Care of Leather Materials

by Chalit Singhasiri

Leather is one of the oldest materials known to man. Even primitive people knew how to bring out the advantage of skins and hides preservation for various purposes. As their communites grew larger, knowledge of animal skin usage also increased; thus they learned how to make new things from leather.

The term "skin" generally refers to the skin derived from small animals (sheep, goats, pigs, snakes, lizards, etc.), while those of large animals (cows, horses, buffaloes, elephants, etc.) are called "hides". Any animal skin or hide starts to putrefy once the animal is slaughtered. To eliminate putrefaction, skins or hides are converted into leather through different mechanical and chemical processes. As a result of these processes, leather becomes relatively resistant to chemical, physical and biological degradation.

The basic raw material of leather is the proteinaceous matter. The material contains about 65% water and about 33% protein. Fatty substances, mineral matter and several other substances account for the remaining portion. Protein of animal skin is composed of structural proteins and non-structural proteins. The structural proteins are collagen, elastin and keratin while the non-structural proteins are the albumins, globulins and mucins, etc. Among the structural proteins, collagen is the main constituent and structural substance for leather making.

Animal skin is composed of three layers. They are the epidermis or outer surface containing dead cells and hair or wool; the corium or bulk skin consisting chiefly of collagen fibers which shows the characteristic grain pattern and leather properties which differs in each kind of animal; and the hypodermis, loose flesh which is removed before curing[1].

Once the skins or hides are removed from the slaughtered animals, the flesh must be removed soonest otherwise it will begin to putrefy. Curing the skin with salt or exposure to the sun will eliminate the problem of bacterial decay but will not produce leather. Leather is produced only when the cured skins are treated with tanning agents[2].

Properties of Leather

Leather produced from different methods of tannage will have distinctive differences in their properties. The properties depend upon the nature of the skin or the hide itself, the tanning agents employed and the technical processes. Generally speaking, leather has some common physical properties as follows: high tensile strength, high resistance to tearing, ability to lengthen or stretch, good perspiration, good flexibility, high resistance to puncture, durable and resistant to wear and abrasion, and the ability to absorb and transmit moisture.

Leather is an organic material. As such, it has a hygroscopic property. This means that its moisture content varies depending upon the changes in temperature and humidity. Change in humidity causes expansion and contraction in the material. On the average, the moisture content of leather lies between 10 and 14 percent. The water absorption capability of leather depends upon the type of tannage and the fat content. Vegetable-tanned leather has a higher rate of water absorption than full chrome-tanned leather. Chamois or oil-tanned leather is most resistant to water. The pH value of leather depends upon the method of tannage and the usage. Generally, they are rather acidic. (See Table)

Types of Leather

The classification of leather is either based upon the tanning method or the usage they are put to. Actually there are quite a large number of tanning techniques but this article only deals with the major types based upon tanning methods.

Vegetable-tanned leather. Skin or hide is tanned with an aqueous solution of vegetable tannin derived from various types of plants. This method has been used since the Egyptian and Mesopotamian period. In the modern method of vegetable tannage, a synthetic tannin called "syntan" is introduced to reduce the time of tannage and to replace vegetable tanning agents.

The natural color of vegetable-tanned leather ranges from pale brown to reddish brown, according to the particular tanning agent employed. It is less supple, less elastic, low resistance to temperature higher than 70-75°C. It is also highly resistant to abrasion, changes slightly in areas with fluctuating humidity; easily absorbs water; useful for embossing; and is less affected by perspiration.

Name of the leather	pH of water soluble
Full chrome upper leather	4.5-6.0
Retan chrome upper leather	3.5
Insole leather	3.3
Sole leather	3.5
Lining leather	3.5

pH of some leather products.

	Outer surface
Epidermis	Epidermis
Dermis	Papillary layer
	Fibre network layer
Hypodermis	Flesh layer

Left: A diagram showing the relative positions of the various layers of skin.

Chrome-tanned leather. Skin or hide is tanned with chromium salt. Chromium salt is most important among the mineral tanning agents. Chrome tannage has a greater advantage over vegetable tannage in terms of the time required for producing leather. The natural color of full chrome-tanned leather is greenish blue. It has a greater resistance to heat and abrasion. It also has good mechanical strength. A combination of chrome tannage and other tanning agents betters the properties of leather as compared with single tannage.

A cross-section of leather: On top is the grain side, showing dense fibre. At the bottom is the flesh, showing loose fibre.

Alum leather. Aluminium salt has been used in tannage since ancient time. Tanning with alum is known as "alum tawing"[3]. Since aluminium salt does not combine readily with the protein in the skin, it is easily washed away with warm water, thus, converting the leather back to the skin.

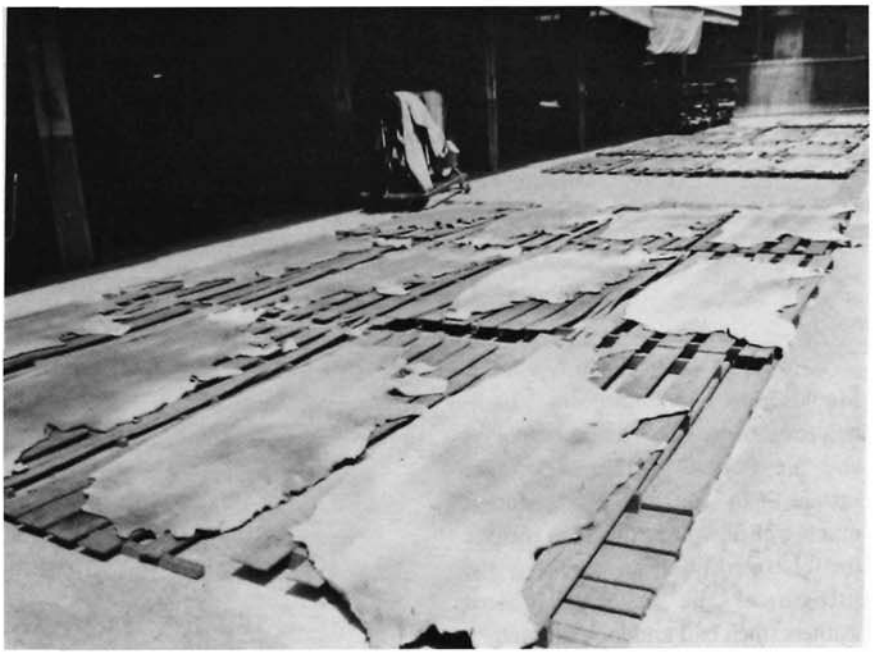
Aluminium sulfate is colorless. It does not impart any color to the skins or to hair. Therefore, it is useful in tawing fur-bearing skin. It is generally used for pretanning, prior to chrome or vegetable tannin, etc.

Alum leather is white in color. Alum tannage is mainly employed for white leather and fur leathers.

Aldehyde leather. Skins tanned with formaldehyde give a pure white leather and are more resistant to water than alum leather. Formaldehyde is used for tanning fur-bearing skin. It also acts as a pretanning agent for heavy, vegetable-tanned leather.

Chamois leather. Certain oils have been used for tanning skin since prehistoric times. Chamois leather is yellowish, very soft and pliable, and is nearly as resistant to water as aldehyde leather. Today it is usually made of sheep or lambskin.

Right: In tropical and arid zones, pieces of leather are dried under the sun. After drying, they are ready to be made into various leather products.



The following are finished leather items classified according to their usage: clothing leather, fur leather, glove leather, lining leather, bookbinding leather, luggage leather, shoe upper leather, sole leather, upholstery leather and sports goods leather. They are made from various types of skin and hide. They are made from different methods of tannage, depending upon the usage they are put to. These hides and skins are usually from cows, buffaloes, sheep and goat. Method of tannage may either be single or combination.

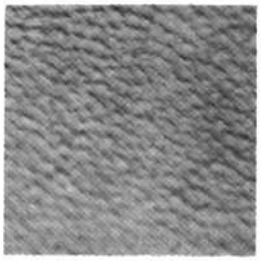
Vital Factors in Deterioration

Action of alkaline and acid. The alkaline and acid residue from the manufacturing process weakens the physical strength of leather. Excessive moisture in leather combines with alkaline or acid and reacts chemically with collagen. The action of acid is more destructive on vegetable-tanned leather than chrome-tanned leather. The leather becomes brittle and finally disintegrates into powder if the leather is very acidic. On the other hand, it becomes hard and chaps if it is rather alkaline.

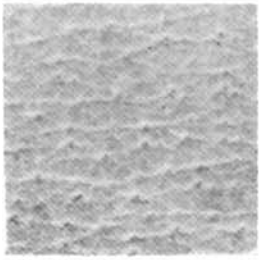
Rawhide is cured with salt to prevent putrefaction before the leather-making process.

Environmental condition. Since ASEAN countries lie in the tropical zone, both temperature and humidity are quite high throughout the year. If leather is stored in a place with low humidity for a long period of time, it will become rather hard and slightly bent. This is due to loss of moisture content. On the contrary, if it is stored in a place with high humidity, mould will easily grow on the leather surface. Mould growth causes staining and is unsanitary. Under unfavourable climatic conditions, leather will deteriorate significantly.

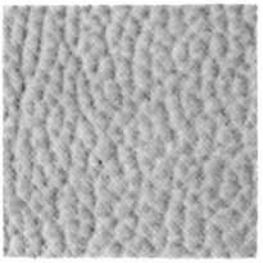
Sunlight. This is one of the destructive agents. It causes shrinkage and brittleness to the leather. It can change the color of the material and causes the chemical reaction between pollute gases and moisture in the air. Dyed leather may change in color if exposed directly to sunlight for a long period of time. High temperature, over 50°C, may lead to irreversible shrinkage and hardening. Deterioration caused by unfavorable climatic conditions is gradual and is not immediately noticeable.



Calf



Pig



Goat

Left: Different animal skins show different grain patterns.

Below: Various products utilizing leather.

Moulds and insect attack. Moulds grow rapidly in humid condition (over 65 to 70% relative humidity) and are normally observed on the surface of the leather. They produce a number of organic acids which corrode the collagen fiber and weaken the strength of the material. Infested leathers smell bad and look unsanitary. Insect pests like cockroaches and silver fish can attack leather if stored in a dirty and badly ventilated area. Deterioration caused by organisms can be observed sooner than the effects of unfavourable climatic conditions.

Human beings. Damage caused by man may be directly or indirectly. Accidents and carelessness in handling and packing cause abrupt damage to the object. Lack of knowledge in preventive measures and wrong planning may damage the object gradually, without notice.

Left: Proteinaceous materials like skin and leather are susceptible to insect attacks. Picture shows a drum damaged by insects.

Preventive Measures

No doubt, humidity fluctuations cause contraction and expansion in the fibre. So leather should be kept at a relative humidity, between 50% and 65%, with minimum fluctuations (± 2% is acceptable). Theoretically, it is advisable to keep the relative humidity as constant as possible, at the recommended level. To prevent the accumulation of humidity, good ventilation is necessary, particularly during the rainy season.

Refrain from exposing leather to direct sunlight. Likewise, it should not be exposed to bright spotlight, over the recommended level, in an exhibition or storage room. Dyed or painted leather can be extremely light sensitive.

Leather should not be displayed near a heat source. Temperature where leather is kept should not exceed 25°C.

Thermohygrograph, UV monitor and light meter should be provided in order to record the humidity and light condition in a museum. Data from their readings are very useful, especially in correcting mistakes, in planning a museum.

It is quite difficult to eliminate dust and to prevent gases from diffusing into a museum. This entails high expense. But this can be done simply. Exhibit object in well-sealed showcases. If stored, objects should be kept in drawers, cabinets or covered with plastic sleeves.

Leather objects should not be subjected to unequal mechanical stresses while being stored or exhibited. Whatever the object, the aim should always be to ensure that it rests in a position devoid of any strain.

Cleaning

An object in good condition needs only to be cleaned and kept dry. Loose dust can be removed with a soft brush. Do not use moist cloth in rubbing a leather surface. Remove adhering dirt with cotton swabs moistened with a mixture of alcohol and water. Delicate leather should be cleaned with a vacuum cleaner at a low speed. The nozzle must be covered with a nylon netting and should not directly touch the object.

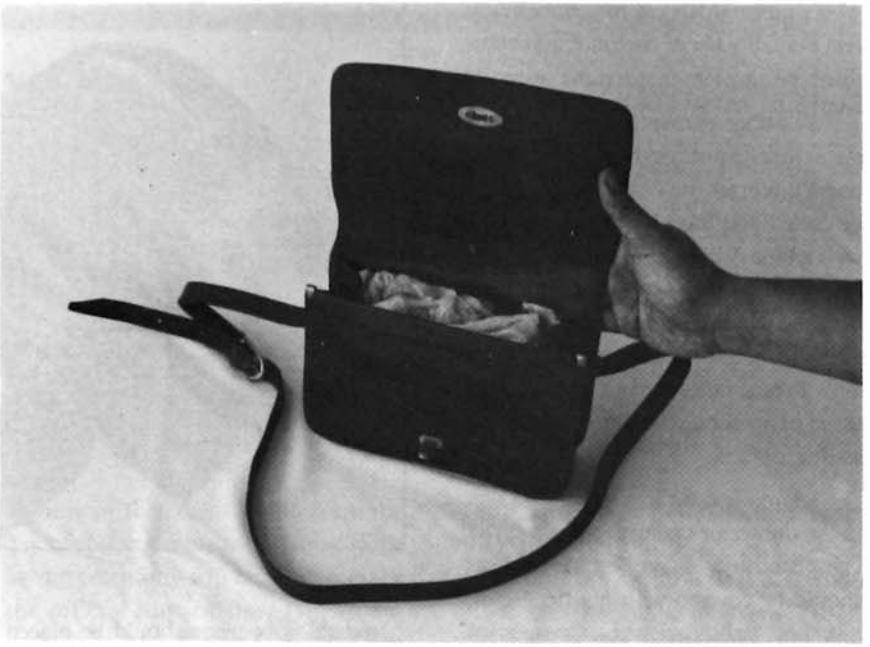
Handling

Keep in mind that any creases or foldings on a leather material should be minimized. Gentle handling will help to keep leather objects in good condition. Minimal handling is a must for objects that have lost their flexibility. Soft and pliable leather objects may be handled by rolling or lying down flat. Leather garment and shoes should be lifted together with mannequins. If they are stiff or wrinkled, no attempt should be made to restore them to their original shape.

Storage

The storage room for leather objects should always be cleaned from time to time. Good housekeeping is an essential activity. Thermohygrograph should be monitored continuously in order to know the temperature and relative humidity level of the storage area.

Any source of moisture leakage should be searched, like rooftile cracking or water seepage. More air ventilation is needed after the rain. Humidity inside the storage room should not accumulate, otherwise mould problems will arise. During heavy rains, if the drainage system is not good enough, beware of flooding on the ground floor of the storage room. When the graph

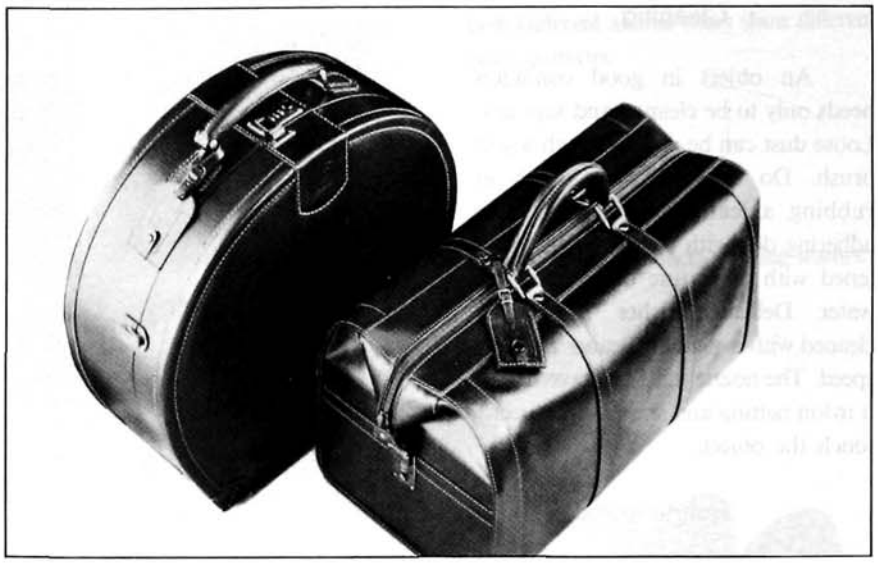


When in storage, leather products should be padded with balls or pieces of tissue paper. They could also be fitted with dummies to prevent wrinkles that could likely form.

shows unusual figures for temperature and humidity levels, corrective measures must be implemented right away.

Leather garments should be put on a mannequin or hung on a well-padded hanger. Belts and straps could be coiled and loosely held in position with a tape. Wallets, purses and bags or even shoes may be supported with balls of tissue paper. Flat, but flexible leather objects, should be laid down horizontally. Foam, cardboard or sponge with tissue paper should be placed under the leather objects.

Dyed and fur leather may be kept in the drawer or cabinet to avoid direct light exposure. Large leather objects should be covered with plastic sleeves, but not tightly sealed. Crystals of paradichlorobenzene should be placed inside the drawer or cabinet to keep insects away. But these crystals should not be allowed to come in direct contact with the leather itself. Spraying with commercial insecticide can be done at a corner of the cabinet/storage room or on the floor but not directly to the object. Frequent inspection is a must to check problems of mould and insect. ■



Footnotes

1. Any process for preservation of rawhides and skins.
2. A chemical which combines with the proteins and renders animal hides or skins imputresicible.
3. Dressing skin into leather with solution of aluminium potassium sulfate, salt and other materials instead of tannin.

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