Alternatives to Salt Curing Techniques — A Review

J Kanagaraj* and N K Chandra Babu

Leather Processing Division, Central Leather Research Institute, Adyar, Chennai 600 026, India

The raw hides and skins are flayed from the animal and processed further to manufacture leather. As the main constituent of the raw skins and hides is protein, they are much susceptible for bacterial degradation. Thus, it is essential to preserve the protein matrix and also to arrest microbial attack temporarily. Several chemical, biocidal and physical methods have been advocated and adopted, preservation using salt remains the popular curing technique worldwide due to ease, cost-effectiveness and the quality of the finished leather produced. The skins/hides preserved with salt (40-50 per cent, green weight basis) generate huge amount of pollution in the form of total dissolved solids (TDS) and chlorides (Cl-) during leather processing. A great deal of research is being done worldwide in search of a salt-free, alternative curing systems. An attempt has been made to review various alternative curing techniques and their merits and demerits have been described.

Introduction

Leather Industry is an age-old industry and has been serving the society as an important consumer industry. It provides a wide range of consumer goods such as shoes, garments, bags, etc. However the tanning industry has been categorised as one of the highly polluting industries and there is concern that leather making activity can have adverse impact on the environment. The global production of about 24 billion m² of leather by the year 2000 presents a considerable challenge to the industry considering the harmful nature of some of the chemicals used in leather processing.¹ The tannery effluents are characterised by high contents of dissolved and suspended organic and inorganic solids giving rise to high oxygen demand and potentially toxic sulphide and chromium metal ion. Electrolytes, mainly neutral salts are also coming under critical scrutiny due to their contribution to total dissolved solids in the effluent. The discharge limit for TDS is quite stringent in India and hence, there is a tremendous pressure on the tanners to avoid the use of salts in processing or resort to in-process control measures to avoid/reduce the discharge of salt bearing streams.

Salts in the effluent are mainly contributed by the conventionally employed salt curing methods, pickling and chrome tanning operations with the major proportion coming from the common salt used in the curing process. There are attempts made to bring about process inventions such as adoption of pickle-less chrome tanning, recycling of pickle float, pickle-tan closed loop chrome tanning methods, etc to minimize salt discharge from pickling and chrome tanning. But limited attention has been focused on the preservation method which employs huge amount of the common salt (40-50 per cent, green weight basis) for the preservation leading to huge amount of salt pollution. Continued use of salt cured stock without any pollution control measures for many years before the environmental consciousness could take roots has given rise to degradation of land and pollution of the underground water due to high salinity in and around many of the tanning clusters in the country. The current strategy to deal with the highly saline soak liquor can be better termed a stop-gap arrangement and the permanent solution may rely on salt-free curing methods. Hence, efforts should be harnessed to search and adopt cost effective and environmentally safer curing methods which will not affect the quality of the resultant leathers adversely.

Inadequacy of the Current Approaches to Deal With Pollution Due to Salt Curing Methods

Sodium chloride discharged in the soak liquor due to salt curing methods forms the largest component of most tanning effluents in terms of contribution to dissolved solids and chlorides in the effluent. Sodium chloride is the most difficult to treat and hence pose difficulties in the effluent treatment. They contribute in large measure (more than 40 per cent) to total
dissolved solids (TDS) and to chlorides (about 55 per cent) in the composite tannery effluent. This electrolyte remains almost at the same concentration levels even after treatment. There is still no technology available for treating the effluent containing such high concentration of neutral salts.

Currently adopted strategy to deal with the spent soak liquor involves segregation of this sectional stream from the rest of the effluent and taking it to solar pans for evaporation to recover the salt. At the outset, it may look an attractive option for a tropical country like India but in many tanneries which have put up their solar pans, little efforts are being made to recover the salt. In the absence of effective salt recovery systems, the solar pan concept may not really offer a solution to the salt pollution. Moreover, in many tanning centres there are also constraints regarding space available for the construction of solar pans and in some others the efficiency of solar drying is poor due to prevailing climatic condition. Even in the few tanneries, which take pains to recover the salt from the pans, difficulties are often experienced with respect to disposal of the recovered salt.

The improved desalting methods prior to soaking reduce the salinity in the soak liquor. However, the disposal of the recovered salt again poses problems in many tanneries. The counter current soaking method which involves recycling of the spent soak liquor, though reduces soak liquor per tonne raw material considerably, may not prove to be an effective solution if the salt is not recovered by evaporation subsequently. Thus the lasting solution to the problem may rest on alternative curing methods based on saltless and less-salt preservation. Hence the need for studying various curing methods available and the factors responsible for hide/skin putrefaction is imperative. This study would help in developing newer curing system in the near future.

Factors Responsible for Putrefaction of Hide/skin

The raw hides and skins consist mainly of water and protein, which make them vulnerable to attack by microorganisms. The microorganisms decompose the protein and it is technically called putrefaction of hide/skin and eventually make the hide/skin unsuitable for the manufacture of good quality leather. The process or the treatment, which is followed in preventing attack by various kinds of bacteria on raw hide and skin is termed as curing. The various factors to be considered in curing process are (a) Bacteriological aspects of curing, (b) Moisture content, (c) Temperature, (d) Humidity, (e) pH, and (f) Pre-curing period

Bacteriological Aspects of Curing

The hide/skin once flayed is deprived of oxygen and nutritional components. The removal of the metabolites from the cell is stopped leading to the accumulation of toxic products, this in turn leads to the breaking of the part of the enzyme controlled process starts. Process of self-digesting or autolysis of the cell starts. In this process intracellular enzyme cathepsin is involved$. The various bacteria (aerobic, anaerobic and facultative) are involved in the degradation of collagen. But the most dangerous bacteria are anaerobic type that deteriorates proteins into the stage of amino acids. Various researches have tried to find out the bacteria responsible for collagen degradation and inhibition of the same$. The first microbial enzyme (collagenase) capable of degrading collagen at neutral pH is isolated from the species Clostridium histolyticum$. This is shown to cleave the native collagen molecule into two fragments in highly fashion at a temperature below the denaturation temperature of the substrate. It was shown that the cleavage of native collagen molecule places at a specific site closer to the e-terminal end of the molecule, yielding segments of one quarter and three quarters of the length of the native collagen molecule. The active bond cleaved in all species was Glycine-Leucine or Glycine-Isolenee link$^9$.

Moisture

The moisture content of the raw hide/skin is an important factor to be considered those controls the bacterial activity. Bacteria cannot grow unless there is a critical moisture in the hide/skin. The principle of dehydration of water below the level of minimum requirement was adopted in the curing process. The moisture content present in the raw hide/skin is found to be 70 per cent. Hence, in the curing process the moisture content is brought below the critical moisture content. The critical moisture content was found out to be 50 per cent$^{10}$. Above this level of moisture content the hide/skin is conducive for bacterial attack and the control over moisture content is an important factor.

Temperature

The higher temperature during curing always play negative role in the curing process. If the temperature
is more, the curing efficiency is affected by bacterial damage or by the loss of hide substance. Hence, it is necessary that even the skin is being preserved should be stored below 30°C. But the skin preserved by chilling (+2 to +5°C) and freezing (−10 to −20°C) may injure the hides and skins by freezing the ice crystals around the material and cause rupture of the tissue. Hence keeping the raw material at optimum temperature is an important factor. Most of the bacteria in living conditions showed optimum temperature between 15°C to 37°C [12-15]. It has also been reported in literature that better preservation could be established at temperature range between 10-18°C.

**Humidity**

It is very difficult to control the moisture content without controlling the atmospheric humidity. Elevated humidity, especially in the monsoon induces sodium chloride (in the case of salt curing system) or curing agents to absorb more moisture and thereby helping bacterial growth. Hence, elevated humidity is not suitable for the curing process.

**pH**

pH is an important factor to be considered in any curing process of the hide/skin. The reason is that bacteria or enzyme is active at the pH of neutral or slightly alkaline conditions. Hydrolysis of collagen by proteolytic bacteria shows a maximum at pH of 7.5. At the pH 9 the activity is weaker, while at pH 5.5 to 6.5 the activity is practically negligible [14-15]. But the precautionary measure has to be taken in the case of alteration of pH, once the pH goes below 4, there is a chance of swelling of collagen and in turn would weaken the fibres which would make the hide/skin unsuitable for leather making.

**Pre-curing Period**

The pre-curing period is the time between the actual slaughtering of the animal and commencement of the curing process. It is an important factor as the hides and skins become putrefied to some extent due to delay in curing. If the condition of the hide/skin is sufficiently fresh and without the onset of bacterial action, the aim of curing simply lies in quick dehydration of water from the material. It has been found that if the pre-curing period delayed for about 5 h, is slight degenerative changes take place in the cells lying round the sweat glands. After 11 h, the remaining skin structure also gets affected leading to break down of the polypeptide into dipeptide level [16].

**Alternatives to Salt Curing**

Mainly, due to the pollution related problems associated with the salt curing methods, many research groups have been actively involved in the development of alternative curing/preservation techniques. Some of the work carried out in the area by various research groups has already been reviewed.

The popular salting methods are wet salting and dry salting. Here, in wet salting, salt at the level of 40 per cent (based on green weight) is applied to the fresh skin for preservation. The applied salt reduces the moisture to 30 from 70 per cent. But in the case of dry salting, the salted hide/skin is further dried to reduce the moisture content of below 20 per cent to enable to transport the goods easily, pose problem in wetting back in the leather processing. It has been estimated that in India 20.3 per cent of the total hide production is cured by ordinary sun drying, 75.8 by wet salting and 3.9 per cent by dry salting. Of the total skin production in India, 47.7 per cent is cured by wet salting, 49.9 by dry salting and 2.4 per cent cured by flint drying [17].

**Sun Drying**

The simplest and cheapest method of curing hides and skins without the use of salt is to dry them by evaporation under the sun. It is one of the eco-friendly curing process. This method is however practicable only in countries with dry warm climate. This preservation method where ever practiced is often poorly controlled resulting in either over drying leading to subsequent problem in further processing into leather or under drying leading to deterioration in the skin quality. Generally, the sun-dried skins produce inferior quality leathers and these are difficulties in wetting back of the skins and hides while processing into leather [18]. Since, the leathers produced with sun dried stock are of inferior quality there are attempts made to improve the curing process by resorting to controlled drying methods.

**Controlled Drying**

The fresh wool skin can be dried in a controlled environment within 24 h by using drying chamber [19]. The chamber used in these experiments consist of a 6
of the following methods is adopted to bring about refrigeration of the skins and hides. 

(i) Cooled air treatment 
(ii) Addition of ice 
(iii) Carbonic dry ice addition

Cooled air treatment — This technology is adapted to large slaughterhouses where it is possible to automate and therefore cool and store large quantities of hides without handling. By this technique it is possible to process 300 hides/h on a continuous conveyor. Hides are cooled at 5°C for about 45 min. It has been reported that in Australia, the skins preserved this way after storage for 5 d are transported to a wet blue tannery about 700 km away. A Company in Germany is processing 70 per cent of its production with cooled air. The hides after flaying are cooled at 3°C and piled on pallets. In the case of hot weather, some ice is added between the hides. The use of conveyor during the cooling process helps to improve the thermal exchange on hunged hides.

Addition of Ice — It is possible to cool hides and skins in a continuous way in a mixer by using some ice cubes, cakes or flakes, just after flaying. It is also possible to put hides or skins in a cooled tank and then to add some ice in the storage container. Within 2 h, hides are cooled from 30 to 10°C and can be stored for 24 h without further treatment. This method is being followed on large-scale in Switzerland, Germany and Austria. The cost of an ice making machine is low compared to a cold room investment. This technology has been further improved by British Leather Confederation, UK by the use of preservative solution to produce ice. The limitation of the process is the draining of liquor containing high concentration of preservative.

Use of Dry Ice — Compared to the normal ice, the hides and skins are cooled to -35°C and cooling is achieved rapidly in the whole area of skin/hide. The method does not suffer from the problems with the use of ice, as given earlier, such as re-wetting problem and brine draining from melting of normal ice. It gives a uniform cooling and preserves the hides or skins for a minimum of 48 h.

However, special care has to be taken because of the suffocation risks by the use of carbon dioxide. The cold conditions and the high pressure of carbon dioxide storage must be taken into account. Dry ice is estimated to be applied @ 60 g/kg hide, corresponding to 15 L gaseous carbon dioxide. This type of processing seems much more adopted for skins that keep the temperature longer than hides. It was possible to compare the advantages and disadvantages of each technology.
The advantages and disadvantages of the above methods are summarized in Table 2.

**Use of Chilling**

The above mentioned cooling systems provide only short term preservation for 24-48 h. When it is necessary to store hides or skins for a longer period of time, it is possible to process it in much colder conditions up to -10 or -20 °C. At -10 °C, it is possible to preserve hides for 3 mo without any problem. Sometime the tissue fiber may be damaged, therefore, it does not appear to be reliable. It is also reported that at the end of the freezing period, bacterial degradation is faster than with the cooled hides. Any hindrance in the freezing step may promote bacterial growth.

Advantages of this chilling system are the good grain quality of the resultant leathers, fewer environmental problems because of no use of salt; safer handling of the cooled and chilled hides. The disadvantages are the high investment and operation costs and high power consumption, especially in warm climates and higher slipperiness of the pelt during fleshing.

**Curing by Potassium Chloride**

The preservation of animal hides and skins with potassium chloride in place of common salt has been carried out with steer hide by brine curing method. The cured stock cannot be distinguished from that cured with common salt except that the potassium chloride hides are considerably drier on the surface.

The advantages of this method are:

- The prevention of red heat and
- Potassium is a macro-nutrient to the plant.

The disadvantages are:

- The high cost of potassium chloride and
- The dependence of solubility of potassium chloride on the temperature; the solubility of potassium chloride decreases if the temperature drops.

**Liricure**

Attempts for hide and skin preservation using powder biocide compositions have been made. The powder preservatives are applied to freshly flayed sheep skins for effecting curing. Minimum effective dosages and relative activities of various preservatives have been worked out. In this method, a mixture of antiseptics with medium coarse sawdust (pine) is applied uniformly to cover the flesh surface. The powder preservatives used are chlorinated phenol (PCMC) and EDTA (ethylene di-amino tetra acet acid). Finished leathers are manufactured from the sheep skins and cattle hides after the storage period of 12 mo. The physical properties are reported to be comparable with sodium chloride cured system. A serious disadvantage is that EDTA content in Liricure powder which may cause difficulties in precipitating chromium compounds in effluent treatemnts.

**Preservation by Irradiation**

Radiation processing (irradiation) is a safe method involving systematic exposure of materials to ionising energy to effect specific chemical or biological changes. An alternative method to

<table>
<thead>
<tr>
<th>Technology</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooled air</td>
<td>Automation of handling</td>
<td>High investment</td>
</tr>
<tr>
<td></td>
<td>No increase in weight</td>
<td>Need in tracks equipments</td>
</tr>
<tr>
<td></td>
<td>Adopted to sorting</td>
<td>Constant feeding with hides</td>
</tr>
<tr>
<td>Ice addition</td>
<td>Low investment cost</td>
<td>Increase in weight</td>
</tr>
<tr>
<td></td>
<td>Low running cost</td>
<td>Brine to recover</td>
</tr>
<tr>
<td></td>
<td>Adopted to low quantities</td>
<td>Limited protection in time</td>
</tr>
<tr>
<td>Dry ice</td>
<td>Moderate investment cost</td>
<td>Risks with carbon di-oxide</td>
</tr>
<tr>
<td></td>
<td>Reduced increase in weight</td>
<td>Limited protection in time</td>
</tr>
</tbody>
</table>

Table 2—Advantage and disadvantages of various technologies used
conventional thermal methods for initiating and driving chemical reactions, irradiation is a cold process, which minimises energy expenditure and dramatically reduces the need for costly or toxic chemical catalysts. While sufficiently energetic to drive chemical reactions, the radiation does not induce radioactivity. Consequently, exposed products can not pose any radiation danger\textsuperscript{27,29}.

The two principle radiations used by industry are gamma rays (photon emissions from radioactive materials) and electron beams. For hide processing, for reasons of efficacy, safety, versatility, speed and cost, electron beams are superior to gamma rays. In electron beam processing, ionising energy is produced without the use of any radioactive materials. An accelerator generates an electrical field through which electrons are brought up to near the speed of light similar to a television tube. As this stream of electrons exit the accelerator, it is magnetically scanned or shaped to form a fan shaped beam. As products are passed through this beam, they are exposed.

A microprocessor controls the electron beam dose parameters of the exposure, monitoring them every one hundred milliseconds and documenting them continuously. The “dose” or measure of energy absorbed by the treated product is reproducible to within a fraction of a per cent. Once the system parameters are established for a given product, the computerised control systems ensure that the process can be repeated without deviation\textsuperscript{40}.

High-speed electrons are used to sterilize the hides. If the hides are sterile and the enzymes in them are inactivated and they are not allowed to be re-infected, the hides will retain the properties of fresh green hides. Advantages of this system are the decreased salinity of effluents and there is no toxic effect. The disadvantages are (i) need for very expensive equipment, (ii) need for full protection of the workers operating the equipment, (iii) possible reduction in tensile strength of the leather, (iv) need for covering each hide with plastic bags to prevent recontamination with microorganisms during storage and (v) high cost of treatment\textsuperscript{5}.

**Benzalkonium Chloride as a Preservative for Hides/Skins**

Benzalkonium chloride (BAC) is tested for the short time preservation of hides and skins and as an adjunct for use with salt in brine-curing and green salting. The per cent age of (BAC) used for the preservation of fresh calf skin ranges from 0.1-0.4 per cent. There is no difficulty in processing hides treated with this material and no adverse effect on the leather is found\textsuperscript{37}, BAC is a widely used household and industrial antiseptic. There are no toxicity problems at the recommended concentration but BAC may be unacceptable in some by-products.

**Preservation of Raw Hides and Skins With Boric Acid**

Temporary preservation of hides using a saturated aqueous solution of boric acid (approximately 4.5 per cent, v/v) both alone and in conjunction with saturated sodium chloride solution has been investigated. Hides soaked in saturated acid solution alone had storage life of only 5 d\textsuperscript{17}.

Boric acid is stable to heat, light and air and it is not volatile so that it will remain effective on the hides during suspension drying. It is nontoxic to humans (LD\textsubscript{50} value = 3000 mg.kg\textsuperscript{-1}) and it is unlikely to cause effluent problem\textsuperscript{4}. But the use of boric acid for curing has recently come under effluent restriction in Australia.

The addition of boric acid and naphthalene (0.5 per cent) became standard practice in New Zealand in the early 1960s. These additives are found to improve the shelf life of the salt cured stock appreciably and to be instrumental in eliminating bad odours, flies and other pests from hides stored.

**Curing by Silica Gel**

In place of the salt which functions mainly because of its ability to dehydrate the hide/skin below critical moisture content from its bacteriostatic property, a dehydrant silica gel is used to preserve the raw hide/skin\textsuperscript{55,57}. Silica gel at the level of 15 per cent alone and the level of 10 per cent with biocide Para Chloro Meta Cresol (PCMC) could bring about effective preservation of the hide/skin. Similarly silica gel at the level of 5 per cent with minimum amount of salt 5 per cent with or without PCMC also established a preservation effect in the raw hide/skin. The efficacy of the systems are analyzed over conducting various tests in the preservation period such as moisture content, total extractable nitrogen content, NMR imaging for moisture content, bacterial count and pollution load generated during leather processing. The results showed that the leather obtained is comparable in properties with a potential to reduce pollution load
in terms of TDS by 70-75 per cent and chlorides 80-85 per cent over salt curing system.

Curing by Aryl Alcohol, Hypo

A short term preservation with aryl alcohol has been reported \(^ {36-39} \). It was found that aryl alcohol a total dosage of around 2-3 per cent (on green weight) gave satisfactory preservation for about two months. It was also found that hypo at the level of 5 per cent was able to preserve the buffalo hide and goat skin for 10 d. The zinc sulphate at the level of 5 per cent and a mixture of benzaldehyde (0.5 per cent) with B-napthol (0.5 per cent) could also preserve the stock for 3 d and 1 wk, respectively.

Other Reported Curing Methods

It has been found that the wide range of materials, both organic and inorganic, can be used for the preservation of skin/hide without employing common salt\(^ {40} \). They include sodium chlorite, sodium carbonate, propionic acid and peracetic acid as well as organic antiseptic reagents such as teborit and hyamine.

Preservation of skin by using sulphites, bisulphites and meta bisulphites used in conjunction with an acetic acid are also present\(^ {41-45} \). It is possible to effect short term preservation employing a mixture consisting of 2 per cent sodium sulphate and 4 per cent sodium bisulphite which is applied on the flesh side of raw hides. The authors claimed that the hides are kept free of bacterial contamination by treatment for at least four weeks and that the leather produced from the treated hides is of equal standard with that produced from regular wet salted stock. An incidental disadvantage encountered by Nathan using the process, however, is that the Swedish acceptable limit for atmospheric sulphur dioxide (2 ppm) is exceeded.

Screening and evaluation of preservatives for skin preservation\(^ {46} \) is carried out at CLRI. This is carried out by studying the inhibitory action of the preservatives against certain strains of bacteria. Preservatives are added to nutrient broth media in different proportions (0.01, 0.02 and 0.04 per cent, w/v), the medium is distributed in tubes (10 mL/tube) and sterilized. The tubes are then cultured with a strain of Bacillus species and Pseudomonas aeruginosa species. The culture tubes are then incubated at 30°C for 24 h and growth is estimated by Klett-Summerson photoelectric colorimeter using 660 mp filter. Un-inoculated tubes are taken as control. Results obtained are expressed as optical density. Optical density values of 5 or below 5 are considered insignificant.

It has been reported that sodium sulphite can be used to avoid pollution associated with the use of sodium chloride. The effective preserving agent is the sodium sulphite. Its use is claimed to meet the requirements for a low cost, non-polluting, easy to apply curing system that does not have any adverse effect on the leather quality produced\(^ {47} \).

It is also reported that enhanced antiseptic activity is obtained when some commercial antiseptic materials, including merpin TKE, Nercolan GLO and vantocil CL are applied to washed fleshed hides at levels of 0.5-1.0 per cent in association with a reduced level of sodium chloride 10-15 per cent, all treatments being based on green hide weight. The leather quality is comparable with conventional salt curing method\(^ {47} \).

It is possible to hold wool sheep skins at 25°C for 20 d in good condition after treatment with a combination of sodium chlorite, sodium silico fluoride and boric acid. Sodium silico-fluoride (SSF) is mainly used as a salt additive but it was recommended that hides and skins should be dipped for 30 min in a saturated solution of SSF prior to shade drying. Controversy arose on leather making quality of treated hides, mainly the sheep skins. Although SSF has LD50 of 125 mg/kg, it has been considered safe. The chemical is stable to heat, light and air and is nonvolatile. As fluoride is precipitated by calcium, effluent treatment in the tannery will precipitate out most of the fluoride used\(^ {48} \).

Chlorites and hypochlorites are effective bactericides but they may cause adverse effects on leather making qualities. More grain blemishes are present than are normally seen on leathers produced from wet salted skins\(^ {49} \).

It has been found that the preservation of skin/hide is possible by the application of 15 per cent salt in conjunction with other preserving chemicals at 1-3 per cent. Hides thus treated were stored for 3 mo at 20-25°C, 85 per cent RH. At the end of storage, the hides were in a satisfactory condition without any adverse odour with bacterial counts within limits\(^ {49} \).

It has been found that a further alternative to the traditional salt cure, advocating the use of formaldehyde at a concentration of 0.25 per cent on hide weight. They added the reagent through the
The development of saltless preservation by the use of neem oil with alcohol has also been reported. The neem extracts were applied to both flesh and hair sides at a rate of about 1 per cent on the green weight. After the treatment the experimental skins are allowed to dry in the shade. The skins, by this method can be preserved for more than 6 months but the resultant leathers were of inferior quality.

In India, immersion of hides and skins for 4-8 h in a mixed solution of zinc chloride and sodium penta chloro phenate (PCP), at 0.15 and 0.16 per cent respectively, prior to salt curing is found to preserve hides and skins for at least 7 d. But due to pollution concern the use of PCP is banned.

Use of antibiotics to control green hide biodegradation has been also reported, where effects of aureomycin, terramycin, chloromycetin, tetracycline, and streptomycin have been examined. The author has developed microbiological bioassays to determine the antibacterial activity of selected β-lactams tetracyclines and aminoglycosides against Vibrio alginolyticus, used as collagenolytic test bacterium. Results indicated that the tetracycline type antibiotics are most effective at 1 per cent, w/v, with β-lactam to a lesser extent.

A short term preservation technique for the cattle hides using a combination of sodium chloride and hydrolysed starch-poly acrylo nitrile graft copolymers after washing with 4 per cent acetic acid has been reported. The approach made is based on the principle that by regulating water activity to maintain micro bio-static conditions to produce a quality hide with minimum handling processing and storage. This method of short term preservation depends on control of gram-positive micrococci and bacilli and there was no sign of bacterial or mold growth after 11 wk of storage.

The preservation of hides and skins by taxidermists approach, where the living shape of an animal is re-created in a relatively permanent condition, often illustrative of an attitude characteristic of the living animal. This is done by using various chemicals including mercury, bichromate, alum, borax, boric acid and phenol derivatives, but toxicity of many of these chemicals is questionable.

For the short term preservation of hides, a Zimbabwean method based on chilling, and treatment with bactericides such as benzalkonium chloride, boric acid, vantocil (IB), Busan 30 and Busan 52 have been reported to yield better results in comparison with conventional salt cured method.

vantocil IB, a polymeric biguanidine hydrochloride is widely used as food bactericide. This has been tried as a preservative on hides in admixture with another vantocil product CL. A short term preservation for 8 d at 25°C has been possible with this curing method. However, storage at lower temperatures is preferred.

A short term preservation by using Busan 30, 2-Thiocyanomethyl thio-benzothiazole (TCMTB) are used in conjunction with boric acid. The recommended treatment is 2 h drum application of busan 30 (0.3 per cent) plus boric acid (0.9 per cent) in 10 per cent float, based on green hide weight. Cost and quality are comparable with conventional salt curing process.

By using Busan 52, a product based on a mixture of sodium 2-mercapto benzo thiazole and potassium N-hydroxy-N-Methyl dithiocarbamate, the short term preservation of hide has been carried out. Good result is reported when this product is used in conjunction with boric acid, naphthalene and a wetting agent.

Another short term preservation of cattle hide using 20 per cent, w/v, soda ash has also been reported. The raw cattle hides, thoroughly washed in cold water, are immersed in the solution for 4, 6 or 8 h and then stacked flesh side up after drip draining for about 45 min and then covering samples with wrapping paper and preserved at ambient temperature of 25°C. The treatment may be used for preserving raw cattle hide for 8 d.

For the short term preservation of hides by the use of zinc chloride or calcium hypo chlorite as alternative to sodium chloride have been reported. Three option for carrying out the preservation have been suggested—zinc chloride (0.3-0.5 per cent) with 0.05 per cent biocide, or 0.05-0.1 per cent phenol with 20-25 per cent float—for drumming about 2 h will preserve hides for a maximum of 5 or 6 d at 25°C. The second option is 1 per cent application of a 30 per cent sodium chlorite e.g., Imprapell CO, Hoechst (equivalent
to 0.375 per cent solid sodium chloride, 80 per cent active) with 0.05 biocide or 0.05-0.1 per cent alcohol with float 20-30 per cent drumming for 2 h gave better result.

Conclusion

It is evident that curing agents could preserve the raw hide and skin by proper control of parameters like moisture content, temperature, humidity, pH and concentration of curing agents applied, retaining the raw hide/skin is immediately preserved. But any curing agent applied should inhibit the enzyme responsible for hide/skin putrefaction. This could be easily achieved in the biocidal type of curing technique but control over moisture is not possible in this type which may later lead to putrefaction. But in the case of chemical type preservation where control over moisture is achieved could not inhibit the specific enzyme. Hence, combination of eco-friendly chemical and biocide curing system could yield better results.

References


