



EXAMINING COMFORT PROPERTIES OF LEATHER and ARTIFICIAL LEATHER COVER MATERIALS

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Abstract: *The analysis and regulation of workplace, working instruments, the comfort of office chair, business environment (sound, lighting, climate, vibration, temperature, and humidity), work and break times, analysis and editing of the organization, are some of the topics of interest of ergonomics. Environmental impact and conditions have important role on the employee's working comfortably and efficiently. Therefore these conditions need to be aligned to the human body nature. Unsuitable working conditions (noise, etc.) cause additional load, which the human body endures, and this additional load reveals the signs of tiredness in the body. Even an office environment, unsuitable physical environment impairs health of workers and reduces the performance. Therefore, office climate, environmental factors such as lighting and noise must be harmonized with the employee's body nature in all working environments.*

Seating comfort is one of the important factors affecting the performance of employees in the office environment. There are so many studies about chair dimensions and the disorders on human body which were caused by the inappropriate chair dimensions and sitting positions. However, there are a spot of studies about the surface of the chair and the discomfort caused by the chair cover and its negative performance effects.

In this study, some results of seat cover analysis for the design of an ergonomic chair. Recently, ease of cleaning, low cost advantages caused the increasing of the use of artificial leather especially on the surface of the seat used in offices. The physical properties of natural leather and artificial leather were compared as the candidate covers to be used on the design of an ergonomic office chair.

Key words: Natural leather, artificial leather, ergonomics, office chair, seat cover

1. INTRODUCTION

Seating comfort is one of the important factors affecting the performance of employees in the office environment. Apart from its influence on posture and hence comfort, poor ergonomics of a workstation can have a bad effect on job satisfaction. This is so as people become increasingly aware of the existence of good furniture.(1) There are some diseases caused by chair dimensions not be eligible the dimensions of the human body. This discrepancy affects the performance of workers negatively. Besides, some physical properties of the surface of the chair can give discomfort to people and this low comfort can be the reason of negative performance of workers at the same time.



One of the most important features which form the clothing and textile surface comfort is physical properties. Therefore, there are many test devices and methods for detecting physical properties of leather today. Water vapor permeability, air permeability comes first for determination of physical properties. Water vapor permeability (%) is the material's capability of permeating water vapor. The water vapor or sweat permeability of the material affects the wear and surface comfort. The result of low moisture permeability cause excessive wet and this disturbs people. However, high moisture permeability is not sufficient solely. It should be coupled with high absorption capability. (2)

Although polymer materials have acceptable permeability, they are lack of good absorption properties of natural leather.

These tests are important physical properties in terms of hygiene and physiology. Air and water vapor permeability are required up to a certain degree.

According to Umbach (1993) the water vapor transfer is closely related to the moisture permeability characteristics of clothing. Also the materials with high increase evaporation amount even in variable ambient conditions. However, moisture transfer capacity is always sufficient to compensate the sweat. Moisture storage capability should be sufficient in order to give the feeling of dryness. The created buffer zone which is formed with the moisture storage capability can imply the comfort in variable ambient conditions.

As natural leather will not give the feeling of wetness, even if they have 30% moisture content, they provide a more comfortable use. However, the artificial leathers cannot bear more than 2-3% water within its build. (4) Water vapor permeability of natural and synthetic leather depends on applied finish. Because synthetics will typically have extremely limited water vapor permeability due their waterproof-coat.(5) The use of synthetic leather in garment production and the seating surfaces is highly increased in recent years.

This is because of their sales with meters, their effectiveness due to their not containing errors like natural leathers. Their most important feature is their dramatically lower cost advantage.

2. MATERIALS AND METHODS

2.1 Materials

A chrome tanned , water-based finish applied and pigment dyed cowhide leather and artificial leather, which is coated with polyurethane and polyvinyl chloride mixture and master batch pigment dyed and having 100% PES knitted lining the floor, were used in the scope of research

2.2 Methods

A variety of physical analysis, such as watervapour permeability, thickness, stitch tearing strength, extension set, air permeability test, absorbtion of water, abrasion resistance of automotive leather, colour fastness to water spotting, have been conducted with the leather and artificial leather used as upholstery.

The Sampling of leathers which were used for the physical analyzes was carried out as indicated in the TS EN ISO 2418 Leather - Chemical, physical and mechanical and fastness tests - Sampling location standard.

Test samples were taken and conditioned according to TS EN ISO 2419 "Leather - Physical and mechanical tests - Sample preparation and conditioning standard" in standard atmosphere, temperature of $23\pm 2^{\circ}\text{C}$ and the relative humidity of $50\pm 5\%$ for 48 hours before starting the physical tests. In the first step the samples were cut from the whole leather, in the second step Samples were cut with a press using molds of appropriate size from the first step taken parts for the physical tests.

The weight measurement was determined by 0.01 g precision Sartorius CPA2245 balance.

The physical tests are made according to the standards given in Table 1.



Table 1: Standards of Physical Tests

Test	Standard
Water Vapor Permeability %45 RH 15°C	TS EN ISO 20366
Thickness	TS 4117 EN ISO 2589
Stitch tearing strength	TS 4138
Permanent elongation set	TS EN ISO 17236
Static water absorption	TS 4123 EN ISO 2417
Air Permeability	Method of Corporate
Automotive leather abrasion resistance	TS EN 14327
Color fastness to water spotting	After 30 min After 24 hours

3. RESULTS AND DISCUSSION

One of the most important features which form the clothing and textile surface comfort is physical properties. Artificial leathers are mostly used materials as seating covers. However they have some advantages and disadvantages while using in office environment.

Temperature and humidity of the contact surface has an essential influence on comfortable sitting. The following factors are related to microclimate: material and texture of the cover material, thickness and density of the cushion, compression of the cushion, perforations of the cushion and of the seat backrest shell.

Generally, water vapor permeability increases with increasing compression due to the shorter diffusion thickness, but starts to decrease sharply with 75.45% of compression due to the increase of foam density. In order to avoid a warm and humid microclimate, the listed components (cover fabric, foam, and seat shell) should be optimized with regard to their water vapor permeability. (6)

In our study the obtained results are given in below Table 2 and the results are consistent with the literature.

Table 2: Results of Physical Tests

Test	Results	
	Artificial Leather	Leather
Water Vapor Permeability %45 RH 15°C	0.03 mg/cm ² h	0.48 mg/cm ² h
Thickness	0.78 mm	1.09 mm
Stitch tearing strength	507 N/cm	2196.5 N/cm
Permanent elongation set	4.1 mm/100 mm	6.3 mm/100 mm
Static water absorption	After 2 hours 42.8 mL/100 g After 24 hours 44.1 mL/100 g	After 2 hours 151.98 mL/100 g After 24 hours 163.8 mL/100 g
Air Permeability	Grain Side:0.12 cm/s Flesh Side: 0.05 cm/s	Grain Side:0.07 cm/s Flesh Side: 0.04 cm/s
Automotive leather abrasion resistance	50 rev :4/5	50 rev :4/5
Color fastness to water spotting	After 30 min:4 After 24 hours:4	After 30 min:4 After 24 hours:4

Abrasion resistances, color fastness to water spotting features of artificial and natural leather are the same.

Thickness of artificial leather is less than natural leather and this is an advantage when we consider sewing process. Its tearing strength is also less but it is not a disadvantage when it is used as a



seat cover.

Abrasion resistance of natural and artificial leather is sufficient for upholstery material.

Even if thickness of artificial leather is less than natural leather, it has less water vapour permeability. This cause more disturbing sitting comfort than the natural leather, in the high temperature and humidity environment.

The less air permeability of natural leather can be explained by the processes of tanning, finishing and etc.

Beside this, the less thickness of artificial leather causes lower air permeability than natural leather. This allows a better seating comfort.

4. CONCLUSIONS

Recently, ease of cleaning, low cost advantages caused the increasing of the use of artificial leather especially on the surface of the seat used in offices. However it has some disadvantages when we consider sitting comfort. Its water vapor and air permeability is not good. Although it's a good choice for a cheap ergonomic office chair design, it will not be a preferable material, if ergonomics and sitting comfort are considered. In further study alternative textile covering will be examined for better choices.

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