. Textile Research Journal. 2013; 83: 618-27.

[4] Kim BC, Innis PC, Wallace GG, et al. Electrically conductive coatings of nickel and polypyrrole/poly(2-methoxyaniline-5-sulfonic acid) on nylon Lycra® textiles. Progress in Organic Coatings. 2013; 76: 1296-301.

[5] Bo Q, Yiting X, Yuanming D, Xiaoliang P, Jiangfeng C and Dai L. Polyaniline/Carbon Black Composite as Pt Electrocatalyst Supports for Methanol Oxidation: Synthesis and Characterization. Journal of Applied Polymer Science. 2010; 118: 2034-42.

PHYSICAL PROPERTIES OF DENIM FABRICS AFTER VARIOUS DENIM WASHING FORMULAS

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ABSTRACT

Besides durability, design and fashionable, also, today fabric handling and comfort of a cloth are becoming into prominence. In general, consumers prefer a ready-made product by looking its softness-stiffness, hand, glossiness, and drape in other words its comfort properties. Nowadays, denim fabric has been gained a great importance considering its usage area from the work wear to the daily clothing. This type of fabrics can maintain their presence in the market by either applying different finishing methods on or applying different patterns on. Denim fabric washing process gives an effect to a specific product colour and appearance which enhance the denim fabric quality. In the washing process various chemical compositions are used with different pH values. These washing steps cause some defects on fibre and fabric surface thus the physical properties of the end product is an issue that should be considered in detailed [1-4].

In this study physical properties of the denim fabrics after various denim washing processes have been investigated. For this purpose, denim fabric samples have been washed by five different mostly used washing formulas in industry. After washing process, fabric samples have been investigated in terms of warp/weft densities, fabric weight, tensile strength, abrasion resistance and pilling tests respectively before and after washing processes. Regarding the test results the effects of different washing formulas on the physical properties have been analysed.

Key Words: Denim Fabric, Denim Washing, Abrasion Resistance, Pilling Test.

EXPERIMENTAL

Denim fabric samples have been washed according to the formulas which were given in Table 1. After washing steps, fabric weight and warp/weft densities have been measured. Tensile strength test was carried out according to the TS EN ISO 13934-1 [5] standard. Pilling and abrasion resistance tests have been applied according to the TS EN ISO 12945-2 [6] and TS EN ISO 12947-2 [7] standards respectively. Additionally, scanning electron microscopy (SEM; JEOL Ltd, JSM-5910LV) was used to observe the physical change of the fibre surface in micro scale.

Table 1. Washing formulas and pH values of the processes.

Washing Types	Washing Formula	pH
1	Sizing enzyme, stone enzyme, double rinsing, softening	7
2	Sizing enzyme, velour feather enzyme, double rinsing, softening	4.5-5
3	Sizing enzyme, feather enzyme, double rinsing, softening	4.5-5
4	Sizing enzyme, feather enzyme, hypo-bleaching, rinsing, softening	4.5-5
5	Sizing enzyme, feather enzyme, hypo-blue bleaching, rinsing, softening	4.5-5

RESULTS AND DISCUSSION

The fabric weight, pilling and warp/weft density values were given in Table 2. Tensile strength and elongation at break values can be seen in Table 3. Accordingly, a remarkable weight and tensile strength loss was observed. The highest weight and tensile strength loss and the worst pilling values were shown in the washing type-4 and 5 respectively. The reason is that in both washing formulas of 4 and 5, hypo-bleaching was used. This bleaching step causes fibre damage thus affects the physical property of the fabrics negatively. There was no remarkable change in warp/weft densities after washing.

Table 2. Fabric weight, pilling and warp/weft density values after washing processes.

Washing Types	Fabric Weight (g/m^2)	Pilling Values	Warp Density/cm	Weft Density/cm
Raw Fabric	163.7	5	42	26
1	147.3	4-5	43	26
2	135.4	4	43	26
3	137.4	4	43	26
4	131.1	3	42	26
5	134.4	3-4	44	26

Table 3. Tensile strength and elongation at break values after washing processes.

	Tensile Strength (kgF)		Elongation at Break (%)	
Washing Types	Warp Direction	Weft Direction	Warp Direction	Weft Direction
Raw Fabric	96.12	36.85	26.36	10.95
1	73.08	24.97	23.65	10.26
2	33.23	12.58	18.61	8.64
3	39.24	14.44	18.14	8.12
4	32.49	9.72	20.48	7.63
5	24.13	11.21	17.23	7.87

REFERENCES

[1] Değirmenci Z., Çelik N ., "An Investigation About Knitted Denim Fabrics Preferences" Electronic Journal of Textile Technologies, 2013, 7(2) 18-32.

[2] Gusakov, A. V.,Sinitsyn, A. P., Berlin, A. G., Markov, A. V., Ankudimova, N. V., "Surface hydrophobic amino acid residues in cellulase molecules as a structural factor responsible for their high denim-washing performance" Enzyme and Microbial Technology, 2000, Volume 7, Issue 9, 664-671.

[3] Yesilpinar, S., Bahar, S., "The effect of sewing and washing processes on the seam strength of denim trousers", 2007, 7 (10) 27-31.

[4] Arkady P., Alexander V. Gusakov, Sergei G. Grishutin, Olga A. Sinitsyna, Natalie V. Ankudimova, "Application of Microassays for Investigation of Cellulase Abrasive Activity and Back staining", 2007, Volume 89, Issues 2–3, 233–238.

[5] TS EN ISO 13934-1: "Textiles – Tensile properties of fabrics – Part 1: Determination of maximum force and elongation at maximum force using the strip method", 2002, p.14.

[6] TS EN ISO 12945-2: "Textiles – Determination of fabric propensity to surface fuzzing and to pilling – Part 2: Modified Martindale method", 2002, p.13.

[7] TS EN ISO 12947-2: "Textiles – Determination of the abrasion resistance of fabrics by the Martindale method – Part 2: Determination of specimen breakdown", 2001, p.13.

RISING TREND IN FUNCTIONAL TEXTILES "COSMETIC TEXTILES"

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Throughout the history, for the people dressed in order to veil or smarten up, beside the features as durability, aesthetics, design and fashion, functional properties of textile products began to be more important than ever. In recent years, cosmetic textiles take over as a rapidly growing and developing segment of functional textiles used in health and hygiene sectors, means new target groups and new markets for textile industry.

The wellness or health promoting aspects of textile finishes have gained great importance due to concept of wellness related to health and healthy living in the last times [1]. Wellness has derived from the words well being and fitness and means that a person feel herself physically and psychologically good. Wellness could be provided by body care, balanced nutrition, exercise and textile wear products [2]. Cosmetic textiles, which evaluated as wellness textiles(Tarakçıoğlu, 2008), are accepted one of the best examples of these wear products.

According to Cosmetic Directive (76/768/EEC), a ''cosmetic product'' is defined as any substance or preparation intended to be placed in contact with the various external parts of the human body or with the teeth and the mucous membranes of the oral cavity with a view exclusively or mainly to cleaning them, perfuming them, changing their appearance and/or correcting body odors and/or protecting them or keeping them in good condition [3].

Cosmetic textiles are textile materials which release substances or solutions in given time intervals and are claimed to have properties such as cleaning, perfuming, protecting and correcting body odors [1].

There is nowadays an increasing vogue for so-called cosmetic textiles which are essentially garments that are designed to come into contact with the skin which then transfer some active substance that may be used for cosmetic purposes. Especially in the developed nations people desire to live longer and look youthful, so there is now a demand for products which are designed to beautify and to combat ageing [4]. Large number of attempts on cosmetic textiles, cause the questions why textiles using for the cosmetic purposes. Consumers does not have enough information on these products, so although their interest in these products, they are skeptical. Cosmetic textiles, accepted as new generation under garments [5] are claimed to have cosmetic effects such as slimming, firming, moistening. However these claims are accepted only as marketing strategy by the consumers, because these claims are not supported by the science based studies. Also cosmetic textiles surround the body like a second skin and contact with the skin. Therefore it is very important for human health to determine the cosmetic efficacy of these clothes and their impacts on human skin.

As a result of the literature reviews on cosmetic textiles is a serious deficiency in this area is outstanding. In the study, it is aimed to investigate that the actual cosmetic effects are satisfied or not and to specify whether cosmetic textiles cause any itching, redness, irritation and other

adverse effects on the human skin, standard science based test methods about cosmetic textiles will be developed.
Cosmetic textile products developed and improved with this study, will ensure as well as high customer satisfaction with their comfort features, cosmetic efficacy and also ability to skin friendly product, will create a market where the high value added products are sold in the textile industry. Study method will contribute to the literature and guiding for further studies on this subject.

Key Words: Cosmetic, textile, wellness, skin.

REFERENCES

1. Singh, M.K., Varun, V.K. and Behera, B.K., 2011, Cosmetotextiles: State of Art, Fibres and Textiles in Eastern Europe, Vol. 19, No. 4(87), 27-33.
2. Tarakçıoğlu, I., 2008, Tekstil Sanayi Gelecekte Nerede Üretecek, Bölüm II. (www.orsad.org.tr/belgeler/orsad_26.pdf)
3. Pauwels, M. and Rogiers, V., 2007, EU legislations affecting safety data availability of cosmetic ingredients, *Regulatory Toxicology and Pharmacology*, 49, 308-315.
4. Holme, I., 2007, Innovative Technologies for high performance textiles, Society of Dyers and Colourists, 123, 59-73.
5. Teixeira, C.S.N., Martins, I.M.D., Mata, V.L.G., Barrerio, M.F.F. and Rodrigues, A.E., 2012, Characterization And Evaluation Of Commercial Fragrance Microcapsules For Textile Application, Journal of Textile Institute, Vol. 103, No. 3, 269-282.

A SAMPLE STUDY TO PLAN THE DESIGN AND COLLECTION PREPARATION PROCESSES IN CLOTHING INDUSTRY

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The customer have been obtained information about a product by perception manner of that product. Therefore, customer behaviour has been determined by how the customer perceive the products and services in their own backyard. In this respect visual design of the product offered to customer is very important in the clothing industry. Because preferring a product to other product else, liking and purchase decision of customer substantially depends on this visual design. [1]

Fashion industry works seasonal. Although it has been worked seasonal, the time intervals gradually shrinking. Later on the main season collections, it has become an important success factor to produce new designs and to make changes according to sold products by the constantly and to bring them together demands of the customer as soon as possible. [2]

It is necessary to have an active and effective marketing network in clothing manufacturing in order to cater the needs of the day and rapidly changing consumer tastes. In order to sell a product, visual appeal of the product is important than verbalize of the product. At first customer want to see the product which want buy. For this reason, designers and collections being prepared have become more important. [3]

Clothing firms produce for their own brands and aim to operate in the national and international markets, primarily are required to organize the design and collection management processes very well.

Management of design and collection preparation processes provide companies the advantage of acting quickly and flexibly in the market. Nowadays the fast fashion applications have gain intensity, these two criteria are vital for companies to achieve sustainable competitive advantage.

In this study, an application was performed to plan the design and collection preparation processes in a clothing company that carry out the production and retail sale of the classic men's clothing.

Planning of design and collection preparation processes performed by using the technique of Gantt chart in the study.

Key Words: Clothing industry, collection preparation, design planning

REFERENCES

[1] Mozota, B.B., ‘Design Management’, Kapital Medya Hizmetleri A.Ş. 2003, İstanbul.
[2] Sevil, B., ‘Moda Sektöründe Küresel Marka Yaratılması: Markalaşma Çalışmaları Üzerine Bir Uygulama’ Yüksek Lisans Tezi, Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü, 2006, İzmir.
[3] Molla, A., “Giysi Tasarım Aşamalarının İncelenmesi ve Hazır Giyim İşletmelerinde ki Tasarımcı Performansının Değerlendirilmesi” Yüksek Lisans Tezi, Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Giyim Endüstrisi ve Giyim Sanatları Anabilim Dalı, 2007 Konya.

SINGLE-BATH COMBINED DYEING OF UNTREATED COTTON FABRIC USING ULTRASONIC ENERGY

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Enzymatic pre-treatments of cellulosic materials and its blends are widely used processes nowadays and the pre-treatments undergo in mild and environmentally friendly conditions, compared with those in conventional processes. The possibilities of enyzmatic processes were experimented many times to use of amylase, pectinase, catalase or glucose oxidase etc. from the beginning to the end of the finishing processes of cellulosic materials and its blends [1-3]. A single-step scouring/bleaching with anti-peroxide enzyme were investigated [4-8]. The process of combined pretreatment and dyeing in the same bath of cotton fabrics were attemped with various reactive and direct dyes in catalase-treated H_2O_2 bleaching baths without carrying out any intermediate washing/rinsing to the pilot scales for longer batches using a pilot scale jig and winch [9-13]. The ultrasonic energy has been used for textile materials wet finishing processes since 1990s and has advantages such as energy saving, short process time, less chemical use and less textile damage. It is an alternative method to the conventional processes to accelerate mass transfer in textile materials [14-16].

The aim of this research was to dye 97% / 3% cotton/lycra knitted fabrics after carring out enzymatic processes prior to the dyeing stage in the same bath with and without using ultrasonic energy. The single-bath processes were carried out without any intermediate washing/rinsing until the end of the reactive dyeing by C.I.Reactive Red 180 and C.I.Reactive Blue 181. The results of the colour differences, fastness properties, water saving and reduced process time of dyed fabrics with single-bath combined, ultrasonic assisted and ultrasonic assisted single-bath combined processes were compared to the conventional process.

Water absorbency of the bleached samples were checked in accordance with AATCC 79-2000 Method. The wetting time was found to be less than 1 s. The colorimetric parameters and colour differences of the dyed fabrics are given Table 1.

Table 1. CIELab values and colour differences (ΔE^*) of dyed materials

Dyed Materials	Process	L^*	a^*	b^*	C^*	h°	ΔE^*
Red 180	Conventional	55.74	56.47	-1.41	56.48	358.57	-
	Single-Bath Combined	53.85	57.47	-0.14	57.47	359.83	2.49
	Ultrasonic Assisted	53.50	56.27	-0.72	56.28	359.27	2.35
	Ultrasonic Assisted Single-Bath Combined	52.95	56.66	-0.21	56.66	359.12	3.04
Blue 181	Conventional	65.35	-5.69	-34.05	34.52	260.52	-
	Single-Bath Combined	63.26	-5.35	-35.16	35.57	261.35	2.39
	Ultrasonic Assisted	64.29	-5.70	-34.18	34.66	260.50	1.07
	Ultrasonic Assisted Single-Bath Combined	66.05	-6.03	-33.59	34.12	259.84	0.90

[a] The conventional processes were taken as 'standard'.

The CIELab values of the dyed samples and the colour differences were calculated in accordance with AATCC Evaluation Procedure 7. The washing fastness tests are carried out in accordance with the method described in ISO 105-C06 A1S test conditions and the rubbing fastness test were carried out in accordance with ISO 105-X12. The washing and rubbing fastness results of the single-bath combined and ultrasonic assisted single-bath combined dyed fabrics are quite good, when compared to those of the conventionally dyed fabrics. As a result, the single-bath combined and ultrasonic single-bath combined processes were about 60 min shorter than the conventional and ultrasonic assisted processes, since there was no washing process after scouring and bleaching. The amount of water used in the single-bath combined processes were decreased from 1.6 units to 1 unit.

Generally, this experimental work has showed that, using ultrasonic energy for dyeing with reactive dyes can be obtained good colouristic properties and adequate fastnesses. Ultrasonic assisted single-bath combined processes have many advantages such as less chemical use, water and energy savings. Further investigations have also been carried out to optimize process time of ultrasonic assisted single-bath combined dyeing process.

Key Words: Enzymes, combined-dyeing, reactive dyeing of cotton, ultrasonic energy

REFERENCES

1. Quandt, C., Kulh, B., 2000. Operational possibilities and optimisation of enzymatic processes in textile finishing industry. Melliand English 10, E198-E200.
2. Eren, H.A, Aniş, P., Davulcu, A., 2009. Enzymatic one-bath desizing-bleaching-dyeing process for cotton fabrics, Textile Research Journal, 70 (12), 1091-1098.
3.Yılmaz-Şahinbaşkan, B., 2012. Dyeing properties of bamboo/cotton blended yarns by single-bath combined process, Asian Journal of Chemistry, 24 (4), 1638-1642.
4. Duran, K., Toloui, A., 1998. The bleaching and dyeing of cotton knitted fabrics in the same bath using antiperoxide agents, Tekstil ve Konfeksiyon 5, 324-327.
5. Tzanov, T., Calefell, M., Guebitz, G.B., Cavaco-Paulo, A., 2001. Bio-preparation of cotton fabrics, Enzyme and Microbial Technology 29, 357-362.
6. Tzanov, T., Costa, S., Guebitz, G.B., Cavaco-Paulo, A., 2001. Dyeing in catalase-treated bleaching baths. Coloration Technology 117, 1-5.
7. Tzanov, T., Costa, S., Cavaco-Paulo, A., Guebitz, G.B., 2001. Dyeing with enzymatically treated bleaching effluents, AATCC Review, October, 25-28.
8. Tzanov, T., Costa, S., Guebitz, G.B., Cavaco-Paulo, A., 2001. Effect of temperature and bath composition on the dyeing of cotton with catalase-treated bleaching effluent, Coloration Technology 117, 166-170.
9. Oner, E., Yılmaz, B., 2005. New approach to single-bath combined dyeing, 5th International Istanbul Textile Conference, pp.19-21 May 2005, Lecture No: DFT-17, Swissotel The Bosphorus, Istanbul, Turkey.
10. Yılmaz, B., Oner, E, 2005. Dyeing of untreated cotton by one-bath combined process using various enzymes, 84th Textile Institute Annual World Conference, 22-25 March 2005, 4th Session, No: 156, Raleigh, North Carolina, USA.
11. Yılmaz, B., 2004, The optimization in a single-bath combined dyeing process of cellulosic materials, M.Sc. Dissertation, Marmara University, Institute for Graduate Studies in Pure and Applied Sciences, Istanbul, Turkey.
12. Yılmaz-Şahinbaşkan, B., 2010. Dyeing of cellulosic fibre containing materials by environmentally friendly process, Ph.D. Thesis, Marmara University, Institute for Graduate Studies in Pure and Applied Sciences, Istanbul, Turkey.
13. Oner, E., Yılmaz-Şahinbaşkan, B., 2011. A new process of combined pretreatment and dyeing: REST, Journal of Cleaner Production, 19, 1668-1675.
14. Mason, T.J., Lonmier., J.P., 1988. Sonochemistry: Theory, Applications and Uses of Ultrasound in Chemistry, Ellis Horwood Limited.
15. Basto, C., Tzanov, T., Cavaco-Paulo, A., 2007. Combined ultrasound-laccase assisted bleaching of cotton, Ultrasonics Sonochemistry, 14, 350-354.
16. Yachmenev, V.G., Blanchard, E.J., Lambert, A.H., 2004. Use of ultrasonic energy for intensification of the bio-preparation of greige cotton, Ultrasonics, 42 (1-9), 87-91.

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