HIDES:
In the tanning trade the outer coverings of large domestic animals are called hides. Hides are large in size, thicker in substance and heavier in weight than skin. In Bangladesh Cattle hides above 25 lbs. in the wet salted conditions are classed as **hides** and those below 15 Ibs. as **calf skins**. Light buffalo hides weighing from 14.5 to 18 lbs. are called **'Katta'** and those weighing from 7-14 lbs. are called buff calves or **'Kattais'**.

Example: Cowhide, Buffalo hide, Horsehide etc.

SKINS:
The outer coverings of small domestic animals and wild animals are called skins. Skins are smaller in size, thinner in substance and lighter in weight than hides.
Example: Goatskin, Sheepskin, Tiger skin, Crocodile skin etc.

KIPS:
A kip is the hides of immature cattle. In the western countries cattle hides weighing between 15 lbs. to 25 lbs. in the wet salted condition are classed as **kips**. It is smaller, lighter and thinner than a hide, but larger, heavier and thicker than a calf skins.

CHEMICAL COMPOSITION OF HIDES & SKINS
The chemical constituents of hides and skins can be divided into four main groups, such as,

1. Protein - 1 9 % to 33 % on the green weight
2. Water - 60 % to 70 % on the green weight
3. Minerals - 0.36 % to 0.5% on the green weight
4. Fatty matter - 2 % to 30 % on the green weight

The epidermis is a comparatively thin layer which forms the upper boundary of the skin. This layer measures only 1% the total thickness of the skin and serves to protect the corium which is the most important part of the skins. The corium is a much thicker layer of connective and other tissues which constitute the true leather forming substance of the hides and skins.

STRUCTURAL DIFFERENCE BETWEEN HIDES AND SKINS:

PROPERTIES OF HIDE:
1) Fiber length is medium.
2) Number of fibers is huge.
3) The thickness of hair is medium.
4) The fiber bundles of female are more uniform than male.

5) Only one hair grows from one hair follicle.
6) Fiber weaving is parallel.
7) Fiber structure is compact at butt area and lower in neck and belly side.
8) The hair is random, scattered on the grain surface.
9) Fat gland is optimum.
10) The hair root does not fully enter into the corium layer.
11) Grain surface is smooth.

PROPERTIES OF SKIN:
12) The epidermis of calfskin is thinner than cowhide.
13) Grain surface is smooth.
14) Fat content is less than cow.
15) Calf skin has 100% cutting value.
16) The hair follicles are much smaller than cow.
17) Collagen bundles have fine structure as compared to cow hides and useful for the finest of leather.

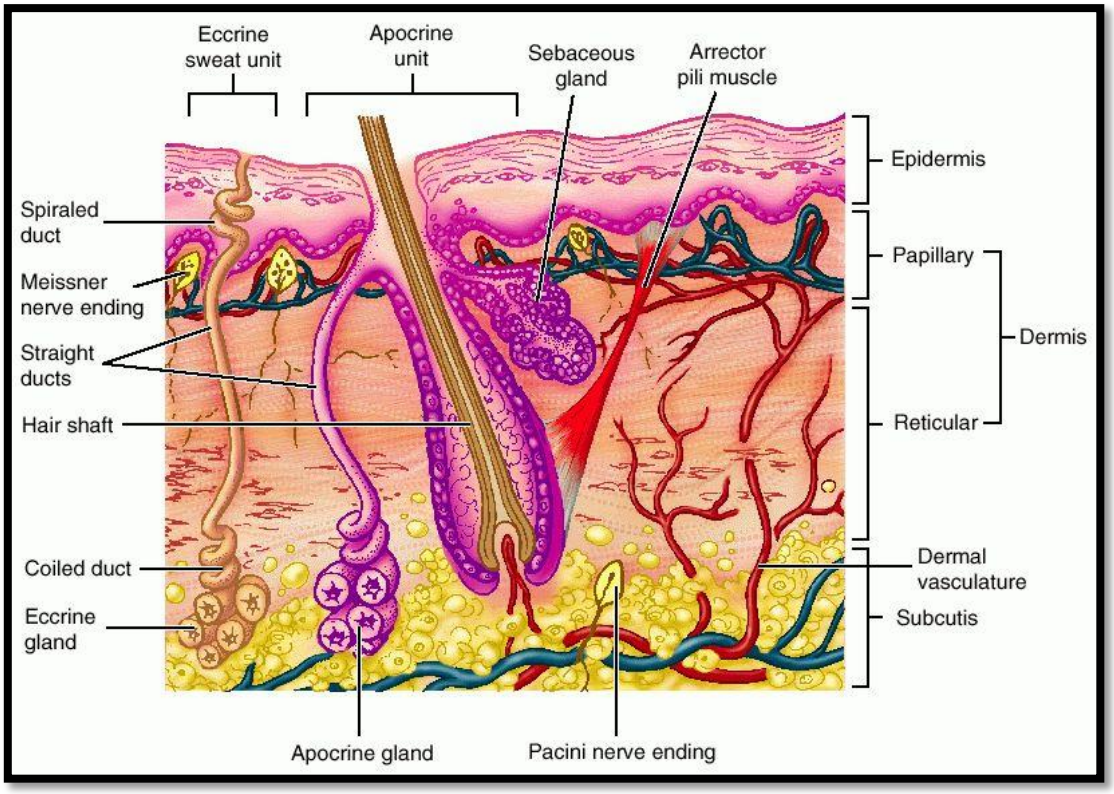
DEFINITION OF LEATHER
Leather is non-putrecible stabilized material obtained from putrecible raw hides / skins by virtue of tanning. It dries out to a soft and flexible material and dose not swell when wetted back.
Owing to tanning process, a chemical combination takes place between the hide substance (collagen) and the tanning agents & auxiliaries, which determines the quality and characteristics of the finished leather. Leather can be produced as soft as cloth or as hard as harness by controlling parameters, sequencing & methodology of manufacturing process as well as selection of raw materials. The material that is responsible to produce leather from hides & skins is known as tanning agents. For example:

· Mineral tanning agents like salts of chromium, aluminum, zirconium & iron.
· Vegetable tanning agents like mimosa, quebracho, chestnut etc.
· Oil tanning agents.
· Aldehyde tanning agents
· Synthetic tanning agents.

The ultimate physical and chemical properties of leather chiefly depend on the nature of these tanning materials.

CROSS SECTIONAL BRIEF OF A LEATHER
Leather is nothing but a natural fibrous protein sheet made from raw hide and skin through tanning and finishing in a tannery. Raw hide or skin has the following sections or layers:

Derma layer which is 85% of the total raw hide thickness	**Epidermis**	**→ Approximately 1% of the raw hide thickness.**
	Corium minor	**→ 20% to 50% of the derma thickness.**
	Corium major	**→ 80% to 50% of the derma thickness.**
	Hypodermis	**→ Approximately 15% of the raw hide thickness.**



To

convert the raw hides and skins to leather, the epidermis layer is first removed and the remaining section, called derma is tanned. Before tanning, appreciable amount of hypodermic layer also removed during fleshing of pre-tanning operation. Leather is therefore made from derma only which has mainly two layers:

· Corium minor,
· Corium major.

History and Process of Leather

The story of leather is long and colourful. Many years before recorded history people wrapped themselves in dried animal pelts. The fact that the skins turned stiff and rotted was a problem, but ways of softening and preserving the hides were discovered. This was the beginning of leather processing. At first the hides or skins were probably dried in air and sunlight. Later they may have been soaked in water and dried over a fire. Still later it was discovered that certain twigs, barks and leaves soaked with the hides in water helped to preserve them. Through archeologist.s findings, we know that primitive man used the skins of hunted animals for food as well as clothing. Nomadic tribes made shelters from the hides of larger animals, such as bison.

As civilization advanced, preserving hides and tanning them into leather became an important industry. In the 18th century tanning was an old and respectable trade and a tedious one. Nearly a year was spent manipulating a hide before it was delivered as leather to the saddle maker, harness maker or other craftsmen.

Leather Manufacturing Process:

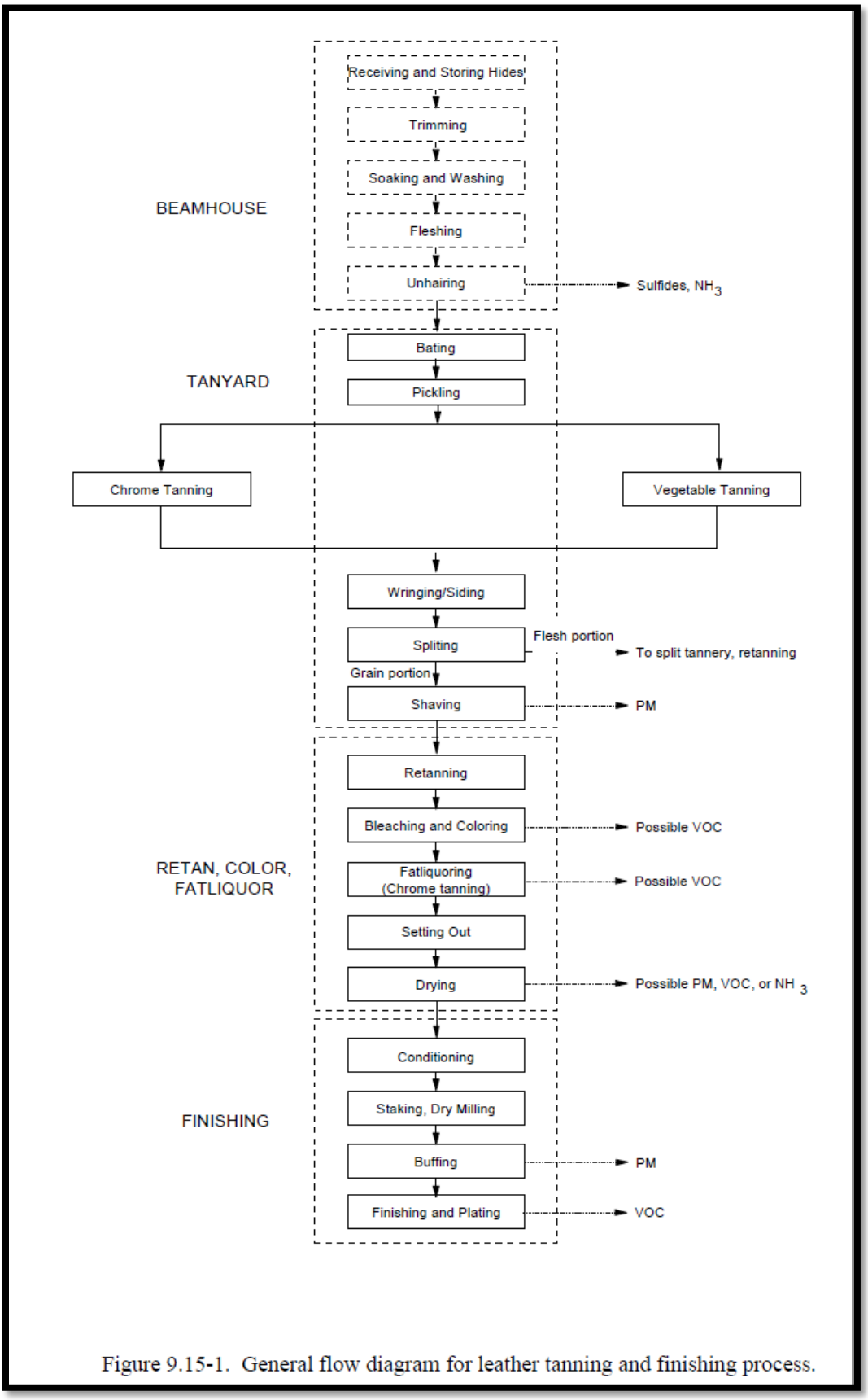


Figure 9.15-1. General flow diagram for leather tanning and finishing process.

The processing of hides and skins into leather is a complex procedure that requires a precise combination of many chemical and mechanical operations. A step-by-step diagram of these processing operations is shown in Figure.

Curing: Deterioration begins immediately when a cow is killed. After the hides are removed from the carcass, they are salted through and through at the slaughterhouses to prevent decay (decline). After they are salted, 55% of the water in the hide is removed, and they are dried for 3 to 6 days. The rawhides are then sold to tanneries.

Soaking: In order for the tanning process to work properly, the dry salted hides must be washed free of the salt. This is done by soaking the hides in water to which chemical wetting agents (similar to household detergents) and disinfectants are usually added for 8 to 20 hours, depending on the thickness of the hides. This soaking procedure rehydrates the hides to their original flaccid (loose) condition and removes the dirt.

De-hairing: The hair must now be removed from the hides. This is done by soaking the hides in chemicals, or depilatory agents (having power of removing hair), which destroy the hair by attacking the hair root so it will release freely from the hides, loosen the epidermis, and remove certain soluble skin proteins that lie within the hide substance without destroying the desirable collagen of the hides.

Fleshing: Excess flesh, fat and muscle must now be removed from the hides. This is done with a fleshing machine.

De-liming: All the depilatory chemicals must now be removed from the hides. This is done by washing the hides in ammonium sulfate or ammonium chloride and then clear water in big drums. These chemicals not only clean the depilatory chemicals from the hides, they also adjust the acid-alkaline conditions (pH) to the proper point for receiving the bate, which are enzymes similar to those found in the digestive system of animals. When the bates are applied, they attack and destroy most of the remaining undesirable constituents of the hide.

Pickling: The hides must be placed in an acid environment (low pH) so they will be ready to accept the tanning materials, because chrome tanning agents are not soluble under alkaline conditions. This is accomplished by adding salt and acid to the hides. This is a preserving process in itself, and hides can be kept in this state for extended periods of time without any deterioration.

Tanning: The raw collagen fibers of the hides must be converted into a stable product which is no longer susceptible to rotting. This is done by adding chrome tanning agents to the hides in a revolving drum. These tanning agents also significantly improve the hide's dimensional stability,

abrasion (act of rubbing off) resistance, resistance to chemicals and to heat, the ability to flex innumerable (countless) times without breaking, and the ability to endure (last) repeated cycles of wetting and drying.

Wringing: The excess moisture must be removed from the hides. This is done by placing each hide through two large rollers similar to those on a clothes wringer.

Splitting: The hides must now be split into the desired thickness. Unsplit hides average to be 5mm thick. The thickness for upholstery (for house decoration) leathers range from .9mm to 2.0mm. The hides are put through a splitting machine that is set to split the hides to the desired thickness. It cuts the top grain off first. Another layer, and sometimes two, is cut. These layers are called splits.

Shaving: The thickness of the hides must be made uniform all over the hide. This is done with a shaving machine through which the hides are run. The helical (coiled or spiral)shaped cutting blades level the overall thickness to exact specifications and open the fiber structure to better receive subsequent chemical processing.

Re-tanning: This process is done to impart special end-use properties with other tanning chemicals. The substances used add solidity and body to chrome leather and help minimize variations in the character of the leather that may still exist between different parts of the hide.

Coloring: As soon as the retanning process is completed, aniline dyes, derived primarily from petroleum and added to very hot water, are added to rotating drums to penetrate the hides for desired color.

Fatliquoring: This is the last of the wet chemical operations to which the leather will be subjected. Fatliquoring has the most pronounced effect on how soft leather will be and it contributes greatly to its tensile strength. The more fatliquors that are added, the softer the hides will be.

Setting Out: This operation smoothes and stretches the hide, while compressing and squeezing out the excess moisture. This puts the hides in the proper condition for drying.

Toggling: The hides are stretched across a perforated frame and held in place with clips called toggles. One hide is clipped to each side of the frame. The frames are then slid into channels in drying ovens.

Staking: Leather is staked to make it pliable. In combination with the correct fatliquoring treatment, staking governs the final firmness or softness of the leather.

Dry Milling: The hides are placed in a large dry drum and tumbled until the desired softness is obtained.

Buffing: This process improves the final appearance of the hides by lightly sanding the surface to remove some of the natural imperfections such as scratches, healed scars, etc. It provides the hide with better cutting yield.

Finishing: This process applies film-forming materials on the surface of the hide. Here is where layers of pigments are added if required. This process also adds the protective sealant to the surface.

Plating: This is the final step in the leather process. During this process, heat presses a chosen grain into the surface of the hides.

USES OF LEATHER:

The distinctive grain off ostrich, snakes & alligator skin makes them popular handbags, purses & other fancy goods. The tough hides of bulls, oxen & cow make excellent shoe sole leather, while the softer skins of sheep are suitable for show upper leathers coats & bookbinding.

Leather is used for car & furniture upholstery, luggage, wall painting, gloves, hats, coats, dress, handbags, wallets, bookbinding's & numerous other products. In the world of sports, leather is essential-cricket, soccer & rugby ball are made by leather. And then there are such items as boxing gloves & head guards, football, boots, saddles & harnesses, ski & riding boots, leather gloves & leather covered steering wheels help racing drivers to keep their under precise control. Protective motorcycle racing leather has helped to reduce serious injures in accidents. The biggest use of leather is in the manufacture of shoes. The table below shows the uses of leather for different purpose in approximate percentages:

1) footwear :---------- 50% of all leather
2) clothing :---------- 25% of all leather
3) Gloves :---------- 7% of all leather
4) Hand bags & Luggage:--------- 8% of all leather
5) Upholstery :---------- 5% of all leather
6) Chamois :---------- 4% of all leather