BONAFIDE CERTIFICATE

This is to certify that the project work titled "Studies on the production of semi chrome shoe upper leather from goat skin" is a bonafide work carried out by Iqbal Hossain a student of the B. Sc. in Leather Technology course, Bangladesh College of Leather Technology, under my guidance and direction.

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I am full of appreciation for the admirable guidance, cordial co-operation and honorary service of my guide teacher Mr. Asraful Alam sir (Lecturer, Leather Technology)

I will be fail in my duty if I donn't pay hearty gratitude and thanks to my other teachers who give me inspiration and informatics supports to complete my work properly.

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Finally, I wish to reveal my thanks to my beloved parents and all of my friends whose continuous inspiration, unconditional support and sacrifice made me possible to accomplish this project work.

With the best regards

Iqbal Hossain
June, 2008

THE AIM OF THIS THESIS WORK

Finishing of leather is an extensive and complex technology. Finishing technology has assumed considerable importance of the present day competitive leather market. Finishing of leather involves application technology based on certain scientific principles, and stimulation of personal creativity aided with sensitive appreciation of art. Application part of the technology consists of manual or mechanical operations during which film-forming/ binding agents are applied on leather surface aiming to improve appearance, feel, grain character and surface protection in relation to then use. The art of the finishing relates to aesthetics, modes and creative fashion.

Bangladesh is a developing country which has only a few items for export. Finished shoe upper leather is one of them. Its demand always on its high quality. So, leather industry of Bangladesh in changing and challenging phase since a decade. Bangladesh banned wet blue leather export from 1990 and within few years crust leather export may banned. So, at present, finished leather is increasing more rapidly and also in turning to leather goods. For this reason, now finishing technology is very important for tannery a sector and this technology development will offer foreign currency in a large scale for our country.

In leather finishing there are many finishing components as for example dye, pigment, binder, cellulose compounds, plasticizers, gums, waxes, slip agents, preservative, fixing agents, etc are used. The leather finished is classified into two kinds:

a) Aqueous.
b) Non-aqueous.

All the leather properties are influenced by the type of finishing agents used and the method of application. There is a great demand of full grain finished in the world leather market. Unfortunately our raw hides and skins are not of best quality. They have many defects on grain side. So, we have to sincere when we finish the leather.

In my project I tried to assess why does a buyer generally look for in aniline finishing shoe upper leather? For shoe upper in general, the buyer desires to see that-

a) The leather has fashionable look.

b) It has a soft, supple and a pleasing handle with fine grain break and natural look.

c) The finishing is resistance to repeated flexing (Wet, dry and cold weather)

d) The finishing is resistance stretching ironing/plating an elevated temperature and exposure to hot dry air.

The finishing preparation of clothing, gloving and upholstery/cushion leather which are required to give longer and rough services require improved qualities in the finish compared to shoe upper such as:

a) Resistance to ageing and expose to light (high fastness)
b) Enhanced film elasticity and superior adhesion on the leather.
c) Resistance to perspiration (an essential property)
d) Scuff resistance; rub fastness and milling properties so that leather surface does not look crumpled during wear.
e) Resistance to solvent and alcohol is yet another property which is much desired in this leather.

A buyer first selects a finished leather by visual examination to determine that it leather of has suppleness with an even high grain break and appealing level color. The buyer may also use key-test to assess grain strength and also examine if there is any peeling off or powdering odd the finish. The visual test May also include fastness to dry and wet rub, water-spotting on the finish. After the leather passes through these simple but very essential visual tests the buyer thinks of employing recognized laboratory testing methods (Chemical, physical).

ABSTRACT

Project work is a part of our syllabus. Which have to done every student of our college in final year. A topic is select by our academy for each student. Then students have to experiment on this topic in a fixed duration. After that a thesis paper are submit to our college.

My project work topic is, “Studies on the production of semi chrome shoe upper leather from goat skin.”

Semi chrome leather is a type of tanning in which combination tanning method is used. To say it more frequently both chrome tanning and vegetable tanning method and these types of tannins are used. Theoretically semi chrome leather is such leather that chrome treatments are give to vegetable tanned leather. But is practice, vegetable tanning on to a chrome leather is called or known as a semi chrome leather. Obviously vegetable tanning extract are used at retaining stage on to chrome tanned leather. Only chrome tanning and vegetable tanning both have some difficulties or problem on the final leather. So avoiding this problem and owing to a standard article for the particular purpose or semi-chroming is done that can ensure all of these prosperities which must be have a leather for its specific use of hue.

As a result such type of leather which can be used for shoe upper that reduced cost of production and used of chrome. So personally I think that semi chrome finished leather is most applicable in that view.

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CHAPTER – ONE

1.1 INTRODUCTION OF LEATHER MANUFACTURING TECHNOLOGY:

The history of leather production goes right back to prehistoric times, when primitive methods were developed for treating animal hides and skins so that they could be used for clothing to protect people from the elements.

It is to be assumed that the raw hides and skins were at first merely dried and preserved by smoking until with the advance of civilization, it was found that they could be made much more durable by treating them with vegetable matter containing tannin (crushed bark, wood or fruits). It was also discovered that by suspending the hides in water (controlled decomposition process) treating them with ash (liming), it was possible to remove the hairs if the "tanned" hide material was not to be used as fur but as leather.

In addition to various types of vegetable tannage (bark tannage), chamois tannage with fish oil, fat or oil is also known to have existed in ancient times and is still sometimes practiced today. White tannage with alum was presumably a later addition to the methods used by the early tanners.

The practice of dyeing (originally painting) leather with colored materials of vegetable, animal or mineral origin likewise goes back thousand of years.

From these early beginnings a craft steeped in tradition developed over the centuries. Following the introduction of chrome tannage about the end of the 19th century, this craft evolved into an industry of great economic significance which has now become established throughout the world.

According to the 'International Glossary of Leather Terms',

"A general term for hide or skin with original fibrous structure less intact tanned to be imputrescible. The hair or wool may or may not have been removed. Leather also made from a hide or skin which has been split into layers or segmented mechanically and/or chemically into fibrous particles, small pieces or powders and then with or without the combination of binding agent, is made into sheets or other forms such sheets or forms are not leather."

1.2 HIDES AND SKINS :

The outer coverings of big domestic animals like cow, buffalo, horse, steer etc. are called hides whereas those of small domestic animals like goat, sheep, deer, snake etc are known as skins. This classification of course is not true in the case of outer coverings of wild animals. Tiger skin as for example is as big as or sometimes bigger than cow hide but it is called a skin.

Raw hides and skins of domestic herds and flocks are usually used in making leather. They consist of cattle hides (cow, ox, bull and calf) buffalo hides, goat skins and sheep skins. Hides and skins differ in their structure depending upon the breed and origin of the animal, its mode of life, its food, its general condition, and season of year, age and sex. There are many other factors have a very great influence on the properties of the hides and skins and on the process of the leather manufacture. There are also differences between individual's pieces of hides or skins from different parts of the body of one and the same animal.

In the case of cattle hide, the fiber is heavier in the back areas than in the belly and the hair is longer. The main difference between calf skins and cattle hides from a structural point of view is the fitness of grain, smaller collagen bundles and smaller and closer hair follicles in calfskins. As a result calfskins have a very fine structure compared to cattle hides and are useful for the finest of leather. In buffalo, hair pores are less in

number and the pore diameter vary tight fiber structure and so are used in the manufacture shoe upper leather and other durable type of leathers.

1.3 ANATOMICAL STRUCTURE OF GOAT SKIN :

A hide or skin appears to be a mere covering for the animal; however animal skin is composed of an orderly arrangement of various types of cells the structural units of all living matters.

The tissue elements of the skins are embedded in a soft, homogeneous material called amorphous ground substance. Its consistency varies from fluid to gel like substance and it dries out to hard transparent mass. This material is often referred to as "cementing substance".

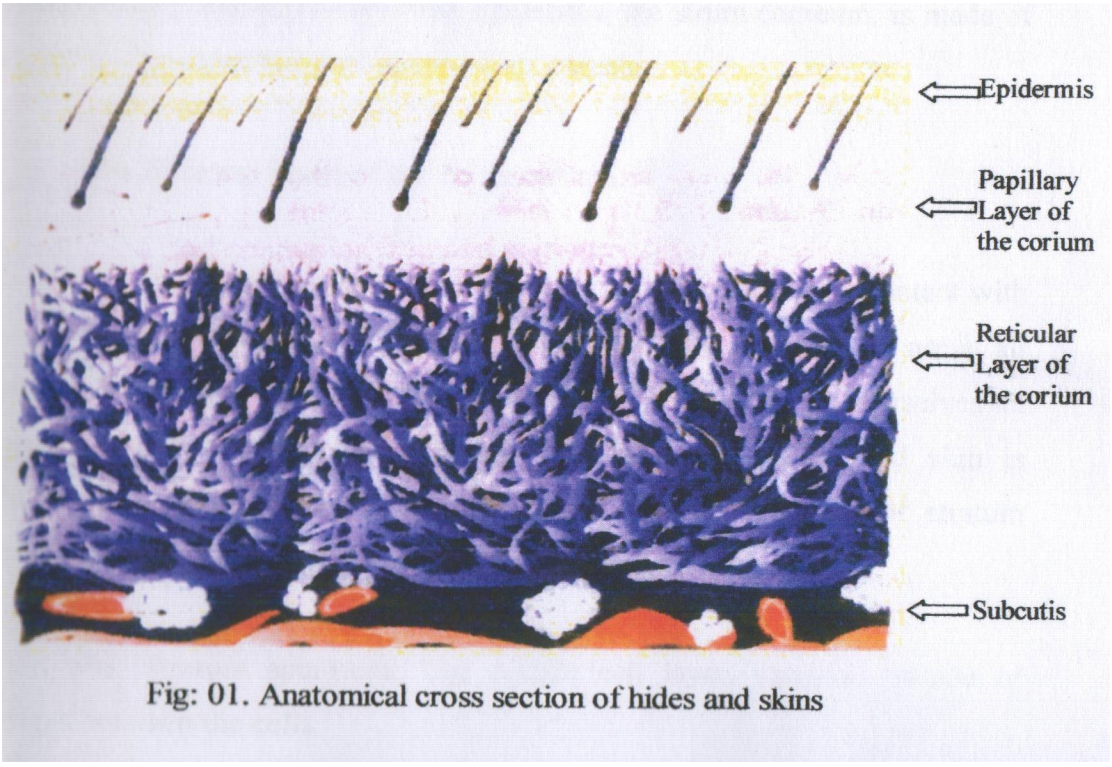


Fig. – 1: Anatomical Cross-section of Skins

Most hides and skins consist of three parts. Such as:

I. **Epidermis**
II. **Dermis or Corium or True skins**
III. **Hypodermis or Adipose layer**

I. EPIDERMIS :

The epidermis is a continuous thin layer of cells forming the outermost layer of hide and skin surface and carries the hair root. The thickness of the epidermis varies in different animals and covers approx. 0.5 to 2.0% of the total thickness of the hide or skin. The epidermis is cellular in structure and characterized by several distinct layer of epithelial cells. The epidermis contains 5 layers. From bottom to top layer are named stratum germinativum, stratum spinosum, stratum granulosum, stratum licidum and stratum corneum. As the cells move into the higher layers they flatten and eventually die. The top layer of the epidermis, the stratum corneum is made of dead, flat skin cells that shed about every 2 weeks.

The different layers of the epidermis are:

1. **Stratum germinativum :** This layer is in immediate contact with the corium and is an actively growing tissue. The cells of this layer are at all times reproduction new cells, the lowest cells reproducing them in vertical direction. Thus the epidermal covering of the hide and skin is constantly growing outward from the corium below. The cells of stratum germinativum contain blood, iron and sulpher.

2. **Stratum spinosum :** The pickle cell layer showing pickle or bridges between the cells.

3. **Stratum granulosum :** The cells in the upper part of the stratum granulosum, in the process of growing outward become clongated and show a progressive accumulation of dark granulescalled the “Keratohyaline” granules. Two or five layers of these fat cells from a layer known as stratum granulosum.

4. **Stratum lucidum :** In thicker epidermis a conspicuous thin clear band called stratum lucidum is found above the granular layer. The individual cells of this are seldom visible.

5. **Stratum corneum :** This is the uppermost layer of the epidermis . This horny layer is made up of flat and hard scale like dead cells which have lost their cellular identity and are continuously being removed by such mechanical means as rubbing and friction and are replenished by the cells of the germinative strata.

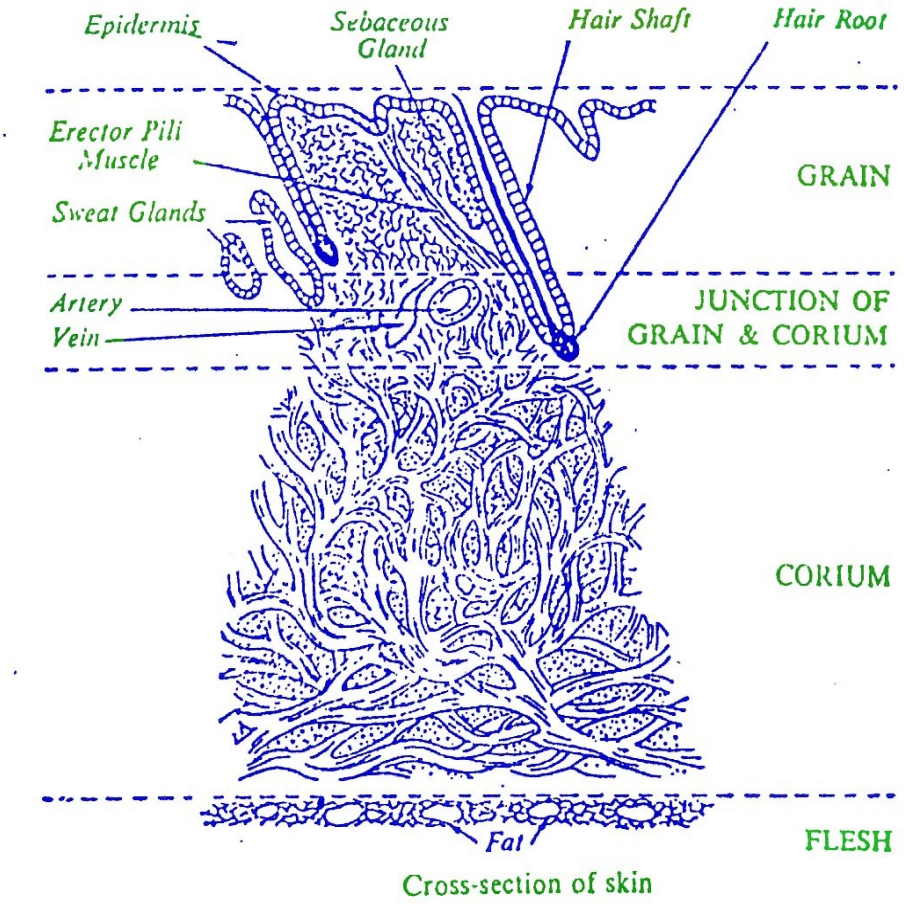


Fig. - 2: Cross-section of Skins

II. DERMIS OR CORIUM OR TRUE SKINS :

The layer below the epidermis is the dermis or corium. The epidermis is connected to the corium by an exceeding thin structure of delicate, fine, felted fibers called the "grain membrane"; at the top of this layer there is an exceedingly thin structureless film known as the "hyaline layer"

The corium is divided into two distinct layers. Such as:

1. Corium minor or Grain layer

The grain layer or corium minor consists of a dense layer of collagen and elastic protein fibers. It constitution about one fifth of the total thickness of corium and differs structurally from the main part. The grain layer gives leather its distinctive appearance.

2. Corium major or Reticular Layer

The corium major consists of a dense layer of collagen protein fibers, arranged in layer bundles, and interwoven to give the structure high strength, elasticity and durability. This is the main parts of corium. In practice, the corium or true skin is that portion of- the hide or skin, which is called pelt, and from which the hair has been removed.

III. HYPODERMIS OR ADIPOSE LAYER:

The adipose tissue is the tissue left adhering to the flesh Side of the hides or skins. It consists mainly fat cells containing tallow like fats, with a few scattered fibers. There is also some muscular tissue. All these structures are useless for the leather manufacture and must be removed in the fleshing operation after suitably preparing the pelt in the soaking and liming process.

So, in the preparation of the hides or skins the epidermis and adipose tissues must be removed leaving corium which is converted into leather.

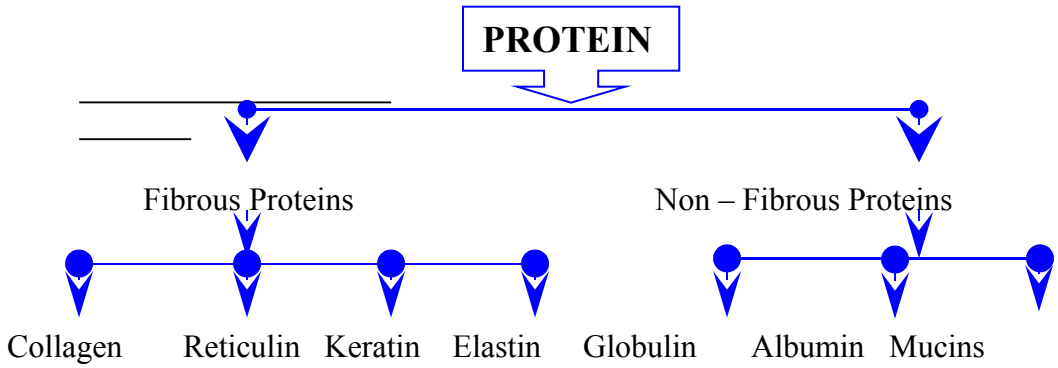
1.4 COMPOSITION OF SKINS :

Fresh hides or skins consist of water, protein, fatty materials and some mineral salts. Of these the most important for leather making is the protein. This protein may consist of many types. The important ones are collagen which on tanning gives leather and keratin, which is the chief constituent of hair, wool, horn and the epidermal structures.

The approximate composition of a freshly flayed hide is as follows :

Substances		Percentage	
Water	**----------**	**60% – 70%**	**Based on green wt.**
Proteins	**----------**	**19.2% – 32.75%**	**Do**
Fats	**----------**	**1.5% – 12.25%**	**Do**
Mineral salts	**--------**	**0.36% - 0.5%**	**Do**
Other Substances-- (Pigments etc.)		**Traces**	

There are different types of proteins in Hides/Skins. The protein content consists mainly of collagen and this collagen is transformed into leather by the tanning process. They are classified as follows:



The percentage of these materials vary from skin to skin depending upon the age, species, breed and health of the animals.

1.5 What is leather

Real leather is a natural product. It breathes warm and durable and has individual characteristics, which make each hide unique. Leather will always bear the marks of its natural origin and these characteristics can show as scratches, growth marks areas of differing fiber density and hair pore structure.

Leather Definition :

Legal definition in the UK a definition of leather is set out in the British standard Glossary of Leather Terms (BS 2780)

BS 2780 Definition :

Hides or skins with into original fibrous structure more or less intact tamed to be impressible. The hair or wool may or may not have been removed. It is also made from a hide or skin that has been split into layers or segmented either before or after tannins.

Note 1: It the leather has a surface coating, the mean thickness of this surface layer, however applied, has to be 0.15mm or less.

Note 2: It the tanned hide or skin is disintegrated mechanically and or chemically into fiber particles, small pieces or powder and then, with or with out combination of a binding agent is made into sheets or forms, such sheets are not leather.

1.6 TYPES OF LEATHER :

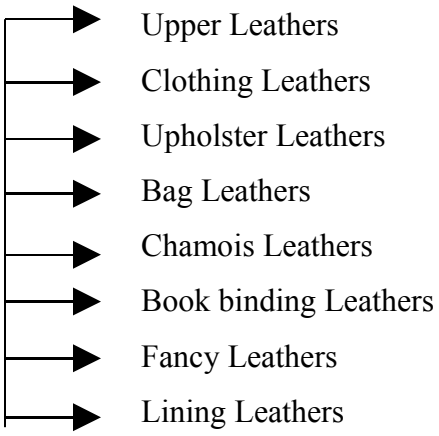
There are different types of leather. Leather may be broadly classified under the following categories :

A. Heavy and industrial leathers
B. Light leathers
C. Sport leathers
D. Parchments.

A. **Heavy and industrial leather :**

- Belting Leathers
- Buffer Leathers
- Bucket Leathers
- Engine Leathers
- Hat Leathers
- Horse Leathers
- Hydraulic Leathers
- Lace Leathers
- Meter Leathers
- Strap butt Leathers
- White Leathers
- Textile hide Leathers (Picker band, Pocking band)
- Combing Leathers
- Condenser rubbing Leathers
- Roller Leathers
- Industrial gloving Leathers
- Washer Leathers
- Grinning Leathers
- Binder Leathers
- Gear Leathers
- Oil mill diaphragm Leathers

B. **Light Leathers :**



There are different types leather produced using different types of tanning operations:

There are many types of finished leather according to the methods of finishing:

A. ACCORDING TO THE FINISHING MATERIAL USED:

- Casein finished Leathers
- Resin finished Leathers
- Nitrocellulose finished Leathers
- Patent finished Leathers
- Polyurethane Leathers

B. ACCORDING TO THE FINISHING TECHNIQUE USED:

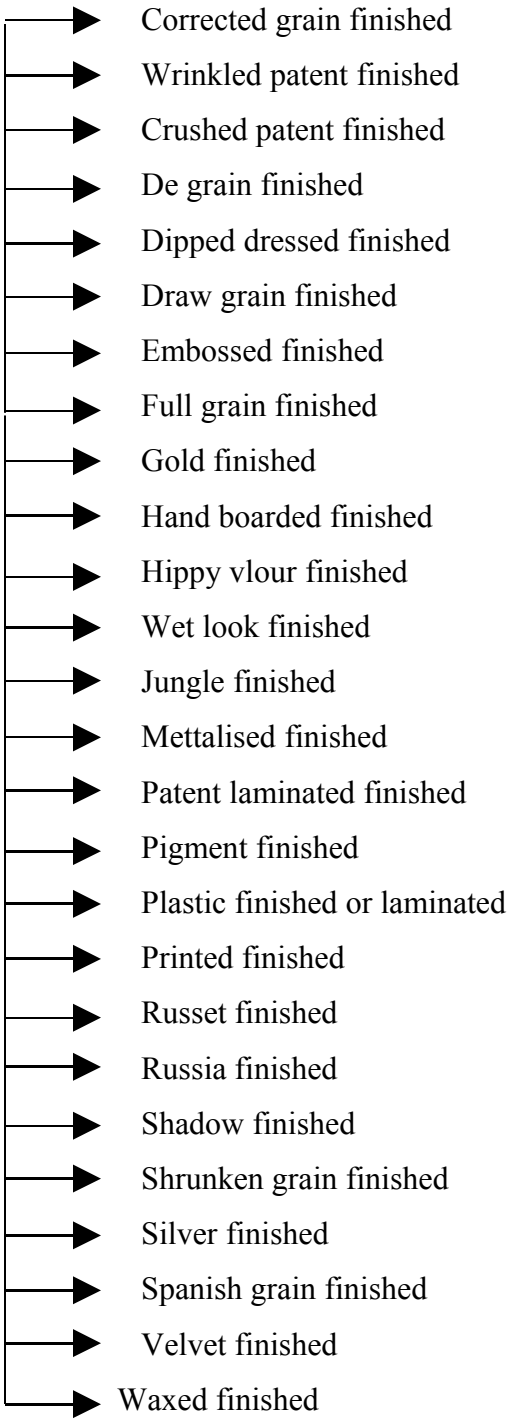
- Elated finished Leathers
- Plate finished Leathers
- Embossed finished Leathers
- Spray finished Leathers
- Coating finished Leathers

C. ACCORDING TO THE FINISHING EFFECT:

- Aniline finished Leathers
- Semi aniline Leathers
- Opaque finished Leathers
- Easy care finished Leathers
- Antique finished Leathers
- Two tone finished Leathers

D. ACCORDING TO THE FINISHING VARIATIONS:

- Aniline dyed finished
- Aniline stained finished
- Antique grain finished
- Buff finished


Corrected grain finished
Wrinkled patent finished
Crushed patent finished
De grain finished
Dipped dressed finished
Draw grain finished
Embossed finished
Full grain finished
Gold finished
Hand boarded finished
Hippy vlour finished
Wet look finished
Jungle finished
Mettalised finished
Patent laminated finished
Pigment finished
Plastic finished or laminated
Printed finished
Russet finished
Russia finished
Shadow finished
Shrunken grain finished
Silver finished
Spanish grain finished
Velvet finished
Waxed finished

1.7 DIFFERENT STEPS OF LEATHER MAKING:

a. Pretanning and Beamhouse operation:

i **Curing:** Raw hides and skins must be preserved to stop then deterioration before the leather making process begins. Methods of preservation include salting, chilling, freezing and the use of biocides.

ii **Selection :** Defect free hides and skins should be selected.

iii **Trimming :**To get regular shape and to prevent loss of chemicals.

iv **Washing :** To clean the hides and skins.

v **Soaking :** Cured hides and skins are soaked in water for several hours to several days. This allows them to reabsorb any water they may have lost in the curing process or during transportation. It also helps to clean then of salt and dirt.

vi **Painting :** Painting is a method by which wool can be removed from sheep shins using a sulphide based mixture.

vii **Liming :** Liming removes the epidermis and hair. This also results in alkaline swelling of the pelt to cause a controlled breaking of some of the chemical crosslinking of the collagen.

viii **Fleshing :** After fleshing the pelt is passed through a machine to remove fleshy tissue from the flesh side. Hides may be split into layer at this stage or after tanning

ix **Deliming :** The principle action of deliming is to gradually neutralize the alkali in the pelt, avoiding rapid changes in pH which could lead to distortion or disruption of the tissue.

Bating : A long deliming can significantly improve the removal of any remaining lime, scud (miscellaneous debris) and residual components broken down during liming. Bating based on the use-of enzymes-complete this process, so that the pelt is flat, relaxed, clean and ready for pickling and tanning.

x **Pickling :** Weak acid and salt solution are used to bring the pelt to the weakly acid state required for most tanning process, stronger pickling solution are used to preserve pelts so that they can be stored or transported in a stable form over period of several months.

xi **Degreasing:** Solvents and water based systems can be used to remove excess grease before tanning.

b. Tanning :

Tanning converts the protein of the raw hide or skin into a stable material, which will not putrefy and is suitable for a wide variety of purposes.

Tanning materials form cross linking in the collagen structure and stabilize it against the effect of acids: alkalis, heat, water and the action of microorganism. The main types of tanning materials are:

i. Mineral tannage

Most leather is tanned using salts of chromium. Alum, zirconium are also some time used.

ii. Aldehyde and oil tannages

Tanning with aldehyde and oils produces very soft leather and this system can be used to produce dry cleanable and washable fashion leathers and also chamois leather.

iii. Vegetable tannage

Various plant extracts produces brown colored leather which tend to be thick and firm. This type of tannage is used to produce outsole leather, belting leather and leathers for shoe linings, bags and cases.

c. Post tanning operation :

Samming :

This process reduces water content to about 55% and Can be achieving by a number of machines, the commonest being like a large angle with felt covered rollers.

Splitting:

Splitting machine slices thicker leather into two layers. The layer without a grain surface can be turned into suede or have an artificial grain surface applied.

Shaving:

A uniform thickness is achieved by shaving the leather on the non-grain side using a machine with a helical blade mounted on a rotating cylinder.

Retaining :

Additional tanning material may be applied to give particular properties which are required in the finished leather.

Dyeing:

The dyeing of leather into a wide variety of colors plays an important part in meeting fashion requirements. Some leather is only surface dyed, while other need completely penetrated dyeing, as in the case of suede leather.

Far liquoring :

Fat liquoring introduces oils to lubricate the fibers and keep the leather flexible and soft. Without these oils the leather will become hard and inflexible as it dries out.

Setting out:

The leather is stretched out and grain side is smoothed, the process also reduces the water content to about 40%.

Final drying:

Leather is normally dried to 10-20% water content. This can be achieved in a number of ways (vacuum drying, hang drying, toggling) and each method has different effect on the finished leather.

Staking and dry drumming:

A staking machine makes the leather softer and more flexible by massaging into separate the fiber. To finish off the leather may be softened by the crumbling action inside a rotating drum.

Buffing and Brushing :

The flesh surface is remove mechanical abrasion to produce a suede effect or to reduce the thickness. In same cases the gram surface is buffed to produce a very fine nap. e.g. nubuck leather. After buffing the leather is brushed to remove excess dust.

Finishing:

The aim of finishing are to level the color, cover grain defects, control the gloss and provide a protective surface with good resistance to water, chemical attack and abrasion.

Final Grading :

Leather will be graded before dispatched to the customer This grading may consider the color intensity and uniformity, the feel of the leather, softness, visual appearance, thickness, design effects and natural defects such as scratches.

Measurement:

The area of each piece of leather is measured by machine. Nearly all leather is sold by area. So accurate measurement is important.

Chapter Two

2.1 GOATSKIN

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

2.2 PROPERTIES OF GOATSKIN

The characteristics property of goatskin is following below:

(a) The grain layer of goatskin usually occupies approximately 24 to 25% of the total thickness of the skin.

(b) The tight-natured fiber of goatskin is recognized.

(c) In the grain layer the collagen of goatskin fibers are compactly woven.

(d) There are more elastic fibers in goatskin than in sheepskin, 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 straight hairs. The hair follicles in goatskin are quite deeply rooted and dip 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.

2.3 SOURCES OF GOATSKIN

These are tougher and more tightly fibred than sheep, and have a very hard-wearing grain. There are no domestic supplies in the U. K. and tanners have to import them from Bangladesh, India, Pakistan, East and West Africa, Ethiopia, Yemen, South Africa, Southern Europe and Central and South America. Large supplies are also available from

the Far East. The raw skins are dry-salted, wet-salted or simply dried, and then baled for shipment to the tanneries.

Bangladesh:

Bangladesh skins of direct interest to upper leather tanners are confined to Dhaka, Dinajpur and Kushtia.

'Wet blue' goatskins in an unhaired, chrome-tanned condition have become a major export commodity from India and Bangladesh.

India:

Raw goatskins obtained from India, usually from the Kolkata districts, are invariably of a miscellaneous quality and size.

Africa:

East Africans often suffer frain damage due to disease and drying faults and the majorities are used for the production of suede. These are usually suspension-dried on a frame. From Nigeria the skin of the red goat of 'Sokoto' is one of the finest obtainable, 'kanos' too are popular, as they are uniform in size and shape and are spared the many hazards of the nomad herds. These skins are used for all types of kid upper leather.

2.4 STRUCTURE OF GOATSKIN

In many respects the skin of the goat may be regarded as having a structure intermediate between those of calf and sheep. The epidermis is thicker than in sheep skin and covers approximately 1.5 to 1.8%of the thickness of the skin. Unlike in sheep, hair follicles a goat are straight and less deeply rooted. The glands and fat cells, which are responsible for the sponginess of sheep leather, are very much less in number in goat skins and the glands are rather smaller in size. Hair muscle is well developed and longer in goat skin than in sheep skin.

The thermostat layer covers approximately 24 to 54% of the total thickness of the skin and is relatively thicker in the neck. A dense network of elastin is found in the goat skin covering approximately two-thirds of its thermostat layer. As in sheep skin, a relatively greater amount of elastin is present in the neck in the goat.

The corium proper in goat skin covers approximately 45 to75% of the total thickness of the skin, the percentage varying considerably over the entire area. The collagen fibers in this layer are fuller and firmer than those of sheep but are hardly equal to those of the calf. Unlike in sheep skin, fat cells and fat droplets are rarely found in this laver of the skin.

2.5 GRAIN PATTERN OF GOATSKIN

In many respects the skin of the goat may be regarded as having a structure intermediate between those of calf and sheep. The epidermis is thicker than in sheepskin and covers approximately 1.5 to 8% of the total thickness of the skin. Unlike in sheep, hair follicles a goat are straight and less deeply rooted. The glands and fat cells, which are responsible for the sponginess of sheep leather, are very much less in number in goatskins and the glands are rather smaller in size. Hair muscle is well developed and longer in goatskin than in sheepskin.

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The corium proper in goatskin covers approximately 45 to 75% of the total thickness of the skin, the percentage varying considerably over the entire area. The collagen fibers in this layer are fuller and firmer than those of the sheep but are hardly equal to those of the calf unlike in sheepskin, fat cells and fat droplets are rarely found in this layer of goatskin.

2.6 TYPES OF SHOE UPPER LEATHER:

GRAIN LEATHER:

Sl.No.	Types	Raw stocks	Thickness mm	Tanned	Properties
1.	Full grain leather	Full grain means that the original grain surface should be exposed without snuffing.			
2.	Side upper leather	Cattle Hides (all classes)	1.2-1.8 mm	Chrome tanned	Good fullness, no loose grain.
3.	Box sides	Cattle Hides (15-25 kg)	1.4-2.2 mm	purely chrome tanned	Full handle with firm structure.
4.	Corrected grain leather	Cattle Hides (all classes)	1.2-2.0 mm	vegetable /synthetic/ additional resin tanning	Given an artificial grain layer by impregnation and thicker, filling finish coat.
5.	Waterproof leather	Cattle Hides (Medium weight classes)	1.8-2.4 mm	chrome tanned /chrome-vegetable tanned.	Full, slightly rubber like handle with tight and smooth grain.

Sl.No.	Types	Raw stocks	Thickness mm	Tanned	Properties
6.	Russet upper leather (Heavy footwear such as hiking and mountaineering boots, army boots industrial shoes)	Cattle Hides & kips (15 kg and more)	1.8-2.8 mm	natural-colored, vegetably tanned side upper leather	Softness, fullness, pliability, sufficient firmness, little washing out loss, good tensile strength, good air permeability etc.
7.	Russian leather (shoe and boot upper, harness and fancy leather)	Light cattle hides & calf skins	1.4-2.6 mm	combined vegetable tanned and chrome tanned	To achieve the characteristic smell, it is impregnated with birch-tar oil.
8.	Polishing leather	Cattle Hides (all classes)	1.2-1.8 mm	chrome tanned, have slightly vegetably /synthetically retanned and have received a polishing finish	Soft, similar to aniline, with a light/dark contrast when the grain is extended.
9.	Sandal leather	Cattle Hides (all classes)	1.6-3.0 mm	Vegetably tanned with reduced fat liquoring.	Mostly used unlined, the fleshed side is processed with short fibres by dry shaving or buffing.
10.	Box calf	calf skins (all classes)	0.8-1.4 mm	chrome tanned, glaze or glaze/plate finish	Full, supple handle with good firmness and good tensile strength.
11.	Calf upper leather	calf skins (all classes)	0.8-1.8 mm	chrome/ Vegetable tanned.	Good firmness and good tensile strength.
12.	glazed kid leather (highest quality and most elegant leathers, used mainly for ladies footwear)	kid skins and light goat skins of good substance (4 sq,ft.)	0.6-0.9 mm	Formerly two-bath today one-bath chrome tanning method, with smooth glaze finish.	Firm grain, no poor substance, no elasticity in all sides and flanks, high gloss, non-coating finish.

Sl.No.	**Types**	**Raw stocks**	**Thickness mm**	**Tanned**	**Properties**
13.	Goat skin upper leather	Goat skins of all breeds and sizes.	0.6-1.4 mm	chrome tanned /chrome-vegetable tanned.	Have all degree of softness and all variations of finish.
14.	Chevrettes (imitation of glazed kid leather)	Lamb and sheep skins of good substances from special raw stocks.	0.6-1.0 mm	Strongly vegetable retanned.	Have lower strength properties and a different appearance of grain.
15.	leather of reptiles	Smaller types of crocodiles, lizards, snakes.	0.3-1.2 mm	particularly attractive pigment patterns are received by alum tanning	Dyed and finish with colorless glaze top coats. Are only processed to a small extent for highly fashionable shoes and trimmings.
16.	Horse and foal upper leather	Horse hides (12 kg and more), foal hides (7-12 kg salt weight)	1.0-1.6 mm	more intensive opening up of the skin by stronger liming	Glazed horse upper leather, horse side leather
17.	Pig upper leather	Pig skins (2-4 kgs)	0.8-1.4 mm	vegetable /synthetic/ additional resin tanning and Grain buffing.	Good water repellent and good water proof ness properties.
18.	Kangaroo upper leather	Clear grain Kangaroo skins	0.8-1.2 mm	chrome/ Vegetable tanned. / Synthetic tanning.	Maximum strength properties and used for hard wearing footwear.
19.	Patent leather	Cattle hide, calf skins or goat skins	1.0-2.0 mm	Cold lacquering processes with P.U. lacquers, less frequently by lamination.	Leathers with a mirror bright gloss and with a relatively thick finish coat. Good adhesion, Good cracking resistance.
20.	Shrunken grain leather	Cattle hide, calf skins or goat skins	1.0-2.2 mm	chrome/ Vegetable tanned. / Astringent Synthetic tanning agents/ glutaraldehyde.	Have a grain shrinking effects.
21.	leather of fish skins	some types of seal, shark, dolphin, several types of cod, Pollack and eel etc.		Avoid excessive decomposition of albumen substance, short soaking and liming at below 20°C.	The strength properties are insufficient in types of fish skins.
22.	Split upper leather	Flesh side lower splits of firm texture made from cow hides.	0.8-2.2 mm	Vegetable / Synthetic retannage.	Smooth short-fibre nap, good filling. Good adhesion.

2.7. PHYSICAL PROPERTIES OF SHOE UPPER LEATHER:

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

1) Tensile strength:

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

2) Stitch tears strength:

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

3) Split tears strength:

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

4) Elongation at break:

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

5) Distension at grain crack:

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

6) Percent set:

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

7) Reaction of finish to two-dimensional stretch:

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

8) Bond Strength:

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

9) Resistance of upper to heat and pressure:

The upper leather must be to resist the effect of heat and pressure applied in the direct mould and the injection molded sole process of footwear construction.

2.8. FUNCTIONAL PROPERTIES OF UPPER LEATHER:

i) Break and peppiness 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 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 adapts to the foot during fitting and conform to the shape of the foot during wear.

iii) Flex endurance: -

The supper leather has undergo a large number of flexes in where with out creaking of the finish or breaking of the grain. A finish, which does not damage unto 10,000 flexes in Bally Flexometer will be considered static factory in wear.

iv) Fastness of finish to dry and rubbing: -

The finish of upper leather should resist dry rubbing for maintaining its good appearance.

v) Adhesive of finish: -

One of the common complaints in the leather shoe uppers is due to the peeling or flaking of the finish. The adhesive of the finish test is designed to reproduce the type of failure where the bond between the substrate and the finish breaks down and the finish peels or flakes off.

vi) Light Fastness: -

The finish should not change color when exposed to nature light to a Xenotest apparatus for the eight hours than of No. 3-5 of the Grey scale.

2.9. THE IMPORTANT QUALITY REQUIRMENT OF SHOE UPER LEATHER.

Sl. No.	Tests	Requirements
1	Flexing endurance in the cold (-20^{o} c)	50000 dry, 10000 wet min 30000 flexing
2	Adhesive of finish	3.0 N Dry 2.0 N wet
3	Bur fastness	Min. 50 Rub cycles (dry)
4	Fastness of hot plating	Min. 40 degree Celsius
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 (Blue scale)
9	Fastness to migration	Max rating 3 (Blue scale)
10	Tensile Strength	Min. 100N
11	Value of Ph	Not less than 3.5%
12	Mineral substances removal by washing	Not more than 1.5%
13	Water vapor permeability	10.0 mg/h cm square
14	Water vapor absorption	10.0 mg/h cm square (after 8 hours)
15	Water proofing	Penetration of water Min 60 min absorption of water max 35%
16	Water spotting test	Draying with out staining

2.10. EXPORTING COUNTRIES:

Bangladesh export leather to the following countries

1) Spain
2) England
3) Korea
4) Germany
5) Hong Kong
6) Italy
7) Japan
8) Brazil
9) Taiwan
10) Vietnam
11) France
12) China
13) Australia
14) Singapore
15) Philippines
16) New-Zealand
17) Malaysia
18) Thailand
19) Russia

Chapter Three

3.1 LEATHER FINISHING

The term finishing refers to the further processing of the leather after crusting. The aim is to adapt the leather to suit the fashion demands of the consumer with regard to color surface effect etc.

The reason for this is probably that finishing of the leather had long been more of an art that science.

The grain far surface of the leather must be provided with coating which protects the leather from injuries caused by rubbing and scratching and from penetration of excessive moisture and dirt. This protective coating should impart to the leather a level appearance and wear a suitable at fain-high utility value and quality.

Leather finishes should not be affected by rubbing or peeling during the processing of leather end products should be resistant to heat, cold and moisture should not crack on extension or fixing and should be fast to staining and light.

Leather finishing may be expressed as the treatment of the fur face off the leather and/ or top section of the leather with materials, which will exchange the appearance of the leather and improve its properties for the purpose to which it is to be used.

3.2 OBJECT OF FINISHING

1. Levelness of color on the leather.

2. Uniformity of shade from skin to skin and pack to pack.
3. Changing the color to that, which is required.
4. Imparting color or pattern to undid leather.
5. Giving a surface to the leather varying from matt to gloss.
6. Adding a transparent film through which the natural appearance of the leather may be viewed.
7. Adding a transparent colored film to the leather.
8. Covering the leather with and opaque film in order to obliterate all defects.
9. Alter the surface of the material, i.e. splits.
10. Improve the water resistance of the leather, i.e. the finish should not discolor or swell and hence protect the leather and retain its good appearance.
11. By filling the surface of loose leather improve the break of the grain.
12. Give a leather of optimum cutting value.
13. Seal the leather surface so that it remains clean.
14. Render the leather light fast; heat fast, fast to alkalis, fast to acids.
15. Render the leather resistant to a light pull up on lasting.
16. Improved the scuff resistance of the leather.

3.3 CHARCTERISTICS OF AN IDEAL FINISH FILM

3.3.1 Flexibility and stretchiness:

Leather is a flexible material with certain degree of stretchiness. If the film to the leather surface does not possess these properties to the same extent as leather, it will make the leather hard and the film crack in course of time.

3.3.2 Adhesion:

The film should be firmly fixed to the leather surface so that the formal does not come out during use. The film should also adhere to the pigment particles and others very firmly.

3.3.3 Holding power:

The film should have sufficient capacity to hold in it other substances like pigment, plasticizer etc. During drying or film formation no ingredient of the finish should precipitate out. The ideal film will never allow the plasticizer to migrate into the leather.

3.3.4 Gloss:

The film should glaze by itself or should acquire this quality after glazing under glazing machine or hot plating or brushing.

3.3.5 Abrasive Resistance and fastness:

The film should have sufficient resistance to abrasion for longer life and at the same time, it should hold the coloring materials so tightly that it does not come out when rubbed will a dry or wet cloth.

3.3.6 Water proof ness and water vapor permeability:

The film should repeal water so that it does not spoil the leathery appearance of the finished leather at all but at the same nine, the film should hide all the defects in the leather.

3.3.7 Thickness:

The film should be as thin as possible so that it does not spoil the leathery appearance of the finished leather at all but at the same time, the film should hide all the defects in the leather.

3.3.8 Resistance to acid, Alkali and chemicals:

During use the leather comes on contact with dirt, mud, acid and alkaline fumes, sweat etc. this is especially true for leathers used by army in the field. The film on the leather should have therefore, sufficient capacity to protect the leather from these.

3.4 CLASSIFICATION OF LEATHER FINISHING:

In many cases two or more names may exist for the same finish when classified according to finishing techniques finishing materials and finishing effects:

A. Classification according to the finishing technique:

- Glaze finish
- Plate finish
- Glaze/ plate finish
- Corrected grain finish
- Embossed finish
- Spray finish
- Curtain coating finish
- Spray finish

- Roll coating finish
- Film transfer finish.

B. Classification according to the finishing effect:

- Aniline finish.
- Semi-aniline finish
- Opaque finish
- Easy care finish
- Two or multi tone finish
- Brush off finish
- Antique finish
- Fancy finishes
- Invisible finish
- Craquele finish
- Padding finish
- Foam finish
- Solvent free or solvent poor finish

C. Classification according to the finishing materials used:

- Casein finish
- Polymer or binder finish
- Nitro cellulose or colloidion finish
- Cellulose ester finish free from nitro groups
- Polyurethane finish
- Patent finish.

FINISHING MATERIAL

3.5.1 Pigments:

A pigment is any particulate matter that is insoluble in and essentially physically and chemically unaffected by the media into winch it is dispersed, three types of pigments are used in leather finishing:

1. Inorganic pigments (e.g. Iron, Oxide, Lead, Chromates, Titenium Oxide, Carbon black, Cadmium Sulfide, Ultramarine blue etc.)

2. Color lakes

3. Organic pigments (e.g.Monoazo, Disazo, Toners, Lakes, Phthalocyanine and metal complex and vat pigments).

Inorganic pigments are insoluble colored materials and have high opacity. These pigments are either prepared pigments or earth colors have the most body, covering power and permanency, hewing least affected by chemicals, but they lack brilliancy. On the other band, the prepared pigments have less body and covering power than the earth colors.

Color lakes, another group of pigments, are precipitated coal tar dyes and available in many shades and various degrees of brilliancy. And some fade on long exposure to light.

The organic pigments are normally insoluble dyestuffs available m different color ranges with different chemical and physical properties. Some new types of micro pigments are also transparent and soluble in some organic solvents.

The organic pigments give better brilliancy, but they have less covering power, less body, less setting, less light fastness and tendency to cause bleeding in comparison to inorganic pigments. Moreover, the organic pigments are expensive and are used in finishing high quality better grade upper leathers.

3.5.2 Dyestuffs:

Soluble concentrated dyes are used for staining, brightening and enriching the color in water pigment finish. Soluble acid dyes of the same color as the pigment should be selected carefully as otherwise there may be bleeding of dyes; poor light fastness and poor dry and wet rub fastness. The use of brilliant dyes is very important for making aniline and semi-aniline finishes. Properly selected metal complex dyes may also be used for better light fastness and rub fastness.

3.5.3 Film-Forming Materials:

These are the most important materials in leather finishing. The film forming materials may be classified according to their general chemical composition as follows:

(a) Protein:

All glazed finishing is done by the use of protein binders. The one specific advantage of this is capacity to retain the original grain characteristics of the leather as different from that finished by synthetic binders. Casein, gelatin, albumen etc. fall under this group and are used for aqueous glazed finishes.

Casein:

Casein is the most important protein binder and is widely used in finishing of leather.

Albumen:

Egg albumen and blood albumen used in finishing produce high gloss when leathers are friction glazed. Egg albumen is considered better than blood albumen.

Glue and gelatin:

Both glue and gelatin is produce from hide cuttings, fleshing, bones of animals etc. by extracting them by heat treatment. When the breaking of collagen molecule is slight, gelatin is produced and heavy breaking at higher temperature results in glue formation. The molecular weight gelatin is higher than that of glue.

(b) Shellac:

Shellac is a natural resin obtained from lac-a resinous exudation of insect " Lacier lace". Aqueous solution of shellac in Borax or Ammonia is used in leather finishing for glazed leather. Shellac is a good film forming material for leather finishes and it imparts waterproof ness, good luster, hardness and strength, fastness to wet rubbing and to light. The main disadvantage with this natural resin is that it is brittle and cannot retain the politicizes for long. Due to its inadequate fixing properties and brittleness it should only be added in small amounts.

(c) Synthetic resin binder:

The proteinious materials and shellac are used mainly for glazed leather and to some extent in making plated finish in combination with synthetic resins. For full grain, glazed finished leathers only first grade raw hides, with no or little grain defects, are needed, which are very scarce in our country. Moreover, the protein finishes can not meet the requirements of absolute waterproof ness, water resistance, flexibility, wet rub-fastness etc. which are required to meet the demands of modern leather and shoe manufactures as well as to fight the competition of leather substitutes. The development

of synthetic resins has made greater utilization of raw materials, particularly of low grade stocks, possible by manufacturing corrected grain leathers of upgraded quality and greater cutting value for shoe and leather goods manufactures. The synthetic resins, which are used for leather finishing, can be broadly classified into two groups:

a) Synthetic resins for aqueous leather finishes and
b) Synthetic resins for non-aqueous leather finish.

The properties resins for bottom coat season are different from those required for pigment coat season and the resins for pigment coat and top coat seasons differ considerably. But there are certain properties, which are more or less common for resins of all the three coats. There are-

1. Softness and elongation
2. Glass transition temperature (Tg)

All resins for leather finishing should be soft and extensible so that the film formed may stretch with the leather without cracking the softness, of course, differing from coat to coat. A resin to be suitable for leather finishing must have stretchiness between 300 to 1000 p.c.

3.5.4 Plasticizers:

A plasticizer is a material that increases the plasticity of mass. The function of the plasticizer is to keep the finfish film soft and flexible and it does> not crack both no solvent and types of politicize are in use.

a) Non solvent type:

Raw and blown castor oil, Specially treated linseed and tong and many other non-drying oils, glycerin, high quality sulphated oils come under non -solvent type are uses to plasticize the films of casein, shellac, albumen, gelatin etc. in the aqueous finishes.

b) Solvent type:

High boiling point solvents such as dibutyl phthalate, trictesyl phosphate, triphenol phosphate, dimethyloxy tetra glycol, benzophenone etc. are used to plasticizer nitrocellulose films.

3.5.5 Wax emulsion:

Aqueous wax emulsion prepared by adding wax to soap solution, preferably Trietholamine soap with constant stirring are added to water pigment finishes to impart of smooth fell, waterproof ness and good gloss. The waxes, which are generally used for leather finishing, are: carnauba wax, paraffin wax, shellac wax, sisal wax etc. a 10 p. c. wax emulsion is commonly used in leather finishing.

Wax emulsions prepared from various waxes are for various purposes. Some wax emulsions from a perfect sealing coat with resin binders used in the bottom coat, some are glazable and can be used in the top coat. Certain wax emulsions reduced the tackiness of resin binders and prevent the leather from adhering to the hot hydraulic plate; others can give a slight waxy feel to the finished leather surface.

3.5.6 Preservatives:

As protein binders used in the preparation of leather finishes are liable to putrefaction, it is necessary to add preservatives after prevent decomposition. Many types of chemicals used as preservatives are:

1. para- Nitrophenol
2. para-Chloro-Meta-Cresol
3. para-Chloro-Metaxylenol

4. Sodium salt of Ortho-Phyenyl Phenol
5. Sodium salts of Di-Chloro, Tri-Chloro and Penta-Chloro Phenates.

3.5.7 Modifiers:

These products give the leather the desired surfaced handled. A variety of finishes can be achieved such as smooth, blunt, slippery, supple, dry and waxy greasy or fatty. They are added to the topcoats or mostly applied as separate topcoat.

3.5.8 Malting agents:

The heavily covered and coated leathers topped with lacquers tend to appear unnatural and unappealing in look. Therefore the gloss of the leather needs to be reduced without affecting other characteristics. For this purpose matting agents, either aqueous or solvent based, are recommended for incorporation in lacquer emulsion in certain proportion for top spraying, the amount depending on the extent of dullness desired. Besides the desired matt effect these products provide fullness, settled surface appearance, smooth handle and reduced thickness of the finish coat.

3.5.9 Penetrator:

Mainly used for grain impregnation and base coating to achieve deeper penetration of the finishing agents below the grain layer. These products are water-miscible organic solvents and/or capillary active substance.

3.5.10 Cross-linking agents and hardeners:

Poly isocyanates are used to harden polyurethane's. The film is formed by across linking reaction. The products based on poly functional aziridine compounds have a cross linking effect on dispersion binders.

3.5.11 Fixing agents:

Formaldehyde is the must popular type of fixing agent to fix protein binders and a mixture of Formaldehyde and Acetic Acid is generally used as the maximum fixing capacity of Formaldehyde is found at acidic pH.

3.5.12 Organic solvents and diluents:

A product based on Nitrocellulose, cellulose aceto buryrate and polyurethane requires the use of organic solvents. In addition, non-dissolving thinners are used as low price extenders and also to regulate the rate of evaporation this does not apply to reactive lacquer components, as these must be used only with free solvents, which are from hydroxyl or amino groups.

Correct adjustment of the rate of evaporation is essential for these solutions. The rate of evaporation must not be too high and not too low because this will impair proper film formation, gloss, adhesion or flow out. The mixture of solvents with diluents should be carefully matched.

(a) Solvent:

Esters- ethyl acetate, propyl acetate, butyl and iso-butil acetate etc.
Ketones- methyl ethyl ketone, cyclohexanone etc.
Ether alcohols- ethoxy ethanol, ethylene glycole etc.
Ether alcohol ester- ethoxyethal acetate, butoxyethal acetate etc.

(b) Diluents:

Alcohols- ethanol, n-butanol, di-acetone alchol, benzyl alchol etc. Aromatic-hydrocarbons-Toluene, xylene, white spirit, decalin, tetralin etc.

3.6 THEORY OF FINISH FILM

Season, containing film forming materials with other ingredients is applied on the leather surface in the liquid state and its dilution is so adjusted that sufficient time is available of uniform spreading of the season on the leather surface by hand or machine evaporation. As evaporation of volatile matters (solvent) continues, the solid content of the season increases with gradual decrease in film thickness till a constant thickness, which again depends on the concentration of non-volatile matters in the season is reached and after which no decrease in thickness is noticed event though evaporation conditions. The molecules of the film forming materials present thus approach each other and since the inter molecular forces, called vender walls is forces are inversely proportional to the sixty powder of the distances between molecules, the force of attraction increases very rapidly with the decrease of molecular distance.

Many practical tanners have the wrong impression that as these molecules comes close to the nearest approach they chemically react (polymerize) and from the film. But this is true when polyurethane linseed mucilage etc. are used for parent leather finishing but which other materials like casein, shellac, acrylic or met acrylic resin, synthetic rubbers based on butadiene, vinyl resins, nitrocellulose lacquers etc. no such chemical reactions take place during film formation. The molecules in such films remain together due to vender walls force of attraction, which is also called residual valence or secondary valence forces. In the liquid or solid state the term internal pressure is also applied. The tensile strength flexibility, water resistance and practically all other physical properties of film naturally depend to a large extent on the strength of this secondary valance force. What is secondary valance force then? This is the force,
which keeps the molecules in matters together just like the atoms in molecules remain together by the influence of primary valance force? The forces due to ionic, covalent, co-ordinate, metallic bonds and resonance in the molecules are the primary valance forces or

inter known as Vender Waals forces are the secondary valance force Hydrogen bonding is a so kind of secondary valance.

The secondary valance forces are actually due to residual fields left about the molecules as a how after two or more atoms have combined together to a form a molecule through primary valance force. When electrons are transferred from one atom to another, as is in round in ionic bonds to forma molecule, the latter becomes a dipole with permanent dipole moment. Similarly when a molecule with dissimilar atoms is formed through co- violent bonds the canters of actions negative charges. The whole system thus will show a dipole moment. The same rule can be attributed when molecules are formed from atomic stages through other types of bonds.

In a molecule there may be several diploes but the overall dipole moment of the molecules is the resultant of 11 the dipole moments is it. For simplicity let us consider two different arrangements of equal and opposite charges at the corners of a square as shown in figure (a) and (b)

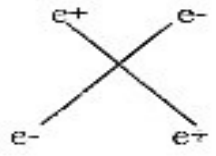


fig: (a)

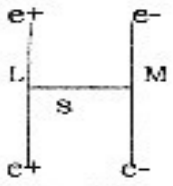


fig: (b)

In fig (a) the canters of action of both the positive and negative charges are at the point 'O' and therefore the dipole moment in zero. But in fig (b) the centers of action of positive and negative charge are L and M respectively. The whole system electrically is thus a rod LM of length S. One end of which is negatively charge which an intensity 2e and the other end positively which the same intensity. The molecules with definite dipole moments are called polar molecules where as no polar molecules have no dipole moments.

Of course, dipole moments can be induced on many no polar molecules are separated from each other; the leathers become no polar again. This is called induction effect.

There is another effect called the dispersion effect by which no polar molecules may gain polarity. This type of secondary valence force Aries from the temporary relative displacements of the nuclei and electrons during the vibration of several parts of molecule with repeat to one another.

During film formation the dipoles rotate. If necessary and finally arrange themselves in ant parallel arrangements as shown below:

Polar molecule
Intermolecular space
This is called orientation effect.

Thermal agitation always tends to upset these alignments, so that this type of secondary valance force is highly dependent upon temperature. In a film, both attractive forces between dissimilar poles and repulsive forces between similar poles play their roles side by side, no doubt but due to orientation effect the average distances between similar poles and therefore overall resultant force is the attractive force, if, on the other hand the resultant force was repulsive, the molecules would behave like a perfect of forming any film.

3.7 SOAKING

The object of this operation is to restore to the cured skins the water lost by dehydration in the curing process. The duration of soaking naturally depends upon the speed with which the skins absorb the water to regain that percentage of moisture content, which they had in their green condition. For wet salted skins 3to 4 hours or at the most, over night soaking is enough, but for dry and dry salted skins which soak slowly the soaking period has to be extended, sometimes to 48-50 hours depending on the hardness and degree of drying of the cured skins. Adding to the soaking bath "soaking agents" can substantially accelerate the soaking of dry and dry salted skins. Since a long time sodium sulphide and caustic soda have been used to facilitate soaking of dried stock. lOOg. caustic soda or 150g. sodium sulphide is generally used per 100 liters soak water. More recently surface active agents known as "wetting agents"-usually sulphated fatty alcohols-have been introduced to aid the soaking operations.

It is not advisable to prolong the soaking to a great extent, because long period of soaking sets up bacterial action, which dissolves the skins substance and affect leather quality. If on account of the nature of the dry cured skin, the soaking period is to be lengthened, antiseptics, such as chlorine, carbolic acid, P naphthol, trichlorophenol, preventol liquids, are to be added in small quantities to the soak liquor.

When the skins are sufficiently soft they are washed either in a drum or in a paddle by two or three changes of water to cleanse them.

If the skins are received in the tannery in green condition, which is seldom the case, soaking is reduced to mere washing of the skin in a few changes in water with the sole purpose of removing the adhering dirt, dung, etc. from the skin.

Adequately soaked skins are ready for liming.

3.8 LIMING :

The objects of liming in the case of glazed kid manufacture are the same as in the case of manufacture of the other types of leather.

(1) Removal of hair by the dissolution of hair roots and the epidermal layer.

(2) Saponification of all fats goat skins usually content high percentage of natural fats. These fats are to be removed, as otherwise they will interfere with getting a uniformly high gloss in finishing, which glazed kid must have. The lime used in liming acts upon the fats and converts them into lime soap which is mechanically removed from the limed skins by scudding.

(3) Removal of certain amount of the interfibrillary substance which is mainly glycoprotein. This is soluble in lime liquor on account of which it is removed to a very large extent in liming process. This removal is necessary to facilitate subsequent tanning and also to make the final leather soft.

(4) Splitting the fibre bundles into fibres and fibres into fibrils. This is effected by the swelling action of lime on collagen fibres. This splitting caused by liming is essential for satisfactory tannage and for getting a finished leather of full substance, soft feel, and open febre structure, the individual fibres and fibrils of the skins are made accessible to the chrome tanning salt during the subsequent chrome tanning process.

In the manufacture of glazed kid the skins are often unhaired by painting their flesh side with a paste of lime and sodium sulphide and piling the painted skins over night. Next morning, the hair is found to be sufficiently loosened for removal by working them on the unhairing beam with an unhairing knife or as is done in the large tanneries by passing the skins through the unhairing machine. The advantage of unhairing by painting is its speed and also the fact that it keeps the goat hair in good condition, unaffected by the alkaline lime and sodium sulphide. Goat hair is an important by-product of a glazed kid tannery and it has a market. Those tanneries which unhair by painting, give the unhaired skins a subsequent liming in a fresh lime liquor made of lime and certain

quantity of sodium sulfide, to plump up the skins and thereby split the fibre bundles and fibres.

There are also tanneries which loosen the hair by putting the skins into a lime liquor sharpened by sodium sulphide or sodium hydrosulphide or dimethylamine. Formerly, arsenic sulphide or red arsenic used to be employed as a lime sharpening agent but this practice has become less common on account of the poisonous nature of the compound and the subsequent risk to lime yard workmen. Arsenic sulphide was used because it did not cause as much swelling of skin as sodium sulphide and thus helped to produce on the finished glazed kid, a fine and silky grain that is very much prized. The recent introduction and use of sodium hydrosulphide and dimethylamine has removed the disadvantage pertaining to sodium sulphide.

An enzyme process known as 'Arazym' process is also employed for unhairing goatskins for glazed kid.

3.9 DELIMING AND BATING

The limed skins are delimed and bated. The object of this operation is:

(1) Deliming.

(2) Pulling down the swollen pelt, making it fallen, flaccid and slippery in feel. Well-bated skins area so slippery that it is said that they can be drawn through a wedding ring.

(3) The opening up of the skin pores so that enclosed lime can be squeezed out through the pelt.

(4) Loosening of natural dirt, remnants of hair roots and hair follicles, fat gland sheaths and insoluble lime soaps, produced by saponification of the natural fats of skins by lime. All these are technically called scud. This scud is loosened by the bating process

and removed by the subsequent mechanical scudding and through washing done after bating.

(5) Removal of the interfibrillary protein, which is glycoprotein or skin mucoid.

When the above objects of the bating process are achieved the skins are thoroughly cleansed and brought to the proper condition which facilitates the subsequent process of tanning and finishing to produce a brightly glazed, soft, full and resilient leather having not much stretch.

Bating is one of the most important operations in glazed kid manufacture on which the final quality of the leather largely depends. The exact stage when the bating can be regarded to have been satisfactorily completed is generally judged by the following indications:

(1) The skin should be thoroughly delimed and phenolphthalein applied to the edge of act piece of bated pelt should not show a red colouration.

(2) The bated skin should be absolutely fallen and flaccid and should lie in any position in which it is kept. It should not show any tendency to spring back. The absence of the tendency to spring back is generally tested by pressing the grain of the skin by thumb, and thumb impression should remain.

(3) When bated skins are scratched on the grain by thumb nail the scud consisting of broken hair roots, other epidermal remnants, dirt etc. should easily come out showing that it has been thoroughly loosened and rendered easily removal.

(4) When the flesh side is scratched by the thumb nail, the adhering flesh should be removal when some pressure is applied, but the flesh should not be too easily removable, as in the case of over bating.

The bates are mixtures of proteolytic enzymes like trypsin and ammonium salts like ammonium chloride or sulphate. The enzymes were originally obtained from animal pancreas, but recently are derived from microbial sources like bacteria, moulds etc.
After bating the skins are ready for subsequent processes of pickling and tanning.

3.10 PICKLING

Pickling may be defined as the conditioning of the pelts for subsequent chrome tannage and is done by treating them with a mixed solution of acid and salt. Pickling completing delimes the pelts, should this still be necessary and acidifies them. This acidification is conducive to a mellow initial tannage. It also opens up the fibres. This opening is imperative for a thorough and uniform fixation of the basic chromium sulfate. If pickling is conducted the subsequent tanning agent will penetrate very quickly, thoroughly and uniformly, producing a leather of round, soft and smooth feel and fine grain. But usually glazed kid tanners do not pickle the skins when double bath tanning is followed, since some sort of pickling effect is obtained in the first bath, which is definitely of acidation.

Pickling is essential if single bath tannage is employed. If pickling is omitted in single bath tannage, the pelts would be exposed to the astringent action of the basic chrome salt at the initial stage of tanning and would thereby become case hardened and coarse grained. These surface being rapidly tanned, the chrome liquor would not penetrated into the inner layers of the pelt and the completion of the tanning would be delayed. Pickling makes the pelt acid and consequently the basic chrome salt of the single bath liquor meets an acid pelt and thereby becomes less astringent and mellow in action. The case hardening action is prevented and the penetration of the tanning agent into the inner layers of the pelt continues unimpeded promoting quick and uniform tannage. Non material difference has been found in the final leathers obtained from pickled skins tanned by single bath tannage and unpickled skins tanned by the double bath process. Of

course, the acid to be added to the first bath in case the skins are pickled is adjusted earlier.

3.11 TANNING

Glazed kid was first introduced into the leather trade by tanning goat skins prepared according to the pertaining operations described above, by the double bath process of chrome tanning discovered and patented by Schultz in 1884.
The first bath is prepared with 5% by chromate of soda or potash, 2.5% hydrochloric acid and 200%water-on bated pelt weight. When bated pelt is introduced into this bath the pelt which terms yellow in colour absorbs the chromic acid produced in the bath. When the yellow colour has penetrated through and through, the action of the bath is completed. The skins are taken out from the first bath and piled up over night covered by gunny bags protecting them from light. In the presence of light the absorbed chromic acid is apt to oxidize the substance of the skin and thereby exert an injurious effect on the skin. The piled skins are them struck out by a putting out machine to remove the excess of chromic acid and also the creases and fold marks on the skin. The struck out skins are then passed quickly through a dip bath one by one. The dip bath may be a used second bath or afresh bath prepared with 2.5kg hypo, 2.5kg hydrochloric acid, 5kg. Salt and 50kg. water. Many tanners, however, omit the dip bath and put the struck out skins into the second bath.

The second bath is composed 20% hypo, 10% commercial hydrochloric acid and 300-400% water on bated pelt weight.

The difference between double bath and single bath processes is that in the former the basic chrome tanning salt, namely the basic chrome sulphate, is produced in situ on the fibres of the skins by the reduction of chromic acid by acidified hypo in the second bath while in the latter, this basic chromium sulfate is prepared separately by various ways but principally by reducing acidified bichromate wit an organic substance like sugar or molasses. It is quite possible that the differences observed between single bath and two

bath-tanned leathers may be due to the differences in the chrome complexes formed in these processes.

3.12 NEUTRALISATION

On completion of the chrome tannage the leather must be properly prepared for the subsequent processes of dyeing and fatliquoring. This preparatory operation is termed 'neutralizing'. It consists of the removal by washing of any uncombined chrome liquor or neutral salts remaining in the tanned leather, followed by neutralization with mild alkali of any free acid left in the washed leather and finally washing the neutralized leather free of the neutral salts form in neutralizing. For, if any appreciable amount of uncombined chrome or neutral salts is left in the leather or if it contains free acid, their presence will affect the dyeing, fatliquoring and the appearance and quality of the finished leather. In neutralising, a strong alkali like NaOH is not employed because it reacts too rapidly with the acid present in the out side layer of the leather, greatly increasing its basicity and producing surface overtanning and consequent case hardening. Milder alkalis like borax and sodium bicarbonate, which react slowly and more uniformally are used. These weak alkalis form more stable chromium complexes which have a beneficial effect upon the subsequent processes of dyeing and fatliquoring.

3.13 DYEING

Aniline dyes are generally used for dyeing glazed kid leather. They were formarlly classified as acid, direct and basic dyes. The acid dyes are sodium salts of color acids of the general formula RSO_3Na. Direct dyes are similar in chemical constitution to acid dyes but are mostly manufactured from benzidine. They are called direct colours because they dye cotton directly without the mordanting required in the case of dyeing with either acid or basic dyes. The direct dyes have been found to have good affinity for chrome leather. Hence they are much used for this purpose. As the matter of fact, direct black is mostly used for dyeing glazed kid into black colour. To produce brown shades, both acid and direct dyes are used, as they produce very level shade without exaggerating

grain defects. In dyeing with acid dyes, it is necessary to use a strong acid like formic acid in order to liberate the colour acid, which had got the greater tinctorial property and not the salt. After dyeing the leathers have to be thoroughly washed to remove any uncombined acid.

Basic dyes on the other hand are usually hydrochlorides of the colour bases, of the general formula RNH_2HCl. They have no affinity for chrome leather and so are not used for glazed kid dyeing. The basic colours have the disadvantage of producing on leather what is known as ‘bronzing’ or a metallic sheen. Sometimes they are used for top dyeing if the leather is mordanted.

3.14 FATLIQUORING

After the skins have been neutralized and dyed to the required shade they are fatliquored. It is well know that unlike vegetable tanned leather chrome tanned leather cannot be dried to a crust state after tanning, because once dried it cant be wetted back for the subsequent operation of dyeing. Even if the leather is dyed immediately after tanning and then dried, the leather can't be adequately softened. On account of this, the process of fatliquoring had been introduced chrome leather manufacture. The object of fatliquoring is to incorporate adequate amount of oil into the leather, so that is dry out soft and supply instead of hard and horny. Apart from this main object, the introduction of oil into the leather also makes the leather desirably resilient and increases its tensile strength and stitch tear resistance. These properties are desirable in all chrome tanned shoe upper leathers and also in other types of chrome leather. They are indispensable in the case of glazed kid.

The incorporation of oil is effected by treating the leather with a hot emulsion of oil known as fat liquor. The process is called fatliquoring. The usual emulsifying agents for making fat liquor for chrome leather in general and for glazed kid also, are soap and sulphated oils.

Of the two types of fat liquor, namely (1) oil and soap and (2) sulphated oil, and oil, the latter is most convenient and generally used by chrome tanners. The glazed kid manufacturers, however, prefer to use soap and oil fat liquor. All oils are not suitable for making fat liquor. Animal oils like neat's-foot oil, cod oil and sperm oil, are considered to be better than vegetable oil. The soap and oil fat liquor the leather less then the sulphated oil fat liquor. The sulphated oil fat liquor makes the leather too soft and raggy whereas a good glazed kid should be somewhat firm and resilient so that the shoes may maintain their form.

3.15 FINISHING

In upper leather manufacture, as in the manufacture of other chrome tanned leathers, all peeresses carried out after the skins have been taken out on the completion of fatliquoring, are included ion finishing. The fatliquored skins are then passed through some mechanical operations, viz. sammying, setting, staking, buffing and ironing etc. and made ready for seasoning.

Seasons:

Black season is usually made of logwood extract, blood and nigrosine. Sometimes milk and egg albumin are added. For brown, pigment, egg albumin, milk, and an acid dye are generally used but nowadays, casein based water pigment finishes are employed.

Some important points to be observed in the finishing of glazed kid.

1. In making colored glazed kid careful attention should be paid to dyeing. The shade of the dyed leather should be as far as possible very close to the shade of the finished leather, which would depend upon the pigment finish to be applied. If the bottom

dyed colour is lighter then the pigment finish colour, the leather will pull up light when it is stretched in lasting the shoe. This is objectionable.

2. Grease in the leather whether coming from the fat liquor or from oiling up or from the natural grease of the skins sometimes, makes it difficult to get a smooth level finish. This is to be avoided and minimized by clearing the grain by brushing with 10% solution of commercial ammonia or a mixture of ammonia and methylated spirit.

3. Sometimes the dyed skins show light coloured patches, especially at their center. This too can be remedied by clearing the skin before seasoning, with a weak solution of ammonia.

4. If a finished leather is turned grain inwards and vigorously rubbed between the thumb and finger, sometimes the finish film crumbles down and the pigment comes off from the grain surface as a fine powder, and if this occurs rapidly it's an indication that the film is dry and brittle. The condition can usually be corrected by the addition of plasticizer to the finfish or by replacing certain inherently brittle materials in the finish such as shellac or albumin by softer mucilage. Sometimes the film may come off the grain in soft rolls on account of the use of excessive plasticizer.

5. if the grain surface of the lather before applying the finish is very acid, there is a possibility of the medium (casein) precipitating in case a water pigment finish is being used, giving the effect of an under bound film. Padding with a weak solution of ammonia should be tried in such a case.

6. The presence of lime soaps and chrome soaps will give rise to areas on which no finish will adhere. Although the actual quantity of soap present may be extremely small, it's almost impossible to overcome its effect in the finishing process. The chromium soaps are extremely sticky and resist all attempts at emulsification, while the lime soaps are practically insoluble in the usual solvents.

7. A finish which is stable at pH 6 shows less binding and may draw up the grain preventing a smooth finish. The finish, therefore, should be stabilized at about pH 7-8.

8. A colorless topping is apt to give a grayish break and it's usual to tint it with a little dye or season solution.

9. 'Fixing' i.e., rendering the colour fast to stripping by water and to dry rubbing may be achieved by spraying the leather with commercial formaldehyde solution diluted with 3-6 parts of water. This fixing slightly dulls the gloss, but this is recovered when the skins are subsequently ironed or plated. The most rapid fixing action of formaldehyde is obtained at pH values less than 4.5. It's therefore now a common practice to add to the formaldehyde small amount of chromium sulphate of chloride or acetic acid for lowering the pH in order to induce the casein-formaldehyde resin formation which produces the fixing effect.

10.To preserve the natural grain of goatskins and to impart a smooth and soft feel to the surface it's essential to use the smallest possible quantity of pigment finish, so that a very thin film is produce.

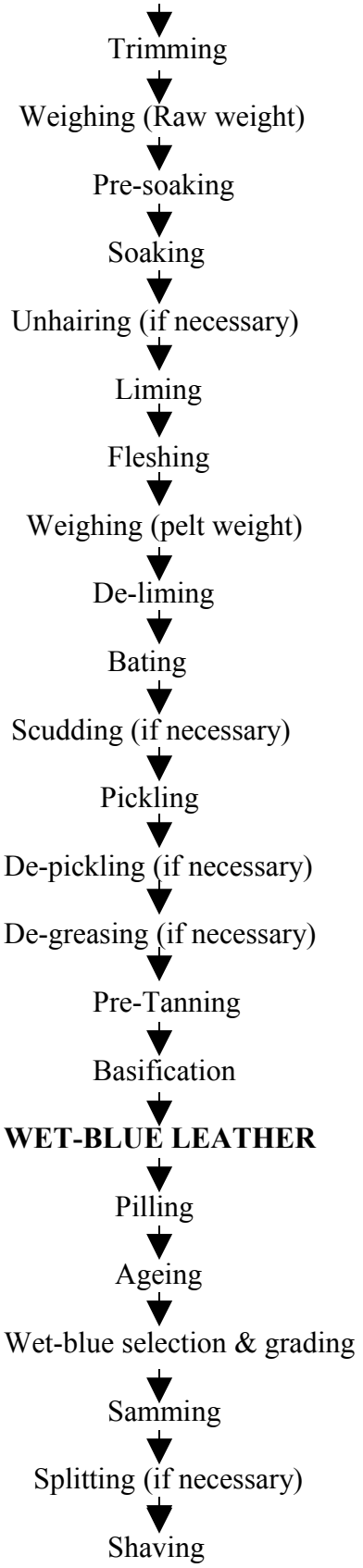
11. Resistance to dry rubbing is tested by rubbing the finished surface with a soft cloth, usually a handkerchief. Dry rubbing should not occur with inorganic pigments unless the film is badly underbound, but brilliant organic lakes are difficult to fasten, principally because of their immense staining power. The usual method of avoiding dry rubbing trouble is to apply a coat of clear nitrocellulose finish over the pigmented surface to provide a protective film.
Sometimes finished skins are oiled with mineral oil to make the finish more waterproof. Key test should not break the finished film until the grain itself is cracked by the test.

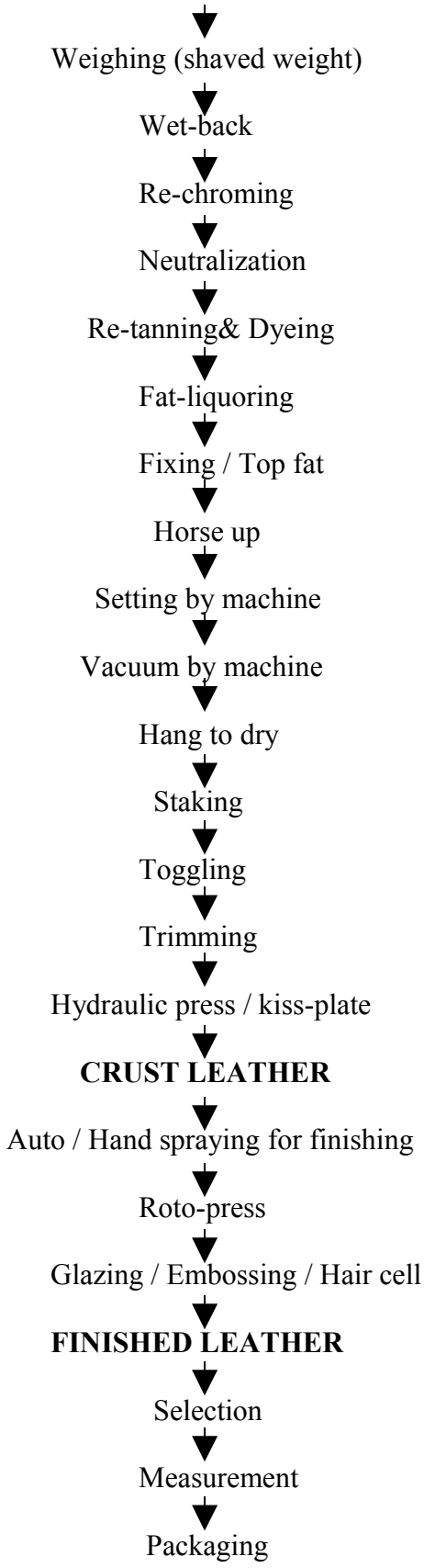
3.16 FLOW CHART OF LEATHER MANUFACTURING:

Raw selection

↓

Shorting


Trimming
Weighing (Raw weight)
Pre-soaking
Soaking
Unhairing (if necessary)
Liming
Fleshing
Weighing (pelt weight)
De-liming
Bating
Scudding (if necessary)
Pickling
De-pickling (if necessary)
De-greasing (if necessary)
Pre-Tanning
Basification
WET-BLUE LEATHER
Pilling
Ageing
Wet-blue selection & grading
Samming
Splitting (if necessary)
Shaving


Weighing (shaved weight)
Wet-back
Re-chroming
Neutralization
Re-tanning& Dyeing
Fat-liquoring
Fixing / Top fat
Horse up
Setting by machine
Vacuum by machine
Hang to dry
Staking
Toggling
Trimming
Hydraulic press / kiss-plate
CRUST LEATHER
Auto / Hand spraying for finishing
Roto-press
Glazing / Embossing / Hair cell
FINISHED LEATHER
Selection
Measurement
Packaging

Ready for Sale

3.17 ENVIRONMENT AND HEALTH

Health, safety and welfare:

With attention to health and safety, all chemicals are kept in a purpose-built store outside the factory. All weighing of materials takes places in departments adjacent to manufacturing areas and protective equipment has to be used in handling these chemicals.

The company runs two shifts of eight hours, and operates a six-day week. Approximately a third of the 250 people employed are women. All are covered by an insurance-linked health assurance plan, covering not only employees for both accidents and ill health at work, but their also their families.

The company also owns two factories producing shoe uppers and shoes in its Presidency Kid Leather Shoe Division. These use 15-20% of the output of the tannery, and are located about 10 km from the parent company.

Environmental Concerns:

Concern for environmental matters has always been a priority, the tannery being situated in 90 acres of picturesque farmland next to lake and surrounded by hills. Initially, treatment was by discharge into a series of linked lagoons for settling. The large size of these lagoons, coupled with a high evaporation of the effluent! The logistics of an increased output, however, called for further developments and, today, treatment is fully comprehensive. Effluents are balanced, chemically dosed and settled, with full biological treatment before discharge.

The company has been a pioneer in using treated effluents for irrigation purpose. With an ideal climate for growing, flowers and woodlands now surround using selected plants and trees, the factory. Presidency Kid Leathers has remained at the forefront of environmental progress being the site of the major UNIDO investigation into reed bed technology.

CHAPTER - FOUR

4.1 MANUFACTURING PROCESS OF SHOE UPPER LEATHER

Raw materials:

3 (Three) pieces of locally available wet salted goat skins of medium size and of medium selection are supplied and used for this investigation

Weighing:
(% based on wet salted goatskin)

Pre soaking:

300% Water	→	**Run 5 Min, 1 hour rest then drain Out and running Wash**

Main Soaking:

300% Water 0.4% Soda Ash 0.3% LD-600 0.2% Busan-880 0.25% DPH 0.2% Sodium sulfide	→	**Run 30 Min, Leave over night in the bath next day drain, wash well**

Painting:

8.0% Lime 2.0% Sodium sulfide 0.2% LD-600, Water require to make as paste	→	**Applied flesh side and kept flesh to flesh for 4-6 hrs. Than unhearing by hand knife.**

Liming:

300% Water
1.0% Lime auxiliary
4.0% Lime
1.0% Sodium sulfide
0.3% LD-600

→ **Run 60 Min, Leave overnight, Run 5 Min per hour. Total liming time 24 hours.**

Fleshed by fleshing machine

Weighing:

(% based on lime pelt)

Chemical wash:

200% water at normal temperature
0.25% Meta-By-Sulfite
0.25 % Ammonium Sulfate

→ **Run 15 min, drain**

Deliming:

100% Water at normal temperature
2.0% Ammonium Sulfate
0.5% Sodium Meta-Bi-Sulfate

→ **Run 60 min,pH-S.2-8.5, check phenolphthalein, drain out.**

Bating:

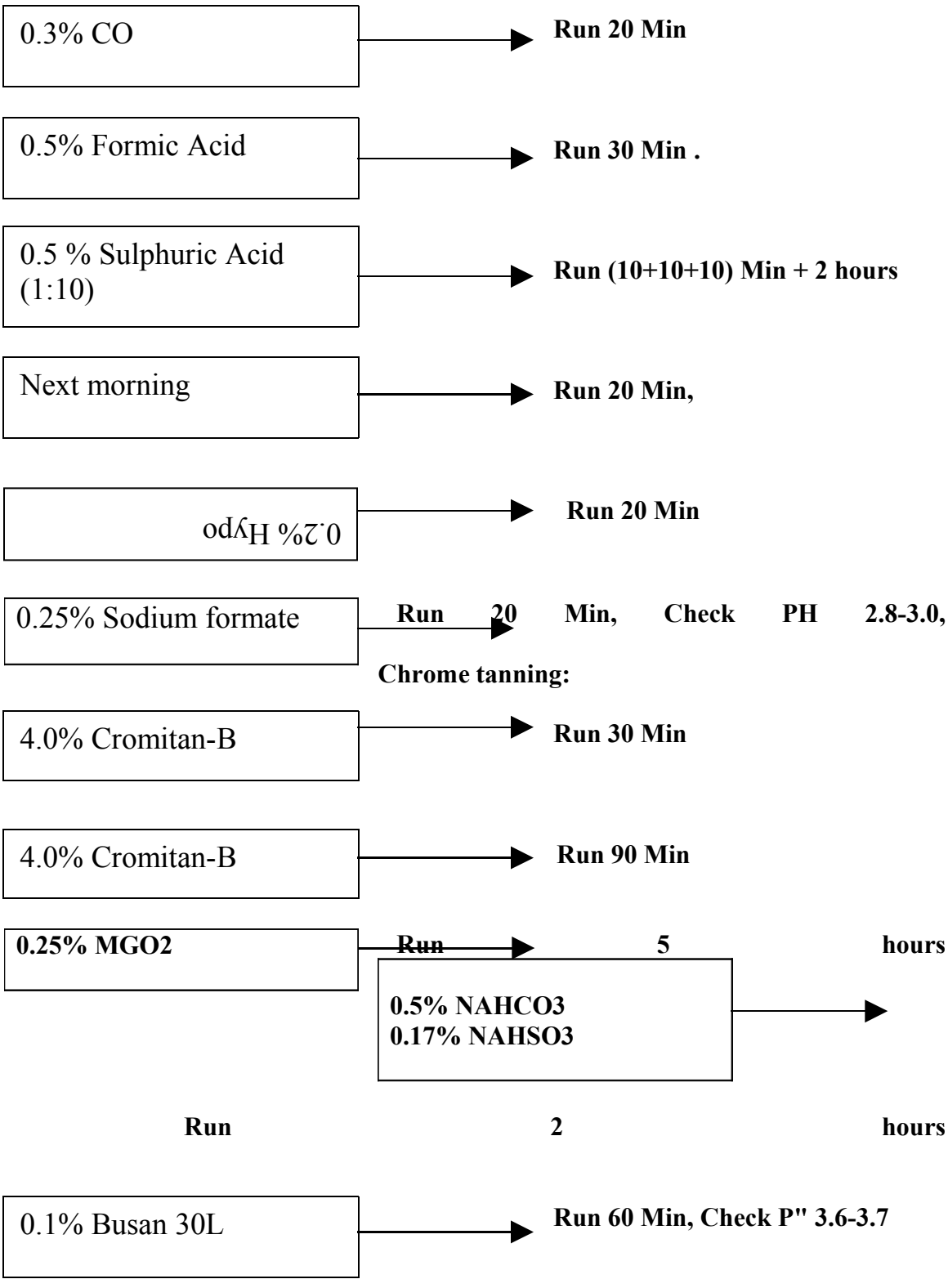
100% Water at N.T 37 ° C
2.0% Pancreol EG-98
0.5% LD- 600

→ **Run 120 Min, Check the thumb impression and scudding hand knife.**

Pickling:

80% water at normal temp
8.0% NaCl

→ **Run 15 Min**



Pile for seven days, Selection, Measurement

Samming:

By sammmg machine

Shaving:

By shaving machining (Thickness 0.8-1.0}

Weighing:

(% based on shave wt.)

Acid Wash:

200% Water 0.3% Oxalic Acid 0.3% LD-600	**Run 30 Min, Drain out, Rinse**

Re-chroming:

150% Water at 35ºC 0.3% Acitic Acid	**Run 20 Min**
0.3% CO	**Run 60 Min**
0.2% Hypo	**Run 30 Min**
0.5% E-123	**Run 10 Min, Check**
1.5 % Derugan 3080	**Run 20 minutes**

4% Nyosyn HL → **Run 20 minutes**

8% Chrome
1% HCOONA →

Run 60 minutes

1% Sodium Formate → **Run 45 minutes**

0.1% Meta → **Run 15 minutes**

0.8% Sodium Bi Carbonate → **Run 30 + 30 + 60 minutes**

Check PH -3.8

Next day Run-15 minutes wash

Nuetralisation:

100% Water at 45°C
2% Tamol A
2% Sod. Formate → **Run 30 Min**

0.4% Sodium .Bicarb →

Run 45 minutes Check

P * 4 . 5 - 4 . 6 , D r a i n o u t , W a s h w e l l

Re-tanning:

50% Water at 40°C		
0.1 % Trilon B	→	**Run 5 Min**
0.5 % UFB/W	→	**Run 10 Min**
3 % CBS Tan AA-40	→	**Run 30 Min**

2% Tanigan OS → **Run 20 Min**

3% Mimosa
3 %Tanigan Os
3% Basyntan AN
1.5% Ormitan –C
0.5% Lipodrum Lic SC
.75% Intan 2771

X% Dye
0.5% Neosyn .N → **Run 30 Min**

3.0% Mimosa
2.5 % Basyntan AN
2.5% Neosyn DFS-3
1% Ormatan-C
2.5% CBS Tan VN
.75 %Intan 2711
0.5% 400R → **Run 60 min**

Check

100% water at 55 C

0.1% Trilon B → **Run 5 Min**

2% HCOOH → **Run 10+10+30 Min**

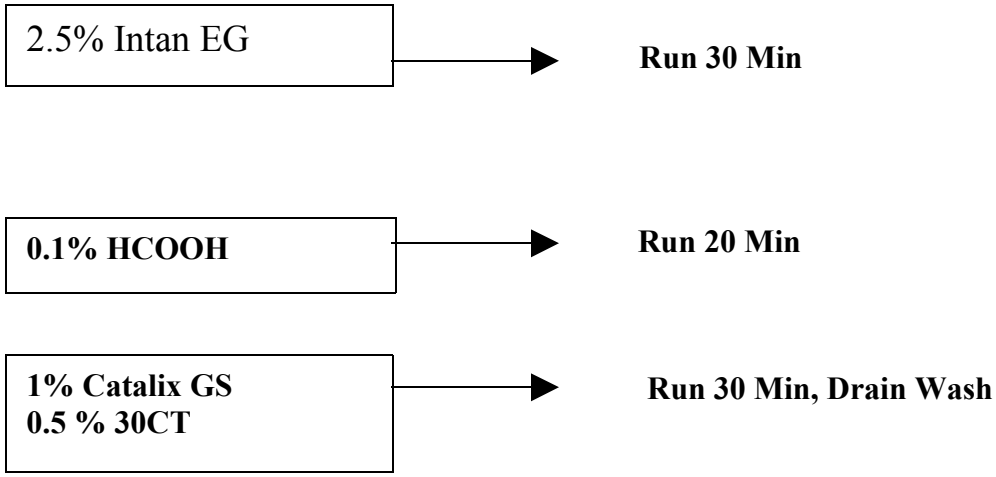
Drain Only

Fat liquor:

100% Water at 55 c
3.5 % Filler SF-2 → **Run 20 Min**

3.0% UFB/W
2.0% H-50
1% TIS
0.5 % 30CT
0.1% 30L → **Run 40 Min**

3% TP 340 → **Run 20 Min**



Horse up setting , Vaccuam, Dry, Staking , Toggle , Triming & Plate.

4.2.1 METHODOLOGY FOR THE FINISHING (SAMPLE ONE – GOAT GLAZE FINISH LEATHER)

Dyestaning :

Dye Solution	80-100 Parts
I.P.A	100 Parts
Water	800 Parts

Spray 2X, Dry well

Polish ground:

Lustral UT	100 parts
Lustrul binder EG	20 parts
CM 502	40 parts
Pref AN	20 Parts
Water	600 Parts
RPU 022	40 Parts
Pigment	20 Parts

Dye	30 Parts
I.P.A	20 Parts

Spray IX, Dry well, Stone polish.

Season coat:

Water	500 parts
Dye	30-40 parts
SFT 6007	10 parts
Lustrul UT	100 parts
Lustrul 511	50 Parts
SFT HG	10 Parts
CM 502	20 Parts
RPU-022	40 parts
Pigment	20 Parts

Spray 3X

Top coat:

Water	600 parts
Dye	20 parts
SFT 6007	5 parts
Lustrul UT	50 parts
Lustrul 511	80 Parts
SFT HG	5 Parts
RPU-022	30 parts
Alpa Top 175	50 Parts

Spray 2X, Dry well.

Fixing Coat :

Acitic Acid	10 Parts
Formal de Hyde	330 Parts
Water	560 Parts

1X Fix, 1X Clear, Dry well, glaze with Glaze Machine, Roto Press

4.2.2 METHODOLOGY FOR THE FINISHING (SAMPLE TWO – GOAT BURNISH LEATHER)

Dyestaning :

Dye Solution	30-40 Parts
I.P.A	100 Parts
Water	800 Parts

Spray 2X, Dry well

Ground coat:

Cat. VFC	80 Parts
Cat. GN	70 Parts
K-72	80 Parts
Water	600 Parts
K-53	20 Parts
RPU-K050	40 Parts
Dye	10 Parts

Spray 3X, Sand Blast, 2X, Dry well, Kiss plate

4.2.3 METHODOLOGY FOR THE FINISHING (SAMPLE THREE – GOAT ANILINE FINISH LEATHER)

Dyestaning:

Dye Solution	80-100 Parts
I.P.A	100 Parts
Water	800 Parts

Spray 2X, Dry well

Ground Coat:

Lustral UT	100 parts
Lustrul binder EG	20 parts
Pref AN/1	20 Parts
Water	600 Parts
RPU 022	40 Parts
Dye	50-60 Parts
I.P.A	20 Parts

Spray 2X, Dry well, Stone polish.

Season coat:

Water	600 parts
Dye	70-80 parts
Lustrul UT	100 parts
RPU-048	30 parts
Wax CF	70 Parts
RF 905	80 Parts
WT 2518	30 Parts
Wax LL	20 Parts

Spray 3-4X

Top coat:

Water	50 parts
Clear Emulsion	100 Parts
TS 095	01 Parts

Spray 2X, Dry well, Kiss plate at 100° C / 50 / 1 Sec

4.3 OPERATIONAL STEPS OF LEATHER PROCESSING:

Steps of procedure	Objects
Pre-tanning operation	
1) Raw hide collection	High collagen contented, desirable sized hides and skins are collected
2) Selection	Defects free hides and skins should be selected
3) Trimming	To get regular shape and to prevent loss of chemicals
4) Weighing	To calculate the chemicals for next operation
5) Washing	To clean the hides and skins
6) Soaking	To wet the collagen properly and back to the state of green hides and skins
7) Liming	To remove the hair, grease, interfibrillary materials, fats And to swell up and split up the fibre.
8) Fleshing	To remove the flesh
9) Deliming	To remove the lime

10) Bating	To make the grain silky touch
11) Scudding	To remove hair roots and excessive surface grease
12) Pickling	To bring the pelt to right acidity for tannage
Tanning operations by chrome / Vegetable/ Zirconoum/ Alum / Aldehyde / Combination / Synthetic tanning etc.	
13) Tanning	To make the pelt non-putrescible substance
Post tanning operation	
14) Samming	To remove excess water from wet- blue leather
15) Splitting	To split the leather into two or several layers
16) Shaving	To get uniform thickness
17) Weighing	To calculate the next operational chemicals
18) Neutralisation	To bring the suitable affinity of retanning chemicals
19) Retanning	To get the required stability of collagen.
20) Dyeing	To get the desirable colour.
21) Fat liquoring	To achieve the desired softness.
22) Setting	To remove creases and excessive moisture.
23) Drying	To remove water and excess moisture.
24) Finishing	To achieve a nice looking.

4.4 MACHINES AND EQUIPMENTS USED IN LEATHER MANUFACTURING RPOCESS:

1. Plastic Bowl.
2. Trimming knife / Blade.
3. Liming drum / Paddle / Pit.
4. Fleshing Machine.
5. Fleshing knife.
6. Blunt knife for Scudding.
7. Tanning Drum.
8. Wood Horse.
9. Samming Machine.
10. Splitting Machine.
11. Shaving Machine.
12. Retanning Drum.

13. Samming-setting Machine.
14. Vacuum Dryer.
15. Tunnel Dryer.
16. Vibration Staking Machine.
17. Jaw Staking Machine.
18. Toggle dryer.
19. Buffing Machine.
20. De-dusting Machine.
21. Hand Spray Machine.
22. Auto Spray Machine.
23. Roller Coater Machine.
24. Polishing Machine.
25. Roto press Machine.
26. Hydraulic press Machine.
27. Embossing Machine.
28. Hair cell Machine.
29. Glazing Machine.

4.5 PICTURES OF SOME COMMON MACHINES USED IN LEATHER MANUFACTURING PROCESS:

Fig: Fleshing Machine

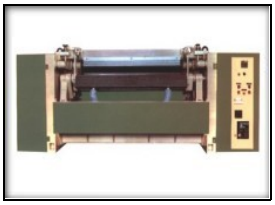


Fig: Fleshing Machine

Fig: Splitting Machine

Fig: Shaving Machine

Fig: Shaving Machine

Fig: Setting Machine

Fig: Staking Machine

Fig: Polishing Machine

Fig: Auto Spray Machine

Fig: Auto Spray Machine

Fig: De-dusting Machine

Fig: Buffing Machine

4.6 Tests:

4.6.1 Tensile Strength: (SLP-6, IUP/6:BS3144-method 5)

Tensile strength is actually the force (Kg) per unit area of cross section (sq cm) required to cause a rupture to cause a rupture of the test specimen,

$$\text{Thus, Tensile strength} = \frac{\text{Breaking load (Kg)}}{\text{Cross section area } \textbf{(sq cm)}}$$

Breaking load mainly depends upon the number of collagen fibers acting in the direction of applied load.

4.6.2 The Percentage of Elongation at break: SLP-6 (IUP/6: BS 3144-method 5)

The extent of elongation of the leather specimen at the time of its breaking, while applying the tensile force, expressed as the percentage of the original length said

specimen is the elongation at break. The elongation at break is taken by the difference between the initial strength and the length.

The % Elongation at break =

$$\frac{\textbf{Final distance between the jaws - Initial distances between the jaws}}{\text{Initial distance between jaws}} \text{X100}$$

4.6.3 Double hole stitch tear strength:

The double hole stitch tearing strength can be defined as load (kg) required to tear the sample of leather between two holes of 2 mm diameter each and centers are 6 mm apart by pressed an its unit thickness (cm).

$$\text{Thus, Stitch tear strength kg/cm thickness} = \frac{\text{Tearing load (kg)}}{\text{Leather thickness (cm)}}$$

The sampling for this test is carried out in both parallel and perpendicular directions to the backbone.

4.6.4 Rub fastness:

This involves the assessment of the change in shade of the leather surface after testing and the transfer of color to the material used in the rub test. There are effectively three of rub test:

- Circular rubbing e.g. using the SATRA circular rub machine
- To the fro rubbing e.g. the veslic machine
- Crock fastness testing using the crock meter

The first two are generally more suited to testing grain leathers while the crock meter is more suitable for assessing the rub fastness of suede's and nubucks. However, it is not unusual for the circular and fro rub rests to be used for assessing suede's and nubucks also.

The degree of staining or change of color is assessed using gray scales (BS 1006:A02 and BS 1006:A03) and results quoted for dry rub or wet rub.

4.6.5 Flex Resistance of finish (BS 3144: Method 13)

This test should be considered in conjunction with the adhesive of the finish. A thin finish with adequate adhesion should show withstand 50,000 dry or 10000 wet flexes. The type of failure itself is often more important than the number of flexes required to cause it. Peeling or flaking of the finish is far more objection able than cracking, and high levels of contrast between the finish and the substrate will make any failure more objectionable.

This is usually done with a bally type flex machine. It is important to examine samples before will often be dry milled and could already exhibit signs of cracking as a general rule, thinner films give better results than thicker films.

4.6.6 Adhesion testing of finishes

This test mainly applicable to resin/pigment finishing systems whether they are classed as pigmented or semi-aniline. Results it is important to note where the adhesion figure but the reason may be that the test adhesive has not stack to the surface possibly because of the use o f a particular type of top coat. It is also worthy nothing that a finish with very poor flex resistance can have a giod adhesion. However, a finish withn poor adhesion will almost certainly have poor flex resistance also.

4.6.7 Waterproof ness test (SATRA model STM IOCD)

Principle: A square test specimen is folded and secured in two V-shaped clamp, which have closed ends so as to form a trough. The trough is then immersed in water and the clamps oscillate at a constant speed so that the specimen is repeatedly fixed. The test is stopped at the first sign of water penetration through the test specimen.

4.6.8 Lastometer test based on (SLP-8, SLP-9, IUP-9, IUP-12)

This test were performed by following the official method of analysis 1965.Ref. 4(e)2, SLP-8, SUP-9, IUP-9, IUP-12.

By lastometer test, grain-cracking strength, busting strength and their corresponding dissension values can be obtained. The bursting strength in an index of the overall strength of the leather. For lastometer test the specimens were cut from the samples by a circle type cutting dice and the specimens were placed on a lastometer being conditioned by clamp whose flesh sides were adjacent to the ball of the instrument. The increasing that is the up thrust of the ball with the pressure by handling indicates the dissension at a rate of 0.2mm/sec. And simultaneously watch the grain surface for the occurrence of a crack and the ball and dissension of grain cracking and bursting wear noted.

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

Again, the bursting strength was determined using following formula,

$$\text{Bursting strength (kg/cm)} = \frac{\text{Bursting load (kg)}}{\text{Thickness (cm)}}$$

4.6.9 Test of heat fastness of finish film based on SLF-2:

This method is intended for testing the color fastness of leather to heating such as may occur when shoes are flamed, hot blasted, or ironed, or subject to other shoe making operations involving contact with hot tools, machine parts air or gasses, the test is used primary to ascertain of changes of color occur, but other changes in appearance are also noted.

A specimen of the leather under test, previously conditioned in as atmosphere at 20° +20°c and 65 +-2 percent r.h, is placed in contact with the felt face of a heated metal member for a period of 5 seconds, with a contact pressure of 3 lb/sq. inch. When cool the resultant change of color is assessed and other changes in appearance of the finish are noted. The test is carried out at three temperatures,100°c, 150°c, and 250°c each tests being done on a separate area of the leather.

4.7 RESULTS AND DISCUSSIONS

4.7.1 The results of different physical tests are summarized are as follows.

Test	Sample- 1	
	Parallel	Perpendicular
Tensile strength	244 kg/ cm^2	277 kg/ cm^2
Percent (%) elongation at break	50%	54%

Stitch tear strength	110 kg/cm^2	133 kg/cm^2

4.7.2 The determination of fastness to rubbing (wet and dry) of correcting grain leather:

The rub fastness of a piece of finished correcting grain leather was to assess the resistance of the finish to colour transfer leather during wear.

(SLF-5 BS 1006:UK-LC).

Principle:

A sample of the leather under was rubbed with a revolution of the pad (dry or wet) required to produce certain effect, was measured with grey scale. The procedure was following by the method of SLF-5 with SATRA instrument.

Result of dry and wet rub fastness test:

Results of dry and wet rub fastness test of leather under investigation.

Table Dry rub fastness.

Sample No	For Leather						For felt						
	32 Rev	64 Rev	128 Rev	256 Rev	512 Rev	1024 Rev	32 Rev	8 Rev	16 Rev	32 Rev	64 Rev	128 Rev	256 Rev
1	5	5	5	5	5	4/5	5	5	5	5	5	4/5	4/5

Remark: the result of the sample is between best and excellent.

Table Wet rub fastness.

Sample No	For Leather						For felt						
	32 Rev	64 Rev	128 Rev	256 Rev	512 Rev		16 Rev	32 Rev	64 Rev	128 Rev	256 Rev	512 Rev	
1	5	5	4/5	5	3		5	5	4/5	4	3/4	3	

Remark: the result of the sample is between best and excellent.

Result of the test of modified colourfastness to washing. This modified test was carried out with the leather sample under investigation.

4.7.3 Adhesion test:

The test is meant where by the strength of the adhesive bond between the finish film and the leather can be measured quantitatively (SLF-11).

Principle:

One end of a piece of leather under test was stucked finish side to a metal strip, by a selected adhesive chosen to give an adequate bond between the finish and metal without affecting the adhesion of the finish to the leather, when the adhesive is fully set of cured increasing force is applied to the loose end of the leather until the finish feels away from the leather the load required to peels the finish is recorded.

4.7.4 Table Experimental data for adhesion of finish film of the sample leather.

Sample No.	Adhesion (N)	
	Parallel	Perpendicular
1	450	580

Result: The good bondage between the leather and finish film.

4.7.5 Flexing endurance:

This test carried out with the leather samples under investigation following the method (SLP-14IUP).

Table Results of test of flexing endurance:

Sample No.	Flexing endurance test at 80,000 flexes	
	Break pipeness after flexing	Leather film
1	3	Slight change

The sample No. 1 gave a pipe ness rating 3.

4.7.6 Water proofness test:

Sample	After 150 cycles	After 200 cycles	After 250 cycles	After 300 cycles
1	No penetration	No penetration	Slightly penetration	Full penetration

4.7.7 The lastometer test result of leather under investigation:

Sample no.	Grain crack strength kg /cm	Grain bursting strength kg/ cm
1	266	311

4.7.8 Results of the test of heat fastness of finish film:

Sample no	Grey scale rating at 150°C	Grey scale rating at 200°C	Grey scale rating at 250°C	Grey scale rating at 300°C
1	5	5	5	4/5

4.7.9 Chemical Test:

The result of % of chromic oxide content is 3.21%

The result of Fat content is 5.5%

4.8 Costing (for per sq. feet)

1. Raw Material:	50 taka
2. Chemical costing/processing cost:	
i. Wet blue:	6 taka
ii. Crust:	12 taka
iii. Finishing :	10 taka
3. Labour Cost:	3 taka
4. Machine Depreciation:	8 taka
5. Utility Cost:	3 taka
6. Maintenance Cost:	3 taka
7. Administration Cost:	14 taka
8. VAT + Tax:	4 taka
9. Others:	5 taka
10. Profit (10%):	12 taka
Total	132 taka

APPENDICES - 1

TECHINACAL INFORMATION ABOUT CHEMICALS USED FOR THE COMPLETION OF PRIJECT:

(1) LD-600 :

It is a wetting agent.

Typical analysis:

Charge : Non-ionic.

Product of BASF, Germany.

(2) Relugan D:

Condensation product based on melamine resin.

Typical analysis:

Charge : Anionic.

P^H : 11

Product of BASF, Germany.

(3) Paramol PA:

It is low molecular weight synthetic organic resin tanning agent based on a water soluble Acerilic polymer.

Typical analysis:

Charge : Anionic

P^H : 7.2

Product of Hodgson, England.

(4) Busan 880L:

Economic disinfectant for use in soaking.

Topical analisis:

Density	: 1.11 gm/ml.
P^H	: 8-10

Product of Buckman

(5) Neosyn HL:

A chrome retanning syntan, which in appearance is a pale green powder

Typical analysis:

Total solids	: 88%
P^H	: 2.5-3.0
Chromic oxide	: 12.5 %

Product of Hodgson , England

(6) Neosyn TX –50

A masked aldehyde which has a strong affinity for hide protein .

It is a pale yellow liquid.

Typical analysis:

Active matter	: 97%
P^H	: 8.0-9.0
Solubility	: Readily miscible with water.
Stability	: Stable through the P^H scale.

Product of Hodgson, England.

(7) Neosyn N:

A natural, naphthalene based, auxiliary-dispersing syntan , which in appearance is a pale brown powder.

Typical analysis:

Total solids	: 92%
P^H	: 6.5-8.5

Product of Hodgson, England.

(8) Mimosa Extract:

Vegetable tannin

Product of Hodgson, England.

(9) Tanigan OS:

A replacement tanning material. Universally application synthetic integral tannin material for the retannage of chrome and for vegetable tanage.

Typical analysis:

Concentration	: 96-98%
P^H	: Approx 3.5

Product of BAYER, Germany

(10) Tamol NA:

Neutralizing syntan with buffing and mellow retanning effect.

Typical analysis:

Charge	: Anionic
Astringency	: Low
P^H	: 7.3-8.2

Product of BASF , Germany

(11) Lipoderm Liquor SN:

Nature : Higher sulfo chlorinated synthetic oil

P^H : 7.5

Pure fat content : 60%

Emulsified proportion : 38

Emulsifying proportion : 22

Product of BASF, Germany

(12) Trisul ML:

Sulphited marine oil blend.

Charge : Anionic

Product of Hodgson, England

(13) Basyntan AN:

Based on aromatic sulfuric acid, Amphoteric

P^H : 3.7

Acid value : 22

Concentration : 95-97%

Product of BASF Germany.

(14) CBS Tan AA40:

Acrylic Co-Polymer

PH : 7

Active Content : 40%

Solubility : Soluble

(15) CBS Tan FR :

Acrylic Polymer

PH : 4.3 +_ .2

Active Content : 30%

Solubility : Soluble

(16) CBS Tan VN:

Phenol Nap-thaline, Sulphuric Condensation Product

PH : 4 +_ .2

Solubility : Soluble

Light brown powder

(17) CBS Oil LAN:

Combination of Lanolin with Sulphated Oils

PH : 7 +_ .5

Active Substance : 51% +_2

Solubility : Soluble

Charge : Anionic

Light Brown Semi Fluid Paste

(18) Neotan CR :

Chrome Syntan Powder

PH : 2.5-3.5

Solid : 90%

Stable to Acids, Sodium chloride and hard water

(19) Impropell CO:

Bleaching E Oxidizing Agent(Chlorine Containing)

PH : 10%

Solution : 13-14

(20) Chromitan B :

Basic Chromium Sulphate

PH : 2.4-2.6

Soluble : Cold Water

BASF Germany.

(21) Lustrul binder

Appearance : Whitish liquid

Constitution : Special compound based on natural and synthetic oils and waxs

PH : 8-9

Charge : Anionic

Dry content : 38%

ALPHA, Italy

(22) Lustrul wax LL

Appearance : Yellow semi transparent liquid

Constitution : Syntetic wax in water emulsion

PH :8-9

Charge : Anionic

Dry content : 35%

ALPHA,Italy

(23) Prefondal K-53

Appearance : Whitish liquid

Constitution : Oily additived emulsion

PH : 5-6

Charge : Cationic-Nonionic

Dry content : 50%

ALPHA, Italy

(24) RPU 022

Appearance : Colourless limpid liquid

Constitution : Anionic water solution of Aliphatic iso cyanate polyurethane

PH : 8-9

Charge : Anionic

Dry content : 20%

ALPHA, Italy

(25) SFT 6007

Appearance : Opale scente fluid liquid

Constitution : Surface active agents

PH : 7-8

Charge : Anionic

ALPHA, Italy

(26) Ingrassante E-123

Appearance : Light yellow liquid

Constitution : Self-emulsifying natural fat liquidCharge : Non-Anionic

ALPHA, Italy

(27) Lustra UT

Appearance : A pale yellow past

Constitution : A specialty based on a mixture waxes

Charge : Anionic

ALPHA, Italy

(28) RPU 048

Appearance	: Opalescent Whitish Liquid
Constitution	: Polyurethane derivative in water dispersion.
Charge	: Anionic
PH	: 8.5+_0.5
Dry Content	: 17% +_ 1%

ALPHA, Italy

(29) Prefundal K/72

Appearance	: Cream Colored Liquid
Constitution	: Derivative based on waxes
Charge	: Weakly Catonic
PH	: 4.5+_1
Dry Content	: 30% +_ 2%

ALPHA, Italy

(30) Cational VFC

Appearance	: Beige Colored Liquid
Constitution	: waxy modified protien
Charge	: Catonic
PH(10% Sol)	: 2.5+_0.5
Dry Content	: 7% +_ 0.5%

ALPHA, Italy

(31) Alpatop CM 502

Appearance	: Beige Colored turbid Liquid
Constitution	: Condensed protein derivative
Charge	: Anionic

PH(10% Sol)	: 8+_1
Dry Content	: 12% +_1%
ALPHA, Italy	

(32) Alpatop CM 175

Appearance	: Opalescent fluid
Constitution	: proteinic modified binder
Charge	: Anionic
PH(10% Sol)	: 8.5+_10
Dry Content	: 12% +_1%
ALPHA, Italy	

(33) RPU K050

Appearance	: Colorless or straw colored liquid from clear to slightly veiled.
Constitution	: Polyurethane derivative in aqueous disportion.
Charge	: Cationic
PH(10% Sol)	: 3+_0.5
Dry Content	: 20% +_1%
ALPHA, Italy	

APPENDICES – 2

I have taken help the following books and journals to finished my project work.

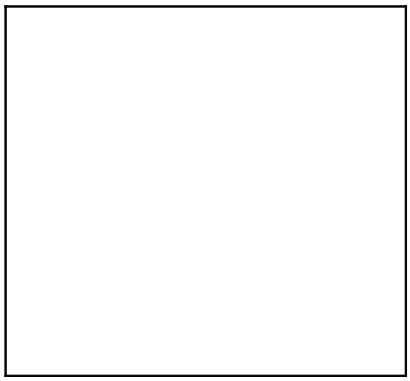
1. Dutta, S.S. "An Introduction To The Principles Of Leather manufacture" (1999) Fourth Edition Ilta, Mercantile Buildings, Lalbazar, Calcutta-700001, India.
2. Sarkar K.T "Theory And Practice of Leather Manufacture" Revised First Edition, 1981, AJoy Sorkar, 4, Second Avenue, Mahatma Gandhi Road, Madras-600041, India.
3. Dutta, S.S. "An Introduction to the Principles of Physical Testing Of Leather" First Eddition, Ilta, Mercantiles Buildings, Lalbazar Street Calcutta-700001.
4. B.A.S.F "Pocket Book For The Leather Technologist" (Second Edition).
5. Technical Literature, Bayer, Germany.
6. Stahl's- Technical Information", U.K.
7. Sharphouse, J.H. "Leather Technicians Hand Book"- Leather Producer's Association, 9 St, Thomas Street, London, Second Edition.
8. John Gerhard, "Possible defects in Leather Production", Printed- Copyright-1996. Druck Partner Rubelmann Gmb H Carl-Benz-Strasse 11, D-69495 Hemsbach.
9. "World Leather" June-July 1994
10. "World Leather" February- March 2004
11. C. Thorstenson, Thomas, "Practical Leather Technology" – Third edition 1985. Printed & published by-Robert K. Krieger Publishing Company, Inc, Krieger drive, Malabar, Florida-32950.
12. Reed R. "Science For Students of Leather Technology", First edition, Pergamon Press Ltd, Headington Hill Hall, Oxford, 4 & Fitzrory Square, London, W,I, U.K.
13. SLF – Official Methods of Analysis – 1996, Society of Leather Technologists and Chemists, Northamption, U.K.
14. "Technical Information" – Hodgson-U.K.

CONCLUSION AND RECOMMENDATION

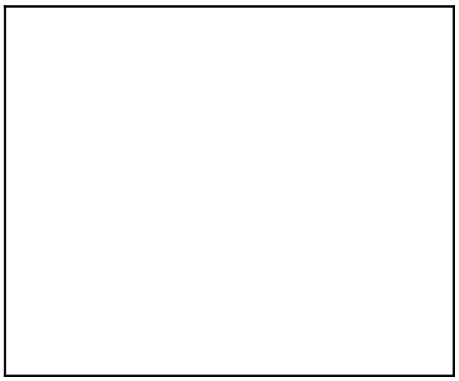
This dissertation has been involved the film forming properties of commercial process for the production of quality shoe upper leather from semi chrome goat skin. I tried my best to produce the quality shoe upper leather. Analyzing all the physical and chemical testing results of the prepared leather sample under investigation, it may be concluded that all required characteristics properties of quality shoe upper leather like adhesion of finish, flexibility, dry and wet rub fastness, tensile strength, vamp flexing, stitch tearing strength etc, are likely present in my leather sample.

So my point of view, all the chemical and physical properties of quality glaze kid leather are fulfilled.

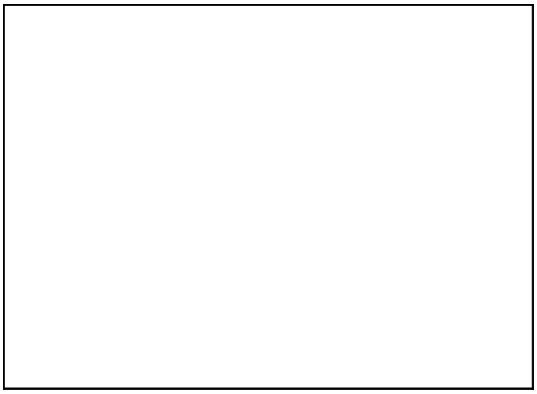
SAMPLE ATTATCHED



Sample 1



Sample 2



Sample 3