



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

September 2001

US/RAS/92/120

**Regional programme for pollution control in the tanning industry  
in South East Asia**

**DESALTING OF RAW HIDES/SKINS AND  
REUSE OF DUSTED SALT IN PICKLING OPERATION**

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## LIST OF SYMBOLS AND ABBREVIATIONS

|                               |   |   |
|-------------------------------|---|---|
| $^{\circ}\text{Bé}$           | : | Degrees Baumé   |
| BOD                           | : | Biochemical Oxygen Demand                                 |
| CETP                          | : | Common Effluent Treatment Plant                           |
| CFU                           | : | Colony forming unit                                       |
| Cl <sup>-</sup>               | : | Chloride  |
| CLRI                          | : | Central Leather Research Institute                        |
| COD                           | : | Chemical Oxygen Demand                                    |
| Cr                            | : | Chromium  |
| CTC                           | : | Centre Technique Cuir                                     |
| Dia.                          | : | Diameter  |
| Dwg.                          | : | Drawing   |
| g                             | : | Gram(s)   |
| INR                           | : | Indian Rupees   |
| kg                            | : | Kilogram(s)   |
| kW                            | : | Kilowatts   |
| l                             | : | Litre(s)  |
| m                             | : | Meter(s)  |
| mm                            | : | Millimeter(s)   |
| mg                            | : | Milligram(s)  |
| m/s                           | : | Metre per second  |
| PAC                           | : | Poly Aluminium Chloride                                   |
| PDU                           | : | Pilot Demonstration Unit                                  |
| PTIETC                        | : | Pallavaram Tanners Industrial Effluent Treatment Co. Ltd. |
| RePO                          | : | Regional Programme Office of UNIDO at Chennai             |
| RoE                           | : | Rate of exchange  |
| RPM                           | : | Revolution per minute                                     |
| SO <sub>4</sub> <sup>2-</sup> | : | Sulphate  |
| TNPCB                         | : | Tamil Nadu Pollution Control Board                        |
| TDS                           | : | Total Dissolved Solids                                    |
| tpd                           | : | Tonne per day   |
| US\$                          | : | United States Dollar                                      |
| UNIDO                         | : | United Nations Industrial Development Organisation        |

## EXECUTIVE SUMMARY

Since the scope for green processing is limited in India, sodium chloride is widely used to preserve raw hides and skins. It contributes to a high volume of total dissolved solids (TDS) in the soak waste liquor. No commercially viable technology for treating effluent has been developed to date. A large amount of the salt sticking to the hide and skin surface can be removed by shaking the hides mechanically or manually.

Within the framework of the UNIDO regional programme for pollution control in the tanning industry in South-East Asia, a pilot demonstration unit was set up to demonstrate different options for (a) desalting hides and skins prior to soaking and (b) reusing dusted salt in the pickling operation after purifying the salt recovered.

Three different desalting methods using (i) DODECA wooden frame, (ii) perforated drum and (iii) brush-type machine were demonstrated. DODECA was found suitable for desalting skins and small hides and perforated drum for hides. The brush-type machine was found suitable for all types of hides and skins. Though the quantity of salt removed varies with the method of desalting, it is generally in the range of 4 – 8% on the weight of raw stock taken for desalting.

Though the dusted salt from desalting operations contains many impurities, a fairly clear salt solution can be obtained by dissolving the salt recovered in water, simply screening it and then clarifying it using poly- aluminium chloride. Demonstrations showed that the salt solution so obtained could be safely used in pickling operations.

Desalting of raw stock reduces TDS level in the composite tannery wastewater by about 15%. Practically, it has been seen that TDS in the composite effluent of a tannery processing salted raw hides/skins to semi-finished leather is reduced from 12,000-18,000 mg/l to 10,500-15,700 mg/l on account of desalting of raw stock, collection and proper disposal of the dusted salt. Though desalting may not directly result in considerable financial benefit, indirect benefits include more efficient soaking and reduction in the volume of soak liquor discharged which in turn reduces area of land required for the solar evaporation of saline effluent, a mandatory requirement in Tamil Nadu, India. More importantly it prevents, to an extent, salt entering the groundwater and soil.

Recommended by the Tamil Nadu Pollution Control Board as one method for desalting, the DODECA wooden frame enjoys increasing acceptance in South Indian tanneries because it is both user-friendly and cost-effective. All the tanneries in the state of Tamil Nadu processing salted raw hides/skins practise desalting of raw stock. The rapid absorption of the techniques by the tanners makes this one of the more successful pilot demonstrations.

This report covers the demonstrations carried out during the period January 1997 to February 2001 of desalting of salted raw stock and use of the recovered salt in pickling.

# **1. BACKGROUND**

## **1.1. Prevalent practices**

Wet salting is one of the most commonly used hide and skin curing practices in the world. Salt is generally cheap and widely available: it has good dehydrating properties. Curing salt is removed during soaking and discharged in waste soak streams. The salt discharged in the soak liquor increases the total dissolved solids content of ground water.

## **1.2. Need for tackling the issue**

Of late, the negative environmental implications of saline effluent from tanneries have been the object of increased attention, particularly those aspects related to high total dissolved solids (TDS) and chlorides. Tanneries located in coastal areas may be able to discharge treated effluent with a high TDS content into the sea. Alternatively, partially treated tannery effluent may be mixed with domestic sewage low in TDS for further treatment where feasible. In all other cases, however, the following measures (or a combination thereof) may be considered:

- (i) Adopting other curing practices that eliminate the use of sodium chloride, without affecting the quality of raw material and creating other serious forms of pollution
- (ii) Removing the curing salt that remains on surface and reusing it
- (iii) Recycling the soak liquor to reduce the quantity of soak liquor discharged
- (iv) Applying appropriate cost-effective technology to reduce TDS in the effluent

Whereas option (i) may be long-term in nature and option (iv) may not be cost-effective at present, option (ii) (minimising the TDS discharged from the tannery) may yield results in the short term. Option (iii) (recycling the soak liquor) will reduce the quantity of soak liquor, but not the TDS concentration.

## **1.3. Objective**

In cooperation with tanners, tanners' associations and (C)ETPs, UNIDO, under its Regional Programme, has been implementing a few Pilot and Demonstration Units (PDUs) addressing TDS-related environmental issues. These range from the basic option such as desalting of salted raw stock described here to the technically more challenging one such as the reverse osmosis.

The objective of the exercise was to remove excess salt from the wet salted hide / skin prior to soaking and reusing the salt in pickling operations after clarification, if so required.

# **2. MECHANICAL DESALTING DRUM**

In a tannery at Pallavaram near Chennai, an existing old wooden drum of size 2.4 m x 1.8 m was identified for modification. Holes of 85 mm dia with a spacing of 130 mm between two successive holes were provided on the surface of the drum. The modified drum fitted with an electrical motor of 3.75 kW rating was used for desalting (Photo 1). Regular reuse of dusted salt in pickling in the tannery started from July 1997.



*Photo 1: Mechanical desalting drum*

## **2.1. Method of desalting of salted hides using the desalting drum**

Wet salted raw hides/skins are weighed and loaded into the desalting drum in lots 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 provided 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. The design details of the desalting drum are given in Dwg. 1, Annex 1.

## **2.2. Performance of desalting drum**

Based on 70 drum loads, the following observations are made:

- (1) In percentage terms, salt removal is higher (i.e. from 5 to 7 % on the weight of raw hides) for lower capacity loads (250-400kg). If the load exceeds 400 kg, the amount of salt removed drops to 4 - 6 % of salt on weight of raw hides.
- (2) During the monsoon season, the hides are wet and a large part of the salt remains stuck to the hides. Salt removal is thus low (11 kg for 350 kg of raw cowhides or some 3% on raw weight).

## **3. DODECA WOODEN FRAME**

### **3.1. Conventional practice**

Manual desalting is conventionally done by using empty plastic chemical containers (drums) as a base platform or wooden tables. Held at its four corners, each hide is beaten two or three times, whereafter they are trimmed, sorted and soaked. Quite often after beating the dusted salt sticks to the hides again: something that the workers find inconvenient and tiresome.

### **3.2. Dome-type wooden frame**

Given these shortcomings, a simple wooden frame (750 mm x 750 mm standing at 750 mm) was designed and made from local wood at a total cost of US\$ 100 as shown in Photo 2. The frame weighs about 30 kg and can be easily lifted and shifted.



*Photo 2: Dome type DODECA wooden frame for manual desalting*

Design details of the DODECA frame are given in Dwg. 2, Annex 1.

### **3.3. Method of desalting using DODECA frame**

Desalting is done by holding the hides at the edges and beating them three times on the frame. The salt 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.

### **3.4. Performance of DODECA frame**

The workers found the frame convenient. Salt removal increased from 5 - 6% to 8% on raw material weight when compared to desalting using empty drums / plain wooden tables.

DODECA wooden frames were installed in the following tanneries in 1997-98 to serve as model stations in the respective tannery cluster.

- i. P.R.C. Leathers, Ranipet.
- ii. Shafeeq Shameel & Co, Ambur.
- iii. Jaibharath Tanners, Ambur.
- iv. H. Mohammed Osman &Co., Vaniyambadi.
- v. A.T.H. Leder Fabrik, Melvisharam.

Within two months of their introduction, about 100 frames based on the UNIDO model were made by tanneries in the North Arcot district



#### **4. BRUSH-TYPE DESALTING MACHINE**

A brush-type desalting machine was installed in a tannery processing heavy buffalo hides. Specifications of the installed machine are given below:

Working width of cylinder: 2,100 mm  
Width of each brush: 125 mm  
No. of brushes: 5  
Speed of brush roller: 400 RPM  
Motor: 3.7 kW

The machine has a cylindrical roller fitted with nylon brushes. As the wet salted raw hide/skin is fed into the machine, the salt on the flesh side is removed by the bristles of the nylon brushes. The salt removed drops down a sloping wooden plank to the rear of the machine.

All metal components, viz retaining frame for the cylinder, motor and plummer blocks, are covered by wooden planks. These planks are bolted together using stainless steel (SS316) bolts and nuts as seen in Photo 3. Dimensions and other details are given in Dwg.3, Annex 1.



*Photo 3: Brush type desalting machine*

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% on raw hide weight basis. The dusted salt can be collected from the rear of the machine.

The desalting machine is available in the following working widths: 1200mm, 1500mm and 1800mm. Depending on the size of the skin / hide they process, tanneries can select a specification suited to their requirements.

#### **5. COMPARISON OF MANUAL AND MECHANICAL DESALTING**

The cost – both capital and operational – and the performance of three types of desalting with respect to one tonne of raw hides / skins has been compared in Table 1.

**Table 1: Comparison of three types of desalting system for one tonne of raw hides****(Values in INR)**

| <b>Parameter</b>                                       | <b>Mechanical desalting drum</b> | <b>DODECA wooden frame</b>      | <b>Brush type desalting machine</b> |
|--|----------------------------------|---------------------------------|-------------------------------------|
| Raw material desalted                                  | Cattle hides                     | Calf skins and Goat/Sheep skins | Buffalo hides                       |
| Average rate of salt removal- % on weight of raw stock | 5%                               | 7%                              | 7%                                  |
| Capital cost   | 125,000                          | 4,000                           | 56,000                              |
| Time taken   | 1 hour                           | 2 hours                         | 1 hour                              |
| Cost of electricity                                    | 13.00                            | 0                               | 13.00                               |
| Cost of labour   | 18.00                            | 65.00                           | 48.00                               |
| Amortization of equipment                              | 100.00                           | 3.20                            | 44.80                               |
| Total cost   | 131.00                           | 68.20                           | 105.80                              |
| Value of the recovered salt                            | 65.00                            | 91.00                           | 91.00                               |
| Cost benefit   | (-)66.00                         | 22.80                           | (-)14.80                            |

RoE: 1 US\$ = INR 46.80

The base line data adopted in the cost comparison are given in Annex 2.

Statistics about different desalting methods practised in tanneries in Tamil Nadu is given in Table 2. Cluster-wise details may be seen in Annex 3.

**Table 2: Desalting methods practised in tanneries in Tamil Nadu**

| <b>#</b>     | <b>Desalting method</b>      | <b>No. of tanneries</b> |
|--------------|------------------------------|-------------------------|
| 1.           | Mechanical desalting drum    | 3                       |
| 2.           | DODECA wooden frame          | 197                     |
| 3.           | Brush type desalting machine | 180                     |
| 4.           | Manual brushing              | 39                      |
| <b>Total</b> |                              | <b>419</b>              |

## **6. REUSE OF DUSTED (RECOVERED) SALT IN PICKLING**

It is estimated that 50 kg of salt can be obtained from desalting 1000 kg of raw stock. Use of the recovered salt in the pickling of 1000 kg raw material can reduce the fresh salt requirement for pickling by about 50%.

Dusted salt contains impurities. The chloride content of the solution prepared with dusted salt is less compared to the solution prepared with fresh common salt. A process flow diagram describing the reuse of dusted salt in pickling is given in Dwg. 4, Annex 1.

## 6.1. Clarification of dusted salt solution

The dusted salt is prepared as a 12% solution. The solution is screened to remove hair, tissue, sand and other insoluble matters and the filtrate is treated with poly aluminium chloride (300 mg/l) and poly-electrolyte (2 mg/l) and allowed to settle for 4 to 6 hours. More than 90% of the suspended solids, about 60% of COD and 80% of BOD are removed by settling. Typical characteristics of clarified dusted salt solution are given in Table 3.

**Table 3: Characteristics of clarified dusted salt solution**

| #  | Parameter                   | Value        |
|----|-----------------------------|--------------|
| 1. | Total dissolved solids      | 213,000 mg/l |
| 2. | Chlorides                   | 123,400 mg/l |
| 3. | Total organic content       | 10%          |
| 4. | Total suspended solids      | 26 mg/l      |
| 5. | Proteolytic bacterial count | 10 CFU/ml    |

## 6.2. Use of dusted salt in pickling

The salt generated by desalting per tonne of hides is only 50-60% of the salt required (i.e. 80 kg per tonne of pelt) in pickling. Fresh water and common salt are added, whereafter the clarified dusted salt solution is mixed in. The drum is run for 5 minutes to dissolve the salt. Salt concentration should be 8<sup>0</sup> Bé. After this stage, diluted (1.5 %) sulphuric acid is slowly added. The drum is then run for 90 minutes and the leather pH checked for 2.8. Thereafter the usual chrome tanning operation is followed.

Upon completion of the chrome tanning process, the leather was checked for any visible grain damage due to micro-organisms, if any, from the dusted salt. No grain damage was found and the wet blues produced were identical with those processed under the normal procedure.

10 cowhides were taken and cut along the backbone to obtain 20 sides. The left sides were processed by replacing 50% of salt used in pickling with dusted salt. The right sides were processed with fresh common salt. These trials were done in full-scale production by making marks of identification on the material taken for study. After tanning the sides were assessed. The grain was examined using a microscope in CLRI. No damage was seen on leathers that were pickled using dusted salt.

Use of dusted salt in pickling was demonstrated in the following tanneries.

1. Arafath Leathers, Pallavaram
2. Manzil Leathers, Melvisharam
3. G. Govindarajulu Naidu & Co., Chromepet
4. P.R.C. Leathers, Ranipet
5. Shafeeq Shameel & Co., Ambur

### 6.3. Pilot study on the use of supernatant from chrome recovery plant & dusted salt in pickling

Recovery of chrome from spent chrome liquor by the process of precipitation is widely practised in Tamil Nadu. More than 60 tanneries have their own chrome recovery units. With a view to reducing use of fresh salt in pickling and conserving water, the supernatant from chrome recovery plants, which is waste liquor, was used for dissolving dusted salt obtained from desalting. The characteristics of supernatant from chrome recovery plant are given in Table 4.

**Table 4: Characteristics of supernatant liquor from chrome recovery plant**

| #  | Parameter                                 | Value       |
|----|---|-------------|
| 1. | pH  | 7.7         |
| 2. | Chloride as Cl <sup>-</sup>               | 44,400 mg/l |
| 3. | Sulphate as SO <sub>4</sub> <sup>2-</sup> | 19,600 mg/l |
| 4. | Chrome as Cr                              | 4 mg/l      |

With chlorides at about 45 g/l in CRU supernatant, 46 kg of dusted salt was dissolved in a volume of 220 l of supernatant and the solution clarified as described in para 3.2. After clarification, the solution was found to contain 50 kg of salt – 40 kg from the dusted salt and 10 kg from the supernatant. This was applied to a drum load of 1,000 kg of pelt. In order to reach the required salt concentration of 8<sup>0</sup> Bé, 30 kg of fresh common salt dissolved in 580 l of water was added to the drum. Pickling and chrome tanning were carried out in the usual way thereafter.

The wetblue leather was checked for colour and hydrothermal stability and found to be of acceptable quality. The grain of the wetblue leather was examined visually and found to be free of bacteria-related damage.

## 7. POSSIBLE BENEFITS

**Table 5: Reuse of dusted salt in pickling (50% dusted salt + 50% fresh salt)**

|  |                       |
|--|-----------------------|
| Average amount of dusted salt collected from 1,000 kg of raw stock                   | 50 kg                 |
| The equivalent amount of fresh common salt for 50 kg of dusted salt                  | 42 kg or say<br>40 kg |
| Amount of salt used in the pickling of 1000 kg of pelt @ 8% on pelt weight           | 80 kg                 |
| Price of common salt   | INR 1.50 / kg         |
| Savings resulting from use of 40kg of salt obtained from desalting (40 kg x INR1.50) | INR 60                |
| <b>Cost of clarification</b>   |                       |
| Quantity of PAC used for settling 50 kg of dusted salt dissolved in 220 litres       | 60 g                  |
| Cost of chemical used for clarification  | INR 4                 |
| Handling cost  | INR 6                 |

|   |                         |
|---|-------------------------|
| Miscellaneous   | INR 5                   |
| Total cost towards clarification  | INR 15                  |
| Savings for using 50 kg of dusted salt for 1,000 kg of pelt weight                                      | INR 60                  |
| Total operation and maintenance cost (including testing)  | INR 27                  |
| Net savings resulting from reuse of 50 kg salt obtained from desalting 1,000 kg of wet salted raw stock | INR 33                  |
| Production capacity of the tannery (4 drum loads of 1,000 kg each)                                      | 4 tpd of w/s raw stock  |
| Savings per day from 4 drum loads   | INR 132                 |
| Annual cost savings - 300 working days in a year  | INR 39,600/- (US\$ 846) |

**However, the more relevant and interesting benefit of desalting is that this technique prevents, to an extent, the salt from entering wastewater streams and reaching the environment and ultimately polluting soil and ground water.**

## **8. ENVIRONMENTAL BENEFITS**

### **8.1. Reduction of TDS**

In the context of the overall cost of treatment of effluent, particularly, when specific discharge limits for TDS and chlorides have been prescribed, such as in Tamil Nadu, India, the removal of surface salt contributes to a significant reduction of eventual treatment cost of TDS. The recovery and reuse of the salt applied in pickling and reuse of supernatant from chrome recovery system will result in reduction of TDS in the combined effluent, as shown in Table 6.

**Table 6: Effect of desalting on TDS emission from soak yard**

| <b>TDS emission in soak</b>   | <b>First soak</b> | <b>Second soak</b> |
|---|-------------------|--------------------|
| 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        |

The overall reduction in TDS in the combined effluent stream due to desalting of raw hides / skins has been found to be about 15%.

### **8.2. Reduction in volume of spent soak liquor**

The efficiency of soaking is improved as the loose salt on the surface of the raw stock together with other impurities is removed during desalting. The raw stock is effectively cleaned and rehydrated with reduced number of soakings. This reduces the volume of spent soak liquor leaving the tannery, which in turn results in the reduction of land area for solar evaporation pans for evaporation of highly saline streams of effluent, a mandatory requirement in Tamil Nadu, India.

## 9. MATERIAL BALANCE OF SALT APPLIED IN CURING

A material balance is made with respect to the salt applied in the curing (wet salting) of cowhides of Indian origin. Table 6 shows the material balance of common salt applied on one tonne of raw hides.

**Table 6: Material balance of common salt applied on one tonne of raw hides**

(The quantities indicated below are average figures)

| Description  | Average quantity |
|--|------------------|
| Applied in curing  | 400 kg           |
| Discharged as leachate resulting from dehydration of raw hides   | 60 kg            |
| Fallen during handling and transport of raw stock  | 40 kg            |
| Fallen during trimming, cutting into sides, handling, etc in the raw material store (This is generally collected for safe disposal or reuse) | 15 kg            |
| Removed during mechanical desalting – 12.5% (of applied salt)*   | 50 kg            |
| Removed during manual desalting using DODECA frame – 20% (of applied salt) <sup>#</sup>  | 80 kg            |
| Washed out in 1 <sup>st</sup> soak –300% float   | 120-145 kg       |
| Washed out in 2 <sup>nd</sup> soak liquor –300% float  | 45-60 kg         |
| Carried over by hides to further operations (estimate)   | 30-40 kg         |

\* Salt removal is 5% on the weight of raw stock taken for desalting

<sup>#</sup> Salt removal is 8% on the weight of raw stock taken for desalting

A pictorial representation of the mass balance is given in Annex 4.

## 10. CONCLUSIONS AND RECOMMENDATIONS

On the three modes of desalting options studied, each one may be suitable for different raw stock.

|                              |   |
|------------------------------|---|
| Mechanical desalting drum    | Suitable for cow/buffalo hides and calf skins |
| DODECA wooden frame          | Suitable for sheep/goat skins and calf skins  |
| Brush-type desalting machine | Suitable for all types of skins and hides     |

- ➔ The quantity of salt removed varies with the method employed for desalting. Salt removal by mechanical desalting using perforated drums is 5% on the weight of raw stock; with manual desalting using DODECA and desalting by brush-type machine, it is 7-8% on the weight of raw stock desalted.
- ➔ The dimensions of the DODECA wooden frame may be adjusted to the average size of raw hides or skins and field conditions.

- ➔ To ensure the better collection of dusted salt, stone flooring in the raw hide storage yard is preferred. It is cheaper than cement or concrete and has a longer working life.
- ➔ The desalting area should be properly ventilated and well lit. Workers handling the raw material (dusted salt and/or dusted salt solution) should wear protective footwear, facemasks and gloves.
- ➔ It is recommended that dusted salt be reused in pickling once it has been clarified. Chemicals such as poly-aluminum chloride and poly-electrolyte can be used to clarify the salt. Care should be taken to ensure the removal of suspended and colloidal impurities.
- ➔ By using dusted salt, soaking can be reduced to a single soak, thus halving the volume of waste soak liquor.
- ➔ Desalting reduces the TDS in spent soak liquor streams by 20 to 30% and in the combined effluent by about 15%.
- ➔ For tanneries discharging treated effluent into sea, desalting may lack appeal.
- ➔ Benefits are limited. Furthermore, it may not always be feasible to obtain additional labour input.
- ➔ By and large tanners are conservative. Although the analysis showed no qualitative difference in leathers processed using the traditional method and those using dusted salt, few tanners have been willing to modify their conventional production processes.

## **ACKNOWLEDGEMENT**

Contributions of the following individuals / organisations to the successful implementation of the project are gratefully acknowledged.

1. Mr. K.V. Emmanuel, National Expert, RePO, Chennai, India
2. Mr. Shamsudin, Managing Partner and staff of Arafath Leathers, Pallavaram, Chennai, India
3. M/s. Shafeeq Shameel & Co., Ambur, Tamil Nadu, India
4. M/s. G. Govindarajulu Naidu & Co., Chromepet, Chennai, India
5. Mr. Imran Siddiqui and staff of Super Tannery India Ltd., Kanpur, India
6. M/s. PTIETC Ltd., Pallavaram, Chennai, India
7. M/s. Tamil Nadu Pollution Control Board, Chennai, India
8. M/s. CLRI, Chennai, India
9. Tanners' associations at Ranipet, Ambur, Vaniyambadi, Erode and Pernambut, Tamil Nadu, India.

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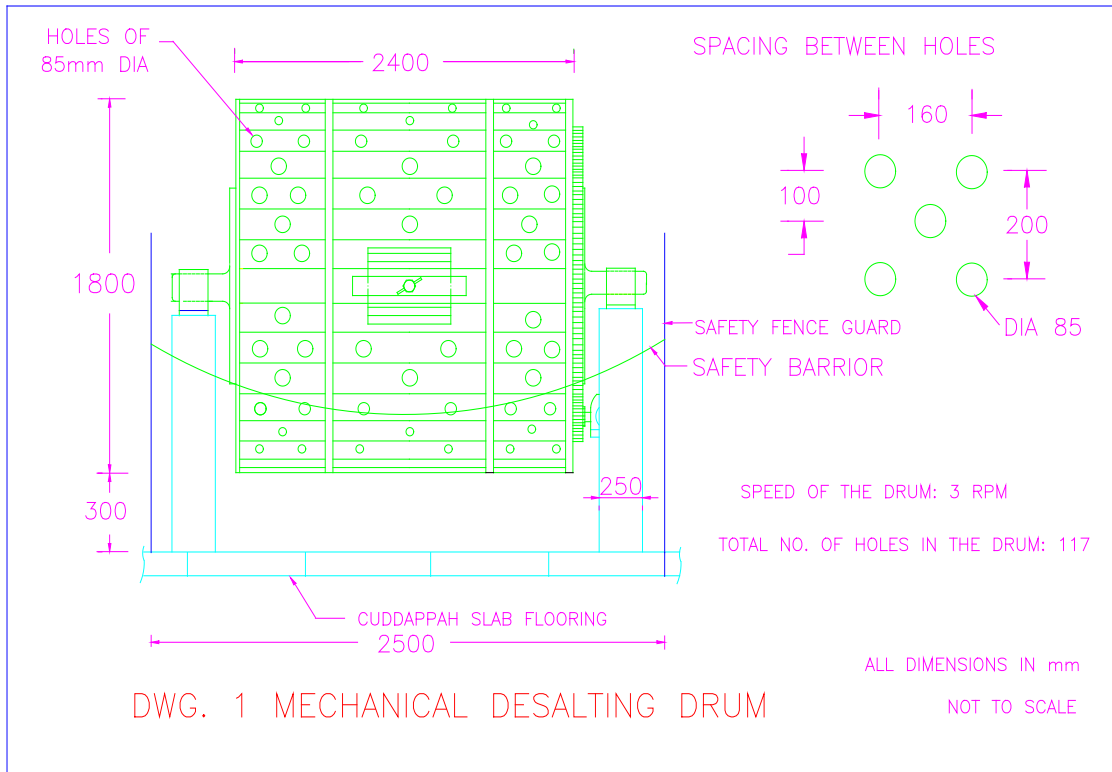
2. Study on flow of hides and skins in the state of Tamil Nadu and alternate techniques to replace salt curing, Dr. T.J. Devassy, June 1996, UNIDO.
3. Terminal report on mechanical desalting and sulphide reduced liming, CLRI-UNIDO, November 1995.

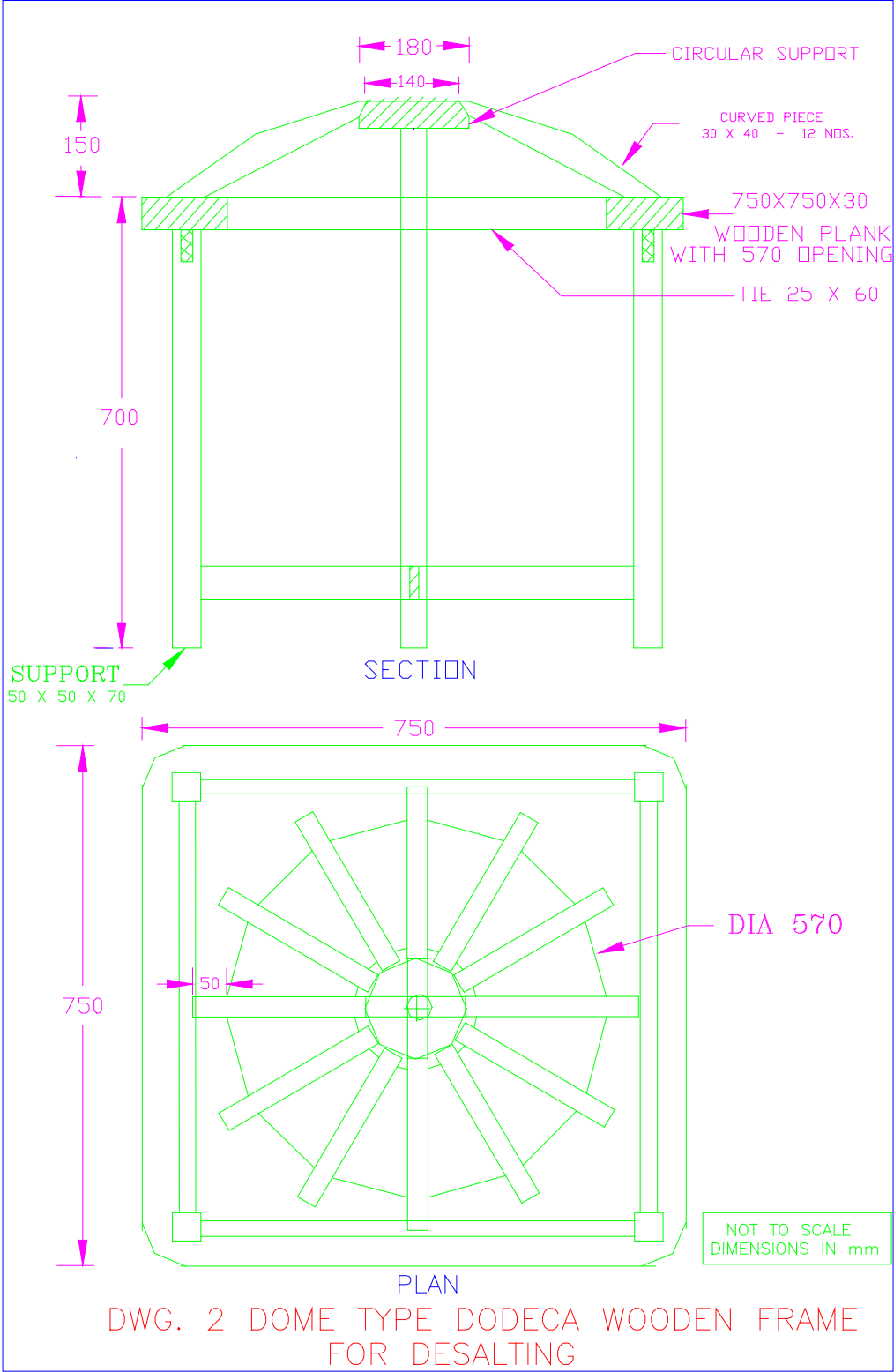


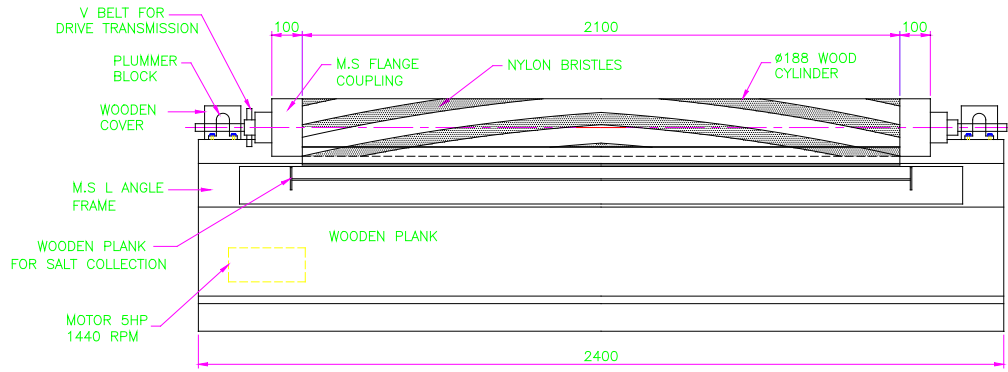
## **Annex-1**

### **Drawings**

- Dwg. 1 Mechanical desalting drum
- Dwg. 2 Dome type DODECA wooden frame for desalting
- Dwg. 3 Brush type desalting machine – Front View
- Dwg. 4 Flow chart for reuse of dusted salt in pickling



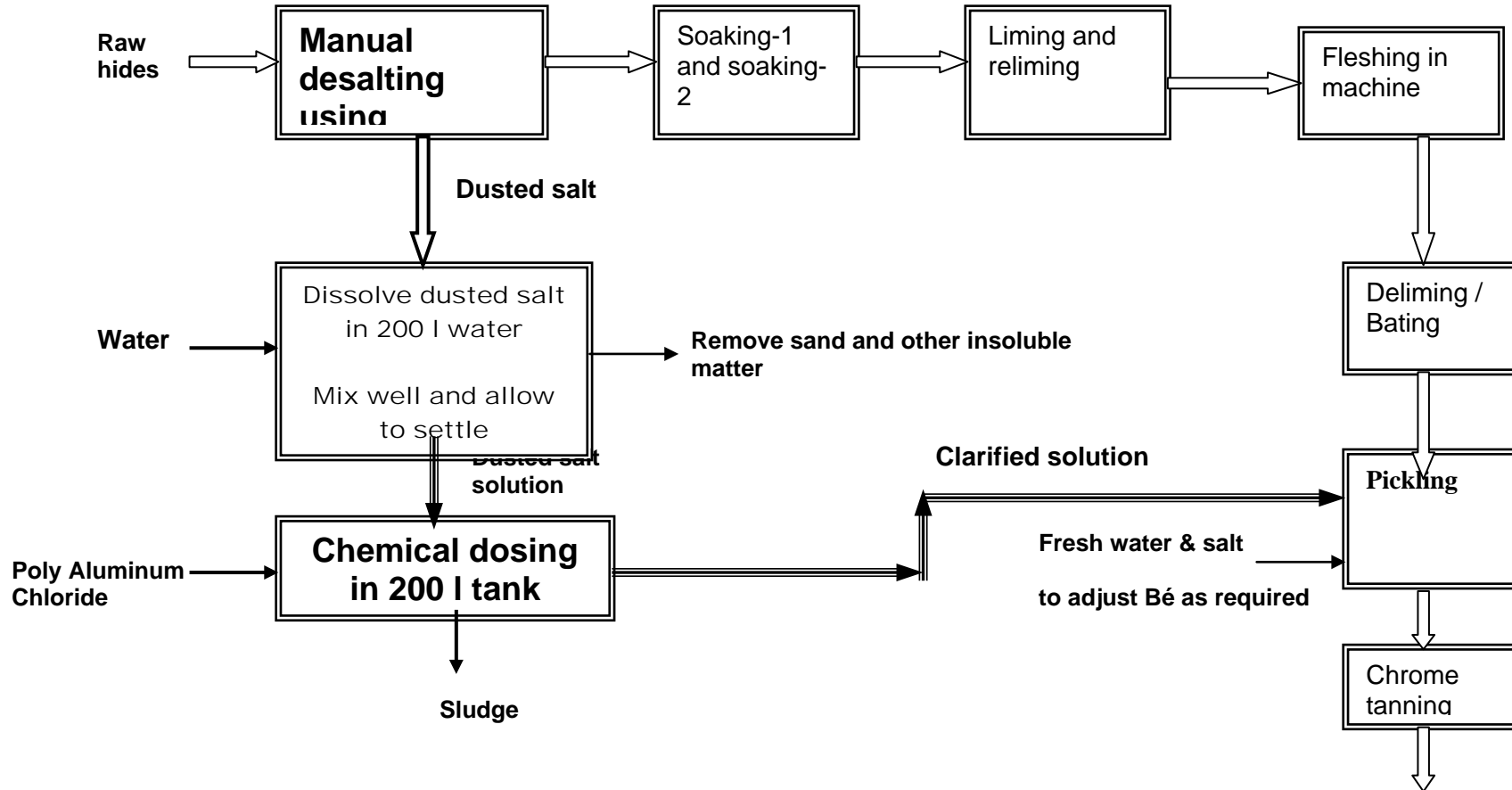




ALL WOODEN PLANKS COVERED BY PLYWOOD  
 ALL DIMENSIONS ARE IN mm.  
 NOT TO SCALE

**DWG. 3 BRUSH TYPE DESALTING MACHINE – FRONT VIEW**

Dwg. 4 FLOW CHART FOR REUSE OF DUSTED SALT IN PICKLING



**Annex-2**  
**Base line data for cost analysis**

**A.1 General**

|   |              |
|---|--------------|
| Energy cost per kilowatt-hour (per unit)                                  | Rs. 3.50     |
| Purity of dusted salt   | 87%          |
| Market price of common salt per kg  | Rs. 1.50     |
| Quantity of raw hide / skin desalted throughout the life of the equipment | 1,250 tonnes |

**A.2 Mechanical desalting**

|   |                            |
|---|----------------------------|
| Motor capacity  | 3.7 kW                     |
| Average quantity of hides loaded  | 300 kg                     |
| Duration of drumming for a batch of 300 kg raw stock                              | 30 minutes                 |
| Time required for desalting 3 tonne of rawhides (including loading and unloading) | 3 hours and 30 minutes     |
| Cost of labour for the mechanical desalting of one tonne of raw material          | Rs. 18.00                  |
| Amortization of mechanical desalting drum   | Rs. 100<br>(125,000/1,250) |

**A.3. Manual desalting using DODECA**

|  |                           |
|--|---------------------------|
| Time required for the manual desalting of 1 tonne of raw stock | 2 hours                   |
| Cost of labour for manual desalting of one tonne of raw stock  | Rs. 65.00                 |
| Amortization of DODECA wooden frame                            | Rs. 3.20<br>(4,000/1,250) |

**A.4. Brush-type desalting machine**

|  |                             |
|--|-----------------------------|
| Motor capacity   | 3.7 kW                      |
| Duration required for desalting one tonne of raw stock | 1 hour                      |
| Cost of labour for desalting of one tonne of raw stock | Rs.48.00                    |
| Amortization of desalting machine                      | Rs. 44.80<br>(56,000/1,250) |

**Wetblue**

### Annex-3

#### Desalting of salted raw hides / skins: Practices followed in different tanning clusters of Tamil Nadu

| #            | Tannery cluster | Number of tanneries processing raw stock | DODECA wooden frame | Brush-type desalting machine | Mechanical desalting drum | Manual desalting using brushes |
|--------------|-----------------|--|---------------------|------------------------------|---------------------------|--------------------------------|
| 1.           | Ranipet         | 85                                       | 77                  | 5                            | 3                         | -                              |
| 2.           | Ambur*          | 32                                       | 15                  | 11                           |                           | 6                              |
| 3.           | Vaniyambadi     | 108                                      | -                   | 104                          | -                         | 4                              |
| 4.           | Udayendiram     | 10                                       | 1                   | 9                            | -                         | -                              |
| 5.           | Erode           | 41                                       | 39                  | -                            | -                         | 2                              |
| 6.           | Trichy          | 18                                       | -                   | 15                           | -                         | 3                              |
| 7.           | Pernambut       | 31                                       | 31                  | -                            | -                         | -                              |
| 8.           | Dindigul        | 61                                       | 12                  | 25                           | -                         | 24                             |
| 9.           | Melvisharam     | 23                                       | 22                  | 1                            | -                         | -                              |
| <b>Total</b> |                 | <b>409</b>                               | <b>197</b>          | <b>170</b>                   | <b>3</b>                  | <b>39</b>                      |
|              |                 | <b>Percentage</b>                        | <b>48</b>           | <b>42</b>                    | <b>1</b>                  | <b>10</b>                      |

\* Desalting using both DODECA frame and brush-type machine is practised in two units.

**Annex-4**  
**MATERIAL BALANCE OF SALT APPLIED IN CURING ONE TONNE OF RAW HIDES**

**SALT APPLIED IN CURING: 400 kg (40% on weight of raw stock)**

