Designing a jacket for motorcycle drivers by combination of leather and denim

Nilay Ork[a], Zumrut Bahadir Unal[b], Behiye Elif Samli[b], Hasan Ozgunay[a*]

[a] Ege University, Faculty of Engineering, Leather Engineering Department, İzmir, 35100, Turkey
nilay.ork@ege.edu.tr, hasan.ozgunay@ege.edu.tr
[b] Ege University, Faculty of Engineering, Textile Engineering Department, İzmir, 35100, Turkey
zumrut.bahadir.unal@ege.edu.tr, behiye.elif.samli@ege.edu.tr

*Corresponding Author: Hasan Ozgunay, hasan.ozgunay@ege.edu.tr

Abstract. In the wake of the development of apparel sector and the increase in consumer demands, designing clothes aimed at their intended use has gained importance. Visual and aesthetic designs in line with fashion trends, as well as clothes that can meet technical requirements are used in numerous fields and there are many studies carried out on developing these technical textiles. Many clothes, examples of which could be given as those designed for firemen, swimmers and dancers, should have distinctive properties depending on their field of use and intended use, and should provide the user with protection and convenience in occupation. For motorcycle clothes, leather is usually preferred as material, however leather is an expensive material. In this study, materials of denim fabric and leather have been investigated in terms of cost and air permeability. Designing a reasonable motorcycle driver jacket is aimed. Thus, a leather-denim combination jacket has been designed, consisted of front and shoulders parts which are mostly exposed to wind, made up of leather material and other parts made up of denim fabric. The cost of this jacket has been assessed, comparing it to that of a full leather jacket, and a new product has been developed that could perform a similar function at a much cheaper price.

Keywords: leather, denim, apparel, motorcycle jacket, air permeability, 3D visualization.

1 INTRODUCTION

The initial development of motorcycle jackets began with companies like Schott which was established in 1913, and started producing motorcycle jackets during 1920's. In Detroit, The Joseph Buegeleisen Company started its business in 1933 providing with motorcycle accessories and saddle bags and began producing motorcycle jackets in 1940's. Another pioneering jacket company still existing today is Harley Davidson which also released its jackets in 1940's (Hake et. al., 2012).

The data from the MAIDS report shows that considerable part of riders (36%) wore jackets (made of e.g. denim or nylon) ensuring medium protection. Almost 21% used heavier jackets, e.g. made of kevlar or artificial leather, whereas 17% of motorcyclists used leather jackets (MAIDS, 2009; Zwolińska M., 2013). These clothes have ventilation place for summers, detachable lining for cold-weather and resistant models to wind and rain. Textile materials have been improved to be softer and provide high protection by means of technology. Textile clothes are cheaper than leather clothes. They do not deform appearance and design besides high protection. These clothes could be produced with different colours, patterns and models.

Providing comfort to driver is important in designing jackets. Feeling comfortable during drive help driver to be more careful and having more accurate and faster reflexes among probable risky situations. Moisture - heat transfer and air permeability have effect on comfortability of clothes. Anyway, motorcycle clothing hinders heat exchange between the motorcyclist's body and the environment as claimed in Zwolińska's research (2013).

Motorcycle drivers prefer leather clothes due to the aesthetic appearance. There are basic elements to be included in the motorcycle driver's clothing. Clothes should protect the motorcycle drivers from probable injuries and must have thermal insulation. Expensiveness is deterrent factor preventing use of special driver clothes even though they are comfortable and they are fateful at the accidents. Since they have limited production in Turkey and most of the products available in the market are imported from abroad, the prices of those clothes are quite high. So, there is a necessity to produce motorcycle driver clothes with reasonable prices. Essential qualities for those clothes are strength, water resistance and low air permeability etc. For the mentioned reasons, properties of motorcycle driver's clothes are important and must be evaluated in many aspects. In this study, denim and leather have been investigated in terms of cost and air permeability, and we have aimed at designing a reasonable motorcycle driver jacket. A leather-denim combination jacket has been designed, consisted of front and shoulders parts which are mostly exposed to wind, made up of leather material and other parts made up of denim fabric.

2 MATERIALS AND METHODS

2.1 Materials

In this study, indigo blue denim fabric, which has favorable material properties for jacket production and twenty garment sheep leathers which are obtained from varied garment leather companies were investigated.

2.1.1 Leather

Hides and skins which are byproducts of meat industry are the raw materials of the leather industry. During conversion of hides/skins to leather; non-fibrous proteins, carbohydrates and lipids, etc. are removed and only the fibrillar proteins remain. Amongst these fibrillar proteins, collagen is the major one with 98% amount (Harmancıoğlu, 1998). For this reason, leather can be defined as a protein based fibrillar network. As the hides/skins are protein based, they are putrescible by bacterial activity in wet-form until tanning process. The tanning process is the stabilization of the collagen matrix to retain a separated fiber structure and to increase the hydrothermal stability. This is the stage at which the pelt becomes 'leather' and is then resistant to putrefaction or rotting. With further processes such as retanning, dyeing, fatliquoring and finishing many types of leathers are being produced having various properties to be used in various fields.

2.1.2 Denim

Denim, which is also known as blue-jean, firstly produced as a heavy duty clothes in the 19th century and usage of denim in daily life started in the 1950s. (Ayyıldız et al,, 2004; Nef, 1996). In 1940s, when the California gold rush was in full swing, Levi Strauss had the canvas made into pants which was called blue jeans, and later the fabric became known as denim. From that on, denim and denim goods spread around the world. Then combined with

American west cowboy, punk spirit and rock style, denim now is a symbol of cultural of USA (Zhai, 2011). Today denims are termed in several ways depends on type of production (grinding, bleaching, etc.) and colour (blue, black, etc.). Indigo-blue warp threads and ecru weft yarns are typical characteristic of denims. Standard denim has 3/1 Z twill weave and appears blue, due to density of warp yarns in fabric structure. The ecru color appears because of the weft yarns on back face of fabric. The warp yarns are thinner and more twisted than weft yarns. Fabrics have 24-27 threads/cm warp density and 15-18 threads/cm weft density (Bali, 1998; Akçakoca, 1999; Ayyıldız et al,, 2004). Denims are expected to have certain performance characteristics during use. These properties are dimensional stability, tensile strength, tear strength, colour fastness to friction and elasticity (Ayyıldız et al,, 2004).

3.2 Methods

Air permeability measurements of samples were performed by Devotrans test device and thicknesses were measured by Satra gauge device. After sampling and conditioning the samples according to TS EN ISO 2419 (Leather-Physical and mechanical tests-Sample preparation and conditioning) thicknesses of different areas of all leather were measured and average values were calculated according to TS 4117 EN ISO 2589 (Leather-Physical and mechanical tests-Determination of thickness). After measuring the thickness of leather and denim, air permeability test was performed under 200 Pa pressure on five different areas of each leathers and denim, the air permeability of the materials were determined from the rate of air flow in 4 minutes. For visualization of prototype leather-denim combination jacket Assyst Vidya 3D Visualization and Simulation program was used.

3 RESULTS

The most important performance expected from clothes of motorcycle drivers is protection against strong winds. Therefore, air permeability was investigated in leathers and denim. Air permeability test results of leathers and denim were given in Table 1 and 2.

Table 1. Air Permeability Test Results of Leathers

Leathers	Mean Thickness(mm)	Mean Air Permeability (m^3/4 min)
1	0,72	0,0032
2	1,24	0,0007
3	1,24	0,0013
4	1,15	0,0078
5	1,29	0,0042
6	0,73	0,0010
7	0,81	0,0060
8	1,19	0,0024
9	0,89	0,0019
10	0,65	0,0004
11	1,03	0,0064
12	0,63	0,0004
13	1,33	0,0005
14	0,90	0,0023
15	1,38	0,0028
16	0,76	0,0012
17	1,16	0,0050
18	0,63	0,0038
19	0,99	0,0082
20	0,95	0,0020
Mean	0,98	0,0031

Table 2. Air Permeability Test Results of Denims

Denim	Mean Thickness(mm)	Mean Air Permeability (m^3/4 min)
1	0,80	0,1895
2	0,80	0,2182
3	0,80	0,2329
4	0,80	0,2373
5	0,80	0,2332
Mean	0,80	0,2222

As it can be clearly seen in Figure 1, denim has higher air permeability compared to that of leather. These results are foreseen because leather has a complex structure like collagen and these collagen bundles constitute these complex structures. But denim has two dimensions and air can pass easily from the outer to the inner side of the garment.

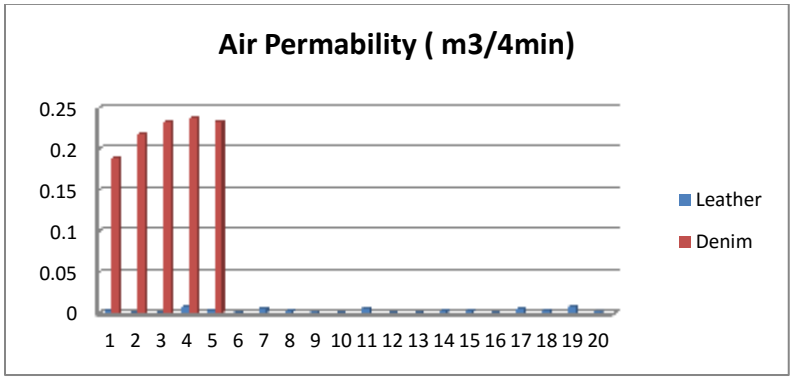

Fig. 1. Air permeability of the samples

Front-view and back-view of the leather-denim combination jacket simulated by Assyst Vidya 3D Visualization and Simulation Program are shown in Fig.2.

Leather is an expensive material and people sometimes don't want to buy leather jackets for this reason. Designing a leather-denim combination jacket may noticeably decrease the price of it considering the prices of the materials. Comprising of the front part from leather which costs approximately a hundred dollars and the back part from denim costs thirteen dollars. Material price of a leather jacket is 200dollars. It has excellent air permeability but expensive. Material price of a denim jacket is 26 dollars. It is cheap but poor in air permeability. Material price of leather-denim combination jacket is approximately 113 dollars, which has more reasonable price and good air permeability for motorcycle drivers.

Fig. 2. Front-view and Back-view of the leather-denim combination jacket

4 CONCLUSION

Leather making is a long and labor-intensive process, thus the garments produced from leather material are more expensive than textile fabrics. For this reason, many drivers prefer unskilled clothes. In this study, a leather-denim combination jacket has been designed, consisting both low cost and wind protecting properties. Mostly front side of the motorcycle jacket is in contact with the wind. That's why; leather was chosen to be used on the front and shoulder parts of the jacket, and denim fabric was used on the other parts. Thus, besides the motorcycle drivers could be protected against tough weather conditions and strong air flow, the cost of the jacket was also reduced. When the models, which are equipped with special protection by combining the elegance of leather and cheapness of denim, were designed; the products, which can be worn both summer and winter, and be in demand by motorcycle riders would be emerged. However, all materials used in design of cloth should be compatible within each other. Therefore, the number and variety of materials (types of leather and denim) could be increased in order to determine compatible materials among each other.

References

Akcakoca, P. (1999). Denim Kumaslar ve Indigo Boyamaciligi, *Tekstil ve Konfeksiyon, 2*, 136-143.

Ayyıldiz, C., & Koc E. (2004). Denim Kumaslarda Performans Analizi I-Kumas Mukavemeti ve Asınma Dayanimi Degerlendirilmesi, C*ukurova University Engineering -Architecture Faculty Magazine, 19, 2*, 69-82.

Bali, Y. (1998). Guncelligini Kaybetmeyen Moda-Denim, *Tekstil ve Konfeksiyon, 3*, 180-183.

Directorate General of Security, Head Of Traffic Services, Traffic Education and Research Department (2016). *Bulletin of Traffic Statistics, 4*.

Hake, C., Heck, J., Koontz, K., Wright, L. (2012). Ultra-Air Motorcycle Jacket, *Senior Design Final Report*, Department of Mechanical Engineering Technology Program College of Engineering, Technology, and Computer Science, Retrieved from http://opus.ipfw.edu/etcs_seniorproj_mcetid/273

Harmancioglu, M. (1998). Deri Kimyası, Ege University, Faculty of Agriculture, Bornova, İzmir, 281.

MAIDS - Motorcycle Accidents in Depth Study (2009). In-depth investigations of accidents involving powered two wheelers - Final report 2.0, ACEM.

Nef, U. (1996). Denim Turu Kumaslar icin Mekikcikli Dokuma Makineleri, *Melliand Turkey Special Volume*, 36-37.

TS EN ISO 2419 (2012). Leather - Physical and mechanical tests -Sample preparation and conditioning, TSE, Ankara, Turkey.

TS 4117 EN ISO 2589 (2016). Leather - Physical and mechanical tests - Determination of thickness, TSE, Ankara, Turkey.

Zhai, J. (2011). The Denim's Characteristics as Upper Material of Footwear, *Advanced Materials Research, 332-334*, 1643-1646.

Zwolińska, M. (2013). Case Study of the Impact of Motorcycle Clothing on the Human Body and Its Thermal Insulation, *Fibres & Textiles in Eastern Europe, 21, 5(101)*, 124-130.

Nilay Ork (Res. Asst.) received her BS and MS degrees in Leather Engineering Department of Ege University in 2009 and 2012, respectively. Her PhD thesis is about 3D visualization and simulation programs in leather apparel. Her researches are generally about leather apparel and physical properties of leather materials.

Zumrut Bahadir Unal (Assoc. Prof. Dr.) received her BS, MS and PhD degrees in Textile Engineering Department of Ege University in 1993, 1999 and 2004 respectively. Her researches are about garment pattern and production applications in apparel.

Behiye Elif Samli (Res. Asst.) received her BS and MS degrees in Textile Engineering Department at University of Ege. She worked as a lecturer at Faruk Sarac Vocational School of Design, previously. She is working now as a research assistant at Ege University and continues her doctoral thesis study.

Hasan Ozgunay (Assoc. Prof. Dr.) studied Leather Technology at the University of Ege (Turkey). After working in Leather Industry for one year, he joined the staff of Leather Engineering Department as research assistant in 1996. He obtained his M.Sc. in the same department. He studied on vegetable tanning materials and obtained his Ph.D. in Leather Engineering. He is currently working as researcher / lecturer in the Leather Engineering Department. His research activities and fields of interests are; tanning materials, leather processing technologies and cleaner leather processing methodologies.