CHAPTER-1

HIDES, SKINS AND KIPS LEATHER:

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 then 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.

Primitive man covered himself with the skins of animals he killed. They had three major defects:

- They were dump,
- They would putrefy,
- They lost their flexibility and softness upon drying (they dried the skins to stop putrefaction.)

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

E.g. Cattle, calf : 2.0 %

Goat : 2.0-10 %

Sheep : 5.0-30 %

The relative proportions of these materials vary from skin to skin depending upon the species, age, breed, feeding and other habits of the animals.

STRUCTURE OF HIDES AND SKINS:

Most hides and skins consist of three parts, such as

(i) Epidermis,

(ii) Corium or true skin and

(iii) Hypodermic or adipose tissue.

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. The corium is divided into two distinct layers:

ANATOMICAL STRUCTURE OF HIDE/SKIN:

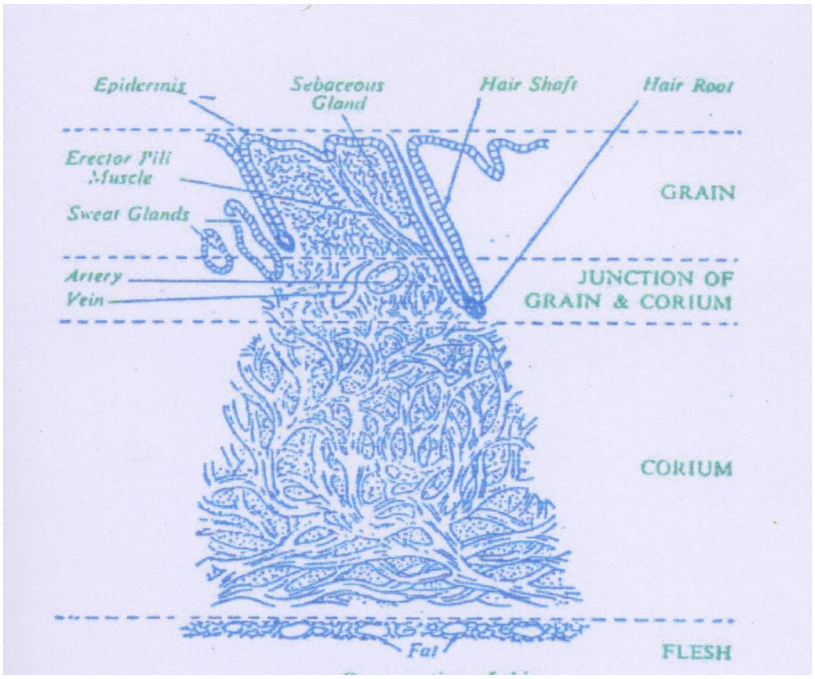


Fig. : Cross section of Hide/ Skin

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.

Goat skin:

Skin of goat is known as goatskin.

The importance of goat leather is well known in spite of the fact that their availability is less then 10% of total leather production. The classic glazed kid leather is among the best in high quality shoe leathers, having a steady position in the area of orthopedic women's shoe upper. This is because one can use the skin almost in its full thickness on the shoe uppers of less than 1.0 mm. this is due to the specific structure of the goatskin; it is tight fibred and has a very tough grain layer, providing an outstanding form-stability and therefore an excellent support for the foot.

STRUCTURE OF GOAT SKIN:

Goats are hardy animals that can live on a side variety of foods can supply meat and milk. They are adaptable to difficult climates and are popular in Asia, Africa, and South America. T he original sources of many of the goatskins are villages of widely diversified areas, so the quality varies greatly. Also important in determining the qualities of the goat skins are the type of animal, the method of slaughter, the method of cure and the marketing practice of the area of origin, between the villages and the world market there is a system of collectors and dealers. The practice of handling skins and the business methods of each area have long been established by customer and tradition. These factors, different each part of the works, are important in determining the quality, characteristics, and price of the skins. The skins are identified by the origin and are sold either on a size specification by the dozen or by the pound.

Goatskins are available in various parts of the world, Bangladesh goatskins are usually considered the best, and among them again the quality differs with districts of production. The normal size below the former and above the latter are called kids and babies respectively. In many respects the skin of may be regarded as having a structure intermediate between that one of the calf and of the sheep and its structural variations at different locations due to differences in the breed of animal and place of origin.

The epidermis of the goat skin covers approximately 1.0 to2.6% of the total thickness of the skin and is relatively thicker at the neck and back bone, hairs are not equally numerous in all the locations of the goat skin, the average number being 8000 hairs per sq, inch of the skin surface area, in some breeds of goats hair density is high and goes up to 18000 hairs sq. inch.

The grain layer of goatskin usually occupies approximately 24 to 54% of the total thickness of the skin. This thickness over the area of the skin normally varies as follow:

Butt 24 to 40% . back bone 26 to54%, neck 32 to54% and belly 27 to45% of the total thickness of the skin. In the grain layer the collagen fibers are compactly woven because of the lesser number of glands and cellular components the grain layer of the goat skin is comparatively more compact than the sheep skin. In goatskin density network of elastic fiber is found covering approximately two- thirds of the grain layer. There is more elastin in goatskin and a relatively greater amount is present in the neck and back bone origins. The elastic fiber can be seen attached to the hair follicles and erector-pili muscles. In goatskin, a considerable amount of elastin is often found throughout the corium and this is like to play an important part in controlling the swelling of the skin in the liming process. The presence of a large amount of elastic in goatskin texture in the pre-tanning processes. A fairly uniform merging of the grain fiber into corium is usually found in good quality goatskin.

The corium of goatskin occupies approximately 45 to75% of the total thickness of the skin. In general, goatskin of the northern region has a comparatively thicker corium than those of the south. The collagen fibers in this layer are fuller and firmer than the corresponding ones in the sheepskins but are hardly equal to those in the calfskin. The weave pattern is goatskin, a very low angle of weave is usually found even in the butt area.

Sheepskin, fat cells and fat droplets are rarely found in the corium of goatskin. A considerable amount of reticular tissue is present in goatskin. The subcutaneous

adipose layer (or flesh) of goatskin covers roughly 1 to 2% of the total thickness of skin, a considerable amount of elastic tissue is present in this layer associated with the collagen fibers. The natural fat in form of the fat cells and as fat deposits is often found in this layer.

PROPERTIES OF GOATSKIN:

The characteristics property of goatskin is following below:

a. The grain layer of goat skin usually occupies approximately 24 to25%of the total thickness of the skin.
b. The tight natured fiber of goat skin is recognized.
c. In the grain layer the collagen of the goatskin fibers are compactly woven.
d. There are more elastin fibers in goatskin than in sheep skin ,and a relatively greater amount is present in the neck and backbone regions.
e. In goatskin a very low angle of weave is usually found even in the butt area.
f. A considerable amount of reticular tissue is present in goatskin.
g. The goatskin has a wider pattern of hairs and a denser structure of skin.
h. The goatskin has straight hair follicles, and consequently a straight hairs. The hair follicles in goatskin are quite deeply rooted and down roughly 0.8 to 2.9 mm. below the skin surface.
i. The glands and fat cells are very much less in number of goatskin.

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.

THE HISTORY OF LEATHER

Leather tanning is one of the oldest human activities. The first rudimental tanning process is mentioned in Assyrian texts and in Homer's Iliad. In the beginnings, skins

obtained from hunting and livestock breeding could be used for clothing or tents, but they became stiff at low temperatures and rotted with heat. It was probably then that attempts were made to render them more flexible and stronger by rubbing in animal fats. Another process was smoking, which almost started by accident, and which latter became formaldehyde tanning, as this substance is found in the vapors produced by burning green leaves and branches. It was soon discovered that drying carried out by exposure to sun, or could also stop the rotting process by the dehydrating action of salt. Vegetable tanning was also known in very ancient times, although it is not clear how the tanning action of the tannin contained in the bark of some plants (especially oak) was discovered. Another method known since the earliest time is tanning, based on the use of alum, a mineral that is fairly widespread in nature, particularly in volcanic areas. These methods, which gradually became more refined and efficient, allowed skins to be used in the ancient s world and continued to do so for century after century up to the present day. The fact mat the use of these techniques was widespread in witnessed by numerous written documents and paintings as well as archaeological finds. In Mesopotamia between the fifth and the third millennium B.C., for example, the Sumerians used skins for long dresses and diadems for ladies. The Assyrians used leather for footwear but also for liquid containers and as inflated floats for rafts. The ancient Indian civilization first processed the type of leather known as the "Morocco" today.

The Egyptians also achieved considerable skill in processing leather, which they used for clothing (even for gloves), tools, arms, or simply for ornament. The historian Strobe tells of an interesting use developed by Phoenicians who made water pipes from it. During Roman times, leather was widely used in all the provinces of the empire, and more efficient tanning techniques were introduced where they had not been developed locally.

The Romans used leather for both footwear and clothing and for making shields and harnesses. A tannery was uncovered amid the ruins of Pompeii and the same equipment of the kind (still in use for centuries thereafter) was found in it.

Skipping forward to the 8th century of Spain, then under the dominion of the Moors, we have the development of the production of" Cordovan", a type of leather famous throughout Europe for centuries, thanks to important progress in tanning. That skill in leather tanning was not a prerogative of the western world as recounted by Marco Polo. In this "Travels" he tells us that the Mongols used leather flasks, covers, masks, and caps decorated artistically, and it was him who coined the expression "Russia Leather" to indicate a type with a characteristic fragrance.

In the fourteenth century, leather was being used in combination with wood in chairs, armchairs, and settees with craftsmanship that reached the levels of an art form. This was also the case later on with tapestries, (especially in Venice in the fifteenth and sixteenth centuries), with chests and cases, and of course, with books binding, perhaps the most lasting and refined use of the material. Going back to tanning techniques, it is more of less in the middle Ages that the depilating action of quick lime was discovered, a technique that is still valid and normally used today.

A radical shake- up was provided in the middle of the last century with the discovery of the tanning power of chrome salts which led to a drastic improvement in production and was applied in practice in the industrial production towards the end of the century. Another revolutionary element was the substitution of the tanning pit with the rotating drum, along with the discovery of new types of tannins.

As a result of all theses innovations, the time required for the tanning was shortened incredible from eight month to a year, to a period of a few days today. But let us take a step back again to have a look at the system and tools that were ones used to work leather. We immediately discover that from Paleolithic times, almost to the present day, the processes and tools remained almost unchanged, gaining only in efficiency and comfort. Similar tools for fleshing, scraping, shaving, perching and trimming are found in practically every epoch known to us. This is a further demonstration of the fact leather tanning has gone hand in hand with the history of man kind, maintaining

those features of " Craftsmanship" which even today, with increasing automation, are an essential part of the personal sensibility and solid experience of those carry it on.

CONCEPT OF QUALITY

A quality is the totality of features and characteristics of a product or service that bear on its ability to satisfy started or implied needs. Five principles approaches to defining quality can be identified:

1) The transcendent: According to this view, quality is something timeless and enduring about its style.

2) The product based: According to this view, the product produced should have all the adequate properties.

3) The user based: According to this view, the product has to have best satisfying properties and preference of the users according to their needs.

4) **The manufacture based:** According to this view, a product should achieve all the necessary chemical and physical properties.

5) The value based: This view actually defines quality in terms of costs and prices.
So, quality leather means which posses all the qualities mentioned above.

DIFFERENT TYPES OF LEATHER GENERALLY PRODUCED

Various types of leather are produced by the choice of raw material and by the variation of a sequence of tanning processes.

- **Aniline leather** is the most natural looking leather with the unique surface characteristics of the hide remaining visible. Aniline leather is coloured only with dye and not with a surface coating of polymer and pigment. A light

surface coating may be applied to enhance its appearance and offer slight protection against spillages and soiling

- **Semi-aniline leather** is more durable than aniline whilst still retaining a natural appearance. The increased durability is provided by the application of a light surface coating which contains a small amount of pigment. This ensures consistent colour and imparts some stain resistance.

- **Pigmented Leather** is the most durable and is used in the majority of furniture upholstery and almost all car upholstery. The durability is provided by a polymer surface coating which contains pigments.

- **Antique grain** (two-tone or rub-off)

  A special surface effect has been created to mimic the unique 'worn' appearance of traditional leathers. This is achieved by applying a contrasting top-coat which is applied unevenly or partially rubbed off to reveal a paler underlying colour.

- **Nubuck**

  Aniline dyed leather which has been lightly abraded on the grain surface to create a velvety finish or nap. In some cases the grain pattern is still visible. The nap is very fine because of the tight fibre structure in the grain layer.

- **Suede**

  A split which has been abraded to create a distinctive nap. The nap can vary in appearance but is not as fine as the nap on nubuck because of the looser fibre structure.

Among the above kinds of leather clothing has recently attaining of the manufacture. Clothing leathers are purely chrome tanned, thin, soft and simple grain leather or suede, made from goat skins, sheep skins and velar as well as pig skins and other large hides and in other words from almost all hides and skins with little exceptions.

British Standard (BS2780) Definitions

Aniline leather

Leather that has been dyed by immersion in a dyebath and has not received any coating of pigmented finish.

Semi-aniline leather

Leather in which the base coat of the finish contains pigment but later coats contain only dye or a contrasting pigment, to give a two-tone appearance, designed to imitate analine leather.

Pigmented leather

Leather to whose grain surface a finish containing fine pigment particles in a binder has been applied.

Corrected grain leather

Leather from which the grain layer has been partially removed by buffing to a depth governed by the condition of the raw material and upon which a new surface has been built by various finishes.

Waxy leather

(1) Upper leather finished on the flesh side and dyed. It is vegetable tanned with a high content of hard grease, though not necessarily wax.
(2) Leather bearing a wax finished.

Suede

Leather whose wearing surface has been finished to produce a velvet-like nap.

Nubuck

Cattle-hide leather buffed on the grain side to give a very fine velvety surface : white or coloured.

Split

(1) A single layer from a hide or skin that has been separated over its whole area into two or more layers. (grain split, middle split, flesh split)
(2) Leather made from the flesh split or middle split.

Finished split

A split leather that has been finished by the application of a surface coating to simulate the appearance of a grain leather.

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

VARIOUS OPERATIONS IN LEATHER PROCESSING

Leather processing involving a number of operations starts right from the death of animal. The natural protection of hides/ Skins ceases the moment the animal dead. The

just flayed hide / skin contains 60-70% of water and large quantities of proteins those mark them liable to bacterial attack and mould growth if they are not cleaned and given protective treatment against bacterial and mould growth. So curing is essential before tannery operation.

Curing:

The protective treatment administered soon after the hides or skins flayed to strengthen the storing properties. It creates an environment for the hides/skins in which the protein destroying micro-organism can not function. It can be done in various methods, like wet salting, dry salting, drying, freezing etc.

Trimming and Sorting:

Trimming is done to remove unwanted long Shank, horn, hooves, ears, tails etc and give a proper shape of hide / skin. Then sorting is carried out according to size, weight, thickness, grade etc and formed into batches to maintain the quality of leather.

Weighing:

Weight of hide or skin is taken in order to measure the chemical required for the subsequent operation. The weight is known as green weight or salt weight.

Soaking:

Soaking is the first operation carried out in drums, paddles or pits with subsequent water, wetting agent & bactericides to rehydrate and restore the hides/ skins to its

natural condition and to remove adhering dirt, blood, curing agents & some soluble proteins. The method & duration of soaking varies according to the condition of raw stock.

Objects of Soaking:

1. To remove the dirt, blood and dung from the hides and skins.
2. To remove the curing salts in case of salted hides and skins.
3. To dehydrate the skins proteins.
4. To open up the contracted fibrous structure of the skins.
5. To clean off surface filth.
6. Softening the hides and skins.

Liming:

The treatment of soaked hides / skins with lime, sodium sulphide (sharpening agent), surface active agents etc in a drum, pit or paddle is liming. The purpose of liming is to remove hairs, epidermis, natural fats and greases interfibrillary proteins (cementing substance) to swell and split up the fiber bundles into fibers, to soften the collagen fiber lattice and make the final leather non patchy, soft and pliable. In this operation pH maintain at 12.5 to 13. After this stage the hide/ skin is called limed pelt.

Objects of Liming:

1. To remove the hairs, hooves, nails and other keratinous materials.
2. To remove some of the interfibrillary soluble proteins like mucins etc.
3. To swell up and to split up the fibres to the desired extent.
4. To remove the natural grease and fats.
5. To bring the collagen to a proper condition for satisfactory tannages.

Fleshing & Unhairing:

Fleshing is mechanical removal of unwanted flesh, connective tissues & fat by hand knife or fleshing machine. Unhairing is done by scraping with blunt unhairing knife or unhairing machine to remove hair from grain side.

Objects of fleshing:

1. To remove fats and surplus flesh from lime pelts.
2. To give a cleaner surface.
3. For good penetrations of chemicals

Weighing:

It weight is taken to calculate the amount of chemical required for the successive operation.

Deliming:

Deliming is killing the alkalinity by washing the pelt in paddle or dram with weakly acidic acid, acid salt, etc. It is essentially done to reduce the alkaline swelling and to remove mechanically deposited & chemically bound lime and of capillary lime which is detrimental for subsequent tanning.

Objects of Deliming:

1. To remove most of the lime and alkaline materials from the pelts.
2. To reduced the swelling of the pelts.
3. Solubilization of Ca-soap.
4. To remove flesh, scud etc.
5. To adjust the P^H suitable for different tannage.

Bating:

The treatment of delimed pelt with enzymatic bate powder to remove non leather making substance and to make the grain surface clean, smooth and fine and give the finished leather soft pliable stretchy feel. The efficiency of bating depend on temperature, strength & pH of bate liquor and duration of the process.

Objects of Bating:

1. To produce smooth, fine and clean grain by enzyme action.
2. To remove some of the non-structured collagen and other proteins like albumins, globulins etc.
3. The scud or dirt, short hairs, greases and lime soap, dark coloured pigments and traces of epidermis are all loosened and are easily removable by scudding.
4. To allow the splitting up of collagen fibres.
5. To make the final leather soft, pliable and stretchy.

Scudding:

Scudding is mechanically pushing out "Scud" i.e. hair roots, pigments degraded epidermis, lime soap and unwanted protein matter from grain to get a very clean grain surface for smoothness and even dyeing and finishing properties.

Washing:

The scudded pelt is thoroughly washed in drum with plain water for complete removal of boiling agent.

Pickling:

Pickling is a process of acidification of the scudded pelt in drum with salt solution and pre diluted acid (organic & inorganic) to preserve and to condition the pelt for tanning. The salt concentration and P^H are most important factor.

Objects of Pickling:

1. To bring the delimed and bated pelts to a required degree of acidity before chrome tannage, even vegetable tannage.
2. To reduced the P^H.
3. To modify the fibre structure.
4. To reduce the astringency of chrome tanning agents.
5. To preserve the leathers and to achieve the special effect.

Tanning:

Chemically treated the pelt with the tanning agent (basic chromium sulphate) and altered in chemical composition from an irreversible stabilization and as to become more resistant hydrothermal shrinkage and micro organisms. After completing chrome tanning, fixing is done by adding basifying agent for e.g. sodium formate /bicarbonate, magnesium oxide etc. Due to blue color of chrome tanned leather in wet condition it is called as wet blue leather which can be preserved for a longer period of time but cannot be used in product making.

Objects of Tanning:

1. To convert the putrescible hides and skins into non-putrescible leather.
2. To raise the shrinkage temperature and to increase the resistance to hot water of the leather.
3. To reduce the ability to swell when wet back.
4. To increase the strength properties of leather.

Ageing:

The tanned leather is kept for few days in piling to get fixed the chrome (tanning agent0 with collagen by olation, oxalation and polymerization.

Grading:

Sorting the leathers into packs according to surface quality, thickness and grades.

Wringing or Sammying:

Reduction (up to 60%) and even distribution of water content by mechanical means (sammying machine).

Siding:

The process of cutting the big hide leather through the backbone producing two sides.

Splitting:

Split of the leathers to the required thickness by producing grain and flesh split with the help of splitting machine.

Shaving:

It is the production of correct and even thickness by shaving the flesh side with shaving machine.

Weighing:

Taking shaved weight for to calculate the quantity of the chemical required in the subsequent operation.

Washing:

Washing is carried out with water one wetting agent or organic acid to remove loose tannin, adherent contaminations and wetted back it properly to penetrate and disperse the chemicals used in next operation.

Neutralization:

Deacidification of slightly acidic wet blue to required P^H by treating with mild alkaline chemicals, like ammonium bicarbonate, sodium formate bicarbonate etc. in drum and it influence the depth of penetration of subsequent chemicals.

Objects of neutralization:

1. To remove the neutral salts and uncombined chromium salts from the leather.
2. Neutralization of free acid in the leather formed by the hydrolysis of the chrome complex.

Retanning:

For the tanning of wet blue leather with the tanning agents, for example, vegetable tanning agent, syntan, resin etc. to produce desirable properties of final leather.

Objects of Re-Tanning:

1. To fill the loose and softer parts of the leathers to produce leathers of more uniform physical properties.
2. To allow for the production of unlined footwear.

The retanning may improve the chemical stability of the leather, particularly its resistance of alkalis and perspiration.

DYEING:

The purpose of dyeing leather is to improve its appearance and to increase the value of the finished leather. The dyeing of leather into various appealing colours plays an important part in meeting fashion requirements. The leather may be coloured with natural and synthetic dyes, pigments and combinations of pigments and dyes. The main objective in dyeing is to produce level colours over the whole surface of each hide or skin and to match the colour of pieces of leather in a pack of leather with one another exactly.

For many years it was not possible to give a satisfactory explanation for all the different facts involved in leather dyeing. Since 1930 attempts were made to find explanation for the processes involved in dyeing leather but it was not till the last decade that the conceptions about the reactivity of dyestuffs as well as of fibre proteins of the compounds found in mineral tanned leather have been clarified.

Leather consists of protein fibres and has a far denser fibre network than have textiles. The fibre network, which may be regarded as a natural fabric is not uniform and it does not react evenly with the dyestuff molecules.

Both these requirement are important and go to ensure greater reliability of the product by improving resistance. In fact, if cracks or appear in the hide after long wear, they are virtually invisible if is dyed in the same colour as the surface.

On the contrary, a dark finish on a light base means that any small is clearly visible due to the difference in colour. Nor must we forget that even in the production phase of the living-room furniture, the same colour base and the passing colour avoid that unsightly row of light dots along the stitching line caused by needle.

Hide dyeing can have a double function. It is an intermediary processing phase, when a hide has to be dyed to give it a colour that acts as base for the final application. It can be considered a final treatment for hides dyed in barrels of pure aniline.

The fact that the hides are apparently the same after these two treatments should not deceive us however, because in reality the products are different. If this fact is not taken into account, it could cause serious problems. In fact, only the best products offered by the market are used for dyeing a hide with "pure aniline" that gives guarantees of reasonable resistance to light together with careful processing techniques, but which are obviously very expensive.

Passing dyeing is an indispensable requisite to obtain a good aniline hide, uses more colorants and therefore higher product cost. On the contrary, when hides are given a base dye, which then undergoes final covering, the tanneries use more economical products, as there are no problem of light resistance, this means that, even if the hide looks the same as pure aniline hide, it is totally unsuitable for upholstery as it has very low light resistance. The living room furniture would be drastically discoloured in a short space of time.

Fat liquoring:

The process of uniform coating of individual fibers with a fat layer by treating with emulsion of fats and oils. The treatment further influence the physical properties of the

leather, such as soft and suppleness, extensibility, tensile strength, water proofness, permeability to air and water vapour etc.

Objects of Fat liquoring:

1. To improve the softness of the leather.
2. To improve the sliding properties of the leather.
3. To improve the toughness, water-repellent properties of the leather.

Fixing:

Treatment with formic acid to fix the retanning, dyeing and fat liquoring agents to the fibers. All these operations are carried out in the same bath.

Pilling:

The pieces are piled over wooden frames for overnight to drain the superfluous water the retanning agent, dye and fat liquor to fix with the leather.

Setting out:

Setting is essential for removal of surplus moisture, crease, wrinkles and folds as well as for smoothing out coarse and drawn grain. It is the first step in the drying process carried out by setting out machine.

Drying:

Leather drying is removed of water from sammed leather by thermal means at a temperature far below the boiling point of water. The physical property of leather is more or less determined by the nature and the rate of drying. There is a number of direct and indirect dryer for leather drying. Generally after setting out chrome-retanneed leather are dried by vacuum dryer first, then go for natural hang dry or tunnel dry.

Fat liquoring:

It is very important operation for leather manufacturing and it depends on the type of leather to be manufactured. The process of fat liquoring entails the treatment of leather with a warm dilute emulsion of oil in water. The function of fat liquoring are; lubrication, adjust of physical properties.

Conditioning:

Conditioning softens the leather by equalizing the moisture content on grain and flesh sides. Normally damp saw dusts are used to condition the dried leather.

Stacking:

Mechanically flex and soften the leather by stacking machine.

Toggling:

Toggling is carried out to flatten and increase in yield area of leather. This leather is known as crust leather which can be used in product making.

Then these leathers are trimmed out, inspected and sorted into different selections for finishing. Finishing is generally applying protective coating to the surface, which give the leather final appearance and make it useful, attractive and appealing to its users.

The above mentioned process is a general outline that can be changed for a particular leather production.

CHAPTER – 2

SHOE UPPER LEATHER

The leather used for making of upper components of shoe is known as shoe upper leather. Most of the shoe upper leathers are chrome tanned leather. Combination tanning is carried out with a combination of chrome, vegetable, synthetic or other tanning agents to improve the fullness and firmness and some other desire properties of shoe upper. The main combinations are semi-chrome and chrome-retanned leather. Leather is first tanned with vegetable and then retanned with chrome tanning agent is semi chrome retanned leather. Chrome retanned leather is softer and flexible and mostly used as shoe uppers.

REQUIREMENTS OF PROPERTIE'S OF SHOE UPPER LEATHER:

The main requirements of ideal upper leather are;

a) Aesthetic appeal that is the leather should have elegant attractive.

b) Physical properties, such as tensile as tensile strength grain extensibility etc.

c) Comfort properties and durability

d) Chemical properties chrome content, fat content etc.

e) Commercial considerations good cutting value costs etc.

Physical Properties:

The important physical properties of upper leather which determine its suitability for use in shoe making are:

i) Tensile strength:

It is an indication of the resistance of upper leather to break. Tensile strength figures shoe a great variability over the whole hide.

ii) Stitch tear strength:

It determines the resistance to tear of the upper leather due to Stitches; when the shoe is in regular use.

iii) Slit tear strength:

It indicates the resistance of upper leather to tear in lasting through perforations, sharp angles or along scams. It is a function of' leather thickness.

iv) % of Elongation at break:

A certain amount of elongation without break is necessary for pulling over leather on the last.

v) Distension at grain crack:

It is an indication of the creaking of grain in lasting usually at the toe.

vi) Percent set:

Upper leather has to set when lasted and the per cent set depends upon the condition of the leather.

vii) Reaction of Finish to two dimensional stretch:

The changes in the finish of upper leather when the leather is subjected to two dimensional stretch is measured using Tensometer.

viii) Bond Strength:

The bond strength of leather is important in stuck on shoe construction when the upper leather is bonded to soles.

ix) Resistance of upper to heat and pressure:

The upper leather must be able to resist the effects of heat and pressure applied in the direct moulded and the injection moulded sole process of footwear construction.

FUNCTIONAL PROPERTIES OF UPPER LEATHER:

i**) Break and pipiness of Leather:**

When the upper leather is folded grain inwards, creases, and wrinkles appear on the finished surface of the leather. A coarse break is usually an indication of an inferior leather or an inferior part of the skin that is inferior to strength and durability. Pipey or loose vamp leather may cause wrinkling at the heel and toe in lasting.

ii) Comfort properties:

Properties, which affect foot hygiene and properties which determine the extent to which the upper material adopts to the shape of the foot during fitting and conform to the shape of the foot during wear.

iii) Flex Endurance:

The supper leather has to undergo a large number of flexes in were without creaking of the Finish or breaking of the grain. A finish which does not damage up to 10,000 flexes in Ba11y Flexometer will be considered satisfactory in wear.

CLASSIFICATION OF SHOE UPPER LEATHER:

The shoe upper leather can be classified into the Following ways:

1. Full grain shoe upper leather.
2. Corrected grain shoe upper leather.
3. Classical box shoe upper leather
4. Softic box shoe upper leather
5. Sued box shoe upper leather
6. Shoe Nappa Leather
7. Nubuck shoe upper Leather
8. Amy boot upper leather

FUNCTIONS OF SHOE UPPER LEATHER:

- To protect the foot against injury while working, standing or working etc.
- To protect the foot against the cold and/ frostbite.
- To protect the foot from dirt and moisture, acid, alkali, chemicals etc.
- To support the foot (sprain, civilized foot).
- To give cushioning the step (walking on pavement, jogging etc.)
- To give outfit, stylish appearance and fashion context.
- To provide special functions for sports.
- To give satisfaction and comfort, durability and reliability to the user.
- To meet the critical and specific requirements for special purpose.
- To protect the foot from pollutants and contaminants.

THE IMPORTANT QUALITY REQUIREMENTS OF A SHOE UPPER LEATHER:

S1. No.	Tests	Requirements
1.	Flexing endurance in the cold (-20°c)	50000 dry, 10000 wet min. 30000 flexing
2.	Adhesion of finish	3.0 N Dry 2.0 N WET
3.	Rub fastness	Min. 50 Rub cycles (dry).
4.	Fastness to hot plating	Min. 80°c
5.	Distension of grain	Bulge height min 7.0
6.	Split tear force	Min. 18N (with lining) Min. 25M (with lining)
7.	Elongation at break	Not less than 40%
8.	Light Fastness	Not less than rating 3 (Bluescale)
9.	Fastness to migration	Max rating 3 (Blue Scale)
10.	Tensile Strength	Min. 100 N
11.	P^H Value	Not less than 3.5
12.	Mineral substances removal by washing	Not more than 1.5^0%
13.	Water vapour permeability	10.0 mg/h-cm^2
14.	Water vapour absorption	10.0 mg/cm^2 (after 8 hrs)
15.	Water Proofing	Penetration of water Min 60 min absorption of water Max 35%
16.	Water spotting test	Drying without staining

CHAPTER – 3

SUEDE LEATHER

A term taken from the French, "gants de Suède" (Swedish gloves), and applied to a leather finished on the flesh side by buffering so as to raise a velvet-like nap. The typical suede leather is produced from the smaller skins, such as calfskin, kidskin, lambskin and goatskin, although cowhide has also been used.

The nap is produced by buffing or wheeling the surface on the flesh side, or the split side of flesh splits; velvet suedes, however, are buffed on the grain side. A common criterion of good suede leather is that the fibers of the nap should be of uniform length and tightly packed together, in order to give a resilience to the nap so that it does not readily shown fingermarks. c The firmness of the nap depends upon the density and compactness of the fiber structure. Velvet suedes are finer than flesh suedes and a younger animal, such as a SLUNK , produces an even finer suede.

A principal concern in making suede leather is to retain the fine nap and still produce a soft leather; however, the leather must not be made soft by means of improper FATLIQUORING , because even a small excess of oil will produce a greasy suede nap.

Suede leather, often tooled in blind, was used in England as early as the 17th century, and in the 18th and early 19th centuries in blankbook binding.

Two distinct layers will be seen

a) Thin upper velvety layer, and

b) Thick lower compact layer.

The thin grain layer, compact but highly splitted and practically free from interfibrillary materials is like the flesh layer. The reticular sheaths around the collagen fiber bundles are completely ruptured and the fibers are separated from each other in the upper layer while in the middle portion the reticular sheaths remain intact even though sufficient degree of splitting inside the fiber bundles are maintained. During pre-liming operation the interfibrillary materials are completely removed from the flesh side, but from the middle layer this removal is avoided to a large extent and the final interfibrillary materials in finished leather is made medium hard so that the leather does not show run like glove. In ideal suede leather it is desired that the separated fibers in flesh side should be very close to each other, uniformly distributed throughout the leather surface, completely dry and non sticky and always point vertically upward. When these fibers are touched with a finger, the formers must bend but should immediately become vertical again as soon as the pressure is removed. Otherwise the touched portion of the leather will show different shade of color than the rest of the portion. This indicates that the piles should have springy property but with sufficient softness. Moreover, the length of all the piles in the buffed layer should be equal and they should not have slightest of greasiness of their surface. Naturally the presence of raw oil in the free state and oil of high iodine value, which show gumminess due to polymerization, is not at all desirable in this region. But is quite different in the middle layer, where good degree of lubrication of splitted fibers and

their bundles with raw as well as modified oils is demanded so that sufficient skidding effects between fiber to fiber, fiber bundles to fiber bundles exist. But same time, these oils should not reduce the hardness of interfibrillary materials of the finished leather.

Generally suede leather is of different types such as:

a) Suede shoe upper;

b) Garment suede;

c) Hunting suede;

d) Suede nappa.

Of all the suede I have chosen to prepare suede shoe upper leather form goat skin.

TYPES OF SUEDE LEATHER

The subdivision of the types of suede leather defined in the Glossary is as follows:

1. Processed on the flesh side:

Buffed leather Mocha

2. Processed on the flesh side:

Degrain Doeskin

Hippy velours (wild suede) Hunting suede Jungle suede Reverse (d) calf Reverse (d) lamb Reverse (d) side

Nubuck

Velvet leather (German & UK)

Silk sheen Sports suede Suede calf Suede kid Suede shearling Suede sheep Suede side or butt Velvet leather (France)

3. Processed either on grain or flesh side:

Antelope Brushed pigskin Buck

Buckskin Mohair velours Shaggy suede

4. **Suede split leather:**

Doeskin

Suede split

SUEDE TERMS

Suede velours: In France the "Suede" refers to a gloving leather which has been buffed on the flesh side. If the leather has been further napped on the flesh side it is then termed "Suede velours".

Suecia: The suede gloving leather in Spain is termed as suecia.

Suede calf: Calfskin leather produce velvet nap on the flesh side is termed as suede calf.

Suede kid: Goat skin leather buffed on the flesh side and produce a velvety nap. Full chrome leather is usually used for this purpose.

Suede shearling: This type of leather tanned and dressed sheepskin, bearing short wool on the flesh side.

Suede sheep: Sheepskin leather finished with velvet nap in flesh side is termed as suede sheep.

Suede side or butt: Side or butt leather finished with a velvet nap on the flesh side.

Suede split: Leather made from the flesh splits of hide or skin and finished with velvet like nap.

CHARACTERISTIC PROPERTIES OF SUEDE LEATHER

1. Suede leather should have line velvety nap on one of its surface, generally on flesh side.
2. The nap should be very close to each other, uniformly distributed throughout the leather surface, completely dry and non sticky and always pointed vertically upward.
3. The naps springy property but with sufficient softness.
4. The velvety nap should not have slightest of greasiness to their surface.
5. It should have uniform color on the surface.
6. It should be penetrating dying.

7. It will have the following physical properties:
    - High stitch tearing strength,
    - High perspiration resistance.
8. It will have the following fastness properties:
    - High light fastness properties,
    - High rub fastness properties,
    - High wash fastness properties,
    - High dry cleaning fastness.
9. It should be lighter in weight.
10. It should have a fashionable color.

The most important quality requirements for Suede Upper Leather

Test	**Requirements**
Rub fastness Test felt, dry Test felt, wet With perspiration solution staining of the felt Grey scale	Rub cycles 20 10 10 Not below rating 3
Tensile strength, kg/cm (min.)	200N/cm^2
Stitch tear strength (Double hole) kg/cm, thickness	Min. 80
% Elongation at break	Max. 75%
Water vapour permeability mg/cm	250
Air permeability cc./min/cm. He Dressure	80
Ash content	2%
Chrome oxide content	2.5%
Fat content	4.5% fatty substance

BRIEF DISCUSSION ABOUT SUEDE UPPER LEATHER PRODUCTION

Suede shoe upper leather is one of the most fashionable items in the world market. The suede shoe upper is mainly used in cold countries where the leather has to perform the role of shoe upper and garment together. In suede leather no looseness is desire and on the other hand it has to be soft in nature. So the control is very important from beam house to finishing.

Raw materials

Cow hides, pigskins, calfskins, and goatskins and less frequently sheep skins are used for suede. Goatskins fibers are comparatively thin and compact, are generally considered to be the best for manufacture of suede leather. Since flesh side of this kind of leather is finished the slightest defects or hair slip on the grain side can be overlooked.

Selection

Skins having poor grain but fairly good flesh side with minimal flay cuts, vein marks, white sports and with cutting value of at least 70-80% can be processed as suedes.

Soaking

Generally non-ionic types wetting agents are used in soaking, which aid in better removal of interfibrillary matter and hence better open up structure. As all types of suede need softy feel good soaking is essential.

Liming

The liming should be such that the liming action is drastic on the surface and mild on the middle layer.

Deliming, Bating & Degreasing

Deliming is mostly used as a preliminary treatment with subsequent being in the same bath. The process serves to remove lime introduce during the liming process (capillarylime, mechanically deposited or chemically bound lime) and to deplete the skin. Inadequate deliming may give rise to an increase of basicity during chrome tanning and cause wrinkled grain , hardness , loose grain or cracky grain .Batting is a treatment with enzymatic system of the pancreases .It effects a further opening up of the collagen fibres, depleting of the skin material, loosening of scud and scruff and splitting of the natural fat by the presence of lipases . The more intense the batting process, the softer and less wrinkled is the leather. Degreasing should be done for uniform tanning and dyeing.

Chrome tanning

Chrome tanning should be controlled in such a way that maximum number of stronger cross-linkage are formed between adjacent polypeptide chains because fibres tanned in this way show good degree of springiness what is desired in the piles of suede leather. It is believed that unmasked, elated and slightly polymerised, cationic chrome liquor can fulfill these requirements.

For maximum cross-linkage formation chrome liquor of very high basicity (45% to 50%) is required but such high basic liquor can not be used at the start for case hardening and so tanning is done first with low basicity and finally finished with high basicity . For further increase in shrinkage temperature the stock is aged for 2-3 days after tanning.

A reasonable good amount of chrome is fixed in the leather (about 2.00% Cr203 on dry weight of leather) in order to provide it with good affinity for anionic dyes .A lower amount makes the leather some what less round and more flat, not desirable in shoe upper leather. Besides, the take-up of dye is lower .The nap also is less dense.

Neutralization & Retanning

The skin should be completely neutralized so that complete penetration of dye and fat liquor may be possible. After neutralization the skins are thoroughly washed as otherwise the presence of electrolytes interferes with both dyeing and fatliquoring. Retanning with replacement syntan aids in improving the nap and feel but does not improve the fullness much . Use of resin tannins in conjunction with syntan contributes to the improvement of nap of shank and belly region.Zirconium tannin agent, at times in conjunction chrome is recommended for ensuring better buffability and nap and also contribute to richness of shade of dyed suede . Retanning with different tanning agents, the particular merits may be:

a) Vegetable tanned

Good fullness, level dyeing but woolier nap, poor light fastness, difficulties with some shades.

b) Zirconium tanned

Tightens nap, particularly gives brilliant dyeing of good fastness properties, improves water repellency.

c) Glutaraldehyde

Give soft full leather, not particularly tight, level dyeing and perspiration resistance.

Fatliquoring

Fatliquoring is one of the most important things for suede shoe upper leather. Due consideration should be given to three factors in this operation.

a) Choice of the fat,

b) Fatliquor additives, and

c) Exhaustion

Sulphated cod oil is the classic fat liquor for this leather ,though the modern trend is to use sulphated sperm oil. Both are excellent from the view of view of drape though sperm is prefferred for its stable character leaving along the fact it is less odorous. A more economical substitute is oxidised fish oil which has a less unpleasant odour than the untreated variety. Synthetic fatliquor impart better wash fastness besides light

fastness. Sperm oil or any other fat liquor of sulphited oils used in suede is always less than 2.5% on the shaved wt. of the leather. Though this small amount of oil is not sufficient to provide the desired sliding effect, the oil percentage cannot be increased because this will not only reduce the resiliency of the fibers but also make the interfibrillary materials soft giving the final leather good degree of stretchiness what in not desirable in suede leather. For this particular reason egg yolk and flour are recommended. The egg yolk acts as an emulsifier, its oil and its solid portion, together with flour stiffens the fibers and fill up the voids of leather when dried. Glucose is also used with fat liquor so that the wetting back operation followed afterwards become easier.

Drying

After fatliquoring the goods are horsed overnight, lightly setting out and hooked to dry. Here again the choice is between toggle drying and hook-drying .Hook drying produces round full leather with a good pile of nap. Toggle-drying produces a flatter leather with a less impressive nap .But the area increase is so encouraging that it is a sore temptation for a producer to toggle dry rather than hook dry his stock. A compromise can be achieved by loose toggle drying. When dry leathers are trimmed, buffed with coarse and fine papers, brushed and weighed.

Buffing

Buffing is a very important operation for suedes. The upper should be good and free from off size grit particles. The backing of the paper should be sufficiently strong and should not grin after one or two buffings .

The manner of buffing is also important. Instead of cutting across the skin diagonally, it is best to work radially towards the center of the skin as this develops a uniformly cut nap.

The type of buffing machine is again an influential factor in getting an undamaged skin. For soft leather like garment and gloving, the overshot wheel is safer as it does not produced any nick or cut in the skin.

Buffing is performed by means of cylinder-type or cylinder-type through feed buffing machines.

The cylinder type machines work with abrasive papers of different grain size sprinkled with carborundum powder. The following sizes of grain are distinguished:

a) 24 - 120 = for coarse buffing,
b) 120 -300 = for medium buffing,
c) 320 - 700 = for fine buffing,
d) 800 - 1200 = for superfine buffing.

For the production of suede leather buffing is first carried out with a coarse paper followed by a paper of fine grain. Apart from the size of grain the rotational speed of the buffing cylinder also determines the fineness of nap.

Buffing directions play important role for desire nap. The buffing should perform from three different directions. This is due to the fact that the fibers of the collagen make an angle more or less than 45° with each other. So, one direction buffing will not produce the nap properly on the flesh side.

Dedusting

The buffed skins are brushed free of buffing dust, preferably in a suction type brushing machine, as the loose dust if left in the skins can cause considerable difficulty later on particularly when the skins are cleaned or washed. Further more suede leather will lose more color cause staining because the dust is also dyed. Therefore, a separate dedusting process is necessary.

Wetting back

Dyeing of suede leather is a very important operation and to carry out this operation correctly, through wetting back is necessary. Prolonged drumming or beating of skins always tends to make the short nap long and wooly which should be avoided as far as possible.

Wetting back is usually done with ammonia and wetting agent, anionic or nonionic in 500 to 700 % floats. If leather is needed better wash fastness, wetting back is done with alcoholic type of solvent and ammonia in a short float.

Dyeing of suede leather

This class of leather requires uniforms dyeing with complete penetration of dyestuff which should be fast to buffing. Light fastness, wet and dry fastness are also demanded. Selection of proper dyestuff which react with protein both by primary and secondary valences and are soluble in water, fast to light and of medium molecular dimension should be selected. In no case cheep type of improper dyestuff should be used to dye this class of fancy leather.

Direct dyestuff generally act on leather surface and should be avoided. Acid dyestuff having a very high degree of penetration must not be used as this property of dyestuff is accompanied by corresponding poor exhaustion, even in the presence of acid. Thus it is extremely difficult to obtain fullness of shade with dyestuff of this type.

On the other hand, dyestuff of low penetration posses the required exhaustion properties in the presence of acid and the necessary penetration can be obtain by temporarily reducing the affinity of the leather for the dyestuff by raising the $p^H$of the dye bath.

ACHIEVING LEVEL DYEING PERFORMANCE ON SUEDE FOR UPPER LEATHERS

The change in raw materials supply to part-processed skins has created many problems for the suede manufacturer as control of their initial processing stage is managed elsewhere. There are many practices that need addressing to achieve high quality dyeing performance on suede. The factors should be taken into consideration.

1. Drying raw hides and skins should be carried out rotationally without using warm air or excessive amounts of naphthalene. Salting of hides and skins should be done as soon as possible i.e. immediately after cooling of the freshly flayed hides. The addition of the small amount of bactericide with salt is advisable to help prevent stains or discolouration of finished suedes.

2. Beam house operations should be accomplished carefully; bad soaking of hides and skins never provides level dyeing performance.

3. Fleshing should be performed on machines that can be accurately adjusted. Care should be taken to see that only the minimum of flesh remains, otherwise subsequent scouring would be required. This can give rise to inter areas of the skin producing darker shades and accumulations of dye.

4. Deliming should be complete. Care should be taken to see that residual lime is removed from the thick flesh layer such as the head part .This is to prevent an uneven distribution of chrome in the tanning operation.

5. Hides and skins that have been subject to strong bating give rise to non uniformity due to excessive of insufficient buffing in areas across the leather.

6. Pickling is important for the removal of residual calcium salts after deliming. If possible, use organic acids instead of sulfuric acid as a water soluble cranium sulphate.

7. Degreasing is crucial to level dyeing. It is suggested the pickled leathers are horsed up for a few days to assist in a complete degreasing .The use of solvents and emulsifiers is an ideal combination to obtain good degreasing. Repickling taking into account the same operation details as discussed in item 6 follows this degreasing process.

8. Chrome tanning is perhaps the most important operation is achieving level dyeing. For effective chrome tanning a good distribution over the hides and skins is most essential. This should be as uniform as possible , and there tanning process should be accomplished over longer period of time.

The process of basification is the most delicate in the chrome tanning operation .An excessively rapid or strong basification provides leathers with an unbalances chrome content throughout the skin section. On the other hand, a weak basification produces leathers with low chrome content, resulting in low affinity for the retanning agents, fatliquors and dyes used.

Magnesium oxide can provide a good basification .Very good distribution of chrome and a high degree of exhaustion can be achieved .The final p^H value should be about 4.0.

It is advisable to stack hides and skins for some days after completion of tannage before starting other processing.

9. Neutralization should be as uniform as possible. For this operation it is suggested using sodium format .If the correct p^{J1} value can not be achieved, it is advisable to add some ammonium bicarbonate as it acts more uniformly and deeply than sodium format.

10. Fatliquoring should be sufficiently dry so that it is not detrimental to-beefing. But provide good lubrication to ensure a good handle and texture. Ideally, the working temperature would range, between 45°-50° c, and running should be for one to two

hours. At the final stage, if necessary small amounts of acetic acid can be offered in several additions so that the p^H values remains at about 5.5.

PROBLEMS WITH PART PROCESSED RAW MATERIALS

Most of the points set out apply when raw hides and skins are fully processed under the control of the tannery. However, it is now common to buy hides and skins as wet blue. Without knowing how the have been treated, and having no influence over their processing, the final result is always uncertain. Hides and skins are often found that are unsuitable for dyeing as suede, due to their lack of capacity to absorb dyes, staining and hardness. Due to the cost of part processing raw materials, stock levels have normally reduced but, technically this is not recommended. At least one representative sample of each leather should be available for further treatment or modification in the event of problems encountered during processing. It is, however, always helpful to do a quantitative extraction of the fatty matter from leather in order to determine the degree of degreasing.

REMEDIAL TREATMENT FOR DYEING IMPROVEMENTS

There are only a few solutions to problems arising when dyeing raw materials that have been processed to the wet blue, as defects due to poor beamhouse/ tanning practices are practically irreversible. The following methods, however, may help to solve some dyeing related problems.

GREASE RELATED DEFECTS

After tanning it is impossible to remove residual fatty matter using aqueous methods. The only way of achieving a satisfactory extraction is by using a dyeing machine. This technique is also efficient for treating wet blue hides where additions of fatliquors have been made to the tanning bath. Manufacturers of wet blues commonly use pre-fatliquoring.

UNEVEN TANNING EFFECT

Retanning and rechroming of wet blue is increasingly important, in particular to ensure uniformity across the pelts. This should be carried out at 35-40°C in order to allow maximum chrome exhaustion. The basification should be slow to get better fixation of tanning agents. Magnesium oxide is recommended, but it should be good quality. The addition time should be long and the final P should be 4.0.

POOR BEAMHOUSE OPERATIONS

It is almost impossible to correct poor beam house operations. Hard leathers do not buff easily, and the only to correct beam house operation that has produced hard leather is treatment with special enzymes.

IMPROVING UNIFORMITY TO DYEING

Dyeing pretreatments or mordanting is common practice. The following techniques have, however, been found particularly useful:

1. When cationic products are needed, these can be used on their own or conjunction with non ionic leveling agent to improve distribution.

2. Non-ionic dispersing agent can be used in a slightly alkaline bath followed by washing and dyeing.

3. The addition of a slightly acid syntan to the bath after running for 30-60 minutes with a dispersing agent, improves the fixation of the dispersing agent. This can significantly up grade the leveling effect.

4. Dye with efficient covering power such as picramic derivates are suitable for using in leather dyeing. The working temperature should be in the range of about 60°C during the entire dyeing process.

5. As a general rule, sodium carbonate provides a deeper and more uniform dye penetration into leather than ammonia. Sodium carbonate is also more convenient to use and avoids increasing the nitrogen content of the wastewater.

SPECIFIC TECHNIQUES FOR SUEDE DYEING

The suede process has changed due to the use of part-processed raw materials, high technical leather requirements and environmental matters. Specific techniques that have been found useful can be summarized as:

1. Soaking with sodium carbonate plus non-ionic wetting agent. Running time is as necessary, with lay-down in bath over night.

2. Non-ionic mordanting as required.

3. Dyeing at 60°C with sodium carbonate and suitable dyes.

4. The combined addition of suitable dye and fatliquor.

5. The use of suitable fatliquor to avoid bleeding of dyes.

6. Follow exhaustion with formic acid by washing. If fat liquor has not been added to the dyeing bath, use a short bath at 50°C and run for 5 minutes. See that the P^H of the bath is not below 4.8 and not above 5.5.

7. When surface dyeing is being applied, if the P^H values at the end of dyeing are between the recommended P^H limits, exhausting with formic acid will not be needed. Run-off the bath adds the surface dye to a new bath at 60°C. The same surface dye as initially used may be suitable.

8. Metal complex dye (1:2) can improve the covering power, but reduce the liveliness of dyeing. These can be used in the system by running for 5 minutes only, with immediate exhaustion using formic acid. After dye exhaustion adds 0.5-1% chrome salts and run for 30 minutes. The addition of the chrome salt impedes the formation of stains caused by air pockets forming between the leathers on pilling.

9. The addition of a silicone-fmishing agent to a fresh and cold bath helps impart writing effects to suedes.

ROLE OF MEN AND MACHINERY IN THE PRODUCTION OF SUEDE LEATHER

Production of suede requires good care and attention at every stage of processing. Cleanliness is very important drying the crust and while dyeing and drying the suede. Contamination with iron should be avoided .Iron stain of leather containing vegetable tannins as a result of contamination at shaving stage can be removed by bleaching .If dry dyeing is followed , care should be taken to see that dye powder does not fly all over, as it will cause stains on already dyed leathers.

During milling, light and dark shaded suede should not be milled together. Here, a lot of practical experience is needed .While drying; leathers should not be dried at elevated temperatures, as it would cause lightening of the shade.

An important aspect of production of suede is proper work control in the crust yard, particularly in the buffing room. While buffing, care is to be taken to see that all the area of the leather is well buffed but not over buffed. If the buffing machine is of single width/double width - conventional type, buffing is done from all sides starting from the tai-end so that the skins are buffed towards the center. In the case of through feed buffing, skins are fed from all four sides so that entire leather is completely buffed .While buffing, leather should not be folded. After each buffing with a specific type of emery, buffing dust has to be removed by brushing or by blasting at shaving

stage; one should take care to avoid shaving mark; as these are not desirable, particularly, in the case of shining suedes.

ZIRCONIUM TANNAGE

Zirconium is a metal belonging to the same group of elements as silicon and titanium. It resembles chromium in that its sulphate and basic sulphate combine readily with pelt. Unlike chromium salts which are colored , Zirconium salts are pure white and produce a white leather which is permanently fast to light.

Zirconium tanning has been employed for making all types of leather including reptiles either as a self-tanning material of in combination with other tannage, e.g., alum , chrome , vegetable or aldehyde yielding leathers to which special characteristics are imparted. In the manufacture of suede leather, it gives the finest possible nap throughout the area and outstanding fullness to the looser parts of the skin. The fact that the white zirconium tanned leather can be dyed in brilliant, full and pastel shades is something considered extraordinary in the leather trade. The other special advantages of zirconium tanned leather are its fastness to light low extensibility, its outstanding fullness and special characteristics imparted to the finished leather. Zirconium tanned leather, due to its good absorptiveness, possesses better finishing properties; but unlike other tannages grain swelling in zirconium leather is considerable less so that the pleasing smoothness of grain is retained even after repeated application of aqueous finishes.

The tanning agent responsible for zirconium tanning is zirconium sulphate or basic zirconium sulphate either of which is taken up by the pelt raising us shrinkage temperature to 81C indication complete tannage. Zirconium sulphate very readily splits into basic salts by hydrolysis.

The zirconium tanning materials are mainly and increasingly used for retanning of chrome leather. Using zirconium as a retannage after normal chrome tanning it is possible to obtain very full leather which can be uniformly dyed. Specially in suede leather manufacture, zirconium retannage after normal chrome tannage shows denser leather structure and finer suede nap. Since zirconium reacts with leather more in the acidic ph range it is used on shaved, unrinsed leather providing about 1-1.5% $Zr0_2$ at

low basicity (10-20%).The higher acidity is offset by subsequent neutralization of leather with larger quantity of neutralizing agent. The retannage should preferable be carried out in a minimum float or no float at all. In this way the retanning material will be taken up quickly and completely. Basification of retanning bath is not recommended but a through rinse after retannage is advised in order to remove a part of the acid in the retanned leather. The leathers are subsequently neutralized, dyed and fat liquored.

CHAPTER - 4

PROCESS OF SUEDE UPPER LEATHER PRODUCTION

I took two pieces wet salted Goat skins. Then trimmed them properly and weighted. The total weight was 1.5 kg.

All percentages (%) are based on wet salted weight

Pre-soaking

400%	Water at normal temperature
0.20%	Wetting agent (LD-600)
0.20%	Preservative (Busan 880L)

Drain out and wash well.

Soaking

300%	Water at normal temperature	
0.30%	Wetting agent (LD - 600)	
Add 0.40%	Sodium carbonate (**Na2** CO3)	
Add 0.20%	Sodium sulphide (Na_2S)	30 min

Drain and rinse well

Painting

6.0%	Lime (CaO)
3.0%	Sodium sulfide (Na_2S)
0.20%	Wetting agent

Water required making a paste

Apply the paste on the flesh side of the goat skin and pile up flesh to flesh manner for 4 to 6 hours or over night in a flat bed. Then unhairing by hand knife.

Liming

300%	Water at normal temperature
0.25%	Wetting agent (LD-600)
Add. 3.0%	Lime(l:10sol^{n})
Add. 0.35%	Sodium carbonate (Na_2C0_3)

Then howling for 10 minutes in every hour for 3 hours and rest for 36 hours. Check the float, if it is insufficient, add water in the pit. After that drain the bath and fleshing and scudding is performed. After that washing and pelt weight has taken. From now all percentage are based on the pelt weight.

Deliming

80.0%	Water at normal temperature	
1.50%	Ammonium sulphate [$(NH_4)_2 SO_4$]	
0.50%	Ammonium chloride [NH_4 CI]	
0.50%	Sodium meta bi sulphite [$Na_2S_20_5$]	Run 90 min.

Checked bath P^H - 8.3 (by P^H meter) and the cross section with Phenolphthalein, result is colorless that indicated complete deliming is done. Bating is started in the same bath. The temperature is risen at 37°C.

Bating

1.00%	Alkali bating agent	60 min
Add. 0.50%	Degreasing agent [Mollescal FA- 607]	30 min

Bubble test is performed and then proper scudding and good washing is done.

Pickling

80.0%	Water at normal temperature	
8.0%	Common salt (Nad)	20 min
Add. 0.50%	Formic acid (1:10 sol")	15'+30'
Add. 0.20%	Imperpol CO	30 min

Add. 1.0%	Sulphuric acid (1:20 sol")	90 min
Check p^H-2.8		
Add 0.50%	Hypo	30 min

Leave in the bath for over night. Next morning run 15'. Drain half the liquor of the pickle bath.

Chrome Tanning

Add to the pickle bath

	4.0%	Basic chrome powder
Add	4.0%	Basic chrome powder
	0.8%	Sodium formate
	1.0%	Remsol OCS

Check the penetration

Add 50%	Water	
1.0%	Sodium bi-carbonate	90 min.
Add 0.25%	Preservative(Busan 30L)	

Check p^H- 3.7 to 3.8. Drain out and pile for a few days

Samming By machine

Shaving By machine (Thickness 0.9 mm) After trimming shaved weight has taken.

All % are based on this shaved weight

Acid wash

200%	Water at normal temperature
0.3%	Wetting agent (LD 600)
0.3%	Oxalic acid.

Drain, Rinse.

Rechroming

150%	Water at normal temperature	
0.3%	Formic acid	20 min
Add 8.0%	Basic chrome powder	
2.0%	Chrome syntan (Neosyn HL)	
1.0%	Sodium formate	60 min
1.0%	Cationic fat	
Add 1.5%	Neosyn TX 50	30 min
Add 2.0%	Neosyn 9P	30 min
Add 1.0%	Sodium bicarbonate	90 min

Check p^H- 3.8 to 3.9.

Drain, Rinse, Horse up over night.

Neutralisation

150%	Water at 40° C	
2.0%	Neutral syntan	
1.0%	Sodium formate	30 min
Add. 0.5%	Sodium bicarbonate (1:10 sol^n)	30 min

Check p^H - 4.5 to 4.6. Drain, Wash well.

Retanning& Fat liquoring

150%	Water at 45°C	
3.0%	ParamelPA/RE	30 min
Add 3.0%	ReluganD/PlOO	20 min
Add 1.0%	Remsol C2	
0.2%	Trilon B liquid	15 min
Add 4.0%	Tanigan OS	
4.0%	Mimosa	
2.0%	Quebracho	60 min

4.0%	Syntan AN	
Add 2.5%	Remsol B40	
2.0%	Remsol C2	
1.0%	Trisul ML	45 min
0.5%	Raw oil / SK	
Add 1.0%	Formic acid	30 min

Drain, Rinse, Horse up over night.

Mechanical operation

Setting out, Vacuum dry, Hang dry, Staking,

Toggling, Trimming.

Buffing is performed three times followed de-dusting after every operation. The buffing is done in 3 different directions by 3 different emery papers. Firstly 320, secondly 400 and lastly 600.

All % are based on the crust weight.

Wet back

500%	Water at 50°C temperature
1.5%	Liquor ammonia
0.5%	Wetting agent

Check p^H- 6.0 to 6.5. Leave over night. Drain, Rinse.

Dyeing and re-fatliquoring

300%	Water at 45°C
1.0%	Neosyn N
Add 6.0%	Acid dye (Black Bl)

Check penetration 100%

Add 2.0%	Remsol C2
2.0%	Remsol B40
Add 3.0%	Formic acid (3 feed)
Add 1.0%	ParvolDF

Check the bath. Drain, Rinse well.

Top dyeing

300%	Water at 50° C	
1.5%	Black Bl	20 min
Add 1.0%	Formic acid	30 min

Drain.

Add 300%	Water at 50° C	
1.0%	Basaic black VM/WR	
0.5%	Acetic acid	30 min

Check the bath.

Add 1.5%	Black Bl	20 min
Add 1.0%	Formic acid	30 min
Add 1.0%	ParvolDF	30 min

Drain, Rinse very well, Horse up over night Hang dry, Staking, Dry milling for 4 hours. Toggling and finally brushing to produce fine nap.

TECHNICAL INFORMATION ABOUT CHEMICALS USED IN THIS PROCESS

1. LD- 600 : Wetting agent, Charge: Non -ionic.

(BASF, Germany)

2. Busan 40L : Bactericide for leather tanning

(Buckman, USA)

3. Busan 30L : Fungicide for leather tanning

(Buckman, USA)

4. Mollescal BW : Soaking auxiliary. (BASF, Germany)

5. Erhavit MB : Sulphide free liming auxiliary.

P^H value: 9-11 -0 (TFL, Germany)

6. Mollescal MF : Amine and Sulphide free liming auxiliary.

(BASF, Germany)

7. Bate EG- 98 : Bate powder (Hodgson, England)

8. Chromitan B : 33% Basic chromium sulphate

BASF

9. Neosyn RW : Cresylic multipurpose replacement syntan, Total solids: 92% , P^H (2% solution): 4.0-5.5 (Hodgson, England).

10. Neosyn BS3 : Naphthalene based neutralizing syntan Total solids: 94% pH (2% solution):7.0- 8.0, (Hodgson, England).

11. Neosyn WO : Replacement syntan, based on Cresylic material. Total solids: 92% pH (2% solution):3.5- 5.0, (Hodgson, England).

12.Tolcide2230 : Fungicide for leather making, (Albright and willson).

13. Relgan RE : Acrylic copolymer, Charge: anionic. P^H: 6.5. Active substance: 40% (BASF, Germany).

14. Paramel P-100 : Amino resin, Total solids: 94% P^H (10% solution): 8.5-9.7. (Hodgson, England).

15. Tanigan OS **:** Replacement tanning materials.

Concentration: 96-98%

P^H (10% solution):3.5

(Bayer, Germany).

16. Neosyn N **:** Naphthalene auxiliary dye leveling Syntan.

Total solids: 92% P^H (2% solution): 6.5-8.5

(Hodgson, England.)

17. Lipoderm liquor SNS: Synthetic fat-liquor (BASF)

18. Slipover liquor 1C: Supplied oxidized fish oil. Charge: anionic,

Fat content: 90%, P^H (2% solution): 7.0

(BASF, Germany).

19. Trisul ML **:** Sulphited stabilized fatliquor based on oxidizing

marine oil. Active content: 80 %,

P^H (2% solution): 5.0-6.0

(Hodgson, England.)

20. Lustral UT **:** Transparent binder that enables very

light and very adherent films.

P^H: 7.5± 1. Charge: anionic (ALPA)

21. Paramal PA : Acrylic Resin Binder (Clariant)

22. Quebracho : Vegetable Extract . (ATO)

23. Mimosa : Vegetable Extract, P^H (10% solution):4.4-4.5

24. Synthol O : Synthetic oil, Active matter: 100%,

Clear yellow oil, **(**Smith & John).

25. Remsol B40 : Sulphited natural/synthetic oils. Anionic,

Active matter: 70 %, (Hodgson, England).

26. Remsol C2 : Stabilized synthetic fatliquor. Anionic,

Active matter: 50 %, P^H (2% solution):7.0-8.0

(Hodgson, England).

CHAPTER- 5

PHYSICAL TESTING METHODS

The finished leather samples under the experiments were tested for their various physical properties. These properties indicate about the quality of the finished leathers produced. Due to limitations of time and the availability of instruments, selected physical tests were accomplished and these tests are briefly discussed here.

MEASUREMENT OF TENSILE STRENGTH AND PERCENTAGE ELONGATION AT BREAK

The tensile strength and elongation at break was measured by Tensometer. Tensile strength is the force (Kg) per unit area of cross-section (Sq. cm) required to cause a rupture of the test specimen.

So, Tensile strength of the specimens was calculated using following formula.

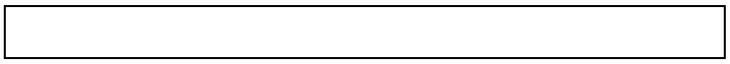
$$\text{Tensile strength} = \frac{\text{Breaking load (Kg)}}{\text{Thickness (cm) X Width (cm)}}$$

Breaking load mainly depends upon the number of collagen fibers acting in the direction of applied load, so it is more or less constant for a piece of leather specimen because the number of fibers in that piece is always constant.

The extent of elongation of the leather specimen at the time of its breaking, while applying the tensile force, expressed as the percentage on the original length of the said specimens the elongation at break. Elongations at break for these specimens are calculated from the distance of the jaws after breaking was occurred.

$$\text{Percentage of Elongation} = \frac{\text{Final length} - \text{Initial length}}{\text{Initial length}} \times 100$$

$$= \frac{\text{Length increased}}{\text{Initial length}} \times 100$$



1cm

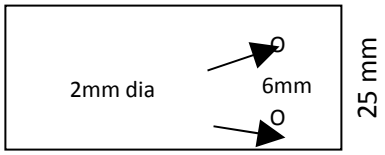
10 cm

Sample for the determination of tensile strength

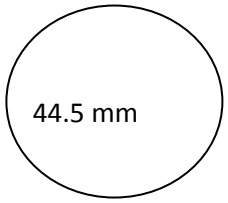
2. Stitch Tear Strength (double hole); SLP-8

The double hole stitch tearing strength can be defined as the load (Kg) required to tear the sample of the leather between two holes of2mm. diameter each and whose centers are 6mm. apart, express of its unit thickness (cm).

$$\text{Thus, stitch tear strength Kg/cm thickness} = \frac{\text{Tearing load (Kg)}}{\text{Leather thickness (cm.)}}$$



50 mm
Sample for Stitch tearing test



Sample for Lastometer test

3. Lastometer Tests (SLP-8, SLP-9, and IUP-12):

These tests were performed by the following official method of analysis 1965. By lastometer tests grain cracking strength, bursting strength and their corresponding distension values can be obtained. The bursting strength is an index of the overall strength of the leather. For lastometer test the specimens were cut from the samples by a circle type cutting disc and the specimens were placed on a lastometer being conditioned by clamp whose flesh sides were adjusted to the ball with the pressure by handling indicates the distension at a rate of 0.2mm/sec. and simultaneously watch the grain

surface for the occurrence of a crack and the ball and distension of grain cracking and bursting were noted.

Then the grain crack strength was determined by the formula,

$$\text{Grain crack strength (Kg/cm)} = \frac{\text{Grain cracking load (Kg)}}{\text{Thickness of the leather sample (cm)}}$$

Craking distention= mm

Again, the bursting strength was determined using following formula,

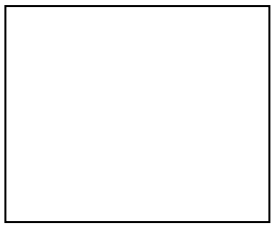
$$\text{Bursting strength (Kg/cm)} = \frac{\text{Load in Kg to burst the sample}}{\text{Thickness of the leather sample (cm)}}$$

Bursting distention= mm

4. Vamp Flexing Endurance (SATRA PM 25):

The test was followed by official method of analysis SATRA PM 25:1992. A square specimen(64mm X 64mm) of the leather is folded over two inverted v-shaped clamps the clamps are able to move relative to another so that as they become closer the specimen is fixed to production one downward crease surrounded by four upward creases during the test the clamps oscillate at a

constant speed so that the specimen is repeatedly flexed the test can be carried out with either wet or dry specimen at room temperature or dry specimen sub-zero temperature After a predetermined number of cycles the test is stopped and the specimen is visually examined.



64 mm

Requirements:

Outer materials (Dry 20^{o}C) – 10,00,000 cycles

Outer materials (Wet 20^{o}C) – 10,00,00 cycles

Lining materials (Dry 20^{o}C) – 3,00,000 cycles

Cold test (-5 to -30^{o}C) – 1,00,000 cycles

5. Tearing strength:

It is the load required to tear a sample of leather of unit thickness.

Tearing load in kg

Tearing strength, kg/cm thickness = ----------

Thickness of the leather sample (cm)

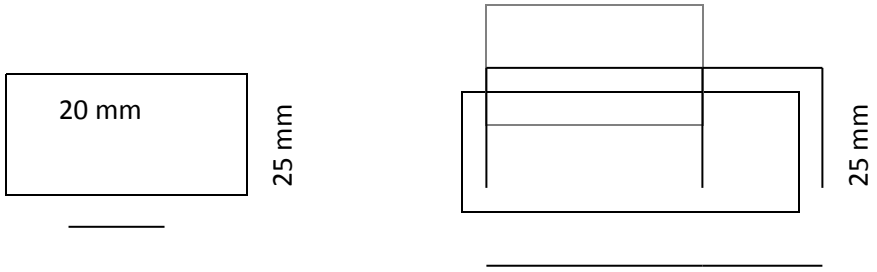
6. Split Tear strength:

It is the load in kg required to continue splitting of half splitted leather into two layers. Splitting is done at the centre of the leather thickness and parallel to the leather surface. Specimen size 75 mm x 25 mm. It gives the idea about the fibre strength of the leather and also the weaving nature of the fibres.

Tearing load in kg

Split Tear strength, kg/cm thickness = ----------

Thickness of the leather sample (cm)



50 mm
Sample for test no. 5

75 mm
Sample for test no. 6

7. Measurement of the Shrinkage Temperature:

8cm. long and 1 cm wide leather sample is taken, then attached to the hooks of the shrinkage meter and are put into the water of the beaker, then heat the water until the specimen shrinks considerably. Leather sample is cut into two ways- parallel to the back bone and perpendicular to the back bone.

Shrinkage temperature (Ts) was determined using following formula,

$$Ts = \frac{T1+T2}{2}$$

Here, T1 = parallel to the back bone.

T2= perpendicular to the back bone.

8. Tests For Dry And Wet Rub Fastness (SLF-5 / IUF- 450 / DIN 53339):

The tests were carried out by official method of analysis SLF-5.This is a very useful test for finished leather. A revolving pad is made to rub the leather for a successive number of revolutions and the effects of such rubbing under both the wet and dry condition are studied using a grey scale. While a 2.5 kg load is used for dry rubbing and 730g load used for wet rubbing.

Dry rub fastness: leather dry, felt dry.

Wet rub fastness: leather dry, felt wet.

Assess the degree of damage or change in the finish coat, staining of the felt pad and change in colour of the test specimen.

9. Tests for wash fastness:

By treatment of the color of leather to washing is meant its resistance to washing under domestic condition. In washing leather, not only many changes in color occur in the leather but also colored substances my bleed from it and may stain adjacent materials. In this method specimens of leather in contact with specified undyed textile of wool land of cotton are mechanically agitated underspecified condition of time and temperature in a soap solution then rinsed and dried. The change in color of the specimens and the staining of the textiles and assessed with standard grey scales.

10. Water vapour permeability (WVP) Test:

Almost all upper leathers should be permeable of water vapour because the perspiration formed inside the shoes, as for example, should go out through the leather to give wear comfort to the users. The WVP of tanned leather is gradually high but it gradually goes down with the incorporation of fats, oils and waxes into the tanned leather during finishing. The finish coat specially that contains resin, casein, shellac and similar film forming materials in excess amount, reduces the WVP of leather considerably. The oil treatments and finishing of leathers should be such that the WVP of tanned leather is reduced to minimum extent.

The basic technique of all WVP tests develop for leather is the use of leather specimen as a diaphragm with a region oh high relative humidity on the other. The gain in weight per unit area on the low relative humidity side in unit time is expressed as the WVP property of the leather.

$$WVP = \frac{7639\ M}{d^2 t} \text{ in mg/ cm}^2\text{/ hr}$$

Where, M = the increase in mass of the jar (M_2-M_1) in mg.

d = the average diameter of the neck of the jar, in mm.

t = time between the first and second weighing in min.

Standard value for shoe upper leather: 180 – 250 mg/ cm^2/ hr.

RESULTS AND DISCUSSIONS

The results obtained by different physical and chemical analysis on the prepared leather samples are tabled in this chapter followed by short description of the result. Physical and chemical tests were accomplished by using international standard methods as described in chapter.

TABLE NO-1

DATA FOR TENSILE STRENGTH AND PERCENTAGE ELONGATION AT BREAK

Sample No	Tensile strength and Elongation at break			
	Perpendicular		Parallel	
	Tensile strength (Kg / sq cm)	% Elongation at break	Tensile strength (Kg / sq cm)	% Elongation at break
A	190	57	188	55

TABLE NO - 2

DATA FOR STITCH TEAR STRENGTH

Stitch Tear Strength		
Sample No	Perpendicular (Kg/cm)	Parallel (Kg/ cm)
A	111	107

TABLE NO-3

DATA FOR TEARING STRENGTH

Sample No	Perpendicular (Kg/cm)	Parallel (Kg/ cm)
A	30	32.8

TABLE NO-4

DATA FOR DRY AND WET RUB FASTNESS

Dry Rub fastness rating							**Wet Rub fastness rating**						
Sample No		32 Rev	64 Rev	128 Rev	256 Rev	512 Rev	1024 Rev	8 Rev	16 Rev	32 Rev	64 Rev	128 Rev	256 Rev
	L/R	5	5	5	5	4	4	5	5	5	5	4	4
	Felt	5	5	5	5	4	4	5	5	4	4	3/4	3

TABLE NO-5

DATA FOR COLOUR FAST NESS OF LEATHER TOPERSP1RA HON

Test specimens	Grey Scale Rating
Sample	A
Wool Washed	5
Acrylic (courtelle)	4
Polyester (Terylene)	4/5
Nylon 6,6	4/5
Bleached Unmercerized Cotton	4/5
Secondary Celloluse Acetate	4/5
Total Leather specimen	5

CONCLUSION

The review on production of suede upper leather indicates that it requires a good understanding of science and technology of leather making, constant vigil and care during processing and abundant common sense in suitability monitoring the fee stock and the process.

I try hard and soul to accomplish my project work sincerely and effectively. Finally, I beg pardon and expect forgive for all shorts of undesirable mistakes in my project work.