



Technology



Polypropylene drums: providing new opportunities within leather-making

Italprogetti Engineering, Italy

After revolutionising the drum concept by introducing polypropylene as a construction material in place of wood, new interesting projects destined to make radical changes to the future of tanning are under investigation.

Polypropylene is a semi-crystalline thermoplastic with high bonding strength. It is tough, stable, elastic, hard and highly impact-resistant. Due to its structure polypropylene has an exceptionally high molecular mass. This makes it highly resistant to chemicals and other media. Polypropylene is resistant to aqueous solutions of salts, acids and alkalis.

The high quality product used for drum construction has the following properties:

- Extremely smooth surface
- High impact strength
- High level of hardness, stiffness and tensile strength
- Resistance to stress-cracking
- Abrasion resistance
- Good toughness at temperatures of -5°C to 95°C
- Excellent electrical/thermal insulation properties
- Very good chemical resistance
- No water absorption

In addition to being perfectly recyclable, polypropylene is also extremely long lasting. At 20°C there is no significant deterioration even after 50 years use.

As well as the direct benefits on the skins by using a high specification material, drums made from this material allow other technological innovations. This provides enormous advantages to both the leather making process and the environment.

Two of innovative processes that the Italprogetti technical staff helped to develop, both directly and by developing machinery suitable for use in the tanning industry, are described.

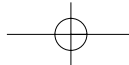
1. The oxidation process for unhairing

At present Italprogetti Engineering is working alongside the University of Pisa and the company Solvay⁽¹⁾ to produce an oxidative unhairing process. This is already being used by some clients for small product lots.

Compared to skins unhaird/limed in the traditional manner, the quality of the skins from oxidative unhairing/liming is much better, as they are easier to dye and have a finer and clearer grain. This is because there are no leftover fragments of hair or hair bulb, and an absence of stains from liming.

The oxidative depilation stage is compatible with the





The extremely smooth drum interior due to polypropylene construction.

traditional tanning process in terms of time taken and methods used. Although the unhairing stage in the conventional lime/sulfide process is complete within a few hours, the total time for unhairing and liming is much longer. When hydrogen peroxide is used, more time is needed for dehairing (10-15h), but the liming phase is carried out as the skins are being depilated. This means that the time required for liming is more than sufficient for the hydrogen peroxide to depilate the skins fully.

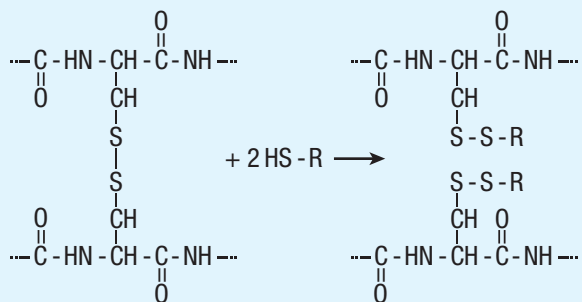
The oxidative process also notably improves the quality of the working environment and safety inside the tannery. Some of the highly dangerous side-effects of operations—such as the evolution of toxic hydrogen sulfide gas in deliming and pickling—are eliminated.

ADVANTAGE IN THE TREATMENT OF EFFLUENTS

Oxidative unhairing provides definite advantages in the treatment of both effluent and solids. In conventional unhairing, a reducing agent such as sulfide breaks the disulfide bridge of cystine as indicated in *Panel 1*.

Panel 1:

Unhairing: breaking the disulfide bridge



In the oxidative unhairing process, the hydrogen peroxide breaks the cystine bridge –S-S- of keratin forming sulphonic-keratin acid. By lowering the pH of the unhairing/lime waste to acid conditions, it is possible to precipitate a large part of this soluble protein. As a result, it is possible to simply and quickly lower the BOD of the lime waste, which alone makes up more than 60-65% of the contamination contained in all the tanning waste.

This leads to immediate advantages, not only in terms of direct environmental improvements and reduced purification costs, but also for the development of recycling systems. Recycling of the

wastewater provides an opportunity of less water consumption, and the precipitate is available for other applications such as fertilisers and animal feed.

The total costs of the chemicals used in process are practically the same as conventional costs for the chemical products. Moreover, even if the precipitation phase as described is not taken into account, the COD of the oxidative lime waste is around 80-90% of the COD of traditional lime.

2. Zirconium Tannage

Polypropylene drums provide opportunities for the development of technologies which may be difficult to use in conventional equipment. An example is zirconium tannage, according to technician Massimiliano Rosi who has been researching the subject.

Tanning with zirconium salts can be considered an aggressive process as it works at very low pH levels (approximately pH 1.0). As a result, the steel, which the drums or their small parts are generally composed of, tends to oxidise and to corrode. This means that the stained parts of the drum are wearing quickly, being a difficult process, and that the skins may become damaged. However, even the smallest parts are covered in the polypropylene drum, so that it is perfectly suited to this tanning method.

The process was patented in 1931, but has been slow to develop. It has been given a boost through the development of retanning processes, which can make the leathers more soft, full, reactive, and plump. It has been used on the main types of skin including baby calf, calf, buffalo, goat and lamb. Items produced using zirconium salt for tanning without doubt stand out thanks to the possibility to make white leathers that are very light-fast, as well as very light, clear and bright colours when dyed. These are important features in present and, no doubt, future fashion.



Innovative equipment—new opportunities

The use of polypropylene in processing drums offers exciting opportunities for tanners in terms of new process opportunities. The goals of Italprogetti Engineering are to improve the quality of the finished product and to limit environmental pollution during leather production, and two examples have been detailed.

With the oxidative unhairing process, the polypropylene drum with attendant hi-tech features, can provide enormous benefits for the environment. Working conditions can be greatly improved and the living conditions of the population in the surrounding area. If well managed, this innovative process could slow down or even stop the migration of tanneries from the so-called industrialised countries to the developing sector.

Legend

- 1. Solway are producers of hydrogen peroxide.

