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Hides and skins: Physical change and effects within chemical processing

The forces applied to skins in wet chemical processing relate to the type of processing vessel and its internal configuration. These forces can be viewed as constant when processing at uniform loadings, float levels, speed of rotation and time. However, the way that these forces act will vary as the skin physically changes. For example:

- As skins rehydrate in soaking they soften, so the mechanical action is reduced.
- Alkaline swelling causes the hides to become less flexible, and the mechanical action increases.
- The inflexibility of a limed skin decreases in deliming, and the skins become more flaccid.
- As fully-penetrated tanning agents throughout a pickled skin begin to fix and create leather, the skin becomes more rigid.

Even if the forces applied remain constant, the mechanics involved alter in line with changes in skin characteristics and behaviour.

Changes in skin motion

In a drum process, soft flaccid skins tend to follow a flexible flowing movement, but firming causes a change to a bending/folding motion. As swelling takes place in the early stages of liming/unhairing, or firming as pickled hides penetrated with tanning agent begin to "leather", these changes cause a marked shift from the tumbling movement in the bottom of the drum to a lift and drop action. To a degree these changes can be taken into account by adjusting the float levels or drum speed.

In soaking, slow speeds are used to minimise mechanical action. If low floats are used in the early stages of a drum unhairing system, a well-soaked hide can remain flaccid, so relatively high speeds

can be used for chemical distribution and grain penetration. As the main alkali is added, and perhaps the float is raised as part of controlled swelling, then less mechanical action and slow speeds are essential to avoid an accentuation of growth and draw.

The effects of temperature variation

However, temperatures often vary once a process is established, normally rising due to friction. But in cold conditions the losses from a vessel increase, so the working temperatures may fall. In addition, there may be other variations in the early stages of the process, such as shortages of warm water, poor control, or temperature variations from use of ambient water, as is often found in hot climates.

Processing at lower temperatures

Lower temperatures will affect the speed of the chemical reaction, and on first consideration can be easily managed by slight process modifications. But the physical changes within the skin in terms of softness/firmness and elasticity/plasticity have other implications. This is because the continuous stretching and relaxation of the skin within the processing vessel is so important for both the release of non-structured proteins from the skin, and the rate of penetration of chemicals.

As the skins become firmer the mechanical action will become more severe, but the reduced ability to flex means that the release of unwanted skin components and the penetration of chemicals is slowed down. These effects are quite marked, for example:

- Limed hides are less extended, and this is reflected in a greater retention of growth and draw. Moreover, the appearance is less clean as more pigmentation, hair root, grease and degraded protein remains trapped within the less pliant grain layer.

- The deliming changes. At the point of complete deliming, as measured by checking the pH of the section, a greater quantity of non-structured protein still remains deep within the structure. The grain layer also appears dirtier as debris normally squeezed from the grain remains entrapped.
- The reduced flexing results in a slower rate of chemical penetration, so in tannage more tanning agent is left in the float. The distribution throughout the section thus changes, so there is less tanning agent fixed in the centre, but more fixation on the grain and flesh.
- Firmer skins are not extended to the same degree during a pre-tanning stage or within the tanning process. The structure becomes set by the tanning action in a less relaxed configuration. In contrast, tanning under warmer conditions encourages a more extended structure, so there is less growth, draw and a smoother grain. There can also be a significant improvement in area.

Accumulative effects

Over and above structural changes, the degree of swelling and temperature-related effects influence the way that mechanical forces act upon the skin in chemical processing. This affects the outcome of actions including the relaxation of the grain, the release of unwanted skin components, and the penetration and distribution of chemicals. And these effects, once established, are mainly outside simple process modification.

These changes influence all subsequent processes, and the outcome of many small shifts can be seen as synergistic. Although not bound by seasonal change, the outcome is typically one of summer-winter variations. This may be profound in terms of grain and tactile characteristics, and physical properties including hardness, break, distension at grain crack, tensile strength, and area. 🌐