

THE EFFECTS OF DIFFERENT FINISHING TYPES ON WATER VAPOUR AND AIR PERMEABILITY PROPERTIES OF SHOE UPPER LEATHERS

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In this study, the effects of different finishing types on water vapour and air permeability properties of upper leathers were investigated. The leathers were classified into three groups based on finishing types like aniline, pigmented and patent finishing. The water vapour and air permeability tests were applied to all leathers before and after finishing processes for determining the change in these properties. The water vapour and air permeability values of unfinished box calf and goat leathers were found to be considerable high prior to finishing process; however these values were significantly decreased after this process. It was determined that the patent finishing significantly reduced the water vapour and air permeability values and the minimum decrease was observed with aniline finishing.

Keywords: Upper leather, water vapour permeability, air permeability.

INTRODUCTION

The water vapour and air permeability are important properties for wear hygiene and physiology. These properties are required from leathers used for both garment and shoe manufacturing to some extent. Human body is capable of keeping the body temperature constant and spreading it to the environment. The clothing material surrounding the body and especially the feet should be suitable for the body temperature regulation system and also it should support the system (Sari and Bitlisli, 2000; Bitlisli et al., 2004). Besides, this property should also be kept for leather footwear products in long-term use and should not be decreased (Bitlisli et al., 2003).

In finishing process a protective coat is applied on leather surface, by means of this finishing coat protection of grain against external factors, increasing application areas through offering colour and design variety and marking up sales price of leather is provided (Thorstensen, 1993). For this purpose various finishing chemicals (casein, nitrocellulose, polyurethane, acrylic, other resin and polymeric compounds) and techniques can be applied (Sarkar, 1996). Therefore finishing coats applied on upper leathers for different intended uses are important in terms of warranting water vapour permeability, hygiene and physiology of clothing. In our study different finishing types, which are applied on shoe upper leathers were investigated for their effect on water vapour and air permeability properties.

MATERIALS AND METHODS

Materials

In this study, 42 upper leathers were used in total obtained from leather factories in Turkey. 18 of them were box calf and 24 of them were goat leathers. 9 of the box calf and 12 of the goat leathers were crust and the other half were the finished products.

Methods

The finished leathers were classified into three groups according to finishing recipes applied in leather factories as aniline, pigmented and patent finishing. Prior and subsequent to finishing process, water vapour and air permeability tests were done to leather samples for determining the effects of different finishing films on these properties. The water vapour permeability test was done according to the test method of TS EN ISO 20344 (2007) and the air permeability properties were determined with air permeability test equipment (DEVOTRANS). The measurements were done at 200 and 500 Pa for 5 minutes for determining the amount of air passing through the leather as m^3 .

RESULTS AND DISCUSSION

It can be seen from Table 1 that the lowest water vapour permeability test results were obtained from patent finished box calf and goat leathers. It is not surprising to have the lowest water vapor permeability values for patent finishing type because the patent finishing film acted as nonporous barrier and reduces the water vapour permeability. Thus Milasine (2003) indicated that the decrease in water vapour permeability depends on the reduced porosity of upper layer, coating thickness and the amount of binder and pigment. According to the statistical evaluation, the values obtained from the crust and finished leathers for every finishing type were found statistically significant. Also the statistical analysis shows that the water vapour permeability values of goat leathers are higher than the box calf leathers.

Table 1. The average values of water vapour permeability for boxcalf and goat leathers (mg/cm^2h)

Type of Leathers	Types of Finishing	Water vapour permeability (mg/cm^2h) $\bar{X} \pm S_x$
BOXCALF	Crust	Before Aniline Finishing Process
		Before Pigmented Finishing Process
		Before Patent Finishing Process
		Aniline Finished Leathers
	Finished Leathers	Pigmented Finish Leathers
		Patent Finished Leathers
GOAT LEATLER	Crust	Before Aniline Finishing Process
		Before Pigmented Finishing Process
		Before Patent Finishing Process
		Aniline Finished Leathers
	Finished Leathers	Pigmented Finish Leathers
		Patent Finished Leathers

Wilbik-Halgas et al., (2006) indicated that the air permeability can also be determined as a function of coating thickness and the surface porosity such in water vapour permeability. Thus it is possible to tell that the air permeability values of leathers directly affected from the same factors of water vapour permeability. As it can be seen from Table 2, the lowest air permeability values were obtained from patent finished box calf and goat leathers. According to the statistical evaluation, the values obtained from crust and finished leathers for every finishing type were found statistically significant. Also it was determined from the statistical analysis that the air permeability values of goat leathers were found higher than the box calf leathers.

Table 2. The average values of air permeability for boxcalf and goat leathers

Type of Leathers	Types of Finishing	200 Pa, 5 dk X±Sx	500 Pa, 5 dk X±Sx
BOXCALF	Crust	Before Aniline Finishing Process	17,22 ± 3,13
		Before Pigmented Finishing Process	14,35 ± 0,92
		Before Patent Finishing Process	18,47 ± 0,15
		Aniline Finished Leathers	13,02 ± 0,17
	Finished Leathers	Pigmented Finish Leathers	8,72 ± 2,12
		Patent Finished Leathers	7,89 ± 3,95
GOAT LEATLER	Crust	Before Aniline Finishing Process	24,83 ± 1,24
		Before Pigmented Finishing Process	19,76 ± 1,33
		Before Patent Finishing Process	15,23 ± 1,35
	Finished Leathers	Aniline Finished Leathers	22,73 ± 0,93
		Pigmented Finish Leathers	15,75 ± 6,00
		Patent Finished Leathers	10,61 ± 6,02

When the air permeability test results were examined, it can be seen that the lowest and the highest values of air permeability results were similar to water vapour permeability values which is an also an expected result.

CONCLUSION

Water vapour and air permeability values can be change depending on the structural properties of leather, porosity, thickness, collagen and elastin fibre bundles, leather processing steps and the presence of grain and papillar layers. However, the finishing type can reduce the permeability values significantly.

In our study, the water vapour and air permeability values of both goat and box calf leathers before finishing process were determined considerably high, however they were reduced significantly after finishing. It was determined that the lowest water vapour and air permeability values were obtained from patent finished leathers for both goat and box calf leather types. Pigmented and aniline finished leathers have higher values respectively.

The previous studies show that the water vapour and air permeability properties of leather goods are closely related to wear comfort and hygiene. Like in upper leathers for

military, sports and some special occupational groups. the wear comfort and hygiene of casual shoe upper leather is expected to be high. By means of advanced technology and increased knowledge, especially increasing the wear comfort of shoe products will also increase the efficiency of professional and daily life activities.

Consequently, finishing process which significantly has an effect on water vapour and air permeability properties of upper leathers should be well considered and while developing new fashion products having different colors and effects wear comfort should be taken into consideration.

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