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METHODS OF TANNING AND PROCESSES IN TANNING

5.1 INTRODUCTION

This chapter deals with the various methods of tanning and processes in tanning. We also discuss in this chapter about the livestock population, raw materials used in tanning—hides and skins and vegetable tanning materials in use in India.

Tanning like all ancient industries has developed in the course of ages through experience. The last century however witnessed not only the vast development in pure sciences, but also the commencement of a new era in industries. Just as science has been applied to and used in the manufacture of soaps, dyes, metals and so on, so also has it been applied to and used in the manufacture of leather. Leather manufacture has become a branch of Chemical Technology. Indian leather industry and tanning industry has also adopted some new changes. Following methods show the changes adopted by the Indian tanning industry.

Tanning is one of the earliest industries, like agriculture, which has developed in India. It was originally a cottage industry mainly confined to villages, but gradually it has spread to the town where production is done in organised units.

The three chief methods of tanning in vogue in India are:
1. **Primitive Village Tanning or Vegetable Tanning: Bag Tanning**

2. **Improved Indigenous Tanning or Mixed Tanning: Pit Tanning**

3. **Modern Tanning**
   - A) Chrome Tanning or Chemical Tanning or Mineral Tanning.
   - B) Oil Tanning.
   - C) Alum Tanning.

5.2 **PRIMITIVE VILLAGE TANNING OR VEGETABLE TANNING**

   **BAG TANNING**

   Several indigenous processes are in vogue, the most common one being the bag tanning process where hides and skins are sewn in the form of bags and tanned with liquor poured in it. The industry is run on the cottage industry scale, by the people of the Dhor and Chambhar Communities. They are generally poor and use whatever tanning materials they get from their locality, mainly barks, leaves and fruits. The leather produced is not very fine, it is rough. Bag tanned leather is generally used in the making of country chappals, sandals, shoe soles and other types of footwear, leather buckets for drawing water from wells and other goods where fineness and finish are not important.

   The industry which was at one time consuming a fairly large proportion of hides and skins in the prewar years, is now showing a declining trend. The village tanner is generally uninfluenced by the modern methods of tanning. He was
indispensable in the Indian village in earlier days, but with the advent of modern production by organised tanneries, his production is now not so much in demand. Besides, the industry is mostly located in places where the organised factories which produce better types of leather are also generally located.

The indigenous tanning of hides is prevalent in U.P., Madras, Andhra Pradesh, Maharashtra and Bengal, while the tanning of skin is concentrated in Bengal, Punjab and U.P. The most famous centre in Punjab is around Jullunder.

The outbreak of World War II in 1939 gave a great fillip to the Industry. During the War, the tanned sole leather was in great demand. The entire production of pit tanned sole leather by the organised factories was required by the Government to meet the war demands. Therefore, to meet the demand of the general civilian population, tanners had to increase their production. In fact their production of bag tanned leather increased to such an extent that they became a serious rival to the organised factories in obtaining suitable hides.

In 1945 the War was over and the organised factories resumed production for civilian demands. The bag tanning industry to some degree received a setback once again.

In view of the fact that the industry consumes in normal times most of the inferior quality hides produced in India and gives employment to a large number of poor people, it would be of great economic importance if it could be placed on a sound footing. The village tanner (Dhor) would certainly be
able to obtain, in some measure his former position in the village if the quality of leather produced by him is improved and he is trained in producing improved leather and leather articles. Government has been carrying on some programmes for the training of the tanners. In some states, peripatetic tanning demonstration parties hold tanner's camps in which they demonstrate the methods of preparing better varieties of leather.

The tanners should be organised so that they can avail themselves of the benefits of co-operative purchase and sale. When in Calcutta Chrome Tanning is done on a cottage industry scale by the Chinese Cobblers there is no reason why modern methods should not be adopted successfully by the Indian bag tanners. They must not only be trained in the new methods but also be organised properly.

5.2.1 PROCESS OF BAG TANNING

Leather tanned by the bag method is consumed locally. Hides used in this tannage are as a rule sun-dried. Today fresh hides or salt cured hides are also used. In some places sun-dried hides are soaked in clear water and in some places in old soaks. They are then given a paint of lime paste, left some time in a pile, then thrown into pits with fresh water and lime and are handled every second day for ten days. They are then unhaired by a Shimpi and then put back into a new lime liquor for five days before fleshing. After fleshing, the hides are washed with one or two changes of water and the
grain cleaned by scudding.

After scudding the pelt looks clean and white. The pelt is washed in old weak tan liquor and then put into vats or kunds which contain fresh tan liquor made of certain amount of babhul bark and myrobalan. In some places tanners use only finely chopped babhul bark in this first liquor and in some places only myrobalan. In different places the quantities of bark and myrobalans vary very much, but as a rule two to ten kilograms of babhul bark and two to five kilograms of myrobalans are used per hide depending upon its size. They are kept in the vats or kunds for about five days. The hides are handled two to five times during this period and are then given a new layer with a similar amount of tanning material, for the same number of days. After taking the hides out from the second liquor they are squeezed till they are sammed (semidried). Each hide is then stitched with agave (ghaipat or Kekati) so as to form cylindrical bags (usually a buffalo's hide is in sides and a cow's whole). The end of the bag is kept open at the neck, through which it is partially filled with crushed babhul bark and myrobalans.

The bag is then hung up on a horizontal beam over a shallow pit and tan liquor is poured on the tanning material in the bag. As the water percolates through the tanstuff, it extracts tan in and this tan liquor is forced by the gravity through the fibres of the distended hide, which effects the tannage. The percolated liquor which is collected in the pit
beneath is poured repeatedly on the top of the tanstuff in
the bag, which gets stronger. After four days the bag is taken
down, the open at the neck is sewn up and an opening is made
at the butt end. The bag is then hung up again, this time the
butt end being on the top and the same procedure as before
is followed. After three to four days the bag is taken down
and the stitches are removed and the exhausted tanstuff is
thrown away. The leather is flattened and dried in the sun.
In some places the leather, after the sewing has been cut is
thrown into the liquor-pit and left in it for one or two days,
to remove the air stains. This treatment generally brightens
the colour. During drying, the flesh side is on top. After
completely drying it, the tan leather, is ready for sale.
Leather tanned by the bag process is mainly used for sole
leather, mots, pakhals, gin washers and jutas etc.

5.3 IMPROVED INDIGENOUS TANNING OR MIXED TANNING—PIT TANNING

The process adopted in this case is known as pit tanning by which leather of a far superior quality is obtained.
The tanned material is soft and light coloured with no smell.
The tanning materials used are more or less the same as in
the case of bag tanning, but the process takes longer time than
that required by the bag tanning method.

Before the First World War of 1914-1918 turwad (avaram)
was mainly used as a tanning material but it has now been
completely replaced by wattle for hide tanning. In the case of
skin tanning however turwad (avaram) is considered to be the
It is estimated that about 86 lakh pieces of hides and 191 lakh pieces of skins were tanned by this process during the pre-war years. In the pre-war years the industry was mainly concentrated in Madras province, Hyderabad, Mysore and to some extent in Bombay province also. The predominant position which Madras occupied was due to the skillfulness of the local tanners and the availability of suitable tanning materials in that area. Madras itself was a large producer of raw hides and skins but in addition to utilising its own supplies it imported nearly 38 lakh pieces of hides and skins from Calcutta, Decca and other North Indian centres.

Out of the 86 lakh pieces of tanned or dressed hides produced 48 lakh were sent abroad mainly to the United Kingdoms. The remainder was used in India for making better types of country made shoes and soles of western pattern shoes. Harness, saddlery and travel goods were also made from the dressed hides. In the case of dressed skins as much as 175 lakh, pieces out of the estimated production of 191 lakhs, were exported during the pre-war period to foreign countries. The balance was used in the country.

With the outbreak of World War II in 1939, the demand for tanned hides increased enormously as India became the chief supply base in the East for the developed nations. But the prices in the foreign markets were not very attractive. The World War II gave a great stimulus to its
production. To meet the war time demands of the defence services, the Government found it necessary to introduce control in 1942 to ensure that the limited supply of available raw hides suitable for the production of leather was utilised to the best possible advantage.

At the time of war the processes of tanning in 43 organised tanneries were standardised which not only improved the quality of their leather but also reduced the duration of tanning process from 6 months to 3 to 4 months. The Government purchased the entire production of the controlled tanneries and as a result of encouragement the output of controlled tanneries increased by nearly 30%.

Though the production of pit tanned sole leather has considerably expanded there is still room for further expansion. The industry has good future prospects, if the duration of pit tanning is reduced to 2 months.

Other important vegetable tanned leathers are harness and saddlery leathers, Industrial leathers, Hydraulic leathers, leather useful for making bags and suitcases. Light leathers are made from sheep and goat skins by pit tanning process. They are useful for making uppers of shoes of lighter type, book binding, lining and making purses, portfolios, leather articles and other leather goods. Now Bombay is the main producer of fancy leather goods. Upholstery leather for car seats, seats of upper class
railway compartments furniture etc. is also made by the pit tan process.

Nowadays the sole leather used in military boots and superior quality civilian shoes is generally made from buffalo hides, by the pit tanning method with vegetable tanstuffs. In quality it is far better than the bag tanned leather.

Today not only vegetable tanstuff but also chemical mineral or chrome tanstuff is used in the pit tan process. So it is called as a mixed tanning process. Skins are generally processed with pit tanning. If chemicals are used in pit tanning, the duration of the entire process can be reduced.

5.3.1 PROCESS OF PIT TANNING

It is a mixed process. The process is the same as is used in bag tanning to some extent. Pits of bricks are built in the earth, where tan liquor is filled. In these pits hides and skins are kept for tanning purposes for a long time. The process of tanning is carried out by hands as well as by machines. It is therefore called as "Semi-mechanised" process of tanning. In this process of tanning, vegetable materials as well as various chemicals are used, to tan the hides and skins. Instead of preparing bags of hides and hanging these bags vertically, hides are kept horizontally in pits for 3 to 6 months. There is strong tan liquor or a solution of chemicals in the pits. Generally this process
is used to produce pressed leather. This is a time consuming process, but the leather produced by this method is very strong and of high quality.

5.4 MODERN TANNING

5.4.1 CHROME TANNING OR CHEMICAL TANNING OR MINERAL TANNING

Vegetable tanning is an old method, but it is a time consuming method. Now chemistry is applied to improve the process of leather making in several ways such as shortening the period of tanning, improvement of leather quality and maintaining a uniform standard etc.

The modern method of tanning is called as Chrome or Chemical or Mineral method of tanning.

Knapp started research in 1858 and invented the new method. Schultz, an American, used it successfully for commercial purposes in 1884. It spread thereafter to other parts of the world.\(^5\)

Chrome tanning process is a very sophisticated process. It is an acknowledged fact that chrome tanning factories and bark tannage factories started all over India after the successful experiment of Sir Alfred Chatterton at Madras. His successful pioneering work led to the starting of chrome tanneries in Bangalore, Calcutta, Berhampore, Allahabad and Rewah.\(^6\)
Alfred Chatterton demonstrated that bark tanning was a slow process, but it could be expedited to a great extent by the use of tannin extracts instead of barks. But the use of tannin extracts was almost unknown that time. Hence he advocated the starting of chrome tanning. He pointed out the superiority of the leather turned out by the Chrome tanning process as follows:

"Chrome leather has special and peculiar qualities which distinguish it from all kinds of leather and these special features cause it to be a superior fabric for all purposes for which leather is used. It has often been stated that Chrome leather is water-proof but this is not a proper term in connection with it; it should be more properly called non-absorbant. All kinds of leather produced with tannin absorb water readily like a sponge, while chrome leather does not absorb water but resists it or sheds it like the feathers of a duck. Even boiling water has no effect upon chrome leather, while any sort of leather produced with tanning and placed in boiling water is utterly destroyed. Moreover chrome leather is of much lighter weight than bark leather and this is the decided advantage for almost all purposes for which leather is used".
Mr. Talhati, a Parsi gentleman learnt the Chrome process in America and started a successful factory in Bombay called the "Minocher Leather Works" and showed that chrome tanning is suitable to this country and that cow-hides, calf-skins and sheep skins can all be chromed like goat skins. Chrome tanning not only yields lasting leather suitable for water-buckets and other articles but it can also be finished in a day, while bark tanning is essentially a long process requiring nearly a month to complete the process.

Mr. Chamber also took up successfully chrome tanning at Pallavaram (Madras) and these three can be said to be the pioneers of Chrome tanning in India.

Chrome tanning is essentially a chemical process involving the use of chrome salts (bi-chromate of potash or soda, chrome alum) lactic acid and boric acid. A successful chrome tannery requires a large capital, considerable amount of machinery, trained labour and expert technical knowledge. The larger the scale on which it is worked the better are the prospects of financial success.

5.4.2 PROCESS OF CHROME LEATHER

Hides and skins of good quality are required for the chrome tanning process. Hides and skins are tanned by chrome tanning in our tanneries. In some tanneries Sodium Sulphide is used in liming. After the pelts have been drenched,
scudded and washed they are pickled either with sulphuric acid and salt or with alum and salt. Then the pickled pelts are tanned by "Single bath" process where "basic" solution of chrome salts are used.

The earliest of the mineral tanning materials were alum and salt. Leather was made with the help of alum and salt in Ancient Egypt, Assyria, Babylonia. It is still made in this way today.

Chrome or Chromium is a metal that comes from many parts of the world. Before it can be used in the tannery it has to be treated to make it dissolve in water. Scientists do this for us and from them we get the chromium salts we need for making leather. Chrome has an effect on the fibres of the pelt so that the product will last and will not go bad (decay). A mineral tanning material has to be mixed more carefully than a vegetable tanning extract. If the chrome method is used, skins of calves, sheep and goats can be tanned in a few hours only.

In this process, a complex of basic chromium sulphate and an anionic sulphated fat liquor is used to tan the hide. Hides or skins are kept in this complex in small or big drums for four to five hours. Afterwards the so-called semi-finished leather i.e. wet blue leather is withdrawn from the drums.
In order further to hasten this process, revolving drums are used. The drums are fitted with shelves. Skins are put in the drums together with the right quantity of tanning liquid. Then the drums turn round slowly. As they go round, the shelves pick up the skins and drop them roughly into the liquid again and again. This helps them to tan quickly because the skins are bent in different directions, and this separates the fibres slightly and makes it easier for the tanning liquid to get in than when the fibres are close together.

When the skins have been tanned they are cut to suitable size. A skin cut in this way is commonly used for upper leather. But it cannot be used for upper leather until it has been split. The skin is split through its thickness so that we get two thinner pieces. The split with the grain side is the better of the two and is used for shoe uppers, bags and suitcases and light straps. The inner split or the flesh-side split is eventually made into in-soles, cheap gloves and upper leather for very light footwears such as slippers.

Leather is made of uniform thickness by shaving the skins in a machine where the leather is pressed against revolving drums with curved blades. The skin is now put in drums containing water with some oil which makes leather more water-proof, prevents cracking and softens it.
Lastly, for getting the finished leather, dye is sprayed on the leather. Compressed air spray gun is used for dye spray. Light leather is sprayed with nitrocellulose spray. Nitrocellulose gives the sort of finish to the leather that is required by shoe manufactures. It also helps to hide any faults such as scratches or band marks in the surface of the leather. More heavily marked skin is finished with black colour, because this colour covers the marks best. Various colours such as red, green, blue, brown etc. are used.

Pure chrome leather is made by using only chrome salts. If a mixture of vegetable and minerals is used for tanning, it is called semi-chrome. In this method leather, first made by using a vegetable extract, is then tanned with chrome salts.

Sometimes different forms such as those of crocodiles, snakes, elephants etc. or letters or words are embossed on the finished leather. Sometimes embossing is done in such a way as to give the leather the appearance of e.g. an original snake skin leather etc.

5.4.3 OIL TANNING

Some type of leather is tanned with the help of shark oil or castor oil.
Chamois Leather

It is an oil tanned sheep or lamb skin, originally made from the Alpin antelope or chamois which is now practically extinct. The leather is mainly used for cleaning motor cars, polishing the glass and metal wares, filtering petrol and in the manufacture of gloves, pouches, jewel-bags, overcoat linings etc.

The principal producers in India are The Chrome Leather Co. of Madras, National Chamois Works, The Bengal Tanning Institute, The Textil Leather Manufacturing Co. and National Tannery Co. of Calcutta. Quality of their product has been found quite satisfactory. The demand for chamois leather will increase considerably when the automobile industry will develop in India.

In oil tanning process oil is applied on the flesh side of the skin again and again.

5.4.4 ALUM TANNING

This is done for dressing skins of wild animals like tigers, leopards etc. and also for tanning cow hides for use in the making of hockey and cricket balls. At present in India only a small quantity of leather is alum tanned. The principal producers are Wazirabad Tannery and the Upper India Leather Works at Calcutta. A number of Chinese tanners in Calcutta are also engaged in its production.
5.5 PROCESSES IN TANNING

Apart from the methods adopted and processes used, the quality of the finished product depends on various other factors also. As for instance the quality of water available plays an important part in the production of good quality leather; similarly, the quality of finished leather depends on the quality and conditions of raw materials which the tanners have to use. If they do not get suitable raw materials or if they get damaged raw materials they would not be able to produce good quality leather. Following are the important principles underlying the chief processes in tanning.

5.5.1 SOAKING

The first process in tanning is soaking. Foreign matter like blood, flesh, dung, manure, farm and floor refuse etc. clings to the hides and skins. Such foreign matter introduces serious complications if it is not removed as early as possible in the process. All reasonable steps must, therefore, be taken to remove it.

In many tanneries fresh as well as dried hides and skins are used. In the case of fresh stock, this operation is very simple. In order to remove the blood and dirt clinging to the hides and skins, they are to be washed with water.
But in the case of dried and salted hides and skins, a much thorough soaking is required in order to remove the salt and to restore them to their original soft and permeable condition.

A large portion of this stock is dried in the hot sun without any consideration of the bad effect it would have on the hide. Even before drying some parts of them are putrefied owing to the negligence of the people who do this work. Such dried hides require more drastic treatment than the fresh stock. So the first important thing to do is to sort out the hides and skins and then to give them the treatment according to their condition. Completely dried hides absorb cold water extremely slowly, and as such hides are invariably contaminated with proteolytic bacteria. The use of water alone is very risky unless the process is very carefully watched. In such cases to hasten the required effect, addition of small quantities of formic acid or sodium sulphide or bisulphide of a soda in the soak water is necessary.

After the hides become somewhat soft by soaking for a few hours, they are "broken over" on a beam with a blunt knife. They are then soaked again for a short time and this process of "breaking over" is repeated once or twice till the hides become sufficiently soft. After this they are washed in clear water and cleaned. They are now ready for liming.
5.5.2 LIMING

The next process is liming. When the tanner gets hides or skins from the market they are covered on the one side with hair while on the other side there is still a certain amount of flesh and fat. What the tanner wants is the true skin which lies in between. So first he has to remove the hair, flesh and fat. The process of liming is very necessary to remove this unnecessary material. Lime is pasted to the flesh side and the hides or skins are kept in the pit where lime liquid is already available. This eats away the hair-roots and the lower layers of unwanted skin. Both the hair and the unwanted flesh and fats thus become loose and can later be scraped away easily.

Pits for liming vary in sizes but are usually 4ft. square for skins and 6ft square for hides. Hides are kept for 7 to 8 days in the pit containing liquid lime. During this period they are handled daily or on alternate days. After 8 days the hides are taken from the pit to remove the hair and unnecessary flesh. This work is done with the help of machines in big factories. But the village tanner does it manually. He lays the hides over a beam—a big sloping piece of wood. He then uses a large blunt knife with a handle at each end to rub away, first the hair and then the flesh. Sometimes the flesh is removed with the help of a rapi or rampi.
When the hair and the flesh is removed from the hides we can see the two sides of the true skin, one is called the "grain side" from the grain left by the removal of hair. The other is called the "flesh side". This is the side where the skin is joined to the animal flesh.

5.5.3 DELIMING AND BATING

Though lime is a very useful and satisfactory means of loosening hair, its action on tannins is most injurious. Therefore, its complete removal from the hides or at least from the grain surface is necessary.

After liming, the hides have to be unhaired, fleshed, scudded and washed well in several changes of water to remove the lime. But mere washing in water is not sufficient, as lime has a strong attraction for fibres. Therefore, it is necessary to add a little acid such as hydrochloric, sulphuric, lactic and boric acid etc. to the water during the deliming process.

In the case of leather for uppers, skins are bated and drenched. This is required in order to bring down the skins from swollen condition to a soft and flaccid condition. In the case of sole, belting and gin washer leather, however, no softening is necessary, mere deliming is enough.
5.5.4 **TANNING**

There are two important conditions essential for successful tanning:

1) The natural physical structure of the skin must be changed but little,

2) The degree of tannage must be as nearly uniform as possible.

The tanning process consists in soaking the pelts in infusions of various vegetable products containing bodies of the class known as "Tannins". Tannins have the power to combine with the skin-fibres and to convert the skin into a leather.

If in the beginning strong infusions are used, they act too violently on the surface of the skin hardening and contracting it. This impedes the subsequent tannage of the interior and leaves the grain surface drawn and wrinkled. To avoid this first, weak infusions should be used.

Infusions which have already been exhausted partially on pelts in an earlier tannage, should be used first and then gradually stronger infusions should be used.

5.5.5 **FINISHING**

The mere conversion of hides and skins into leather is not as a rule sufficient to make them suitable for use. Tan leather requires proper finishing. There are innumerable
kinds of finished leather which require a different special series of operations.

A few general processes common to large classes of leather are :-
Bleaching, retanning, dyeing, fat-liquoring stuffing, seasoning, glazing, graining etc.

These are the various processes involved in the tanning of hides and skins.

5.6 RAW MATERIALS -HIDES AND SKINS

Raw hide is the basic raw material on which the whole structure of the leather industry stands. "Raw hide or skin is the outer covering of the animal, which is taken out after the animal is slaughtered for meat or dies a natural death". The quality of the hide therefore depends upon the quality of the animal. The hides and skins of adequately nourished and properly kept animals are superior to those of the animals which are not properly looked after and fed. 9

It is an accepted fact that the hide or skin of an old animal is in every detail inferior to that of a young one. It is comparatively thin, flimsy, papery and of poor substance. It has very little tensile strength. A good portion of the fallen hides are obtained from the animals dying a natural death due to old age and are, therefore of poor quality. 10
Good leather can only be made from good hides and skins. The thicker the hides and the closer the texture of the fibers, the better are they in their leather making properties. Hides and skins constitute the essential basic raw material of the tanning industry.

In the tanning trade the skins of large animals are called hides and those of small ones are generally called skins. Pelts of large and full grown animals like cattle and buffaloes are called hides. Hides are larger in size, thicker in substance and heavier in weight than skins. An intermediate class is called a Kip; A Kip is a hide of immature cattle. It is smaller, lighter and thinner than a hide, but larger, heavier and thicker than a calf skin. In the Western countries cattle hides weighing between 15 lbs to 25 lbs in the wet salted conditions are classed as Kips. Most of the Indian cattle hides fall within this range of weight and are known as East Indian Kips in the International hide trade. Indian cattle hides above 25 lbs in the wet salted conditions are classified as hides, and those below 15 lbs as calf skins. Skins are obtained from smaller animals such as sheep, goats, deers etc.

Normally hides and skins of domestic livestock namely bullocks, cows, buffaloes goats and sheep are used in the tanning industry. This is because supply of these hides and skins in regular in commerical quantities as these
animals are reared for milk, meat, and agricultural purposes; and their hides and skins produce different types of leather which are in general demand. In most of the countries cattle are slaughtered for meat and the slaughtered hides and skins are obtained as a by-product of the meat industry. Almost one-fifth to one-third of the profit from a slaughtered animal comes from the sale of its hide.

5.6.1 SEASON FOR HIDES AND SKINS

The important season for hides and skins is the period from October to March. Hides and skins produced in these months possess good substance and are of better quality than those produced during the rest of the year. After the monsoon, there is sufficient fodder and when the animals are properly fed, they improve with the result that the quality of their hides also improves. The sun is not so hot during these months and hence hides and skins when kept out for drying, sustain less damage during these months than in the other months.

India occupies a predominant position in the world production of hides and skins and is a major supplier of both by virtue of her huge animal population. She is the largest single holder of livestock in the world. In India a large proportion of cattle hides was derived from the fallen stock i.e. from animals which have been allowed--to--linger till they die of old age or disease. This is mostly
due to the prevailing sentiments against cattle slaughter and beef eating. But some section of the people eat beef and hence a limited quantity of cattle hides was obtained from slaughtered animals. The estimate was that in India fallen hides formed about 80 to 85% of the total output. In recent years however the picture is changing slightly. Hides from fallen as well as slaughtered cattles are available in more or less equal proportions. The 'fallen' stock constitutes hides from animals which die of -

a) Cattle diseases,
b) Seasons of drought,
c) Accidental deaths or
d) Death due to injuries of various nature.

There are also some cases of malnutrition of animals which have ceased to be useful.

Goats and sheep are however raised and slaughtered by a large section of the people for food. Goat and sheep skins are therefore available from slaughtered animals, and practically no 'fallen' skins come on the market.

5.6.2 PRODUCTION AREAS

Madras State and adjacent areas produce a large portion of the hides used by E.I. tanners. In addition supplies are obtained from Calcutta, Kanpur, Bombay and M.P. Hides from different areas have well defined
characteristics. Those from Bangalore are of an average size, well grown and plump with a leather yield of 8-9 lbs. Hyderabad produces a well-grown hide of square shape and fair substance; whilst those termed "West Coasts" are small and of light weight and are much favoured by the E.I. tanners. Nellores represent better quality hides. Calcutta and Kanpur also supply best quality hides.

5.6.3 BUFFALO HIDES

Buffalo hides, including calves, are largely used in the production of leather for shoes, chappals, water buckets and other local purposes. Being large and heavy, they are not suitable for the lighter type of production.

Madras produces over 35% of India's total production of buffalo hides with Madhya Pradesh coming second (15%), the bulk being from the fallen animals. Uttar Pradesh, Gujarat and Maharashtra come next to Madhya Pradesh.

5.6.4 SKINS

Nearly all goat and sheep skins are obtained from animals slaughtered for food purposes and are generally of better quality and free from defects. Flaying is also better, skins being free from deep cuts etc., but there is a need for improvement in curing and storage.
5.6.4.A SHEEP SKINS

It was estimated that there was 48.1 million sheep population in India in the year 1982. South India has about one third of the total sheep population of the country. Sheep skins available in the country are 31.4 million, out of which the E.I. tanner uses 10 to 12 million annually, the majority being exported in the tanned condition. Most of the South Indian Sheep are of the red hair variety and give excellent tight-grained skins averaging 5 to 6 lbs. per 10 skins.

Red hair sheep are found in Coimbatore, Trichinopoly, Madurai, Salem and Ramnad districts; whilst to the north of Madras, small wool sheep are common in Hyderabad and adjacent area. The chief areas for sheep skin production are Madras state (23%) followed by Maharashtra State (10%) and Uttar Pradesh (10%). Indian sheep skins are of medium size, weighing 700 to 800 lbs for 500 dewooled dry-salted skins. Bombay market of Maharashtra supplies every year more than 30 lakhs of sheep skins.

5.6.4.B GOAT SKINS

The breeds and sizes of goat vary considerably in different parts of India, hence the skins differ in size and grade. Those obtained from the northern parts of the country average 2.5 lbs dry salted and about 36 inch in length. Medium skins of about 2 lbs. Weight and 34 inch length are obtained from Rajasthan, Maharashtra, Andra Pradesh, Madras and Uttar Pradesh. The chief production areas are Uttar
Pradesh (20%), Bihar (10%), Maharashtra (10%), Rajashtan (8%) and Tamil Nadu (7%) etc. Production of goat skins in 1986 was 75.3 million out of which E.I. tanners used about 10 million.

Before independence India was a major supplier of hides to the rest of the World, as she possessed a large quantity of light hides known as kips and she was the main reservoir for buffalo hides in the World. India was exporting hides to Germany, U.K., Italy, U.S.A. etc. Now Indian Government has completely stopped the export of hides and skins. All the hides and skins produced in the country are utilised in the country itself.

Some years back, besides leather goods, semi-finished and finished leather was exported. But now there is a ban on the export of semi-finished and finished leather. Only leather goods such as footwears, garments etc. are exported. This change in the policy of the government has helped the leather industry in India to prosper.

The leather industry, with a total export earnings of Rs. 2,500 crores in 1991-1992 ranks sixth among the important export oriented industries in the country. It provides direct and primary employment for more than 1.2 million people of whom socially and economically backward, traditional leather artisans constitute a predominant part.
The major species of livestock that supply hides and skins to the leather industry are cattle, buffalo, goat and sheep. The availability of hides and skins in India is scattered and diffused throughout the country and their collection practices vary from region to region.

5.7 LIVESTOCK POPULATION IN INDIA

India occupies a predominant position in the livestock population of the world. She is the largest single holder of livestock in the world.\(^1\)

In 1990, cattle population was 192.45 million, buffalo population, 69.78 million, goat population, 95.25 million and sheep population, 48.76 million. As regards the cattle population, she ranked first in the world with a population of 192.45 million out of a total world cattle population of 1,284 million. This huge livestock population gives India a large raw material base which is mainly instrumental in the development of her tanning and leather industries.

5.8 HIDES AND SKINS PRODUCTION IN INDIA

India occupies a dominant position in the World production of hides and skins. This can be seen from the following table.
Table 5.1 indicates that in the year 1986 totally there were 144.2 million pieces of hides and skins available in India. The volume of hides and skins increased to 155.3 million pieces in the year 1990. There is an increase in the quantity of pieces of cattle and buffalo hides as well as goat skins. But the number of sheep skins and its share into the total production of hides and skins decreased in the year 1990 as compared to the year 1986, from 31.4 million pieces (21.53%) to 27.2 million pieces (17.42%).

**TABLE 5.1**  
**AVAILABILITY OF HIDES AND SKINS IN INDIA**  
(In Million Pieces)

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Category</th>
<th>Year 1986</th>
<th>Year 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cattle hides</td>
<td>21.7 (15.28)</td>
<td>23.6 (15.48)</td>
</tr>
<tr>
<td>2</td>
<td>Buffalo hides</td>
<td>15.7 (11.11)</td>
<td>20.5 (12.90)</td>
</tr>
<tr>
<td>3</td>
<td>Goat Skins</td>
<td>75.4 (52.08)</td>
<td>84.0 (54.20)</td>
</tr>
<tr>
<td>4</td>
<td>Sheep Skins</td>
<td>31.4 (21.53)</td>
<td>27.2 (17.42)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>144.2(100.0)</td>
<td>155.3(100.0)</td>
</tr>
</tbody>
</table>

Figure in the brackets indicate percentage to total hide and skins.

The share of cattle hides in the total hides and skins was 15.28% in 1986, it remained more or less the same in 1990 i.e. 15.48%. The buffalo hides share has slightly increased from 11.11 percent in 1986 to 12.90 percent in 1990.

The percentage share of goat skins is highest in the overall production of hides and skins. It was 52.08% in 1986, while it increased to 54.20% in 1990.

Most of the hides available in India are of the animals raised for agricultural and other domestic purposes, while a small number of hides and most of the skins are of the animals that are killed by butchers for food. Only hides and skins, the supply of which is regular and abundant are of interest to the tanning industry.

These hides and skins can be classified under two heads:-
1) Halali (Slaughtered)
2) Mudadari (dead or fallen)

Hide of a slaughtered animal is called halali, while hide of a dead animal is called mudadari. Price of a dead animal's hide is generally less than that of a slaughtered animal's hide, because the carcass of a dead animal is dragged over a long distance before it is flayed. This damages the grain of the hide. If the
dead animal is left in the sun for a long time, the heat also badly affects the hide.

Flaying plays a very important part in the ultimate determination of price. Many people do their work very carelessly. Sometimes, there are holes and cuts in the mudadari hide, as a result of which also it fetches low price.

Price of hides and skins depends upon the condition in which they come to the tanners. It is almost unlikely that hides and skins are tanned immediately after the animals are slaughtered and flayed. Some time passes before they are tanned. In order to keep them in good condition special treatment is necessary. It consists in applying salt to the hides or skins. This treatment is called curing or preserving.

The most important factors which count in determining prices of hides and skins are:-

1) **Proper flaying**: There should not be any butcher's cuts and holes.

2) **Even grain**: There should be no branding, thorn or goad marks, scratches or defects on the grain side due to any disease or putrefaction.

3) **Proper preservation**.
4) Substance, weight, size, quality and so on. These things mostly depend upon the class of the breed of animals and other natural conditions under which the animals are reared.

In the case of the first three factors the defects can be avoided with proper care and nurturing.

5.9 FLAYING

The process of 'taking off' of hides and skins from carcasses is called "Flaying" and the men who are engaged for the purpose are called "Flayers".

FLAYING is perhaps the first art that man acquired and the first craft that he might have followed. Slaughtering of animals for meat is usually done in all civilised countries in slaughter houses which are specially constructed and equipped for the purpose. In U.S.A. they are known as 'Packing Plants'. Principal cities of India also have slaughter houses.

Before cattle are slaughtered they should preferably be allowed to rest and given a good drink of water. The practice is followed in Europe and America. The drink somewhat loosens the hide from the flesh and makes flaying operation comparatively easy. In India however the practice of giving the cattle a good drink of water before slaughter is not followed. Therefore
flaying is more difficult in India than it is in Europe.

The flaying of the fallen stock is generally easier than that of the slaughtered animals. Nowadays however, there has been a considerable improvement in flaying of slaughtered stock. The butchers are slowly realising the value of proper flaying.

Flaying plays a very important part in the determination of price which hides and skins fetch. Flayers know their job well, but owing to their carelessness and want of forethought they damage the hides and skins. As the price of the hide is small compared to that of the meat, many butchers are not very careful in flaying. This ultimately affects the price of tanned leather.

If active steps are taken by the Government with the Co-operation of the hides and skins merchants and tanners, the flayers under a certain amount of pressure will strive to do their work better.

5.10 BRANDING

The second drawback which lessens the value of a hide is branding. Branding is resorted to by agriculturists (1) as a remedy against many forms of cattle diseases and (2) as a protection against theft of the living animal.
Certain local diseases in the body may be cured by branding, but in that case branding the whole of the body or the side is not necessary.

Goad marks on the animals used for draught purposes also lessen the value of hides. Sometimes the animal is so mercilessly goaded that it bleeds and not only is the hide damaged but the poor animal suffers great torture.

5.11 DEFECTS OF HIDES AND SKINS

Very few hides and skins are free from defects. Defects which occur in hides and skins can be many and each defect is due to a specific cause originating either when the animals were alive or after their death. The former is called ante-mortem and the latter post-mortem defects.

<table>
<thead>
<tr>
<th>Ante-mortem</th>
<th>Post-mortem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Poor Substance</td>
<td>1) Flaying defects</td>
</tr>
<tr>
<td>2) Sore marks or abscesses</td>
<td>2) Inadequate curing</td>
</tr>
<tr>
<td>3) Barbed wire scratches</td>
<td>3) Defects due to late curing</td>
</tr>
<tr>
<td>4) Rub marks, horn rake</td>
<td>4) Curing with unsuitable salt.</td>
</tr>
<tr>
<td>5) Brand marks</td>
<td>5) Faulty drying</td>
</tr>
<tr>
<td>6) Goad marks</td>
<td>6) Faulty storage</td>
</tr>
<tr>
<td>7) Yoke marks</td>
<td>7) Crack grain</td>
</tr>
<tr>
<td>8) Ticks fleas</td>
<td>8) Vulture scratches</td>
</tr>
<tr>
<td>9) Scabies</td>
<td>9) Poor pattern</td>
</tr>
<tr>
<td>10) Pox</td>
<td></td>
</tr>
<tr>
<td>11) Warble fly or grubs</td>
<td></td>
</tr>
<tr>
<td>12) Cockle</td>
<td></td>
</tr>
<tr>
<td>13) Borsatis and Danas</td>
<td></td>
</tr>
<tr>
<td>14) Ringworm Scars</td>
<td></td>
</tr>
<tr>
<td>15) Soiling by dung and urine</td>
<td></td>
</tr>
</tbody>
</table>
After the formation of Maharashtra on May 1, 1960 under the leadership first of late Shri. Yashwantrao Chavan and then of late Shri. Vasantrao Naik special emphasis was laid on the development of agriculture and on setting up of agro-based industries through co-operative efforts. As a result in a few years time agricultural production went up. The target of what was described as green revolution was achieved. At the same time many sugar factories were established in various parts of Maharashtra.

Importance was also given to the development of poultry and cattle-raising as supplementary occupations. Cattles having a high yield of milk were imported and special efforts were made to breed them here. There was an appreciable increase in the production of milk. White revolution followed the green revolution. Many modern dairies were established on cooperative basis. They began collecting milk from nearby villages and transporting it to distant places for distribution. They also started processing milk and producing many a milk product.

Kolhapur district which was always in the forefront of co-operative movement in India did not lag behind. Co-operative societies were formed for the implementation of lift irrigation schemes. What have come to be known as Kolhapur type of dam were built in the riverbeds...
at many places to store water. Such measures helped agriculturists who could increase their production and could also have cash crops, especially sugarcane. Many co-operative sugar factories were started.

Cattle raising and milk production also got a boost in the district. Many co-operative dairies have come up in the district. Warna Milk Dairy, Shirol Milk Sangh, Gokul Shirgaon Milk Sangh, Hanuman Milk Dairy at Yalgud are some of the more famous dairies. Milk and milk products of these dairies have reached distant places in Maharashtra. Establishment of dairies has, in turn, helped cattle raising. The cattle-population has increased. This has helped the tanning and leather industries in the district. The cattle-population in Maharashtra in 1961 was 15.3 million; it rose to 17.4 million in 1989. Maharashtra ranked 4th in cattle-population in India in 1989.

5.13 HIDES AND SKINS PRODUCTION IN MAHARASHTRA

In the year 1989, with 17.4 million cattles, Maharashtra ranked 4th in India. This shows that Maharashtra possesses a large number of livestock population. Every year thousands of animals are slaughtered in Maharashtra.
Previously people from the Mahar community used to dispose of the dead bodies of animals. A fairly large number of hides and skins was available from fallen animals. Now they have mostly stopped the work of disposing of the dead bodies of animals. Nowadays butchers are engaged in the business of slaughtering the cattles and selling their meat. This business is flourishing in Maharashtra. So a large number of hides and skins is available from slaughter houses. Dharavi in Bombay is one of the biggest markets of raw hides and skins.

Though a large number of hides and skins is available in Maharashtra only 25% of bovine hides and 5% of ovine skins are processed in Maharashtra and all the remaining hides and skins are sent to other states.

TABLE 5.2
AVAILABILITY OF HIDES AND SKINS IN MAHARASHTRA(1986)

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Category</th>
<th>Fallen (000)</th>
<th>Slaughtered (000)</th>
<th>Total fallen &amp; slaughtered (000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cattle hides</td>
<td>596 (34.02)</td>
<td>1,156 (65.98)</td>
<td>1,752 (100.00)</td>
</tr>
<tr>
<td>2</td>
<td>Buffalo hides</td>
<td>298 (35.73)</td>
<td>536 (64.27)</td>
<td>834 (100.00)</td>
</tr>
<tr>
<td>3</td>
<td>Goat skins</td>
<td>333 (3.19)</td>
<td>10,118 (96.81)</td>
<td>10,451 (100.00)</td>
</tr>
<tr>
<td>4</td>
<td>Sheep skins</td>
<td>178 (3.54)</td>
<td>4,849 (96.46)</td>
<td>5,027 (100.00)</td>
</tr>
</tbody>
</table>

Figures in the Brackets shows the percentages

Source: Reports of All India Survey on Raw hides and skins
Statistics given in the Table 5.2 shows the availability of hides and skins in Maharashtra.

In Maharashtra the percentage of hides available from the slaughtered cattles is 65.98 and that from the slaughtered buffaloes is 64.27. Hides available from the "Slaughtered" cattles and buffaloes are more in number than those of the "fallen" cattles and buffaloes. This is so, because nowadays many cattles and buffaloes are slaughtered for meat purposes. Secondly, people from the Mahar Community have mostly left the work of disposing of the dead bodies of animals in Maharashtra. As a result if animals die a natural death their owners prefer to bury the dead bodies or throw them in the jungles to be eaten by wild animals. Therefore the number of hides recovered from the fallen cattles ----etc. is comparatively small.

Maximum numbers of goat skins (96.81%) and sheep skins (96.46%) are obtained from slaughtered animals, because goats and sheep are raised and slaughtered for meat purposes. A very negligible percentage of goat and sheep skins is obtained from the fallen animals. Their respective percentages are 3.19 and 3.54.

A majority of hides and skins available in Maharashtra is obtained from the slaughtered animals.
5.14 IMPORTANT MARKETS OF RAW HIDES AND SKINS IN MAHARASHTRA

Important markets of raw hides and skins in Maharashtra are Bombay, Solapur, Aurangabad and Kolhapur. The main market at Kolhapur gets its supply from the Konkan region, Miraj, Sangli, Belgaum, Satara and other nearby towns. These places too have their own district markets.12

5.15 RAW MATERIALS-VEGETABLE TANNING MATERIALS

Tanning of leather is an ancient Indian Art. The leather goods we use are made up from the hides or skins of various animals. Before using animal hides and skins for preparing leather articles, they need to be processed. This brings about Chemical and Physical changes in hides and skins. The various properties of leather e.g. colour, texture, durability, hardness or softness etc. depend on how hides and skins are processed. By suitably adjusting these operations, leather of different types and for different purposes is manufactured. The process of leather manufacturing consists of three stages viz. pretanning, tanning and post tanning. Among these, tanning of hides and skins is a very important process that greatly affects the quality of leather.

Only hides and skins, the supply of which is regular and abundant are of interest to the tanning industry. Hides or skins consist of two parts.
The fibrous part, which the tanners turn into leather
and
The rest part, which includes hair, hair muscles, fat and other unwanted matter, which has to be cleared away before the fibrous part can be turned into leather.

The work of the tanner is to change the fibres of the skin in order to produce a material which will not go bad or be spoilt by rain or other bad conditions. He chooses different skins and different methods to make the type of leather he wants. The tanner is therefore always very interested in the fibres of the skins or hides which he uses.

5.15.1 TANNING MATERIALS

Vegetable tanning industry which is practised from ages depends on various tanning materials available in our forest area. Practically every tree in nature bears tannins in some form or the other. But very little is known about the quality, effect and nature of the tannage produced by the various tanning materials and hence their right application is not understood by the majority of tanners in this country.

Vegetable tanning materials are used mainly for making heavy leather. This type of leather is thick, firm and heavy. In different forms it is used for such things as shoe soles and luggage. Vegetable tannins are used for these leathers
because they make the leather thicker and heavier by filling the natural spaces between the fibres.

It is obvious that the thicker the hide or skin, the longer it takes to complete the process of tanning. If the tannin is in a fairly weak form as e.g. when wattle bark is used, it may take many weeks. Use of extracts and other modern methods reduces this time to three to five weeks. By special methods, it is now possible to make heavy leather in only fourteen days. Some tanners, however, think that the leather so prepared is not as good as the leather prepared after several weeks of tanning.

For light leathers, mineral tanning materials are generally used. Light leathers are much thinner and lighter and come from the smaller animals such as sheep and goats. The skins of young animals, such as calves are also made into light leather. Cow hide can also be used for light leather if it is split through its thickness. This is done by a special machine. The light leathers are used for the uppers of shoes, for gloves and clothing, for inner lining and in making purses, belts etc.

Another type of light leather is called "Chamois" leather because it was originally made from the skin of the Alpine Chamois goat was originally used. It is now made from sheep skins. It is also known as Shammy or Shamoy
leather. The sheep skins are split through their thickness and the inner or flesh side of the skin is made into Chamois leather. A fish oil is used for tanning this leather. Chamois leather is used to make gloves or used as a cloth for cleaning polished surfaces such as glass windows or motor cars.

Synthetic or man made tannins are now often used. They are called "Syntans" and were first used in Germany during the World War II, when the Germans could not get any vegetable tanning materials.

Vegetable and mineral tanning process can be used on the same piece of leather, and this was often the practice with the Indian tanners. The tanners in India bought small cattle hides and skins, called kips from farmers nearby. They used vegetable extracts to make these kips into a rough form of leather so that they would last for a long time. The tanners then sent this leather to Britain. The British tanners washed the kips in a special liquid to remove all the vegetable tannin. Then they tanned them again with chrome which is a mineral material.

Turwad barks, Babhul barks and Myrobalan are widely used as tanning materials in Kolhapur district. But there are many other vegetable materials which are used for tanning purposes in other parts of Maharashtra, e.g. barks of Ghatbor, Ain, Jambhul, Behra, Mangrove, Sonari and Divi-Divi, as also leaves of Aonla and Dhavadi.
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