(Version: 2024)

Leather:

AN OVERVIEW OF MANUFACTURE

(Part 6)

Small skins: hair sheep and goat: grain leathers.

Author: Richard P. Daniels

Recommended by:

INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Leather: AN OVERVIEW OF MANUFACTURE

Content and Structure:

This section includes a summary of hides and skins as raw materials.

Small skins: hair sheep and goat skin leathers

There are logistical and technological differences when compared to bovine leather manufacture.

There are four prime matters to take into account:

1] Structural differences.

2] Skin collection and preservation.

3] Availability and supply.

4] Grading and selection.

1] Structural differences

Micrographs have illustrated both the structural and thickness differences of bovine, goat and sheep skin leathers *(Content and Structure: pages 14, 15 and 16).*

Globally, the average weight of bovine hides is set down as 26 Kg *(variations between 8 and 35+ Kg according to region)* with sheep and goat skins 1.5 Kg *(with variations).*

In addition, a sheep or goat skin may be 5 to 10 times smaller in area than a hide. To achieve the same production in terms of area, many more small skins require processing than bovine hides. This means more handling.

The substance is also less. Skins can be extended or strained more easily than hides, and full penetration of chemicals throughout the structure is much faster.

These differences are addressed by machinery of different size and function, and variations in chemical processing too.

2] Skin collection and preservation

The husbandry of bovine cattle is mostly ranch or farm orientated, with a relatively small volume as subsistence animals. These animals are managed for dairy and meat production: slaughter and preservation can be considered centralised.

Sources for hair sheep and goat are largely Africa, the Middle/Far East, and Asia, with a high percentage of subsistence animals. Flocks are numerous, and relatively small in size.

Similarly, slaughter is mainly on a smaller scale and decentralised.

Skin preservation is local, with collection of skins, preservation and trading often through long established trading links: small scale collection feeding larger scale dealers.

Inevitably, this leads to variations in both skin size and quality due to wide ranging environmental and husbandry matters, slaughter practices and quality of preservation.

3] Availability and supply.

Hair sheep and goat are a food source subject to significant variations in demand. At times of fasting there is a very low availability of skins. But, at times of feasting and festivals there is considerable over supply. This is often coupled with poor preservation practice with subsequent skin damage.

For a tannery, these variations mean that large stocks of skins are required to level and manage production.

Preserved raw skins can be kept in store for moderate lengths of time. However, skins are often processed directly by tanners to the pickled state where they can be graded and kept for long periods.

It is also common practice for skins to be processed at collection points by small enterprises to the pickled condition, even to the tanned state. For small skins, this does not require a high investment in sophisticated plant and machinery.

4] Grading and selection

Inconsistencies in the state of preservation, quality, size and substance, are major factors to address in the purchases of small skins. Potential is far from clear in the raw state, only becoming better defined as the goods are processed.

A large part of skin availability and supply is in the pickled state and from many sources. This has major scope for technical variation, more so to purchases in the tanned state.

The thickness of these skins does not lend itself to splitting in the limed or tanned state. Accordingly, there is no usable flesh split to add value to, and the final substance is mostly dependent upon shaving only.

If the potential thickness is not managed correctly at various sorting stages, there can be serious waste of substrate and chemicals in the form of shavings.

Over and above issues of quality and area, the greatest potential of each skin needs extracting in terms of quality and thickness.

If the focus is entirely on one type of leather, there will be many skins that do not fall within the thickness/substance requirements. It is therefore usual for tanners to make a range of quite different types of leathers: larger skins for various footwear uses and clothing leathers, with gloving and golf leathers for smaller skins at lower substance.

The early stages of processing are reasonably generic, and the pickled stage provides a stable structure that enables good grain assessment. Accordingly, this is the key point for inspection before commitment to a specific end use.

Manufacture: raw to the pickled condition

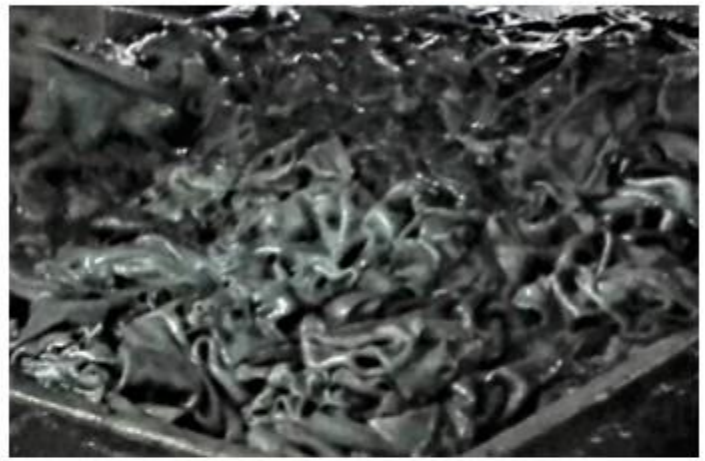
Sorting wet salted hair sheep skins.

Trimming and grading hair sheep.

- Skins are first sorted for general quality and state of preservation.
- They are then inspected for flay cuts - as this affects potential substance - then trimmed and graded.
- For example, there may be 4 different selections for area, and 4 grades for quality in each area selection.
- The skins may also be graded for colour of hair *(black, white, brown)* as any residual pigmentation in the grain will affect dyeing potential.
- As each batch is complete, it can be held in stock until required for soaking.

The hair burn process:

Hair sheep skins after a hair burn drum liming.



Limed fleshing hair sheep.

- Soaking is mainly performed in drums.
- If the hair has no value, this is removed by dissolution or “hair burn” as within a conventional unhairing/liming system.
- After washing, the skins are limed fleshed.

The hair save process:

Brush application of unhairing “paint.”

Skins piled to enable “paint” penetration to the hair root.

- Soaking is mainly performed in drums with a high float, but also in paddles.
- The skins are stacked and drained.
- Hair saving is practised where the hair has value, or to reduce the load on wastewater treatment.
- The hair is released by breaking down the hair root using a “paint” based on lime and sodium sulfide.
- This “paint” is applied by brush or machine spray to the flesh side.
- Skins are piled, *(in pairs, flesh to flesh)* with penetration of the “paint” through the skin structure to the hair root in 1-3 hours.

Manual removal of hair by “pushing”.

Cylinder and blade arrangements in an unhairing machine.

- Once the hair root is destroyed, the hair can be easily removed.
- This is mostly as a hand operation *(pushing),* but can also be by machine.
- The configuration of the unhairing machine is similar to a fleshing machine, but with blunt blades to apply a setting or pushing action across the grain.
- The skins are then limed in a drum using slaked lime and a small amount of sodium sulfide - typically a 1-day unhair/liming cycle.
- They are then limed fleshed.

Recovered hair and skin pigmentation

Natural drying of recovered hair.

Compressed and baled hair.

- Sorting arrangements in the raw state can include hair colour.
- Selections can include black, brown, and white hair.
- The recovered hair may be washed, dried, baled and sold according to colour.
- This can be turned into traditional clothing and blankets without any use of dyestuffs.
- If there is residual pigmentation in the grain at pickle inspection, these skins can be dyed black.
- It is possible to bleach the pickled skins using permanganate or chlorine dioxide.

Options for pickling

It may be that production continues directly from a moderate acid/salt pickle into chrome tannage.

However, advantages may be gained by careful selections in the pickled state, before commitment to tannage or a specific type of leather.

A third option is to use a very acid/salt pickle as a means of preservation.

Acid/salt pickle for preservation

Pickling in a processing vessel.

Pickled skins after discharge awaiting stacking and draining.

- At times of feasting the massive volume of skins available is too great to be fully processed.
- Accordingly, skins are either preserved, or processed to the pickled state.
- Pickling may take place at the tannery, but is often performed by small enterprises near to major collection points, with subsequent sales to tanners.
- Tanners can influence these small scale operations, but inevitably there are variations in processing.

After pickle storage, each skin may require opening before fleshing.

Sometimes, a considerable quantity of flesh needs cutting from the skin.

- It may be that on receipt by the tannery, that the pickled skins have been poorly fleshed.
- These skins are wet back using a salt solution to prevent acid swelling.
- They are then stacked to drain, covered with polythene to prevent drying of the peripheral skin parts.
- Once drained the skins are opened and hand stretched.
- They are then fleshed, with various fleshing machine options.
- This provides advantages in both grain quality and area extension.

Centrifuge for spin drying pickled skins.

Dewatered skins before *(left)* and after *(right)* a light drum tumbling.

- Another option is to bundle the rewetted skins and spin dry in a centrifuge.
- These damp bundles may then be opened manually or tumbled in a drum to remove creases and open before pickled fleshing.

Many gradings according to end use.

Long term storage is possible without deterioration.

- The pickled stock is subject to many selections and gradings.
- These include area, potential substance, quality and final leather type.
- If the pickling process is sufficiently acidic, the skins can be sealed in polythene and held under cool conditions.
- Holding times of around three months before any change in properties.

The manufacture of four different leather types are described:

1] Full grain shoe upper leathers from hair sheep skins.

2] Suede shoe upper leathers from goat skins.

3] Clothing leathers.

4] Gloving leathers.

There will be some cross-over between the different technologies, but these examples provide reasonable overview.

1] Full grain shoe upper leathers from hair sheep skins

Skins being discharged after chrome tannage*.

Skins carefully stacked to drain without creating creases.

- Skins from pickle preservation may be around pH 1.0.
- This is too acid for direct tannage, so they are de-pickled to near neutral – usually pH 6.5.
- They are then re-pickled as required in preparation for tannage*.
- Alternatively, they may be pickled and tanned directly after deliming and bating.
- After tannage, the skins are unloaded and piled.
- They are left to drain for one or two days covered in polythene to prevent surface drying.

*(*also wet white and vegetable tannage according to end-use.)*

Light samm or samm/setting small skins.

Continuous grading required for small skins to maximise value.

- The damp skins are then (re)assessed/graded for substance, area, and quality.
- This may include suitability for leather types other than shoe uppers.
- These various options for end-use within a tannery are a significant part of viable production.

Feed to wet staking to open creases in the shank parts.

Shanks well opened following wet staking.

- Wet blue for footwear may be lightly sammed to dewater and to slightly consolidate the structure.
- The tanned skins may be opened by hand, but wet staking *(wet-stretching)* can be used in preparation for shaving.
- This operation stretches the structure, and creates a flatter and smoother grain layer.
- In particular, it is necessary to open the creases in the shank parts to reduce the amount of cutting damage on shaving.

Careful attention when shaving to sometimes very low substances.

Buffing loose fibres from the flesh parts after shaving.

- The skins are then shaved to substance.
- They may then be cylinder buffed to clean loose fibre from the flesh side.
- These machines comprise a fast rotating straight cylinder with grit of uniform size stuck to the surface, or covered in emery abrasive paper.
- The skin is held manually across this rotating cylinder.
- The action abrades and extends the structure.

Out-feed from a setting operation.

Vacuum drying is the usual drying option as it develops a tight grain.

- The skins are retanned and dyed, then piled to drain.
- They may then be lightly samm/set or set.
- Drying is usually by vacuum drier, followed by an overnight lay to equalise the moisture content before staking.
- After staking, if the skins are of high substance, drying is completed by suspension drying.

Off take of sheepskin leathers after vibration staking.

Cylinder polishing lightly waxed leather in finishing.

- Softening is normally by vibration staking.
- The skins are inspected in the crust condition before entering finishing.
- Finishing can be moderately heavy for the higher substance skins and fairly similar to bovine procedures.
- Leathers of lighter substances can only support light finishes.

Leather of lighter substance cannot support a heavy finish.

A wide range of footwear can be manufactured from small skins.

- Where finishing is minimal with little cover, the dyeing needs to be intense and accurate to shade.
- The fine grain structure lends itself to classic aniline-type finishes.
- However, the range is not restricted to dress and high fashion, and the scope includes casual footwear manufacture too.

2] Goat skin manufacture for suede shoe upper leather

Trimming to avoid tangling in retanning and fatliquoring processes.

Tension-free drying for softness and tightening the flesh fibre structure.

- A one-day soak and hair burn liming process is often used, as goat hair usually has no value.
- Otherwise, processing to the pickled and tanned state is similar to hair sheep.
- Shaved skins are trimmed to remove damaged peripheral parts, and buffed on the flesh side.
- Then retanned and fatliquored only, without a dye addition.
- They may be piled and drained for 48 hours to drain.
- This is followed by a slow, tension-free drying at low temperature to staking moisture content.

There are many configurations of the cylinder staking machine.

The degree of buffing is dependant upon the individual skin structure.

- Softening may be by vibration staking, followed by cylinder staking and extension.
- The cylinder staking machine is similar in configuration to the reverse-action samm/setting machine.
- The conveyor feed roller and support rollers are hard, but a short felt feed belt is often fitted to assist the forward and reverse action used.
- The undyed crust skins are then buffed.

A second tension-free drying to preserve a fine nap.

Presentation suede side up on expanding toggle frames.

- Buffing includes careful inspection and/or rebuffing to ensure a fine and uniform suede surface.
- These skins are wet back and dyed to shade.
- Piled to drain, but covered in polythene to avoid surface drying.
- Tension-free drying, followed by milling to soften and raise the nap.
- A final toggle dry suede side up, with the extension providing flatness and softening.
- Inspect and dispatch.

3] Hair sheep for clothing leather

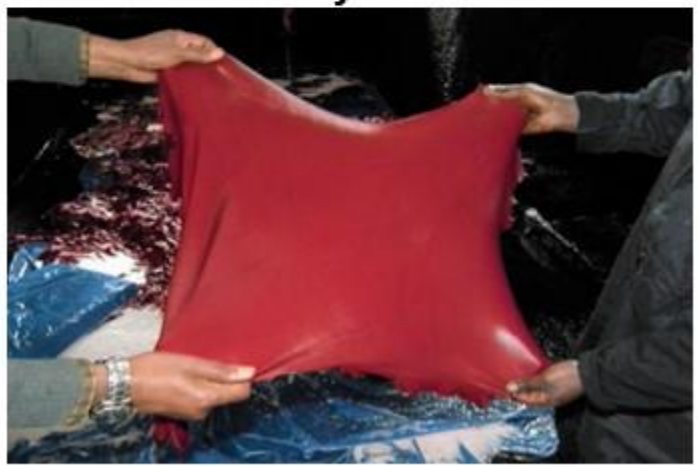
Selections of dry undyed leather *(crust selections)*.

Dry shaving – particular attention to substance.

- **After tanning, the skins are drained for 48-hours to provide a consistent weight for chemical weighing, and to avoid compression *(firming)* of the structure.**
- **Retannage and fatliquoring, without any dyestuffs.**
- **After unloading, drain for 24-48 hours, then set on the grain side and dry-tension free.**
- **Condition if needed, soften, extend and flatten using a cylinder staking machine.**
- **Select for quality, size, potential substance.**
- **Dry shave.**

Buffing or wet wheeling before dyeing to clean the flesh structure.

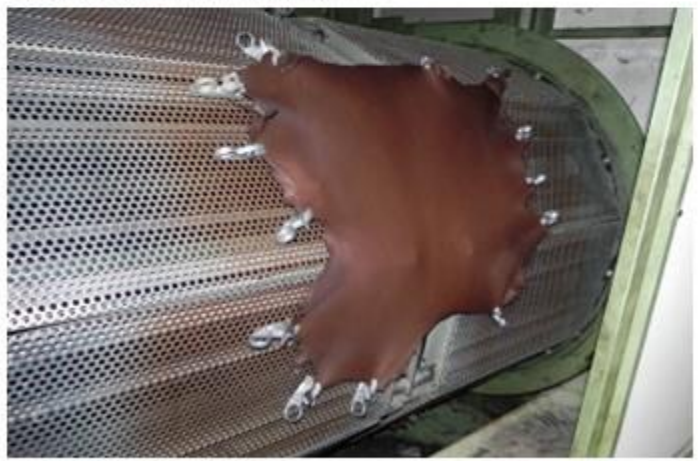
Dyeing crust leather provides both colour uniformity and softness.



- Once shaved, and before dyeing, the skins may be cylinder buffed on the flesh side.
- Alternatively, a rotating wheel covered with an abrasive grit is used to clean the flesh side.
- Known as wet wheeling, the cross- section of this wheel is rounded instead of flat.
- This is especially useful in extending the flanks.
- The skins are then returned to the dyeing department, wet back and dyed to shade.

Setting before tension free-drying.

Toggling after milling to flatten, extend and soften.



- After dyeing, unload, drain for 24 hours, then set on the grain side and hang dry without tension.
- Condition if needed, then soften and extend using a cylinder staking machine or dry wheeling.
- Mill if required for extra softening or texturing.
- Toggle.

Leathers that have been processed to the crust state, then dyed, provide very level surface colour with good dye penetration.

This is technically important as finishes are very light for protection and to enhance the grain appearance.

Dyeing needs to be very precise because of the lack of cover on finishing.

An alternative approach:

Continuous attention to substance measurement on shaving.

Leathers dyed black in high volume may allow a degree of rationalisation.

- An alternative technique is to lightly samm the tanned skins and shave to substance.
- They may then be cylinder buffed or dry wheeled to clean the flesh side.
- They are then dyed, retanned and fatliquored, hang-dry, staked, and/or tumble, toggle.
- This avoids crusting procedures.
- Rationalisation of this type is common where the volume of one colour/texture is particularly great.

Sometimes, If the production is predominantly black, shaving in the tanned state is omitted.

Skins are selected for potential substance, retanned/fatliquored/dyed and dried.

At crust sorting, judgements include the creation of batches according to the potential shaving substance.

Skins are then dry shaved, providing a very accurate substance.

This makes the best use of raw materials in terms of maximum substance that can be extracted from each skin.

The technique provides savings in labour costs and reduces plant use, but the downside is the loss/cost of processing chemicals as shavings.

4] Hair sheep for gloving leathers

Classic slow, cool and tension-free drying for the softest leathers.

Careful grading, with specific attention to substance.

- **Manufacture is similar to clothing leathers.**
- **Once selected according to size, thickness and quality, the skins are processed to the crust state.**
- **They are again subject to careful grading for substance and quality.**
- **They can then be dry shaved.**
- **The substances may be as low as 0.5 +/- 0.05 mm for ladies, and 0.6 +/- 0.05 mm for mens gloves.**
- **Once shaved they may be cylinder buffed, or dry wheeled to clean the flesh side and extend the shanks.**

Tension-free drying for the highest degree of substance and softness.

Each skin is wheel staked according to softening needs.

- After dyeing to shade, and draining, the skins are hang dried to conditioned moisture content.
- They may be cylinder staked, tumbled, and toggle dried.
- Wheel staking may also be used to soften and extend.
- In this operation the skins are held in place against the machine body by pressure applied by the operative.
- The skin is stretched by blunt blades mounted on a rotating cylinder. The application of pressure is controlled by use of a hand pad.

After buffing, there is considerable attention to dust removal.

Wide range of finishes and textures within fashion.

- Buffing may take place on the flesh side for better presentation and to extend and soften.
- Dust is thoroughly removed before entering finishing.
- There are many options in post shaving procedures.
- Final uses may be as varied as white golfing gloves, within high fashion and certain industrial uses.

Additional: Wool-bearing sheep skins for full grain leather

Paddles are required for soaking to avoid matting and wool damage.

Once de-wooled, drums may be used with care for grain leathers.

- Heavy yielding wool-bearing sheepskins have a relatively thick and open structure for the skin size*.
- The skin substance may be sufficient to enable splitting.
- Mature skins at higher substances suit light footwear manufacture.
- In retannage, the structure needs a high level of filling in the corium, and support at the junction.
- This provides shape retention in footwear components, and grain tightening.

*[*Structural differences, including high natural grease content, ref: Part 8]*

Soft naturally textured leathers for jackets and full length coats.

Reproduction of 19th century desk: Fold-down work top - leather inset.

- Other uses for wool-bearing sheep skins include slipper-type footwear, for ultimate comfort.
- They can make very soft grain leathers, especially lambskins for the highest quality garments.

++++

- There are many other uses for small skins too: bags, high value furniture and fittings, and leather goods.
- Specialist products, such as chamois and cricket ball leathers.

Review

Over and above quality issues, there is considerable variation in both area and thickness of raw skins. And with minimum splitting options, there can be considerable substrate waste on shaving.

This favours a production mix of two or three different leather types - shoe upper leathers, clothing and gloving leathers - at their different substances.

These have different technical requirements.

Over and above technical issues, the key is grading and re-sorting to extract the greatest potential from each skin.

For shoe upper leathers, in broad terms, skin manufacture has similarities to bovine manufacture of leather at low substances.

The processing and drying is mainly based on a light samm/setting and a short vacuum drying at low temperature to create a compact structure.

Finishing may be relatively heavy, but where the grain has high quality its fine structure can be enhanced by very light finishes that are reliant upon good dyeing.

For clothing and gloving purposes, after tannage and retannage, leathers are often drained to remove water to avoid fibre compression and firming resulting from samming or samm/setting operations. This is followed by a slow tension-free drying.

The lack of compression of the structure and ability to relax on drying creates a soft leather with a very open fibre structure.

This configuration is very permanent, but enables further softening by mechanical operations in crust manufacture. This soft and open structure can be retained if the crust stock is rewetted for dyeing purposes, and through second time drying.

Very uniform colour can be provided by crust dyeing, and easy penetration throughout the structure. This is required for light leathers with a minimum finish.

Several specialised machines are involved in small skin operations to provide cleaning and softening.

Wheeling, cylinder buffing and cylinder/wheel staking machines are used to remove fibres from the flesh and to soften. They are also very important for extending the skins and assist a reshaping into a flattened structure.

Due to the small area of each skin, the considerable handling, and the need for individual attention and manipulation of each piece, these operations are very labour intensive.

Continues as:

Leather:
AN OVERVIEW OF MANUFACTURE
(Part 7)
Small skins: wool bearing sheep
double face (two face), shearlings, and rugs

Author: Richard P. Daniels

Recommended by:

INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION