



High exhaustion and masking technologies are now available to help tanners minimise waste in chrome tanning processes.

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Sustainable tanning: waste minimisation in the tannery

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Over the last few years the chemical industry has introduced many new technical solutions to the leather industry. Most offer environmental advantage or reduced risk of harm, and these advances are set to continue.

In particular, novel enzymatic beamhouse systems and new wet white technologies are two major wet-end process steps where developments have been focused. Advances in these areas will lead to more sustainable leather articles and process conditions with a lower environmental impact.

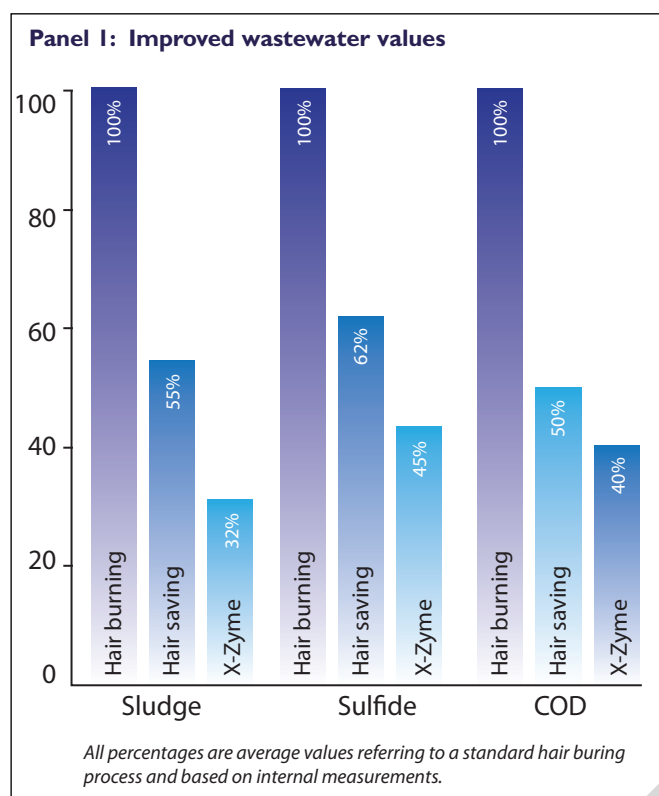
Introduction

The leather manufacturing process has already achieved a state of the art technology level. It can be considered well on its way towards being “sustainable”, although there is still room for improvement. There are three areas that need special attention for improvement:

- Waste reduction and re-use is always an issue. The leather making process generates a high amount of by-products such as fleshings, trimmings and splits compared to the final target product, leather. This is because of the nature of the raw material which is relatively high in unwanted materials from meat processing.
- Significant quantities of sludge and effluent loadings are produced by the leather making process and some of these components are difficult to remove in a treatment plant. A more efficient leather making process will produce less waste, thus less chemical usage for treatment. In turn this will reduce both COD (chemical oxygen demand) and sludge.
- Salinity is an issue in many locations of the world, so products and process with reduced salt will lead to a lower concentration in the effluent. A lower salt content opens up more possibilities for recycling of floats as well as an increase in the efficiency of the wastewater treatment plant.



A higher pH in the chrome tanning process enables a reduction in both time and temperature throughout.



In the last few years several novel solutions have been introduced to the leather industry within the main wet end processing. All of these can be considered as improvements when compared to the bench mark of state of the art technology.

Waste reduction in beamhouse

The beam house is known to be the foundation of the leather making process as it prepares the hide for tanning and retanning processes. If these processes are not performed correctly then value will be lost, but when carried out correctly there are potential gains in leather quality and yield. At the same time, these processes have the largest impact in the environmental profile of the leather making process. A significant amount of sludge is generated.

Chemicals that carry the potential for loss of value or their environmental impact if used incorrectly—such as sodium sulfide—are still core requirements in almost all applications. Thus, the task for new technical advance has to consider the improvement of the environmental balance of the process, but without degrading the technical properties and value of the pelt.

A new and efficient technical solution which should fulfil both requirements is the new enzymatic soaking and unhairing process with Peltec X-Zyme S and U.

Both of these enzymes are industrial engineered products. They are specific enzymes as opposed to mixtures such as found in natural products, and were meticulously selected. They are produced by microbial fermentation, and the highest level of purity, quality and consistency are ensured. Moreover, both of these enzymes work under conditions of pH and temperature that are best suited to the requirements of hides.

Using this technology, the environmental balance for the reduction of chemical usage looks promising. The X-Zyme process requires a significantly lower offer of chemicals, such as surfactants, organic sulfur compounds and amines. These chemicals increase the load on the effluent treatment plant, and by taking this approach the COD value is reduced, and the

sulfide content is minimised.

In a hair saving process, where the hair is removed by screening, less time is required and the amount of sludge and the level of sulfide in the wastewater is considerably reduced. These environmental opportunities are expressed in *Panel 1*.

Due to the cleaving of glucose amino glycans (GAGs) by X-Zyme S, hyaluronic acid is easily washed out and the soaking process time can be shortened significantly, which saves both time and energy. It is noted that hyaluronic acid causes adhesions within the fibre structure, and its enzymatic removal results in a more flexible and improved collagen structure.

Reducing salinity in preparation for tanning

Salinity is a major issue in many locations of the world. Reduction or even avoidance of an acid/salt pickle would result in a significant reduction of salt in the effluent. In addition, by avoiding the sharp drop in pH as found within the normal acid/salt pickle, the pelt is not subjected to hydrolysis at this stage.

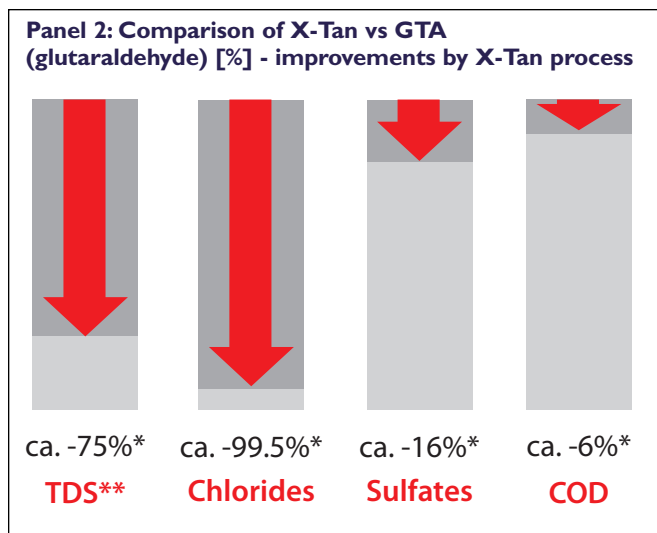
The pH-value within new wet white tanning technologies—such as X-Tan—is relatively high, offering an almost stable pH profile through deliming up to the tanned state. This means that the hides are kept in a relaxed condition during the process.

The maintenance of pH in the X-Tan process also means waste generation is significantly reduced. These conditions lead to an increase in technical performance in terms of tear strength as the integrity of the collagen is protected and maintained, rather than being degraded by acid hydrolysis.

For wet white leathers, X-Tan technology shows an overall mass balance which is attractive from an environmental point of view when compared to conventional systems. More than 75% of the TDS (total dissolved solids) can be eliminated, due to a chloride reduction of 99.5%, a sulfate reduction of 16%, and a COD reduction of approximately 6% as indicated in *Panel 2*.

Improved chrome uptake in tanning

For chrome tanning, high exhaustion and masking technologies allow a process to operate to much higher end-pH. This increases the efficiency of process, and so less chrome sludge is generated than with conventional chrome tanning systems. By using this masking technology, almost all of the chrome tanning material offered to the process is used. This not only minimises the chrome offer in the tanning process (or retanning) processes, but it also causes a reduction in the salts in the effluent.





Panel 3:

A customised portfolio for all chrome tanning processes		Steering mechanisms				
		Final pH value	Final temperature	Cr ₂ O ₃ offer	Process time	Float length
High Exhaustion CHROME TANNING	CHROMOSAL B or BF + BLANCOROL HR or MR	4.0 - 4.2	40 - 45°C	1.4 - 1.1%	12 - 14h	50 - 30%
Standard CHROME TANNING	CHROMOSAL B or BF + BLANCOROL HR or MR BAYCHROM A or F	3.7 - 4.0	35 - 40°C	1.7 - 1.4%	10 - 12h	80 - 50%
Classic CHROME TANNING	CHROMOSAL B + Sodium (bi-)carbonate	3.5 - 3.7	30 - 35°C	2.0 - 1.7%	8 - 10h	100 - 80%

Another advantage is found where chrome regeneration is practised. In this situation, the amount of chrome for precipitation will be less, and so less material will be consumed for both precipitation and regeneration of fresh chrome tanning agents.

Hybrid tanning systems

Hybrid processes are also possible. By combining X-Tan with a chrome-tannage the pickle step can be avoided completely and a fast re-chroming of the stabilised collagen at high pH-values

can be achieved. Both technical and environmental advantages can be gained.

This approach of using a higher pH in the preparation stage for chrome tannage, and within the chrome tanning process, enables a reduction in both time and temperature throughout the process. This offers more gains within the environmental balance sheet. The specific process parameters need to be considered case by case, but the broad issues are set down in Panel 3. ●

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