

The future for leather supply

Leather remains the upper material of choice for the vast majority of shoes produced in the world today. But, with all the pressures resulting from concerns over climate change, long term availability, tanning methods and environmental concerns, just how sustainable is the supply chain of the footwear industry's favourite material and what might affect it in the future?

Climate change is one of the most critical issues we face today. It would appear to be accelerating to possibly dangerous levels, yet our response is divided to say the least. On one extreme it is claimed we have delayed too long and all fossil-based fuels should be replaced by renewable sources of energy as quickly as possible. The other says it is simply not practical in the short term and therein lies the problem; creating a realistically achievable long term solution that will not bankrupt the global economy in the meantime.

The World Meteorological Office says greenhouse gases increased the overall

warming effect by 30% between 1990 and 2011, with CO₂ accounting for around four-fifths. Some sources suggest we could be heading for a 4-6°C increase in global temperature by the end of the century, marked by extremes in weather resulting in declining food stocks and loss of ecosystems and biodiversity. Needless to say, this would have a devastating impact on raw materials for the leather industry. This, however, is still a long way off and there are other things of more immediate concern.

ADVERSE FACTORS

Energy prices are increasing rapidly in countries where governments are pursuing renewable sources that are proving to be more expensive and, in some instances, less efficient than the fossil fuels they replace. Elsewhere, coal-fired power plants are still being planned simply because open cast coal remains a far cheaper option. Shale gas has had a major impact on energy prices in the US but may not produce quite the

same effect when found elsewhere.

Besides the cost of energy, chemicals, salt, water and waste will all be increasingly critical factors for tanners. The Leather Working Group (LWG) has achieved considerable improvements in tannery environmental performance through its Audit Protocol. Protocol 6 due to be in force this year, will be particularly tough in regard to salt and energy usage. Where it may have been less successful is in developing a single scientifically-based restricted substances list or answers to these difficult issues that the industry could follow.

Some major users of leather are hoping to achieve a zero discharge of hazardous chemicals for all products in their supply chains by 2020. This is possibly a reaction to the Greenpeace campaign in Argentina for tanneries to adopt production methods that will eliminate all chromium in effluents and waste. This is neither practical nor necessary and is based more on pre-conceived notions than scientific fact. Indeed, this attitude unfortunately



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affects many environmental campaigns from GM crops through to shale gas. Decisions with the potential to affect the future of the planet should be based on more than un-proven theories.

CARBON FOOTPRINTS

Carbon footprints (CFs) and life cycle analyses (LCAs) are being introduced for leather and footwear but they can be both misleading and misused. For example, sports brand Puma has sought to promote a new line of cotton/canvas shoe by claiming it produced less carbon emissions than the suede shoe it replaced. Our sister publication *World Leather* (August/September and December 2012) found a number of significant flaws in Puma's analysis which invalidated the results.

The company had also failed to take into account the difference in durability between suede leather and cotton/canvas when durability should in fact form an essential part of any footwear LCA. Leather shoes are also comfortable and can frequently be worn for many years. Economic constraints are beginning to make us less of a throw away consumer society and one where comfort and durability becomes more important than fashion; factors that favour leather.

A technical study by UNIDO in 2012 opened the way for the development of practical guidelines in obtaining reliable leather product carbon footprint (PCF) data. It proposed a convergence and harmonisation of the most important elements related to finished leather LCA and PCF studies, making it necessary to determine the system boundaries involved.

As hides and skins are by-products of the meat industry, LCAs and PCFs must therefore begin in the slaughterhouse and end when the finished leather leaves the tannery. Transportation forms part of the process and must be included in any PCF, so there would be major energy savings and CF advantages in tanning hides near their source.

MEAT PRODUCTION

As with climate change and sustainability, there is a dispute as to whether we will eat more or less meat in the future. While some people in western countries may indeed begin to eat less for perceived health benefits, those in the developing world will eat



Figure 1 – The 10 acre area immediately after planting with various tree species.



Figure 2 – Four years later and the growth rate of the trees has been impressive.



Figure 3 – In addition to the trees and hedges there are also flourishing flower gardens.

more and more. For animals to produce meat they must be fed and those fed on grass have the lowest carbon footprint. Modest levels of grazing also cause less ecological damage than growing crops and have been shown to be a more

sensible use of land where soil quality is too poor for crops than simply abandoning it.

Properly managed grazing promotes land restoration through intensive grazing of seasonal rainfall grasslands



In Australia, crops have been irrigated with tannery effluent for many years.

with a high stock density for short periods followed by a long rest. The physical impact of cattle trampling, dunging and urinating on the land for a few days is interspersed with resting for several months to allow plant and soil-life to recover. Healthy plant growth is encouraged, the water table raised, carbon content increased and up to four times the number of cattle can be kept. There is plenty of scope for this to take place across the world.

TANNAGES

Misconceptions concerning the properties of chrome III (Cr III) and chrome IV (Cr VI) continue despite all the evidence to the contrary. Put quite simply, chrome tanning is not harmful if carried out properly or it would not have been used to produce shoe upper leather for the past 100 years. Unfortunately, the proposed ECHA (European Chemicals Agency) 2012 restrictions on leather containing Cr VI take a different view, with suggestions of a restriction on leather articles containing over 3mg/kg of Cr VI which come into contact with the skin.

The proposal is seriously flawed and an opposing document, Consequences of Banning Chromium VI in Leather Articles 5, was submitted to the ECHA later that year. It concluded that the proposed restriction on Cr VI should not be introduced and that better management of chrome allergies to leather items should be investigated

instead. It has also been said that obtaining accurate data at 3mg/kg levels or below is extremely difficult.

In addition, while it was already known that in some cases both Cr III and Cr VI were capable of causing dermatitis at low concentrations, it had not been demonstrated that the proposed restriction would in any way reduce chromium sensitivity to leather items. An important study had in fact found that 30% of chrome-allergic patients tested, reacted to leathers which actually contained less than 3mg Cr VI/kg.

The truth is that as things stand, there is no viable substitute for the use of chrome in shoe leather. In spite of this, the ECHA Committee for Socio-economic Analysis (SEAC) has decided the proposed restriction would be the most appropriate EU-wide measure to address risks of chrome VI in leather articles. It could come into force during the first part of 2015 and should be vigorously contested by IULTCS, REACH and COTANCE.

Any chrome tanned product, whether produced in Europe or elsewhere, could generate Cr VI during storage and wear, even after antioxidant treatment. Leather and shoes imported into Europe will need to contain < 3mg Cr VI/kg, even after manufacture, storage and display. Ageing tests are available but do not simulate real ageing of leather over months rather than days. This ill advised proposal by the ECHA

constitutes a serious threat to all sections of the leather industry and its supply chain.

Vegetable/synton, aldehyde and other white tannages are being widely promoted but cannot realistically replace much chrome leather. Nor is there any sound environmental need for them to do so. Indeed, many of the syntans used originate in fossil fuels and more chemical is required than in chrome tanning. While some of the new tannages claim to need no pickle salt, total effluent salt remains a critical issue.

Some also include aluminium which can be toxic to fish and plants. In countries such as Australia where the aluminium content in irrigation water is required to be < 5mg/L its use could also present even more problems as chrome liquors are recycled and excess chrome precipitated for reuse. Tannery effluent can therefore be irrigated with little treatment while aluminium waste would need to be fully recyclable.

SALT AND THE ENVIRONMENT

For many tanneries, salinity (total dissolved solids or TDS) and the build up of salt in soil and water is in fact a greater environmental problem than chromium. It also occurs at locations where hides and skins are salted. In Africa for example, the salting of hides to preserve them in transit is leading to land degradation.

Excess salinity in water causes high

osmotic pressure which reduces the amount of water available to plants and retards the growth of crops which are not salt tolerant. In addition, high concentrations of sodium ions in water can adversely affect soil structure by causing dispersion of clay. On the other hand, the presence of calcium and magnesium ions in tannery effluent helps to stabilise the soil. It is generally accepted however, that the use of salt must be reduced or eliminated wherever possible.

Preservation salt forms 60-70% of the total salt content of tannery wastewater. Ocean discharge is an environmentally sustainable disposal method for such tannery effluent but is often not an option. Furthermore, with water shortages and droughts, some authorities are replacing ocean discharge with reuse and land irrigation, so salinity becomes a major concern. To give some idea of the size of the problem, about 56.8 million bovine hides were salted in China and about 43.2 million in India during 2007, resulting in over 400,000 tonnes of residual salt entering the environment. In addition to this, there is the enormous amount of salt generated from local and imported hides and skins.

By comparison, Brazil produced about 37.6 million bovine hides and USA 34.4 million with both processing large proportions of green rather than salted hides. By processing fresh/green, unsalted hides and skins, the cost of salting is eliminated and effluent salinity is greatly reduced. Even so, tanneries processing green hides must seek to minimise other salt inputs to allow safe irrigation of effluent. Eliminating this salinity is a major problem which remains on-going.

SOLUTIONS

Salinity has long been a major problem for tanneries in the Indian state of Tamil Nadu. To meet TDS discharge limits, tannery effluents must now undergo costly and energy-demanding treatments including reverse osmosis (RO) and multi effect evaporation to achieve zero liquid discharge (ZLD). The system does generate clean water but the massive energy use (65% for evaporation) plus the enormous quantities of unwanted mixed salts being generated and recovered as dry solids suggests that it might not be

sustainable in the long term.

For example, the common effluent treatment plant (CETP) at Ranipet includes a disposal unit with capacity to store salt generated for two years (*World Footwear May/June 2013*). It is hoped that a use for the mixed salt can be found but, so far, this has not been achieved. For years, solar evaporated, tannery mixed salt has been collected in India and it usually ends up back in the environment during the monsoon rains. Could these dry salts perhaps be recycled back to the abattoir?

On the plus side, a project by VIT University, Vellore in Tamil Nadu, has shown that after conventional treatment, tannery effluent can be successfully used for the irrigation of a variety of tree species. Extensive pilot studies showed no residual environmental damage in terms of soil quality or ground water and the trees actually grew faster than would be expected under normal conditions. Following this, approximately 10 acres of degraded land adjacent to the Ranipet CEPT was turned into a mini forest using treated water from the plant. The results (*Figures 1, 2 & 3*) clearly show how effluent discharge can be effectively minimised and wastewater converted into a valuable resource.

China is making a number of changes aimed at reducing pollution from tanneries. These include reducing the effluent producing beamhouse stage and relocating coastal tanneries inland. The latter would however be likely to create salinity problems due to the discharge of salt effluent into inland rather than coastal waters unless beamhouse operations were indeed totally eliminated.

New discharge standards of water pollutants for tanneries have also been proposed with a limit for chloride of 3000 mg/L for surface discharge and 4000 mg/L for sewer discharge. Chloride would not be restricted if the treated water was discharged directly into the sea directly. Unfortunately, it would be difficult for tanneries using salted hides to meet these limits. Their only options would be a change to green processing and the importation of wet blue.

GREEN PROCESSING

Australia offers a good example of what this involves. Australian wet blue

tanneries process green, full-thickness hides. Chilling or chemical short term preservation, usually using low levels of sodium chlorite, is also used to facilitate green processing. Well fleshed and trimmed green hides are loaded into a large recycling drum in which all processes from unhairing to tanning are carried out. Water consumption is very low at less than 10 kL per tonne of hides processed. These tanneries use cleaner, low salt, low sodium tannery processes which enable all wastewater to be used in irrigation. In addition, high quality tallow and gelatine are produced from fleshings and trimmings.

These tanneries are able to sustainably use the effluent for irrigation even though the TDS can be over 10,000 mg/L because water usage is so very low. On the other hand, it is said that chloride content can be as low as 200 ppm and sodium 1,200 ppm. Many components of tannery effluent are also to be found in fertilisers including ammonium sulphate, lime, gypsum (calcium sulphate), magnesium, manganese and slow-release high organic nitrogen products (hair). Calcium and magnesium ions in tannery effluent also reduce the adverse effect of sodium ions on soil structure. Irrigation using effluent from these tanneries is therefore highly beneficial environmentally provided application rates are carefully monitored.

It is therefore not all bad news and provided threats such as the one posed by the ECHA can be overcome and common sense is allowed to prevail in future, there should be no shortage of leather for the footwear industry going forward. Some things will change however but they are by and large all for the best.

Meat from grass-fed cattle can become a major source of food and a sustainable supply of hides and skins. Tanners become more sustainable using LWG audits to assist them. Increased green hide processing reduces water, chemical and energy use, while its effluent is used to irrigate land to grow crops. It will also take place closer to the source of the hides. Countries with salt problems import wet blue rather than salted hides. 🌱

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