

Desalting of raw hides

Introduction

Common salt is traditionally used in India to preserve hides. This method is often called ‘curing’ or ‘short-term preservation’ as the raw hides/skins are only preserved until they reach the tannery. Common salt is generally applied within a few hours of flaying. This salt serves a dual purpose: it dehydrates raw hides and skins to a moisture level of 50 to 60 percent of the original moisture of 80 to 85 percent; and it prevents microorganisms from decaying on the skin/hide material. In this way, the raw material is preserved from putrefaction.

The process of applying common salt to freshly flayed hides/skins is called wet salting. The common salt used in the preservation process is dissolved in water in the first unit process, called soaking, and discharged as wastewater. This contributes to about 50 percent of the TDS content in the effluent. Alternative curing methods have not been prevalent in India for reasons which include the dispersed nature of slaughtering throughout the country, combined with the easy availability of common salt and its low preservation costs.

The common salt applied on hides for curing enters the soak liquor, which is the first unit process in tanneries. The presence of salt in tannery wastewater contributes to a substantial portion of the TDS. Conventional treatment systems such as the chemical and biological treatment stages are unable to remove the TDS. The removal of salinity or TDS in the effluent requires expensive and very sensitive processes such as reverse osmosis (RO) and the evaporation of RO reject in multiple effect evaporators.

Although alternative curing methods such as chilled hides processing, low salt curing, etc. are being pursued, it is anticipated that the majority of the hide/skin supply will be wet salted for some more time to come.

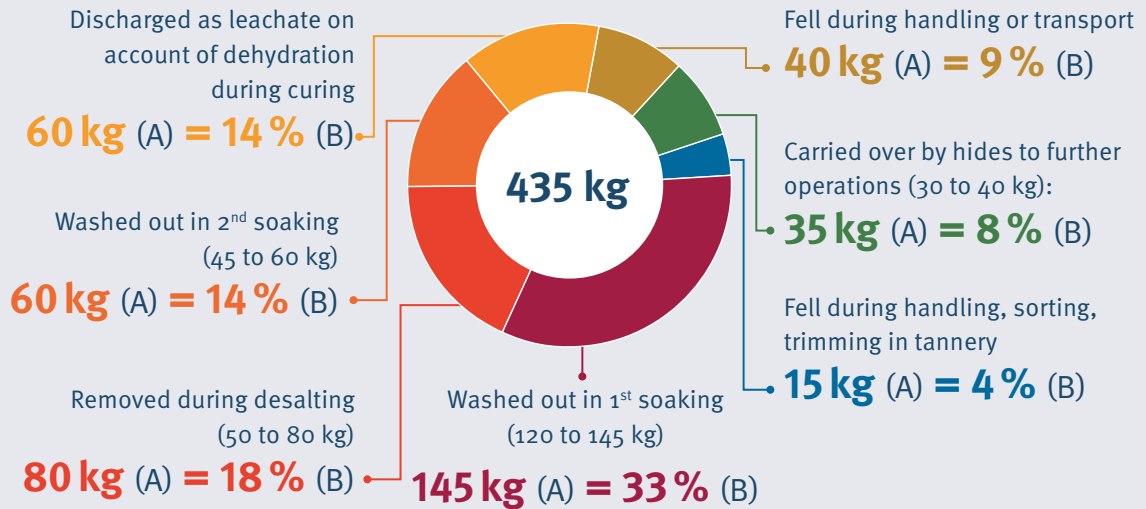
Under these circumstances, the removal of salt from raw and skins to the maximum extent possible will lead to a reduction in TDS in the effluent, which is expected to result in the better treatment of effluent at lower costs.

Salt removal potential in raw hides and skins

About 400 kg of salt is applied per tonne of raw hides/skins. While most of the salt penetrates the skin, a substantial quantity remains on the surface. By desalting, it is possible to remove a

major portion of this salt. The following graph provides a description, followed by the average quantity of salt in kg (A) and the corresponding percentage of total salt applied in curing (B).

MASS BALANCE OF SALT APPLIED FOR CURING



Brief description of the desalting systems

Desalting can be done by simple shaking of the hides or by using salt shaker machines. Four types of desalting operations that can be adopted are described below.

SALT SHAKER MACHINE: The desalting drum (cage) is primarily made of 316 stainless steel and is rotated by a 15 Kw motor. The drum is run at 6 rpm. The raw hides are folded and placed on the conveyor belt. They are subsequently unfolded in the desalting cage and any salt that is stuck to the hides falls off. The desalting process can be timed by modifying the inclination of the drum. The salted hides leave the drum at the rear end. The diameter of the drum is 2.7 metres (m) and the overall length is 7.7 m, of which the length of the drum (cage) is about 5 m. While the transfer time for one hide through the drum varies depending on the inclination, it generally takes about three to six minutes. Ten tonnes are usually desalted in about two hours.

BRUSH TYPE DESALTING MACHINE:

The machine has a cylindrical roller with nylon bristles embedded on it. When the wet salted raw hide/skin is fed into the machine, the salt on the flesh side is removed by the nylon bristles. The hides are pulled out on the rotating brush roller at a speed of 0.075 m/s. The time required to desalt one tonne of raw hides is about one hour. The quantity of salt collected ranges from 7 to 8 percent on a raw hide weight basis. The dusted salt can be collected from the rear of the machine. The removed salt falls over a wooden plank sloping downwards at the rear side of the machine. All metallic components, namely the frame to hold the cylinder, the motor and the plummer blocks, are covered by wooden planks. These planks are bolted using stainless steel bolts and nuts. The following are the specifications:

Working width	2,100 mm
Width of each strip of bristles	125 mm
No. of strips of bristles	5
Speed of brush roller	400 rpm
Motor	3.7 kW



DESALTING MACHINE.



SALT SHAKER MACHINE.

DESALTING DRUM: Old drums which are no longer used for tanning operations can be converted into desalting drums. This is done by drilling holes of 85 mm diameter at a distance of 130 mm from each other into the surface of the drum and fitting it with a 3.75 kW electrical motor. Wet salted raw hides/skins are weighed and loaded into the desalting drum in loads of 400–600 kg. After closing the door, the drum is run slowly at 3 rpm (velocity 0.35 m/s) for 15 to 20 minutes. The salt loosened from the hide surface drops out of the drum through the holes and collects on the stone floor beneath the drum. After 20 minutes, the drum is stopped, hides unloaded, weighed and taken for

soaking. About 7 to 8 tonnes of raw hides can thus be desalted in a day.

DODECA WOODEN FRAME: This comprises a dome type wooden frame with dimensions 0.75 m x 0.75 m x 0.75 m height. Desalting is performed by holding the hides at the edges and beating them on the frame three times. The salt that falls off is collected manually from the floor. For large hides, four workmen are required; for smaller sides and skins, two workmen are sufficient. On average, it takes two hours to desalt one tonne of raw material. This is suitable only for small skins, i.e. goat and sheep skins.

Operational data

The following table provides a comparison of operational parameters in different types of desalting methods:

PARAMETER	SALT SHAKER	BRUSH TYPE DESALTING MACHINE	DESALTING DRUM	DODECA WOODEN FRAME
Salt removal	80 – 100 kg/t	70 – 80 kg/t	50 -70 kg/t	50 – 80 kg/t
Time taken for desalting one tonne of raw hides	30 minutes	60 minutes	60 minutes	120 minutes
Manpower requirement	2 man-hours	2 man-hours	2 man-hours	4 man-hours
Investment cost for one unit	Rs. 3,000,000	Rs. 240,000	Rs. 200,000	Rs. 25,000
Suitability	Hides	Hides and skins	Hides	Skins

Environmental benefits

The environmental savings are mainly the TDS reduction in tannery effluents.

The overall reduction in TDS in the combined effluent stream due to desalting of raw hides/skins is about 15 percent, while the reduction in the soak liquor is about 40 percent.

TDS IN SOAK LIQUOR AFTER DESALTING

TDS EMISSION IN SOAK	FIRST SOAK	SECOND SOAK
Average TDS of soak liquor without desalting (300% water for soaking)	53,780 mg/l	27,580 mg/l
Average TDS of soak liquor after desalting (300% water for soaking)	33,250 mg/l	15,000 mg/l

In addition to the environmental savings, desalting offers a range of other benefits including the following:

- ❖ The decrease in TDS in the effluent will help the biological treatment work more efficiently, due to less salinity;
- ❖ The number of soakings can be reduced from two to one. Thus the volume of effluent will be 150 percent less in the case of drums and 300 percent in the case of paddles;
- ❖ For tanneries that choose to dilute the treated tannery effluent with treated sewage, there will be less dependency on the volume of treated sewage as the TDS in the effluent can be minimized in desalting;
- ❖ For tanneries opting for zero liquid discharge systems, the desalting of raw hides will increase the recovery rate in RO plants by about 5 percent of effluent feed as well as increasing the life of the membranes in RO plants and decreasing the salt load sent to the evaporators. This will result in less salt at the end of the pipe treatment, hence easing the disposal or storage of salt-laden solid residues from the evaporators.

Cost benefit analysis

The following cost benefit analysis has been made for desalting using the brush type desalting machine:

Investment cost (capacity 2 tonnes per day)	Rs. 240,000
Operating cost <ul style="list-style-type: none"> › Electricity: Rs. 26/t, › Labour: Rs.105/t › Depreciation: Rs.80/t 	Rs. 126,540 per annum
Cost saving (for tanneries opting for zero liquid discharge) <ul style="list-style-type: none"> › Savings in effluent treatment cost @ 1500 l/t: Rs.90/t › Cost saving in evaporation for increased recovery rate in RO plants by 2%: Rs. 540/t 	Rs. 378,000 per annum
Cost saving (for tanneries opting for dilution) <ul style="list-style-type: none"> › Savings in effluent treatment cost @ 1500 l/t: Rs.90/t › Cost saving in reduced sewage for dilution by 50 m³/t: Rs. 700/t 	Rs. 474,000 per annum
Annual net savings	Rs. 251,460 to Rs.347,460 per annum
Payback period	0.7 to 0.9 years