

CARE AND MAINTENANCE OF LEATHER UPHOLSTERED FURNITURE WITH TRADITIONAL LEATHER CONDITIONERS

Nikola Mihajlovski, Konstantin Bahchevandjiev

*Ss. Cyril and Methodius University in Skopje,
Faculty of Design and Technologies of furniture and interior - Skopje,
Republic of North Macedonia
email: mihajlovski@fdtme.ukim.edu.mk, bahchevandjiev@fdtme.ukim.edu.mk*

ABSTRACT

The upholstery leather in the furniture is exposed to intensive wear conditions and dust. Periodic cleaning and maintenance is necessary in order to maintain its properties. In the period of use the leather loses its natural fats, absorbs salts then becomes hard and cracks.

Care and maintenance of leather in the upholstered furniture is a system of activities such as prevention, cleaning and conditioning of the leather. All these activities are interconnected to maintain the quality of the leather. The main task of the care products and maintaining of leather is its adjustment to the conditions of use, removal of deformations that occurred during use and prepare for its further use.

The aim of this paper is to review the method of maintenance of the leather in the upholstered furniture as well as to compare the classical care products with the commercial ones through a review of literary and experiential data.

Commercial conditioners do not satisfy the needs for conditioning the leather properties over a long period of time. Traditional conditioners made from animal fat, oils and waxes such as tallow, lanolin, fish oil and beeswax enhance collagen fibrils, maintain elasticity, contribute to hydrophobicity and increase its organoleptic properties.

Key words: upholstery leather, leather furniture maintenance system, traditional leather conditioners, animal fats and waxes

1. INTRODUCTION

According to international quality assurance systems for furniture, all furniture quality features are determined by: functionality, durability, surface resistance and material quality and accuracy of processing. In order to preserve the quality of the furniture in its service life it is necessary to maintain it.

Maintenance of furniture is the preservation of its materials, surfaces and shape, in addition to all factors of use in its original state. This means, first of all its proper use and care (Smithsonian Institution, 2019). The upholstered furniture is most often exposed to a high frequency of use, primarily as furniture for home use, working offices, seats in vehicles, furniture of special importance - antique furniture. Leather as a material in upholstered furniture is always in a trend and most often, through use it gets a patina, so its aesthetic value increases. It is also the most resistant material for upholstery, with the highest resistance to scratches (Goodrich Global, 2016).

The leather production industry aims to produce a product with a high aesthetic effect and a long service life. But the consistency of the leather and its properties over a longer period of time depends most on maintenance (Lange, 1982; John, 1996). The main aims of leather maintenance are: its adaptation to the conditions of use, removal of signs of use and aging, and preparation for further use.

Today, a lot of commercial care products in the form of pastes, creams, oils and sprays are available for maintaining the leather. They are made for one purpose - to maintain the leather and its properties in the initial shape. However, the leather is one of the first materials that a man has started to use in his life and thus has developed a variety of means and ways to maintain it, which in the beginning were primarily animal fats and oils.

This paper has a review character. We want to analyze and explain the needs for the maintenance of leather furniture, as well as commercial products and their efficiency compared to some of the methods and traditional materials and recipes. The paper reviews the needs for maintaining upholstered leather furniture, then scientific observations and experiential facts from maintenance of the leather.

2. NEED FOR LEATHER MAINTENANCE IN THE FURNITURE

The environment in which leather furniture is used has its own distinctive abiotic factors that depend on the climate in the interior: relative humidity, air temperature, light, gases, smoke and dust in the air. In addition to the stated importance, biotic factors include: perspiration and mechanical loads. Changes in the properties of the leather as well as its consumption is a consequence of a complex and interaction of chemical changes in the material and mechanical loads. All these factors contribute to the oxidation and hydrolysis of the material, the consequence of which is gradual degradation.

The sun's rays are partially absorbed, partially refracted from the surface of the leather. Solar radiation causes color changes and degradation of collagen, which is the basic building protein in the fibers of the leather. Even more severe degradation occurs from ultraviolet radiation that is not visible to the human eye. This radiation has a wavelength less than 400nm and possesses high energy that can break up the macromolecular connections in the collagen. The phenomenon is known as photolysis and occurs in the presence of oxygen from the air. In particular, photooxidation degrades the protein chain of the collagen, reducing mechanical properties, cracks on the surface, color changes, and reduction in the pH of the leather (Florian, 2006). Light is indispensable in the home, and the recommended lighting values in the interiors according to (NOAO, 2019) are light levels from 50 to 2000lux, specifically in homes around 150lux. The (Canadian Conservation Institute, 1992) set limit values for the light levels that are not harmful to the leather in the furniture. According to him, the recommended values for furniture and leather products are: light levels up to 50lux and ultraviolet radiation up to $75\mu\text{W} / \text{m}^2$. From the presented data it can be seen that the light levels in the homes is three times greater than the prescribed lower limit value for maintaining the leather. So the leather in the upholstered furniture is constantly exposed to illumination. Radiation can be reduced by using furniture covers and not exposed to direct sunlight (for example, up to a window).

The leather is exposed to the relative humidity of the air. With the change in relative humidity in the air, the percentage of water in it changes. Water in the leather acts on the hydrolysis and oxidation of collagen. The increased hardness and rigidity of the leather are due to the cycles of changing the relative humidity and air temperature. By increasing the relative humidity of the air, the leather absorbs water and when the humidity in the air decreases in the leather a process of water desorption occurs. Over time and cycles of change, these two values equalized, part of the collagen becomes hydrophilic and the leather becomes hard. Leather should not be exposed to extreme change in relative humidity in the air. Very dry conditions when relative humidity is less than 40%, cause moisture loss in the leather and it becomes hard and non-elastic. Figure 1 shows the appearance of dehydrated leather furniture. The high relative humidity in the air above 65% causes hydrolytic reactions to degradation of the collagen fibers on the leather, which is accompanied by the appearance of mold and color change - staining. Gradual changes in relative humidity of the air are not a problem, because the leather can be gradually adapted, but rapid and abrupt changes are extremely harmful (Angus, Kite, Stuge, 2006). The optimal and recommended conditions in the interior of the leather are relative air humidity from 50 to 55% and temperature (from 20

+/- 2 °C). Regarding these factors, the leather does not differ from other organic materials. It responds rapidly to environmental changes and therefore requires preventive maintenance.

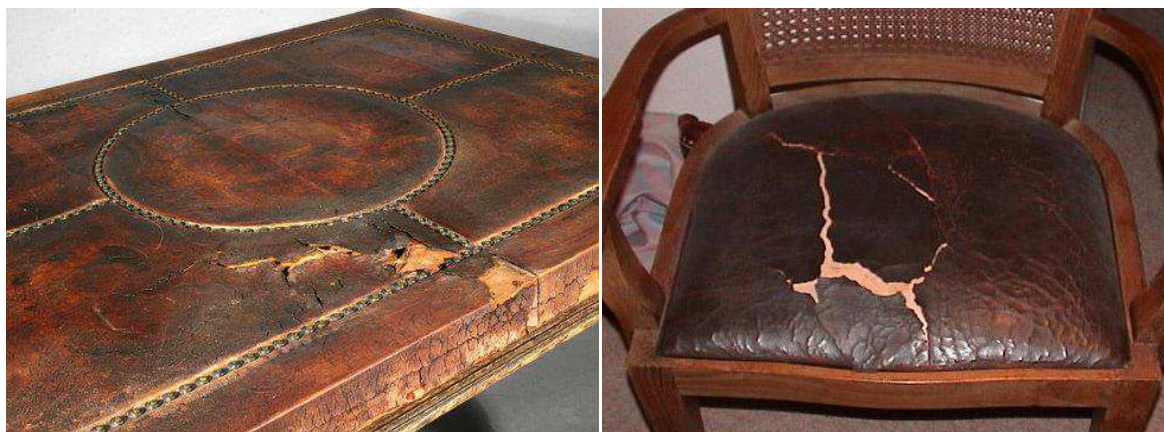


Figure 1. Furniture with dehydrated and damaged leather

Exposing one material to heat means transferring a portion of the kinetic energy, which causes an increased molecular motion and an increased rate of chemical reactions in the material. In the case of a polymer, it is manifested by the breakup of the polymer chain links. Long-lasting exposure of the leather at increased temperature reduces moisture hydration from the air, which keeps the elasticity and the leather becomes hard and cracks. Figure 2 shows the appearance of cracked leather. Normal and constant room temperature does not affect harmfully, but in rooms that are occasionally used and because of this are occasionally warming, temperature changes are a kind of "stress" for the leather in the furniture. In this sense, leather furniture must not be exposed to a direct heat source. According to the literature (Bacardit et al., 2012) factors: relative humidity, air temperature and ultraviolet radiation have the greatest impact on leather aging, and the most influential is humidity.

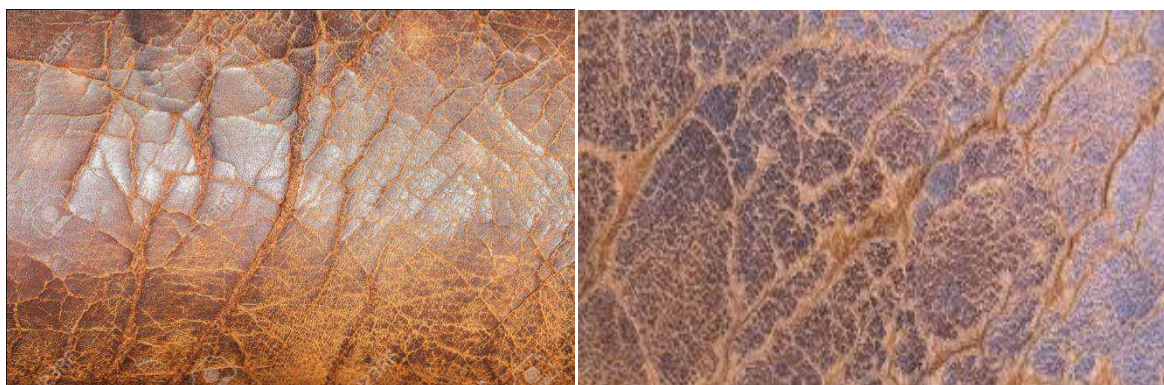


Figure 2. Hard and cracked leather

Air pollution, chemical substances and dust particles also act on leather furniture. Chemical substances such as: nitrogen, oxygen, carbon dioxide and ozone, react with leather matter. Oxidation builds acidic compounds that act degrading to the leather. Particles that accumulate in the form of dust fill the pores of the leather, which makes the process of sorption or its "breathing" difficult, making it easier to get mold. The dust is hygroscopic, additionally attracts moisture that dehydrates the leather. The fine dust particles act abrasively on the surface of the leather (Storch, 1987). The presence of metal particles in the air further degrades. The dust is particularly intrusive and very difficult to remove from the surface of the leather that has been neglected for a long time (Canadian Conservation Institute, 1992).

Human body perception was established as a very influential factor in leather degradation in furniture (Bowes, 1963). Perspiration is mainly composed of: sodium chloride, lactic acid,

amino acids and urea (Montain, Chevront, Lukaski, 2007). These chemical compounds act degrading to collagen, especially chromium-tanned leather (Haines, 1991c). The perception also causes a change in leather color in darker tones, which can be seen in the following Figure 3.



Figure 3. *Perspiration effect on the leather in upholstered furniture*

Mechanical loads occur during regular furniture exploitation, and on upholstered furniture they are extremely intense. Loads may be dynamic, as a result of: sitting, standing, backrest and arms, or static, such as: long-term load with body weight when sitting, lying down or a similar position, etc. These burdens cause deformation of the leather that is stressed, structurally on: stretching, pressure, bending, twisting, etc., and surface to: wear, abrasion and scratching. According to the (Canadian Conservation Institute 1992; Storch, 1987; Waterer, 1971; Plenderleith, 1970; Guldbeck, 1969), most of the mechanical damage occurs in places where the leather is folded. In these places there is a cracking and splitting of the material.

All these factors, which are based on the conditions in the environment in which the furniture is used, interact with the leather in upholstered furniture, and in order to maintain the quality of the leather as a material it must be properly maintained.

3. LEATHER MAINTENANCE SYSTEM IN UPHOLSTERED FURNITURE

The manner of maintaining leather furniture depends on the frequency of use, the exposure, duration and intensity of the action of the aforementioned factors. Leather furniture maintenance systems mainly contain the following three groups of activities: prevention, cleansing and conditioning of the leather.

Prevention means control of the conditions in the environment of use and exposure of furniture to the destructive factors affecting the climate in the interior. These factors have previously cited as abiotic factors: temperature and relative air humidity, UV rays and heat, air pollution, dust, smoke and chemical evaporation and biotic factors: perspiration, mechanical and a surface load. Prevention in the sense of using coverings for the surface protection of leather furniture.

Cleaning should be periodic, depending on the effect of the abiotic climate on the interior and the frequency of use of leather furniture. We noted that the upholstered leather furniture is exposed to dusting in use, and if this contamination is allowed to be excessive, then cleaning is not possible or is complicated (Rausch, 2006). Periodic cleaning is based on brushing the surface with soft fibers or using a vacuum cleaning machine (Canadian Conservation Institute, 1992). If necessary, the leather is also wiped with wet cotton rug to remove the residual dust and sweat residues. This is especially important, to be done before conditioning of the leather. Soaps and detergents are not adequate to cleaning the leather due to their alkaline pH (the leather has a pH of about 5.5) and these alkalis act degrading (Canadian Conservation Institute 1992; Storch, 1987).

Conditioning is the most important stage of leather maintenance. Fats are an integral part of the natural skin, which is why some of the fats are added to the processing. During processing, fats prevent the collagen fibers from interconnecting, which is especially important when the leather is drying. Fat also impregnates the leather and restores the previously lost fats, which are necessary for further exploitation (Bogacki, 2005), when aging loses some of the fat, it becomes hard and cracks. Conditioning is actually maintaining the natural properties of the leather at the optimum level. This concept of "feeding" or restoring lost fats was scientifically confirmed by Walter (Weterer, 1972). With the increase of fat in the leather, it increases its flexibility (Plenderleith, 1946). It is well known that conditioning is combined with hydration. It is best to perform conditioning while the leather is wet because the water acts as a medium which allows deeper penetration of fat (White, 1856, Blockey, 1919). According to recent studies (Jarnagin and Knopp 2009), water and fats are key to "rejuvenating" the leather, penetrating deeply into collagen fibers that are making the leather soft and flexible. The amount of added fat should be in proportion to the density of the fibers of the leather (Stambolov, Van Soest, Hallebeek, 1984).

4. COMMERCIAL CONDITIONERS OF MAINTAINING LEATHER IN UPHOLSTERED FURNITURE

Commercial conditioners are offered in multiple shapes and with different consistency like oils, soaps, pastes and sprays. Some of them are multipurpose, for simultaneous cleaning and conditioning and some just for conditioning the leather.

4.1. Neatsfoot oil - bone oil

The use of Neatsfoot oil for leather maintenance dates from 18 century. It is yellow color, and is obtained by boiling of bones. In the past it was used as pure crude oil, and today it is used as a commercial product mixed with mineral oil and some vegetable oils, most often with soya oil. The composition also contains solvents. Characteristic of it is that it quickly penetrates into the leather, absorbs, and much darkens. It acts oxidizing on the leather.



Figure 4. Commercial types of Neatsfoot oil - Bone oil

4.2. Saddle Soap - Soap for leather

Conditioner that has a long tradition of use. It is used at the same time as a cleanser and conditioner. It is a soap with the addition of lanolin and bee wax. This agent has a basal character with pH 10, acts alkalinizing on the leather that usually has acidity pH 5. Saddle soap reacts by naturally occurring oils in the leather, leaving white spots on the surface of the leather. Conditioner is mainly degrading.



Figure 5. Commercial Forms of Saddle Soap

4.3. Pastes with animal fats and oils

Pastes that are composed of animal fats and oils with waxes or resins dissolved in solvents. They have fats and oils from: mink, cattle, whales, bears, etc. Besides the fats, they contain waxes, pine resin and solvents such as turpentine or other oil solvents. The best known is the mink based grease based product, "Mink oil". Some of them contain a large percentage of solvents, thus achieving past form.



Figure 6. Mink oil – conditioner

On a market are also available cosmetics cleansers, soaps and detergents and some of them are shown on Figure 7.



Figure 7. Commercial cleaners and conditioners

The listed commercial agents (including those based on animal fats and oils) also contain solvents that further dissolve occurring fats in the leather. The solvents are degrading both to the leather and to the coatings and colors used for surface treatment of the leather (Soest , 1984; McCrady, 1993). Also, the mineral oils that are part of some of these agents are not related to the collagen, they do not "feed" the leather improperly. According to some authors (McCrady E, 1993) as the criterion for selecting and using commercial maintenance means are the current visual effects on the leather. Unfortunately,

it does not pay attention to the long-lasting effect that in the long term is negative and degrading to the leather.

5. TRADITIONAL CONDITIONERS AND MAINTENANCE OF THE LEATHER

Fats and oils of animal origin for the treatment and maintenance of leather have been used long ago. The first literary data date back to the 19th Century (White F, 1856; Blockey, 1919; Newbury, 1940). During that period, tallow, lard and lanolin were used, and fish oil.

Traditional leather conditioners were often combinations of fats and oils with the addition of bees wax. The role of wax is to fill the pores and thereby prevent dehydration of the leather. The most commonly used combination was tallow and fish oil in the same ratio, but very good results were achieved with the addition of bees wax (Blockey, 1919). There are also traditional recipes derived from craft workshops, composed of 50% tallow, 25% lard and 25% bees wax (or lanolin instead of lard), which are also used today by craftsmen and individuals (Horse & Hound, 2012). Figure 8 shows the appearance of a combination of these conditioners. These traditional recipes do not contain soaps or solvents. They have the ability to migrate through surface coatings of the leather (Angus, Kite, Stuge, 2006).



Figure 8. Traditional conditioner made of animal fats and bees wax

The author Tusk (Tusk, 1983) lists some facts to use fats and oils to maintain the leather. Porous and fibrous structure of the leather requires conditioning, and according to it, the fats will reduce the friction that occurs in the tanning process between the collagen fibers and increases the durability of the leather. Then, with increasing fat, the stretching strength of the leather decreases, but the probability of dehydration decreases. Fat reduces porosity and prevents the penetration of chemicals. Leather oxidation decreases if the fats have a large number of unsaturated fatty acids and thus increase the chemical stability of the leather. At the same time, the aesthetic effects of the leather are improved.

According to authors (Ludwick, 2012; McCrady, 1983; Kite, Thomson, Angus, 2006), the leather conditioners: reduce aging (degradation), improve appearance and maintain firmness and flexibility.

Natural fats of the same species: animal - leather - fat, are of better quality than other fats to be used for further conditioning the leather (Santos et al, 2005; Nasr, 2017).

The leather that is treated with fats has high organoleptic properties, it is soft and gives a feeling of fulfillment (Sandhya, et.al. 2015). The leather oiled with fish oil has a strong characteristic scent and increases the natural intensity of the scent of the leather.

The only disadvantage of these traditional conditioners is the slow absorption of fat in the leather, which can last up to three days, while the surface of the leather is slick.

6. CONCLUSIONS

According to this review of the needs and possibilities for care and maintenance of leather in the upholstered furniture, and presented in order to maintain the quality of the material and surfaces for the general quality of the product, the following conclusions can be made:

- Care and maintenance of leather in the upholstered furniture is a system of activities such as prevention, cleaning and conditioning of the leather. All these activities are interconnected to maintain the quality of the leather.

- Commercial leather conditioners do not meet the needs for maintaining leather quality over a long period of time.
- Traditional leather conditioners which is made of animal fats, oils and waxes strengthen collagen fibers on the leather, maintain flexibility, improve hydrophobicity and increase its organoleptic properties.
- The most commonly used traditional conditioner contains 50% tallow, 25% lard and 25% bees wax.
- Conditioning is combined with hydration. It's best to perform conditioner while the leather is wet because the water acts as a medium which allows deeper penetration of fat
- Disadvantage of these traditional conditioners is the slow absorption of fat in the leather.

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Corresponding address:

Mihajlovski Nikola,

Ss. Cyril and Methodius University in Skopje
Faculty of Design and Technologies of Furniture and
Interior – Skopje
16-ta Makedonska brigada 3
1130 Skopje, NORTH MACEDONIA
e-mail: mihajlovski@fdtme.ukim.edu.mk