

Dry pre-tanned intermediaries: a step towards sustainable leather manufacturing

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New legislation in Europe states that by the middle of 2005 chrome shavings and other organic wastes can no longer be dumped in landfill sites. Already faced with numerous chemical restrictions for about two decades,^{2,3} the avoidance of many substances and the need for advancing testing requirements have become an important facet in the production of quality leathers⁴. More important than the obligations imposed from the steadily growing list of “harmful substances” and the tightening limits affecting all forms of waste, is the impact of these issues on an increasingly globalised leather market.

Any restriction and change in established production standards is a burden for the industry. This has to be shouldered by present business, but scope for the future has to be seen from a different perspective. With regard to long-term opportunities, the demand for more environmentally friendly and sustainable processes can be seen as a chance for growth rather than a threat.

Sustainable manufacture

The concept of “sustainability” has become one of the major topics in both industry and politics, and probably represents one of the mega-trends of the early 21st Century. This idea is at the heart of a “strategy for sustainable development” which the European Commission and the EU Member States worked out with corporate enterprises in 2002. The major motivations for the chemical industry is to follow a codified set of standards as long-term opportunities as part of Responsible Care being:

- Industrial leadership by setting new standards for best practice
- Long term economic growth, productivity increase and sound financial returns
- Long lasting social well-being in local and global communities

Global consequences of local regulations

It is most important to recognise that with the accelerating pace of globalisation new environmental legislation in one part of the world will have a significant global effect. Globalisation can thus be seen as a catalyst and a dominating driving force for the spread and empowerment of new environmental standards⁵. This is because global players cannot work economically with standards that vary from country to country or region to region.

There are numerous examples where some regulatory activity in one region or country triggers dramatic consequences throughout the world². California Proposition 65 and its consequence, resulting in the complete ban of NMP-based finish systems, is an excellent example. And the situation concerning the ban of alkylphenolethoxylates (APE) in Europe will probably develop similarly. alkylphenolethoxylates and especially nonylphenolethoxylates (NPE) are widely used as powerful degreasing agents and emulsifiers¹. Environmental concerns result from a toxic effect on aquatic life forms⁷. Fortunately for the leather sector a statement has been made in a European Commission directive⁸ that, despite the environmental impact, the use of these compounds for sheepskin degreasing will not be restricted as long as there is no alternative found with comparable performance.

However, one of the most complex discussions of present times arises over the use of chromium. Although an abundant element with no threats so far reported concerning Cr(III) compounds, it is obvious that the chromium-tanning industry in Europe will face severe challenges due to the changing landfill directive of the EC.

Therefore, latest process developments are focusing on the problem of chrome in waste leathers and shavings with chrome-free intermediates central to technique. Consequently, the resulting chrome-free waste as intermediate leather trimmings, unusable splits and shavings can safely be burned. Alternatively, there is the possibility of recycling or use for the production of bio-gas or possibly fertilisers, and it is seen that free-of-chrome (FOC) leathers will be a significantly growing market. Furthermore, another option is to generate chrome-type leathers later in the retannage.

FOC technology: challenges and limitations

Probably the most powerful argument against wet white is the susceptibility of the intermediate to biological degradation. Hot-climate transport and storage is practically impossible. Also the transport of huge quantities of conventional semi-processed leathers is well established, and will increase due to greater globalisation.

Nevertheless there is a threat to the wet blue process due to rising costs of waste management, so the cost benefit of the chrome technology will therefore gradually be lost.

Thermal decomposition of waste leathers will then be the most important waste disposal method, but this presents a very big problem if chromium is present. Inevitably this situation will ►

**Panel I****Ecological Challenges in Leather Manufacturing**

The tannage of leather still holds room for improved product and process developments⁶. One ton of raw hides renders 250-300 kg leather, but also 600 kg solid waste and 40 m³ water as effluent. Most of the waste results from wet processing and includes:

Beamhouse: Lime, sulfide, surfactants, waste waters, solid waste, + salt if wet salted hides are processed.

Tannage: salt from pickle, unused chrome, effluent.

Dyeing, retanning and softening/fatliquoring: unfixed phenol and naphthaline retannages, other unbound products, effluent.

Finishing: VOCs, surfactants, waste finish from washings etc.

These wastes already contribute about 5% of the total production costs. In the future the charges for waste will rise, making sustainable processing more attractive. The use of lime and the dominating wet-blue technology are responsible for most of the sludge and chrome-containing solid waste.

Another problem arises from the salinity of effluents, resulting from the soaking, deliming and pickling processes. Many retanning agents, dyes and auxiliaries also contain significant amounts of inorganic salts. Salt has been used freely in both leather making and the production of leather chemicals, but in the very near future, legislation and self-restriction by the industry will significantly modify this role.

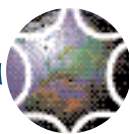
These are the milestones for a more sustainable tannery process:

- A general reduction of water use.
- Unhairing and opening-up without lime and sodium sulfide.
- Improved beamhouse-processes via the use of specific enzymes and APE-free detergents.
- Salt free deliming and pickling processes.
- Development of Free-of-Chrome technology—the use of chrome restricted to retannage
- Increased use of polymer-based fillers and softeners to improve float exhaustions and lower COD.

exert evolutionary pressures on the development of improved FOC technologies—especially regarding pretanning efficiency, filling and handling properties.

The first step is to address the problem of biological degradation, and this could be overcome by developing a dry intermediate. A major requirement would be that this product could be wet back without any loss of quality in the final leather. This is significantly different to wet blue stock where the chrome species changes in size and composition if dried, leading to a deterioration of quality.

Another important factor is to retain a good fibre separation. This is important to enable a good shaving standard, but especially within the drying process of the intermediate to enable easy and complete rewetting of the structure for subsequent processing. The successful development of this



Panel 2

Chrome tanned leathers, car recycling, and the landfill-directive in Europe

- The directive for car recycling in Europe initiated a process, where by the end of 2015 at least 95% of a vehicles total weight must be recovered⁹. Today we have a recycling ratio of 65%, mostly due to the metal fraction. However, in 2005 75% of the vehicle will have to be recycled,
- Simultaneously, changing landfill-directive requires¹⁰, that the organic fraction of materials for landfill is limited to 5%.

These events triggers significant changes for the leather industry:

- Parts of the car interior will be recycled in order to fulfill this requirement, but much of the waste leather from both car recycling and leather manufacture can only be burned.
- This is possible, but very expensive because of the special treatment for ashes containing Chrome (VI).
- The new European landfill directive also represents the end of the deposition of organic sludge as well as waste leathers.

intermediate will provide significant advantages. Technically the substrate can be uniform for the development of both chrome and FOC leathers, and with flexibility to meet the latest ecological standards.

Storage of this product can be long term without need for additional biocide, and there are huge advantages in areas of transport and storage. These are important objectives to meet the demands of both sustainability and good international trade. 🌐

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