1 Pre-tannage

Contributed by Mr. Woodley, Michael
International Consultant,
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The principal chemical component in leather is the protein collagen and the pre-tannage operations are aimed to remove other proteins as required and to prepare the collagen chains for subsequent cross-linkage by the various tannages.
The first stage in pre-tannage is to restore the original moisture to the skin, which will allow all the subsequent processing to be done correctly. The alkaline chemical treatments, normally as lime, then clean the hide structure by removing some types of proteins and giving a degree of swelling. There is a loosening, or destruction, of the epidermis including the hair. The fibre structure is opened up and fats are partially removed as soaps. After the hair is removed, the alkaline swelling is removed and there is a further opening-up of the fibre structure by enzymes. The hide, or skin, is often call ‘pelt’ in these pre-tannage stages.

PREPARE INPUT LOAD

The variety of shapes and sizes of hides and skins reflect the history and health of the animals themselves. It is a good practice to select similar weight, condition and sizes of the raw material so that the chemical and physical processes can be more uniform and efficient. If this is not done, then some pieces will have too much treatment and others will have too little.

SOAK

The object is to restore the hide to its natural moisture content and degree of swelling. There is also the removal of dirt, soluble proteins and curing agents (mainly salt).
It may be either be done in pits (for pre-soaking dried material), paddle (for careful soaking of delicate skins in long floats) or, more usually, in a drum. The drum speed is low and intermittent. Chemicals to aid re-hydration, such as bio-degradable surfactants are often included and slight alkalinity helps to achieve a limited swelling. The salt concentration should not be allowed to fall below 2° Beaumé.
Bactericide is needed to avoid any putrefaction damage. Ideal temperature is 26℃ and pH 9-10

GREEN FLESH OPTION - with a waste by-product of green fleshings and residual fat

The mechanical operation of fleshing is an option, for hides, to cut away flesh tissue so that the chemicals in the subsequent operations can penetrate easier. All chemicals penetrate faster

from the flesh side of a hide or skin, compared with the grain side.

UNHAIR (LIME) - with a waste by product of Hair or Wool

The object is to remove the hair and to open up the fibre structure. This is normally done by lime based, sulphide containing, liquors, in drums or paddles. The drums are slow moving at 2-4 rpm, with intermittent running and the hair structure is completely destroyed.
An alternative is to apply the chemicals on the surface painting; this is done on the flesh side, by hand or machine, without damage to the main hair or wool. The chemicals attack the hair roots, allowing the hair to be physically removed and obtaining a particularly smooth grain. A further advantage is a reduction in the pollution of the effluent. This has meant that hair-saving is also done in drums as a step in Clean Technology. Fats are made into soaps and there is strong swelling, or plumping, due to the high alkalinity (about pH 12-13). Temperature of 26℃ is ideal, but is not to be above 30℃. A thorough w ashing is needed when liming is completed, with the temperature 4℃ above the liming temperatu re. This allows better fleshing and smoother necks.
Liming for heavy leather to be vegetable tanned has an extra day in a weak lime solution. This will increase the opening-up of the structure to permit more filling of the larger vegetable tanning molecules.
Some sheepskins are not put into liquors for unhairing. They are kept in rooms to produce a controlled bacterial attack. This ‘sweating’ is used to improve the quality of the wool but does not improve the leather quality.
As this is the most polluting of all the tannery operations, a lot of efforts have been made to reduce the toxic effects. This includes hair-saving instead of hair destruction, reduced sulphide dosages, recycling and alternative chemicals. Enzyme unhairing is another option being developed to avoid sulphide but some alkaline treatment is still needed to open the fibre structure.

FLESH - WASTE OF FLESHING

The limed pelts are in a swollen state and the cutting action of the fleshing machine is more effective here than in the earlier green fleshing operation. Handling is difficult because of the slippery nature of the limed hides and skins. If limed pelt is exposed to the atmosphere for several hours, there is the risk of damage to the surface by the formation of lime-blast. This describes the formation of calcium carbonate films, when the carbon dioxide in the air reacts with the calcium hydroxide of the lime solution. In practice, it can be minimised.

TRIM - WASTE PIECES FOR GLUE

The cutting action of the fleshing machine blades on hides can cause strings of material which need to be trimmed to give a clear shape. Skins are cleaner.

SPLIT OPTION - SPLITS FOR FURTHER PROCESSING OR GELATINE/GLUESTOCK

The object is to obtain a more even thickness for processing and a more uniform final leather. Hides are much thicker than skins and need to be split either now, or later, in the tanned state. The grain (top) is levelled by an endless band-knife to a few millimetres; the bottom layer, known as the ‘split’, is of irregular shape and thickness. It is a skilled operation and needs experienced operators and a well maintained reliable machine. Although, splitting at this stage is more difficult, and less accurate, than splitting in the tanned state, the advantage is that the tanning chemicals penetrate easier and are absorbed more efficiently. Splits are processed separately and can become an important contributor to profitability. Several layers can be produced from an exceptionally thick hide, such as buffalo. However, the middle layers are weaker in structure than the outer layers.

TRIM - WASTE FOR GLUESTOCK

The object is to produce an economic shape for sale or processing further. The grain layer (top split) needs to have any ragged edge cut away to facilitate other machine work, whilst the lower flesh split has to be trimmed to such a regular shape that can have a uniform thickness. Trimming should be to retain, or improve, value. The quantity of trim should be controlled to see that it is not excessive, because it loses potential leather to sell and represents profit. Hides can be kept as whole hides until after tannage, but there can be an advantage if the hide is segmented for some specialised productions; the best quality butt can be processed for one product and the shoulder and/ or belly pieces for other products. In this way, more value is added to the one hide.

DELIME AND BATE

The object of deliming is to remove the strong alkalinity of the pelts by the use of weaker alkalis, and weak acids, so that swelling is reduced. Bates are enzymes and the object of bating is to produce a smooth clean grain and remove non-structured collagen and other proteins. It is done at specific conditions of temperature and pH and continues the deliming. The enzyme action improves the softness, grain elasticity and colour levelness of the leather. The work is normally done in a drum at a temperature of 28-30℃ and pH to come below 8.5. The drum speed is faster at 10-12 rpm. Maximum temperature is 35℃ for deliming.

OPTION OF DEGREASE (SHEEPSKINS)

The object is to remove excess grease from the skins to allow proper processing. The percentage content of natural fat depends on the type and origin of the raw hide or skin. Based on dry material, hides have 2-10%, goats 5-10%, hair sheep 8-15%, wool sheep 20-30% and pigs 30-40%. Processing does remove some of the lower levels and leathers need to have some fat for softness, which is also added later. Gloving and nappa skins can tolerate 5% but the excess in wool sheepskins (and pigskins) needs to be degreased. Surfactants to emulsify the fat have been used in combination with fat solvents, which produce satisfactory leathers but are environmentally damaging. Kerosene has been used with solvent recovery, but is also not acceptable in modern practice. Enzymes are being increasingly used for degreasing together with bio-degradable surfactants. Temperature is 35-38℃.

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