Chapter one

Introduction

What is leather ?

Leather is a durable and flexible material created by tanning animal rawhide and skin, often cattle hide. It can be produced at manufacturing scales ranging from cottage industry to heavy industry.

People use leather to make various goods—including clothing (e.g., shoes, hats, jackets, skirts, trousers, and belts), bookbinding, leather wallpaper, and as a furniture covering. It is produced in a wide variety of types and styles, decorated by a wide range of techniques.

- ## Composition of animal hides and skins

The skin comprises three layers:

1- **the epidermis,** which is in contact with the outside world and suffers stresses and strains .
2- **the dermis**, which is the layer of living cells, organised into tight connective tissue. This is where the hairs are rooted, and the nerve-endings are located .
3- **the subcutaneous tissue**, a layer of fatty cells and loose connective tissue, which is in direct contact with the muscles.

- ## *Types of leather :*

In general, leather is sold in these four forms:

1- **Full-grain leather** refers to hides that have not been sanded, buffed, or snuffed (as opposed to top-grain or corrected leather) to remove imperfections (or natural marks) on the surface of the hide. The grain remains allowing the fiber strength and durability. The grain also has breathability, resulting in less moisture from prolonged contact. Rather than wearing out, it develops a patina during its expected useful lifetime. High quality leather furniture and footwear are often made from full-grain leather. Full-grain leathers are typically available in two finish types: aniline, semi-aniline.
2- **Top-grain leather** (the most common type in high-end leather products) is the second-highest quality. It has had the "split" layer separated away, making it thinner and more pliable than full-grain. Its surface has been sanded and a finish coat added, which produces a colder, plastic feel with less breathability, and it does not develop a natural

patina. It is typically less expensive and has greater stain resistance than full-grain leather if the finish remains unbroken.

3- **Corrected-grain leather** is any leather that has had an artificial grain applied to its surface. The hides used to create corrected leather do not meet the standards for use in creating vegetable-tanned or aniline leather. The imperfections are corrected or sanded off, and an artificial grain embossed into the surface and dressed with stain or dyes. Most corrected-grain leather is used to make pigmented leather as the solid pigment helps hide the corrections or imperfections. Corrected grain leathers can mainly be bought as two finish types: semi-aniline and pigmented.

4- **Split leather is leather** created from the fibrous part of the hide left once the top-grain of the rawhide has been separated from the hide. During the splitting operation, the top-grain and drop split are separated. The drop split can be further split (thickness allowing) into a middle split and a flesh split. In very thick hides, the middle split can be separated into multiple layers until the thickness prevents further splitting. Split leather then has an artificial layer applied to the surface of the split and is embossed with a leather grain (bycast leather). Splits are also used to create suede. The strongest suedes are usually made from grain splits (that have the grain completely removed) or from the flesh split that has been shaved to the correct thickness. Suede is "fuzzy" on both sides. Manufacturers use a variety of techniques to make suede from full-grain. A reversed suede is a grained leather that has been designed into the leather article with the grain facing away from the visible surface. It is not considered a true suede .

- **There is Less-common leathers include :**

1- **Buckskin or brained leather** is a tanning process that uses animal brains or other fatty materials to alter the leather. The resulting supple, suede-like hide is usually smoked heavily to prevent it from returning to a rawhide state, if wetted. It is easier to soften, and helps repel leather-eating bugs.

2- **Patent leather** is leather that has been given a high-gloss finish. Inventor Seth Boyden developed the original process in Newark, New Jersey in 1818. Patent leather usually has a plastic coating.

3- **Fish leather** is popular for its motifs and its pigmentation. Mainly used for making shoes and bags, the fish skin is tanned like other animal skins.[2] The species used include salmon, perch, sturgeon, etc.

- **Salmon :** farmed in Iceland and Norway, salmon skin has fine scales. Its strength and elegant look make it the most popular fish leather.
- **Perch** : from the Nile, its skin is recognizable with large, round and soft scales
- **Wolffish** : smooth, without scales, with dark spots, and stripes due to the friction of marine rocks
- **Cod :** finer scales than salmon, but more varied texture, sometimes smooth and sometimes rough
- **Sturgeon :** known for its eggs (caviar), its leather is quite expensive
- **Eel :** without scales, its skin is shiny
- **Tilapia :** originally from Africa and farmed in many places, tilapia leather is beautiful, with resistant qualities similar to salmon and perch[3]

- **Shagreen** is also known as stingray skin/leather. Applications used in furniture production date as far back as the art deco period. The word "shagreen" originates from France. It is known as the most difficult leather to work due to dished scales of the animal, and it is one of the most expensive leathers.
- **Shark** is covered with small, close-set tubercles, making it very tough. Shark skin handbags were once in vogue, but interest has fallen as the material and production costs is very high. Moreover, this skin is more difficult to work. (Do not confuse with sharkskin, a woven textile product.
- **Vachetta** leather is used in the trimmings of luggage and handbags. The leather is left untreated and is therefore susceptible to water and stains. Sunlight makes the natural leather darken in shade (develop a patina).
- **Slink** is leather made from the skin of unborn calves. It is particularly soft and is valued for making gloves.
- **Deerskin** is a tough, water-resistant leather, possibly due to the animal's adaptations to its thorny and thicket-filled habitats.[citation needed] Deerskin has been used by many societies, including indigenous Americans. Most modern deerskin is no longer procured from the wild, with deer farms breeding the animals specifically for the purpose of their skins. Large quantities are still tanned from wild deer hides in historic tanning towns such as Gloversville and Johnstown in upstate New York. Deerskin is used in jackets and overcoats, martial arts equipment such as kendo and bogu, as well as personal accessories such as handbags and wallets.
- **Goatskin** is soft but tough, and is used for items such as thorn-resistant gardener's gloves.
- **Nubuck** is top-grain cattle hide leather that has been sanded or buffed on the grain side, or outside, to give a slight nap of short protein fibers, producing a velvet-like surface.

4- **Russia leather** is a particular form of bark-tanned cow leather. It is distinguished by an oiling step, after tanning, where birch oil is worked into the leather to make it particularly hard-wearing, flexible and resistant to water.

- **There are two other types of leather commonly used in specialty products, such as briefcases, wallets, and luggage:**

1- **Belting leather** is a full-grain leather originally used in driving pulley belts and other machinery. It is found on the surface of briefcases, portfolios, and wallets, and can be identified by its thick, firm feel and smooth finish. Belting leather is generally a heavy-weight of full-grain, vegetable-tanned leather.

2- **Napa leathe**r is chrome-tanned and is soft and supple. It is commonly found in wallets, toiletry kits, and other personal leather goods.

- **Leather production processes :**

The leather manufacturing process is divided into three sub-processes: preparatory stages, tanning and crusting. All true leathers will undergo these sub-processes. A further sub-process, surface coating may be added into the sequence. The list of operations that leathers undergo vary with the type of leather.

- **Production management:**

  The leather making process is in general restricted to batch processing, but if the surface coating sub-process is added then some continuous processing can be included. The operation flow has to follow the preparatory → tanning → crusting → surface coating sub-process order without deviation, but some of the sub-processes can be omitted to make certain leathers (or partially tanned/ untanned products).

- **Preparatory stages:**

  The preparatory stages are when the hide/skin is prepared for tanning. During the preparatory stages many of the unwanted raw skin components are removed. Many options for pretreatment of the skin exist. Not all of the options may be performed. Preparatory stages may include :

- **Preservation of hides and skins :**

Fresh or “green” hides and skins are cured to preserve them. Curing removes any water from tissues and thereby slows down the process of putrefaction, as any micro-organisms present develop. Coarse-grained rock salt (with particles 2 to 3 mm in diameter) is used, and antiseptic agents may also be added. During the curing process, hides and skins may lose up to 10% of their weight in water. They are stacked to allow the brine to drain away, inside premises with a relative humidity of between 70% and 90%. The temperature inside these premises is kept at around 10°C to optimise preservation.

After two weeks, the hides and skins are examined one by one, and sorted according to their thickness, the number of flaying defects, the presence of scars, or their weight and surface area.

The following are not "true" organic leathers, but are materials that contain leather fiber. Depending on jurisdiction, they may still be labeled as "Genuine Leather", even though the consumer generally can only see the outer layer of the material and can't actually see any of the leather content:

- **”beamhouse operations”**

Once the skin reaches the tannery, it undergoes a succession of five:

- **Soaking:** the skin is rehydrated and cleaned to remove any impurities and grime.
- **unhairing and liming:** this operation chemically removes animal hairs.
- **Fleshing:** at this stage, the subcutaneous tissue is mechanically removed.
- **Splitting**: the hide/skin is cut into two or more horizontal layers.

- **Reliming:** the hide/skin is further treated to achieve more "opening up" or more protein removal.
- **Deliming:** liming and unhairing chemicals are removed from the pelt.

- **Bating**: this process is used to start softening the leather.
- **Degreasing:** natural fats/oils are stripped or as much as is possible from the hide/skin.
- **Frizzing:** physical removal of the fat layer inside the skin.Also similar to Slicking.
- **Bleaching:** chemical modification of dark pigments to yield a lighter coloured pelt.

- **Pickling:** at this stage, the skin is acidified to prepare it to undergo the tanning process.

• **Depickling**: raising of the pH out of the acidic region to assist with penetration of certain tanning agents

- **Tanning :**is the operation whereby skin and hide are converted into leather, using tannins. These consist of substances of various kinds (vegetable, mineral such as chromium III salts, combination tanning) that convert the skin from a putrescible substance into a rotproof material, which is resistant to hot water and has a low water content.
- **Dressing :**The leather obtained then undergoes the chemical and mechanical treatments required to produce its characteristic properties. Chemical processing will endow it with its colour, suppleness, fullness, etc., while mechanical processing will include shaving (to produce the desired thickness), sammying (to remove any water still present) and setting-out (to stretch the leather and correct any folding-related defects). Lastly the leather is dried.
- **Crusting** : This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. (June 2014) (Learn how and when to remove this template message)

Crusting is when the hide/skin is thinned, retanned and lubricated. Often a coloring operation is included in the crusting sub-process. The chemicals added during crusting have to be fixed in place. The culmination of the crusting sub-process is the drying and softening operation

Crusting may include the following operations :

- **wetting back** - semi-processed leather is rehydrated.
- **sammying** : 45-55%(m/m) water is squeezed out the leather.
- **splitting** - the leather is split into one or more horizontal layers.
- **shaving** - the leather is thinned using a machine which cuts leather fibres off.
- **neutralisation** : the pH of the leather is adjusted to a value between 4.5 and 6.5.
- **retanning** : additional tanning agents are added to impart properties.
- **dyeing** - the leather is coloured.
- **fatliquoring** : fats/oils and waxes are fixed to the leather fibres.
- **filling** - heavy/dense chemicals that make the leather harder and heavier are added.
- **stuffing** : fats/oils and waxes are added between the fibres.
- **stripping** : superficially fixed tannins are removed.
- **whitening** : the colour of the leather is lightened.
- **fixation** : all unbound chemicals are chemically bonded/trapped or removed from the leather

- **setting** : area, grain flatness are imparted and excess water removed.
- **drying** : the leather is dried to various moisture levels (commonly 14-25%).
- **conditioning** : water is added to the leather to a level of 18-28%.
- **Softening** : physical softening of the leather by separating the leather fibres.
- **Buffing:-** abrasion of the surfaces of the leather to reduce nap or grain defects.

- **Surface coating :**

For some leathers a surface coating is applied. Tanners refer to this as finishing. Finishing **operations may include:**

- **oiling**
- **brushing**
- **padding**
- **impregnation**
- **buffing**
- **spraying**
- **roller coating**
- **curtain coating**
- **polishing**
- **plating**
- **embossing**
- **ironing**
- **combing (hair-on)**
- **glazing**

- **Finishing:**At this stage, the leather takes on specific properties, notably in terms of its texture and appearance. These properties enable the leathers produced to be standardised. Depending on the end-uses involved, the following finishes are distinguished:

1. **Aniline finish**: this enhances the surface of the leather by covering it with a transparent substance. This type of leather has a fine appearance, but its upkeep requires a great deal of attention.
2. **Semi-aniline finish**: The leather is covered with a slightly opaque layer of pigment and another layer of translucent material, which masks minor defects.
3. **Pigment finish:** The leather is covered with a layer of opaque pigments only. It offers easycare properties and is not sensitive to water

- **AZADIRACHTA (NEEM) :**

Azadirachta indica, also known as Neem , Nimtree , and Indian Lilac is a tree in the mahogany family Meliaceae. It is one of two species in the genus Azadirachta, and is native to India and the Indian subcontinent including Nepal, Pakistan, Bangladesh and Sri Lanka. It is typically grown in tropical and semi-tropical regions. Neem trees now also grow in islands located in the southern part of Iran. Its fruits and seeds are the source of neem oil.

Neem is a fast-growing tree that can reach a height of 15–20 metres (49–66 ft), and rarely 35–40 metres (115–131 ft). It is evergreen, but in severe drought it may shed most or nearly all of its leaves. The branches are wide and spreading. The fairly dense crown is roundish and may reach a diameter of 15–20 metres (49–66 ft) in old, free-standing specimens. The neem tree is very similar in appearance to its relative, the Chinaberry (Melia azedarach).

The opposite, pinnate leaves are 20–40 centimetres (7.9–15.7 in) long, with 20 to 31 medium to dark green leaflets about 3–8 centimetres (1.2–3.1 in) long. The terminal leaflet is often missing. The petioles are short.

The (white and fragrant) flowers are arranged in more-or-less drooping axillary panicles which are up to 25 centimetres (9.8 in) long. The inflorescences, which branch up to the third degree, bear from 150 to 250 flowers. An individual flower is 5–6 millimetres (0.20–0.24 in) long and 8–11 millimetres (0.31–0.43 in) wide. Protandrous, bisexual flowers and male flowers exist on the same individual tree.

The fruit is a smooth (glabrous), olive-like drupe which varies in shape from elongate oval to nearly roundish, and when ripe is 1.4–2.8 centimetres (0.55–1.10 in) by 1.0–1.5 centimetres (0.39–0.59 in). The fruit skin (exocarp) is thin and the bitter-sweet pulp (mesocarp) is yellowish-white and very fibrous. The mesocarp is 0.3–0.5 centimetres (0.12–0.20 in) thick. The white, hard inner shell (endocarp) of the fruit encloses one, rarely two or three, elongated seeds (kernels) having a brown seed coat.

The neem tree contain more than 100 bio-active ingredients and it is rich in proteins, its bitter taste is due to an array of complex compounds called “limonoids” . the most important bio-active principal is azadirachtin (repellent); other compounds are gedunin (anti malarial), nimbin (anti-inflammatory, anti-pyretic), nimbidin (antibacterial), nimbidol (anti-malarial, anti-pyretic), quercentin (anti-malarial), salannun (repllent), and sodium nimbinate (spermicide).

Young neem leaves contain 60% water , 23% carbonhydrates, 7% proteins more than 3% minerals, and 1% fat.

Neem Leaf ingredients :

Components	**Percentage**
Protein	1.7 %
Fats	2.1 %
Carbohydrates	22 %
Mineral Salts	3-4 %
Calcium	51 %
Phosphorus	80 %
Vitamin	21.8 %

Proline	0.4 %
Votamin	0.1 %
Fiber	6.2 %
Iron	17 mg/100g
Thymine	0.04 mg/100g
Niacine	1.40mg/100g
Carotenoids	19.8mg/100g
Glutamic Acid	73.30mg/100g
Aspartic	15.50mg/100g
Tyrosine	31.5mg/100g

- **Neem Bark Ingredients :**

Components	**Percentage**
Protein	43.4 %
Alkalis	68 %
Mineral Salts	16.4 %
Amino Acids	10-20 %

- **Oils :**

An oil is any neutral, nonpolar chemical substance that is a viscous liquid at ambient temperatures and is both hydrophobic (immiscible with water, literally "water fearing") and lipophilic (miscible with other oils, literally "fat loving"). Oils have a high carbon and hydrogen content and are usually flammable and slippery.

The general definition of oil includes classes of chemical compounds that

May be otherwise unrelated in structure, properties, and uses. Oils may be animal, vegetable, or petrochemical in origin, and may be volatile or non-volatile.[1] They are used for food, fuellubrication, and the manufacture of paints, plastics , leather tanning and other manufactures. Specially prepared oils are used in some religious ceremonies as purifying agents.

- **Types of oils :**

1- Mineral oils , Crude oil , or petroleum :

It's refined components, collectively termed petrochemicals, are crucial resources in the modern economy. Crude oil originates from ancient fossilized organic materials, such as zooplankton and algae,

which geochemical processes convert into oil.[8] The name "mineral oil" is a misnomer, in that minerals are not the source of the oil—ancient plants and animals are. Mineral oil is organic. However, it is classified as "mineral oil" instead of as "organic oil" because its organic origin is remote (and was unknown at the time of its discovery), and because it is obtained in the vicinity of rocks, underground traps, and sands. Mineral oil also refers to several specific distillates of crude oil.

is the scientific term for thefatty acids, steroids and similar chemicals often found in the oils produced by living things, while oil refers to an overall mixture of chemicals. Organic oils may also contain chemicals other than lipids, including proteins, waxes (class of compounds with oil-like properties that are solid at common temperatures) and alkaloids.

Organic oils are produced in remarkable diversity by plants, animals, and other organisms through natural metabolic processes. Lipid

Lipids can be classified by the way that they are made by an organism, their chemical structure and their limited solubility in water compared to oils. They have a high carbon and hydrogen content and are considerably lacking in oxygen compared to other organic compounds and minerals; they tend to be relativelynonpolar molecules, but may include both polar and nonpolar regions as in the case of phospholipids and steroids.

2- Seed oil :

A seed oil is a vegetable oil that is obtained from the seed (endosperm) of some plant, rather than the fruit (pericarp) . Most vegetable oils are seed oils .

The consumption of processed seed and vegetable oils has increased dramatically in the past century . These oils are extracted from seeds , The way these oils are manufactured is very disgusting . it involves a harsh extraction process that includes bleaching , deodorizing and the highly toxic solvent hexane .

The main problem with most of these oils is that they are way too high in omega-6 polyunsaturated fatty acids. Both omrga-3 and omega-6 fatty acids are so called essential fatty acids , meaning that we need some of them in our diet because the body can’t produce them.

Most of the oil seeds are as mixed crop in dry farming regions.

Some examples :

Almond oil , Argan oil , Borage oil , Canola oil , Castor oil , Cotton oil , Corn oil , Grape oil , Hemp oil , Jojopa oil , Macadamia oil ,Mustard oil , Neem oil , Oil Palm , Papeessed oil , Peanut oil , Sunflower oil , Sesame oil , Shea oil .