Salt must go!

Writes ILM Consultant Technical Editor, Karl Flowers.

The consequences of using salt in the tanning process have been covered in detail before (Flowers, 2016). They can be summarised as follows:

- Approximately 10kg of unused salt are added to each hide; close to 350kg waste salt per tonne raw material.
- The salt is not absorbed by the material and needs to be shaken off the material prior to soaking.
- This contaminated dirty salt cannot be used again. It is water saturated and will have bacteria that will contaminate the next use; the salt will generally be placed into landfill.
- The salt that is then inside the hide/skin (about 14% by weight) must be washed out.
- Salt is inevitably an adulterant that is used to lower the cost of chemicals; cheap chemicals have high salt contents.
- Salt has to be added to pickles to protect the pelt from acid swelling.
- It will increase the total dissolved solids (TDS) to close to 8000mg/L.
- Generally, wastewater that is over 500mg/L TDS is considered salt contaminated.

Fundamentally, tanners need to ask themselves how they can avoid salt curing, the use of salt in the pickle and how they can reduce the amount of salt in cheap chemicals that are used.

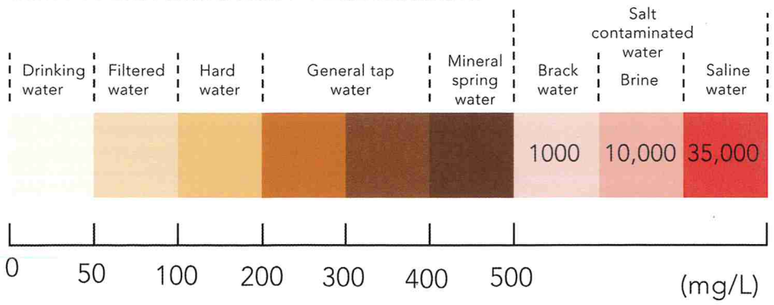

Table 1. A useful scale to help gauge the concentration of total dissolved solids from various waters.

Intractability of salt in the effluent

Sodium chloride is very difficult to remove from water; it can only be successfully removed from water using reverse osmosis, electro dialysis, distillation techniques or ion exchange. Reverse osmosis is generally the most economical, considering energy and money requirements, but as an effluent treatment option is prohibitively more expensive than general tannery effluent treatment.

Of course, avoidance of the pollutant in the first place is always a possibility. Avoidance is practiced in several ways:

1. Salt-shakers remove up to 10% more salt out of the hide/skin before soaking (the 160kg per tonne could be lowered to 144kg per tonne).
2. The use of low or no salt preservation would lower this even further.
3. Using old soak liquors in the pickle process.
4. Cutting down on TDS during deliming, neutralising, dyeing, and retanning.

Salt-free preservation

The global leather industry is looking progressively to agricultural value-add; for instance, the country in question is trying to add as much economic value to their natural resources as they can. Many countries have protected their markets, or even banned the sale of raw hides and skins. The need for salt as a preservative is passing. The national tanners for countries that have quite a large amount of raw material could simply process the material to a semi-processed stage and could then move that material to other countries with the added economic bonus.

The ideal situation in countries that are doing value-add would thus be to position their tanneries next door to their abattoirs. In this manner, the just-in-time principle could be fully enacted. The animals are flayed and the material is moved into cold areas where they can be immediately processed into a more stable form than the raw state. If logistically insufficient material is present, the material can be held for a short one to three days in cold storage. Bactericides could be added to improve the resilience of the material in cold storage.

A good question is, in the periods where animal kill is increased, like during national holidays (where meat eating is up), how does a tanner take advantage of increased low-cost material? One only must look at tanners around the world where pulses of raw material is often seen. With hunting dependent material, licensed culling-type meat operations (such as kangaroo), they rapidly process everything to pickle and then store them for long periods of time until they can be processed further. These tanneries have massive overcapacity in the beamhouse to be able to cope with huge incoming materials.

The alternatives to salt are:

- Chilling and refrigeration; material can be stored for up to five days without any other additives.
- Biocides; the addition of liquid biocides, either by spray application (very short term, one to two days), or drum application (one to five days). A small inclusion of salt can extend this to two weeks.
- Sodium m-bisulfite; the Australian CSIRO (before its closure) found this powdered application to be helpful with short term preservation.
- LIRICURE; the South African leather industries research institute (LIRI) formulated sawdust with a small quantity of salt, EDTA, and a few other salts to allow storage for a few weeks.
- Re-use of curing salt; there is no current economic need to re-use the salt mountains that tanneries have, but there may be a sustainability reason; tanneries may want to use renewable energy to decontaminate the salt through organic material ashing, that will leave a uncontaminated, dry salt.
- Drying; for informal animal kill arrangements (like seen in many developing countries), the hides and skins (are sporadic) and are only collected by hide and skin traders who travel around collecting dry, or dry-salted material. To replace the salt on these is more complicated as the added lack of financial incentive to cure properly is also missing. The tanning industry may need to do more research into how dry material can be rehydrated more effectively, or the general quality of dry material faults could be better diagnosed.
- Sugar; the osmoticant effect of salt is well known. Insufficient attention has been given to the use of sugar. Tanners know that mould growth is more likely when sugar is used but could a bactericide/sugar combination be effectively used.
- Phages; significant progress has been made in the control of acne on human skin, using bacteriophages that naturally keep bacteria in check. Could non-specific cocktails of bacteriophages be used successfully to control bacteria in hides and skins?

Salt and pickling

Modern tannages do not need a pickle. The chromium-free, or chase pickle addition of acidic tanning agents, seem to allow the chromium, or chromium-free tanning agents, regulate the pelt pH and get their own penetration independent of a pickle. The new generation chromium-free agents lower the pH from delime/bate pH down to around 4, hence, no salt is needed to prevent acid swelling. Chase pickles will also lower the pH slowly and can be assisted by a tiny amount of acid to get the tanning agent through without the need for a traditional pickle.

A low salt or salt-free pickle can also be used with chromium and glutaraldehyde tannage. The non-swelling acid proliferation has been the driver for these types of technologies. The acids penetrate the pelt and do not go too low, allowing the tanner to forego a need for sodium chloride.

However, the quality impacts of no pickle can mean a harder leather. Not in all cases; leathers that have not had an additional acid hydrolysis by a pickle operation will have slightly less opening. The tanner could compensate by adding additional retan/fatliquor or even have an additional bating operation.

Pickle recycling was something that tanners have done for many years. The mechanism for the pickle recycling is to complete the traditional pickle, drain the drum partially, and then to add the chromium salts into the recycled pickle. The drained pickle float could then be cleaned up (solid, fats/oils/grease removed) and then the concentrations readjusted for the next cycle.

Salt-free, wet-end chemistry

Salt is used to adulterate chemicals, that is, to lower the cost of the chemical through dilution. Salt can assist with the solubility of the product and is sometimes present as a by-product of the process or is added for a stability benefit in the chemical. Tanners need to continuously examine the Total Dissolved Inorganic Solid (TDIS) content of their chemistry. If the amount of salt present in their products starts posing significant contributions to their overall TDS, then those products should be switched out for lower salt formulations.

Liquid chemicals use water as a diluent, which can make the water (present in the product) very expensive. Chemical companies have a role to play here in that they need to pass on savings over to the tanner, who wants a salt-free formulation but does not wish to purchase the most expensive water on Earth. Liquid chemicals can have stability issues, so some stabilisation may be necessary.