MODULE 7: UNIT #1

Skins and Hides
Leather

Types of Leather
Collection and Storage of Skins
Characteristics of Different Types of skins
Preparation of Skins and the Making of Leather
Quality and Grading Leather
Uses and Marketing of Leather

- **What is Skin?**

- **What is Hide?**

- **What is Leather?**

The Principle behind the Conversion of Hides to leather is the Filling of the Voids.

Approaches at converting Hides to Leather:

- **Dehydration**
  - **Heat/ Solar Radiation**
  - **Use of Ash**
- **Tanning**
  - **Chrome Tanning**
  - **Vegetable Tanning**

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TANNING OF HIDES IN JAMAICA

By Ruben Harrypaul
Senior Technician
Sugracane Feeds Centre, Trinidad and Tobago

SALTING OF HIDES

In Jamaica, there are no buffalypso, so the tannery utilizes the hides of cows and the skins of goats and sheep. Fresh or untreated hides and skins are purchased from the major abattoirs across the country and salted at the plant. Salt-cured hides and skins are also purchased from local butchers and international suppliers like Puerto Rico. The salt-cured hides are treated with a bactericide called Para-Nitro-Phenol by sprinkling, then re-salted to ensure no putrefaction and packed in bales of 50-100 in a cool dry place away from the sunlight. All heads are on one side, the tails on the other. In the event that hides have to be transported, they are easier to fold.

The untreated hides are graded on arrival as follows:

First Grade – These are hides with no knife marks of defects; very slight scores or gouges may be overlooked; the pattern and shape regular and symmetrical;

Second Grade – These hides have a good shape or pattern and are reasonably free from knife marks. One or two flay cuts near the edges or in the belly or shoulders is irregular;

Third Grade – These hides have almost half of their area damaged by knives, showing cuts, scores and gouges. The shape or pattern is irregular;

Reject Grade – These hides show more knifes marks, and the shape is very irregular.

The procedure for salting of hides is as follows:

Salt is sprinkled on the concrete floor, and the hide spread with the hair side on the salt. Salt is used in the ratio of 30% of the weight of the hide, e.g. 30lbs salt to 100lbs hide on the flesh side. Rub the salt well right up to the edge of the hide. A hide consists of approximately 60% water. The salt removes this water and delays putrefaction. Hides are then packed in bales of 50-100 on a slightly sloping floor and allowed to drain. At Tanners Ltd., hides are stored on a concrete floor area 10' x 6' x 4" thick, under a shed built with a concrete post, iron trusses and covered with galvanize. The hides are protected from the rain and sunlight by a sheet of canvas. There are almost fifteen 10' x 6' sections for the storage of salted hides. Tanners Ltd., has their own salt company, therefore a special salt crusher was designed by the plant engineer, Mr. Francis to crush salt from rock to form grains larger than commercial salt. If the salt is fine, it would melt and form a crust which would prevent penetration.

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METHODS FOR CHROME TANNING

SELECTION – The already graded hides are now selected from the various groups for the next stage which is soaking.

SOAKING – The objective is to restore lost moisture to the skin because of the chemical treatment this is to follow. Hides are soaked in the required amount of water in the paddle vats. A bactericide is added (0.2%). Paddles are run for fifteen minutes, then rested for four hours. Water is drained then filled again, paddles run for one hour, then rested for 18-20 hours. The hides gradually absorb water and become softer and cleaner. This removes the excess salt, dirt and blood. Each paddle vat can accommodate 10,000 lbs of hide that is almost 200 hides at an average 50 lbs weight. With a 400% float, that is 4,000 gallons of water.

SIDING – After soaking, the hides are removed from the vat and placed on wood pallets to drain for siding. This dividing of the hides into two parts by cutting with a cutlass along the middle. Siding is important at Tanners Ltd., because the machines installed at the plant cannot handle whole hides.

FLESHING – This is a mechanical operation that rids the hides of excess flesh, fat and muscles on the flesh side of the hide. At this point, the grain side of the hide still contains the hair. The fleshing machine has the capacity to flesh one hundred sides per hour. The machine consists of a number of rollers the most important is called a ***cylinder***. Protruding from the cylinder are many cutting blades that are positioned from the centre to each side. This configuration serves to keep the skins stretched to their full width as they are fleshed, and also helps to prevent the hide from bunching up at the center of the machine. The excess fat, muscles and flesh fall to the bottom of the machine where it is collected into a large container for dumping at the end of the day's work.

LIMING – The reason for liming is the removal of hair, epidermis and certain soluble proteins. At Tanners Ltd., there are four drums and both liming and tanning are done in them. After the hides are fleshed they become lighter. When limed, the hides are rehydrated which becomes twice the normal thickness, a condition known as ***alkaline swelling***. The chemicals have a three-fold purpose:

(a) They must destroy the hair root so that it will be free of the skin;
(b) Loosen the epidermis which is a hard outer layer covering the grain; and

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(c) Remove certain soluble skin proteins that are within the skin substance.

It is also imperative that the chemical does not affect the leather making constituents of the hide, e.g. collagen. The hides are placed into the drum with water, calcium hydroxide (hydrated lime), sodium sulfide and sodium sulphydrate. Liming time is twenty-four hours. The concentration of these materials, the water temperature and the amount of agitation determines the rate at which the de-hairing proceeds.

RE-LIMING – This stage is optional. It depends on the discretion of the tanners after examination of the hides, however, re-liming helps to open up the fibres in the hide more.

DE-LIMING AND BATING – The purpose is to remove the residual de-hairing chemicals and non-leather making substances. At this stage, the hide is turgid or plump and moderately clean. The alkaline materials used in the liming stage are still present in large amounts. They have already performed their functions and it is time to remove them. There are also some non-leather making constituents in the grain, and throughout the thickness of the hide, therefore in order to improve the appearance and resiliency of the leather they must be removed.

The hides are placed into large cylindrical drums. Water, ammonium sulphate, sodium sulphate and tetrapol are added and the drum rotated for one hour. Then cut, test with phenolphthalene; with the result being a change to colourlessness. Oropon is added; it is then run for half-an-hour and washed for twenty minutes. The chemical converts the residual lime into a soluble compound, the excess alkaline swelling begins to disappear and the hide begins to return to its normal thickness. It also adjusts the acid/alkaline condition (pH) to a proper point for receiving BATE. After washing, water and salt are added and the drum is run for ten minutes. The Specific Gravity should be 7.0 – 7.5. The bating removes undesirable constituents of the hide, e.g. hair root and pigment which are in the outer part of the grain portion of the hide. This creates a softer less harsh feeling to the hide grain surface and gives it a cleaner appearance. It also attacks the glue-like protein substances that are located between the leather-making fibres. If this is allowed to remain it cements the fibres together causing the leather to become hard. After the bating chemicals complete their functions the hides are washed thoroughly to remove all substances that were loose or dissolved.

PICKLING AND CHROME TANNING – Pickling is transforming the hide into an acid environment and tanning is conversion of the hide into a stable non-putrescible material. The

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pervious steps have removed all the unwanted constituents, e.g. flesh hair and non-leather making substances from the hide. The final preparatory step is pickling before tanning.

The hide is placed in a low pH environment in order or it to accept the chrome tanning material. Pickling is very important because the tanning agent is not soluble under alkaline conditions. If the tanning agents were added to non-pickled skin they would precipitate and it would not effect a tannage. A percentage of salt is added to the water with a specific gravity of 6.5-6.7 or (Boaume) or hydrometer reading. This is run for about 10 minutes, then 1.2- 1.4% H_2SO_4 (Sulphuric Acid) 1:10 added and run for two to three hours (overnight optional). Cut testing is done with Bromocresol and green yellow colour which shows acidity (pH must be 2.8 to 3.0), is expected. Chromium sulphate (powder) or simple chrome is added and run for six hours. The hide becomes bluish green, which is called 'blue state'. After nutralisation or bacifying with sodium bicarbonate (Baking soda), the pH on checking, must be 3.8-4.0. This reduces the acidity and increases the affinity of the protein for the chrome. Hide is removed from the drum and placed on a wooden pallet and allowed to drain. Checking for shrinkage temperature is done. If the leather is not tanned properly, it will shrink at a temperature of 140°F. Fully chrome-tanned leather can withstand a temperature of 212°F (boiling point) without shrinking.

SAM OR WRINGING – This is done in a sammying machine. It removes excess moisture from the hide in order for it to be split on the splitting machine. While it splits it also compresses the leather to less than its natural thickness but because of the inherent resiliency of the fibres they soon take their normal shape.

SPLITTING – The hide possesses different thicknesses, and since the previous processes or stages do not alter the thickness it is imperative that this is corrected because it would create problems for the leather-good manufacturers. The hide is fed into the machine and the underneath or flesh side that is cut off is called a split which has no grains. However, fairly large areas of the split still have enough thickness to warrant further processing.

SHAVING – Frequently one or two of the thinnest portions of a hide will not be thick enough to come in contact with the splitting knife, therefore the shaving machine is used to further level the overall thickness of the hide to the exact specification.

RE-TANNING, COLOURING AND DYEING – Each one of these stages has a different purpose but the tanner considers them as a unit

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because they are done in sequence and in the same drum.

RE-TANNING – This consists of imparting properties of other tanning agents into the leather. It is a second tannage. The material used is vegetable extracts and syntans. The vegetable extracts are mimosa, quebracho, wattie, symac hemlock, oak and spruce. The substances add solidity and body to chrome tanned leather.

Syntans are man-made chemicals. They are used for the manufacture of softer side leather also for making white shades. It also has a bleaching effect on the bluish green colour of the original tannage. The re-tanning stage takes less time than the original chrome tannage. The skins are washed and neutralized with a mildly alkaline chemical to adjust both temperature and pH. The syntans are added into the revolving drum and combine with the leather within one or two hours time.

COLOURING – This is accomplished with aniline-type dyestuffs which are derived from products of coal. They are dissolved in hot water and poured into the rotating drum as soon as the re-tanning step is completed. The dyestuffs combine with the skin fibres to form an insoluble compound which becomes part of the skin itself. The faster the exhaustion rate the greater would be the amount of surface colour. There are dyestuffs like acid dye, metallized dyes, direct dyes and basic dyes.

FAT LIQUORING – This is the last of the wet chemical operations the leather will go through. The fibres are lubricated so that when the leather is dry they would slide over one another. It also helps to regulate the pliability of the leather and also contributes greatly to its tensile strength. After the hides are coloured they are washed to remove traces of residual dyestuffs, excess acid, etc., and to adjust he temperature to 125°F. The fat liquor is dissolved in hot water and added to the rotating drums which take about one hour for exhaustion. Skins are removed from the drum and rested for twenty-four hours.

SAM SET – The leather is then taken to the Sam setting machine where excess moisture is removed from the grain side. This also flattens the grains and they stretch as the skin. At this stage the skin consists of 60% moisture.

DRYING – There are three different types of drying: (a) Air drying; (b) Paste drying; and (c) Toggling drying. *Air drying* – The most simple method is hanging done by placing the hide over a horizontal shaft just as you would hang clothes on a line. At Tanners, in order to speed up drying,

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the leather is placed into a large drying oven by means of a conveyor system. It is important, however, to ensure the temperature be kept moderately low (130°F and under), in order to minimise shrinkage.

Paste drying – The leather is pasted unto large stainless steel surfaces. Then the paste solution is sprayed uniformly over the surface. The paste is a starch-like material which provides good adhesion on a heavy wet skin and holds it in place during the drying process. The grain side of the leather is placed against the plate stretching and smoothing it with a dull instrument called a ***slicker***. It is then placed in the oven at controlled temperatures of 120-170°F and humidities (40% RH). This type of drying gives more yield, that is, more square foot of leather per hide.

Toggling – The skin is kept in a stretched position by clips called ***toggles*** on a perforated frame and then placed in the drying oven.

CONDITIONING – The leather is sprayed with water and left overnight so that the water can penetrate evenly through the hide. This is to prepare it for softening by means of staking.

STAKING – The leather is then staked to make it more pliable. It is fed into a 'true feed' machine which stretches and flexes as the leather fibres. The water added to the leather when conditioning occurs helps to achieve this. The 'true feed' machine is capable of staking up to 300 sides per hour.

BUFFING – The leather is then trimmed and selected. The leather with good grain is buffed on the grain side. Poor grain leather is selected for correction. It is buffed on the flesh side at bellies and neck because of the marks and scratches on those areas. The leather is then placed in a 'true feed' buffing machine to correct the whole of the grain side of the leather. The grit of buffing paper or sand paper should be 280. After the leather is buffed the dust must be removed. It is then put on a brushing machine to remove all dust. If this is not done it would affect the finishing process.

FINISHING – At this stage, the colour is put on which gives the leather its elegance. The colour consists of pigment, resin and other auxillaries. It can be put o by hand or sprayed on. It is then pressed at high temperatures, which helps to plasticise the resin and give it a smooth surface, or it can be embossed or printed after a protective coating is put on.

MEASURING – Each side of the leather is measured in terms of square feet. It is then written on the flesh side of each piece and then packed for grading.

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GRADING – This is done to determine the quality of the product that is finished. The leather is graded for temper, uniformity of colour and thickness. The graded sides are wrapped in bundles of four or six, secured and labeled, and then placed in a storeroom for sale.

METHOD FOR VEGETABLE TANNING

The procedure below remain the same as in chrome tanning. After de-liming and bating Veg-tanning in drums is done at a revolution of approximately 4RPM.

Selection	**Soaking**
Siding	**Fleshing**
Liming	**Splitting**
Re-liming (Optional)	**De-liming**
Bating	

TANNING – The hide is washed with clean water. After washing another 50% water, 5% syntans (synthetic tanning agent as a pre tan), 1.5% Formic acid are all added. Syntans are run for approximately two hours, 1.5% Formic acid is three parts 10 minutes apart with a pH of 4.0 – 4.5. Tannage 8% Sulphytic quebracho, 3% Syntan, 1% sulphated fish oil, 5% mimosa extract, and another 3% syntan are added then run for four to five hours. After tanning the effluent is drained, then water added and after thoroughly washing the hide is removed from the drum.

SAM OR WRINGING MACHINE – Here excess water is removed from the hide. As an alternative to a sammying machine a flat concrete table slightly elevated can be used with a slicker.

BLEACHING – After wringing the hide is bleached with 200% water 0.5% oxalic acid, 1% bleaching syntans then run in the drums for 15 minutes.

After bleaching you fat liquor, preheat rotating drums with hot water 50°C add 20% water to hide 6% fat liquor mixed and run the drum for one hour, wash and remove hide from drum, then you sam and set in the sam setting machine, then hang to dry. After drying you condition by adding water to the flesh side, pack and allow to rest overnight, then you stake. If a staking machine is not available you can use a staking board, then nail hides to wooden frame to stretch. This causes the hide to get flatter and smoother. After removing from frames trim hides as minimal as possible then you buff.

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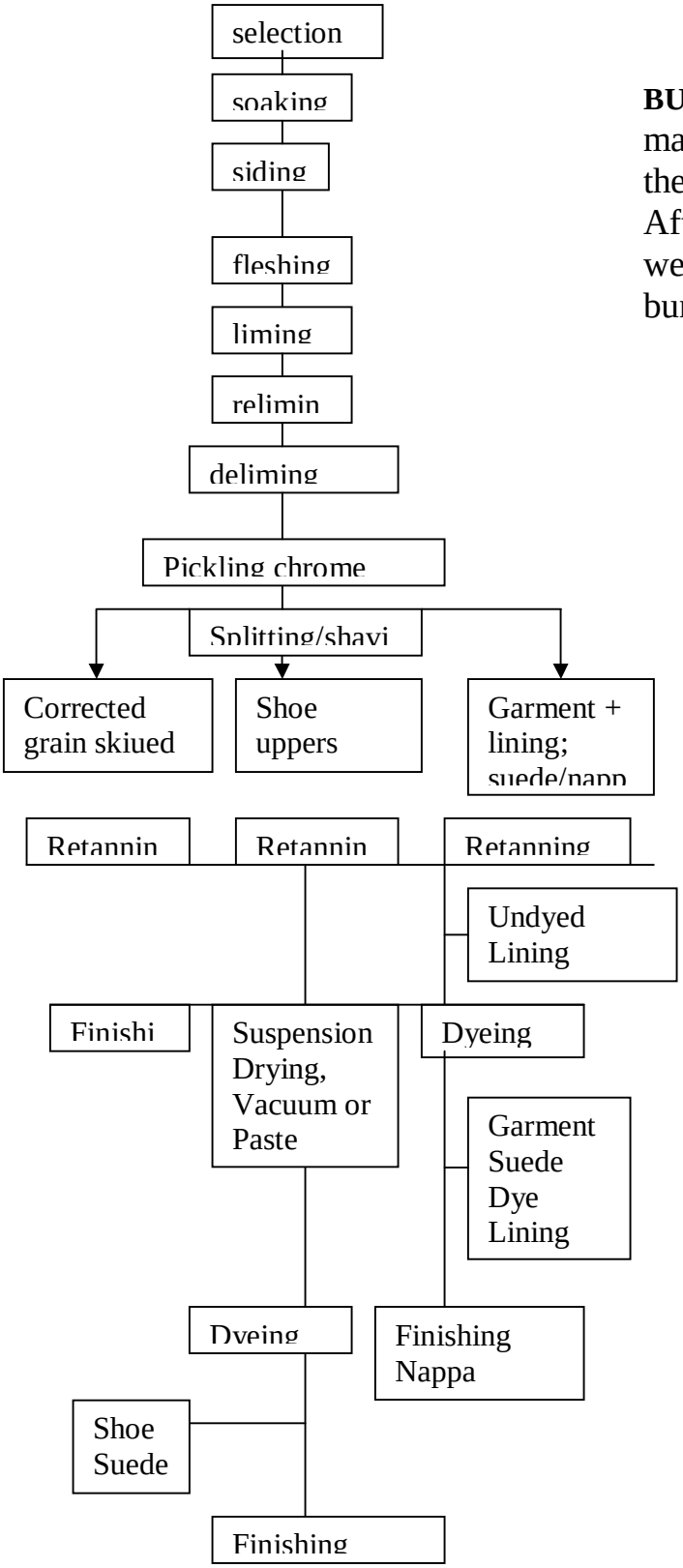
PROCESS FLOW FOR CHROME TANNING



BUFFING – A 10" - 12" buffing machine is recommended. The grit of the sand paper should be 120-100. After buffing brush the dust off, weigh the hide, select, grade and bundle for sale.

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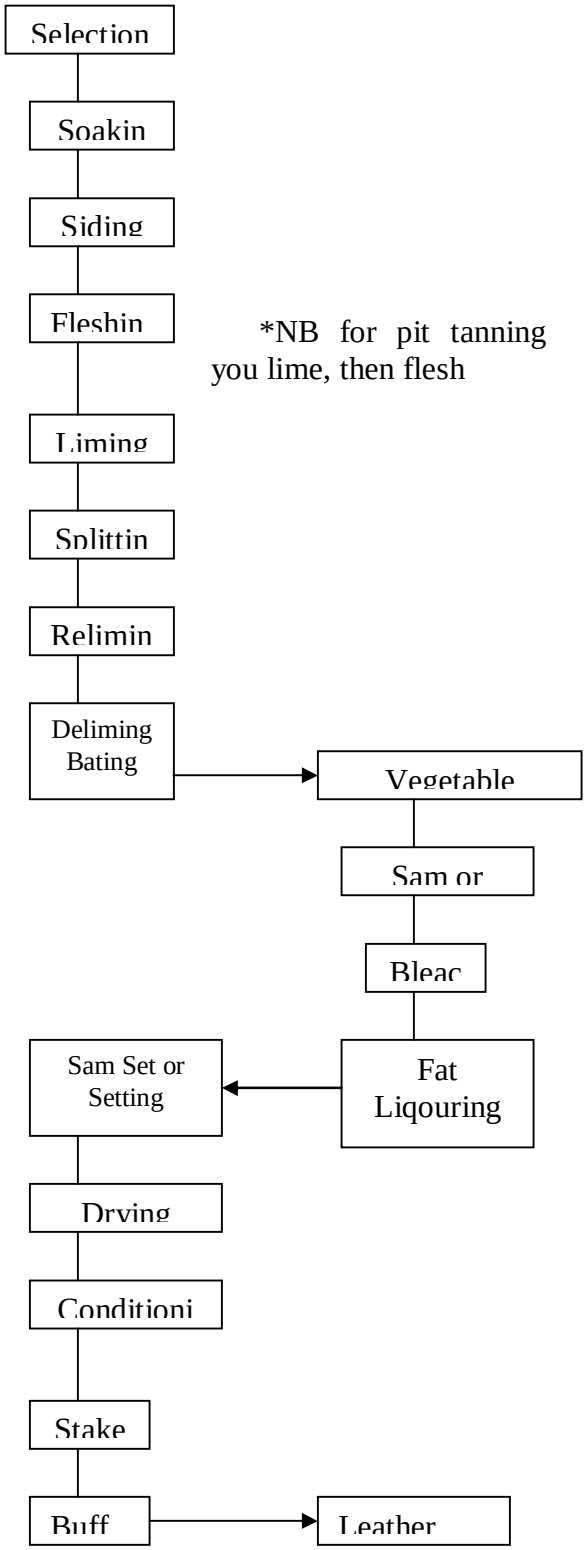
PROCESS FLOW FOR VEGETABLE TANNING



SPACED USED – The main building that housed the paddles, fleshing machine, liming and tanning drums, re-tanning, fat liquor and dyeing drums, sam setting machine, sammying machines, splitting machines, shaving machines, scale are and the area for sorting tanned hides is 200' long and 60' wide.

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A breakdown of their respective dimensions is as follows:

Item	Length	Width
Paddle vats area	36'	18'
Fleshing machine area	36'	18'
Liming and Tanning	36'	18'
Liming and Tanning Drums	36	18'
Storing area for tanned hides and skins	40'	40'
Weighing area	40'	20'
Sammying machine area	40'	12'
Splitting machine area	50'	40'
Shaving machine area	30'	20'
Sam setting machine area	30'	20'
Re-tanning fat liquoring and dyeing area	60'	16'
Finishing building area	110'	60'
a) Padding machine & dryer	60'	16'
b) Spraying cosmetic machine	110'	30'
c) Pressing machine area	40'	20'
d) True feed and buffing machine area also storage for buffed hides	40'	40'
Chemical Stores area	80'	50'
Workshop area	60'	18'
Store room for leather	40'	30'
Leather drying area (air)	40'	20'
Vacuum drying area	50'	30'
Compressed Room area	30'	12'
Boiler Room area	40'	40'
Salt crushing area	20'	12'
Laboratory area	10'	10'
Standby generator area	10'	10'
Administration building	50'	20'

TYPE OF LABOUR

At Tanners Ltd., there are approximately fifty members of the labour force. They comprise both monthly and hourly rated employees. The categories are as follows:

- One Managing Director
- One Technical Director
- One Assistant Technical Director
- One Production Manager
- One Plant Engineer
- Drum Operator
- Machine Attendant
- Splitting Machine Operator
- Shaving Machine Operator
- Setting out Machine Operator
- Sammy Machine Operator
- Fleshing Machine Operator
- Dyeing Drum Operator
- Leather Trimmer
- Leather Selector
- Buffing Machine Operator
- Vacuum Machine Operator
- Mollisa Machine Operator
- Aulson Spraying Machine Operator
- Pressing Machine Operator
- Pressing Machine Attendant
- Padding Machine Operator
- Machinist
- Maintenance Mechanic
- Welder
- Boiler Operator
- Electrician
- Carpenter
- Driver
- Salt Machine Operator
- Stores, Office and Inventory Clerks
- Office Assistant

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EQUIPMENT AND MACHINERY

- Fleshing Machine
- Splitting Machine
- Sammying Machine
- Sam set Machine
- True feed Buffing Machine
- Buffing Machine
- Dyeing and Drying Machine
- Buffing Machine
- Coloring or Spraying Machine
- Pressing Machine
- Salt Crushing Machine
- Dusting Machine
- Coating Machine
- Vacuum Machine
- Compressors
- Siding Horse
- Forklift
- Scales, 100 kg capacity
- Paddles
- Drums
- pH Meters
- MM gauge Machine
- Boilers
- Ovens
- Trucks

ELECTRICITY

All of the machines used are powered by electricity. Tanners received their electricity supplies from Jamaica Public Service Company. There are three wires supplying 10.000 volts of electricity to a pole of six transformers amounting to 75K.V. These transformers break down the current to 415 V to the main breaker in the panel. There are three cables coming from the transformers each of which is 124mm, going to the main panel breaker which is 1000 amps. Three red from each cable is tied into one leg, three yellow from each cable is tied into one leg and three blue from each cable is tied into one leg. The heavy machines, e.g. Paddles, Fleshing, Drums, Splitting and Sammying machines use 415 volts of electricity. There are some smaller motors that are run with 220V and lights are 115V. Tanners Ltd. has installed a huge standby generator on their compound. In the event of a power failure, this automatically gets into play.

WATER SUPPLY

Water is one of the most principal factors to be taken into consideration when setting up a tannery. There must be an abundant supply of an adequate storage facility. If these two factors cannot be realized, the idea of setting up a tannery should be shelved. At Tanners Ltd. there are two sources of supply. The water from the Jamaican Public Service is used for drinking purposes. The water for the tannery is supplied by a well that was drilled approximately forty to fifty feet deep on the compound. The well is fitted with an overhead pump to pump the water to the surface into two large storage tanks with a capacity of 60.000 gallons. At the storage facilities there is another pump installed to direct a steady flow of supply to the tannery.

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FLOOR TYPE

All floors are concrete which varies in thickness. The thickness of the floor where the heavier machines are placed is 6". Where the lighter equipment is located, the floor is 4" thick. In the main building where the paddles, the liming an d tanning drums, the fleshing machine, and the retanning fat liquoring an dyeing drums are, the floor is level from both ends to a point, then with a slight drop into a drain in the middle. In the finishing area, vacuum area, storeroom area, buffing area, boiler area, the floors are level and 4" thick. Foundation blocks, BRC and steel ½" and 5/8" are used in the construction of the foundation. There was no construction engineer on the plant however, this information was supplied to me by the Assistant Technical Director.

ROOF HEIGHT

a) From the surface of the floor in the main building to the centre of the roof, the height is almost 40' dropping on both sides to 18' from ground surface. The building is constructed with H beam iron pillars, H beam iron trusses covered with galvanize roofing sheets.

b) The roof height of the chemical store room is almost 30" from the floor level to the center of the roof, dropping to 10' from the surface of the ground. The building is constructed with H beam iron pillars, H beam iron trusses, block walls and covered with galvanize roofing sheets.

c) The roof height of the finishing building is 18' from the surface of the floor to the center of the roof dropping on both sides to 10' from the ground surface. Concrete pillars, concrete beams, wooden trusses concrete walls on four sides, roof covered with galvanized sheets.

d) The roof height of the leather storage building is 25' from the surface of the floor to the center of the roof dropping on both sides to 12' from the ground surface. H beam iron pillars, H beam iron trusses, block walls, aluminium roofing sheets, and concrete floor. The Sales department is also housed in this building.

STORAGE SPACE

The chemical storeroom is 80' long and 50' wide. In this building all the chemicals used in the conversion of hides into leather are stored. Some are placed on the floor, while some are placed on wooden pallets. The roof of the building is almost 30' from the floor. The entire building is well ventilated.

The storage room for finished leather is 40' long by 30' wide. The stands are constructed with 2" and 1" water pipes; the shelves are made of wood 8" wide by 1" thick. It is divided into three sections:

- Leather made from cow hides;
- Leather made from goat and sheep skins; and
- Wholesale and retail sections.

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The section for cow hides is 40' long, 20' high and 5' wide. The section for sheep and goat skins is 20' long 20' high and 5' wide. The section for wholesale and retail hides is 15' long, 20' high and 5' wide. This area is not ventilated as the Chemical Stores is.

The storage area for salted hides and skins is 10' long by 6' wide. This area is open and well ventilated.

DRAINAGE

In the main building where all the different stages in the conversion of hides and skins into leather takes place, with the exception of finishing there are three concrete box main drains. The first, approximately 2' wide by 2' deep, almost 60' long, drains the effluent form the retanning, fat liquoring and dyeing areas. The second of the same dimension and 72' long runs from the liming, deliming and tanning drums to the vat paddles. The third runs underground alongside the front of the building and connects drain #1 to drain #2, emptying all effluent into the main drain which is 3' wide and 18" deep. The drain that takes effluent from the finishing department is independent however; the water mixes with the effluent from the effluent from the main building at a point where it enters the public drain outside the compound. At the end of each drain, there is a mesh made of ½" steel rods which serve to trap pieces of skins from the effluent.

EFFLUENT

From Tanners Ltd. there are thousands of gallons of effluent emanating on a daily basis. Since the method used is chrome tanning, special care and attention should be placed in respect to its disposal. The effluent that comes out as a result of chrome tanning is very dangerous to vegetation and may poison animals and humans if allowed to enter rivers, streams and lakes or wells. At Tanners Ltd., the effluent from the liming, de-liming and tanning drums also from the retanning, fat liquoring, dyeing and the finishing area is allowed to run into concrete drains which are approximately 2' deep by 2' wide. Water from washing off the floor and from the vat paddles after soaking enters the same drain which runs out of the compound into the public drainage system.

At Tanners Ltd., there is no pit or treatment plant for the collection and treating of effluent. Setting up a treatment plant is a very expensive investment. Therefore it is imperative that all the pros and cons be taken into consideration before taking a final decision. However, the management at Tanners Ltd. is presently contemplating the setting up of a modern treatment plant on the compound because of pressure from the public, government and environmentalists in Jamaica. The waste from fleshing is collected into metal bins placed under the fleshing machine and dumped at the end of the

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day's work. The waste after shaving the leather is also collected and dumped. The shavings could be used for making leather boards, but it not feasible because the material is insufficient for setting up a plant.

ODOURS AND OTHER CHEMICAL CONTAMINANTS

At Tanners Ltd. the solid material from the fleshing of hides and skins is collected and dumped. The floor is then properly washed and sanitized. There are no foul smells or odours. Liming, de-liming, tanning, retanning, fat liquoring and dyeing are done in large cylindrical rotating drums at a rapid pace. It is not done in concrete pits, which take long periods of time results in fermentation and eventually odours or foul smells emanating from the liquor. After the different stages outlined above are completed, fresh water is added in large volumes. This helps to dilute the effluent and reduce to zero, any foul smell or odours. Apart from that, when the effluent is emptied from the drums into the drains there is a constant flow of fresh water from a pipe into the drain which further dilutes the effluent, eradicating stench or odours. In the finishing department where plating is done by spraying the chemicals on the leather, there are lots of smelly fumes. Workers in this department wear protective clothing, gloves, respirators, goggles, etc. If chrome tanning is introduced at the SFC the fumes and odours from plating would cause discomfort to workers in the vicinity and possibly the animals. To what extent the effluent at Tanners entering the public drainage system contaminates the environment, only chemical analysis can say t hat.

In the event that a tannery is set up at the SFC, I am optimistic that the effluent emanating from our tannery would have no effect on our livestock population or even on our abattoir operations simply because at the SFC we can hydrolyse the waste from the fleshing operation with diluted Sulphuric acid (H_2SO_4) and convert it into feed. In respect to our existing tannery facilities to which I enclose a copy of the drawing, one would notice that there is an effluent pit made out of blocks and the drains from the tannery which we can use to suction our effluent for safe disposal and the residues can be use das fertilizers. The abattoir is situated to the east of the tannery at a higher level. The underground drainage that drains the water from the abattoir starts at that higher level. If by chance the effluent pit should overflow, the effluent cannot flow towards the abattoir or even close by it. It will flow downwards and enter into our liquid manure pond.

At the SFC, we practise intensive farming and our animals are watered by overhead waterlines, which drain into concrete troughs, controlled by floats in their respective pens. The animals are properly

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secured by iron railings. Our drainage system is so designed that water cannot enter into any of the pens. In the event of effluent seeping or escaping into our drainage system our livestock is safe except in the case of animals breaking loose, which seldom happens.

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FORMULAE – CHROME TANNING

For soaking in Vat Paddle:-
Fill with water 400% float
Run for 15 mintues: Rest for 4 hours
Drain water
Fill again with water
Wash for 5 minutes
Drain and fill again
Add 0.2% wetting agent
Run for 1 hour: Rest for 18-20 hours

Formula for Liming in Drums:-
100% water
6.7% Sodium Sulphydrate
3.0% Lime (hydrated)
Run for 30 minutes
2.5% Sodium Sulfide
Run for 30 minutes: Then run 5 minutes in every half hour for three hours
Add another 40% water
Run 5 minutes in every hour for 24 hours

Formula for De-liming:-
Wash hide until clear
Add 100% water
Add 1.2% Ammonium Sulphate
Add0.5% Sodium Bisulphate
Add 0.2% of Tetrapol MW63
Run for 1 hour
Cut test with Phenolphthalein (colourless)
Add 0.2% Oropon: Run for 30 minutes: Then wash for 20 minutes

Formula for Bating:-
Add 50% water
5% Salt
Run for 10 minutes
Check specific gravity 7.0-7.5

Formula for Pickling:-
Add 1.2% H_2SO_4 in 1:10 in two parts, 10 minutes apart: Run for two hours
Check pH 2.8-3.0
Cut test with Bromocresol Green (Yellow)

Formula for Tanning:-
Add 1.0% Sodium Formate: Run for 15 minutes
Add 8% chromosal B
Add 0.1% Preyentol WB: run for 1 hour
Add 1.4% Sodium Bicarbonate: Run for 6 hours, pH 3.6-3.8
Check boiling test

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