Best Practice – Zero Liquid Discharge System in Tannery CETP in Tamil Nadu

RANIPET TANNERY EFFLUENT TREATMENT COMPANY LIMITED

Providing Environmental Security to the Tanning Industry

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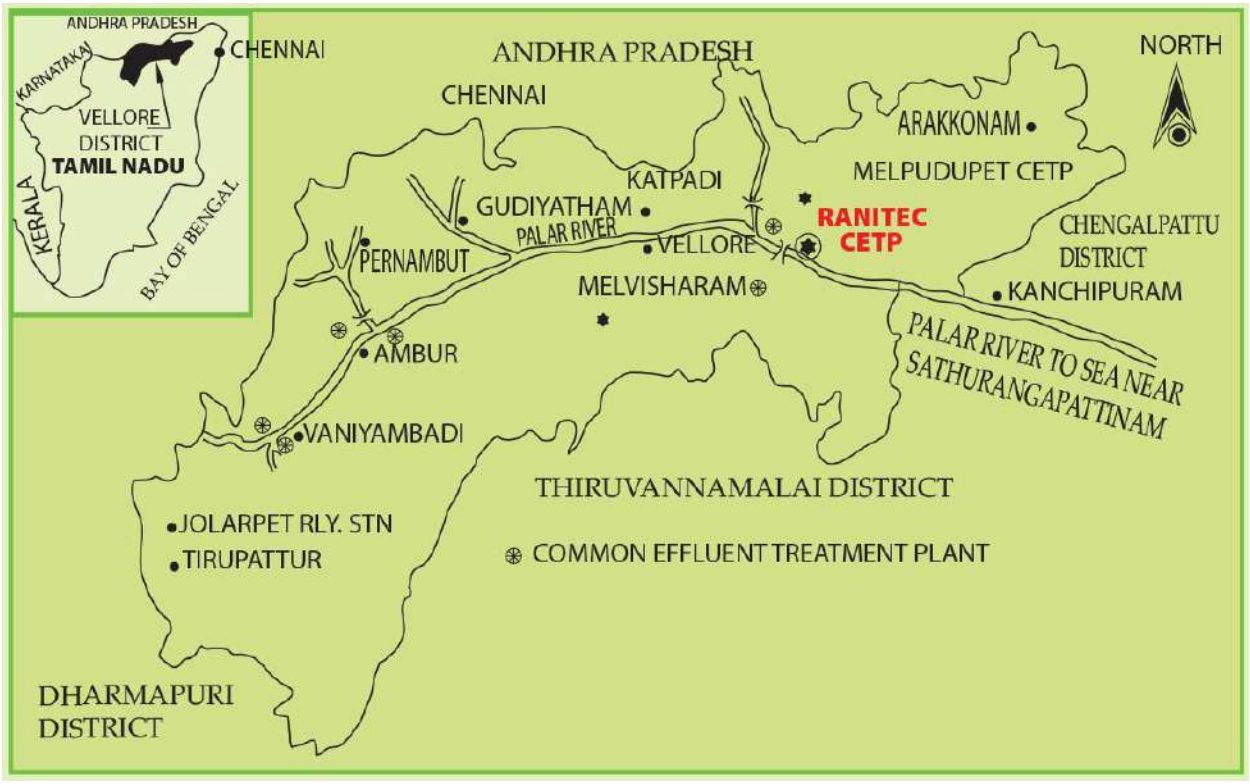
(RANITEC CETP)

Location of the CETP



Concept of Common Effluent Treatment Plant (CETP)

The CETP is based on the concept of 'one for all and all for one'. It is a boon for SMEs. It requires a well knitted organization, involvement, active participation of the member units and a dynamic leadership.

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RANITEC CETP and its functioning:

The CETP of Ranipet Tannery Effluent Treatment Company Limited at Ranipet is one such successful facility catering to the needs of 92 tanneries, which born out of urgent need to address the pollution control problems faced by these tanneries during the first half of 90's.

Tanning Process:

The RANITEC Member Tanneries are doing various type of process of leather involving Raw Hides/Skins to Finished Leather via vegetable/chrome tanning and Semi-finished to Finished Leather. All the Member Tanneries are adopting the following best practices in their processes of tanning:

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1. *De-dusting of salt of the Raw Hides/Skins by using brushing machine "Dodeca" wooden frame.*
2. *PracticingCounter Current Soaking method to reduceconsumption of water.*
3. *Using Enzymes for reducing the consumption of sodium flakes in the de-haring process thereby reducing generation of sodium sulphide in the effluent.*
4. *Using High grade lime with CaO of 70 to 75%, Ca (OH) of 90-95% and Silica less than 2% to reduce the generation of sludge in the tanning processes.*
5. *Installation of Chrome Recovery Plant for recovery of chrome and re-using the same in the process of chrome tanning.*
6. *Installation of Electro Magnetic Flow meter for measurement of Flow by the CETPwith view to encourage usage of water in the process of tanning.*
7. *Installation of Online TDS meter for measuring the TDS load in the effluent before discharging in to the CETP sewer line.*

The Member Tanneries of RANITEC CETP are spread over an area of 4-5 sq.km. The Effluent of these tanneries is conveyed through closed pipe lines with in between two pumping stations and also through pressure and gravity lines to the CETP. The total length of the pipeline is about 15 km.

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Pre-Treatment Unit (PTU) With Flow Metering System

All the Member Tanneries of RANITEC CETP have constructed Pre-Treatment Unit (PTU)as per the design of CETP.

I. *All effluents of Member Tanneries undergoes screening and sedimentation in their PTU before discharging into the CETP sewer line.*

This PTU consists of the following:

a. ***Oil and Grease Trap:*** *The floating matters like fat and proteins presence in the effluent are removed.*

b. ***Bar Screen Chamber:*** *Major particles in the effluent are removed by the PVC/SS type rigid, non-corrosive, fixed bar screens with 5mm spacing provided.*

c. ***Raw effluent Collection Tank:*** *The screened effluent is collected in this tank before being pumped into the Overhead Sedimentation Tanks.*

d. ***Pre-Settlers:*** *Two settlers of overhead type are provided for sedimentation of coarse solids in the effluent. These settlers have valves at the bottom for withdrawal of sludge to the Sludge Drying Beds/Filter Press.*

e. ***Final Collection Tank:*** *The overflow from these Sedimentation Tanks is collected in this tank before being pumped to the CETP Sewer Network through a Flow Metering System.*

f. ***Sludge Drying Beds:*** *Sludge from the sedimentation tanks is discharged into the drying beds with filter media for solar drying. The dried sludge is transported to the Secure Landfill (SLF) of the CETP.*

g. ***Filter Press:*** *Wherever Filter Press is installed, the sludge from the sedimentation tanks is fed to the same for quick drying of sludge with less moisture content for disposing in to the SLF.*

h. ***Flow Metering System:*** *A skid mounted unit comprising of an Electromagnetic Flow Meter with flow Indicator and Totalizer with a pump is installed in each tannery. The effluent from the Collection Tank is pumped through the flow meter to the CETP Sewer Network. The quantity of effluent discharged is recorded in the flow meter. The flow metering system is housed in a sealed close room with opening to switch ON/OFF of the pump. The room key is in the custody of the CETP.*

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Chrome Recovery Unit.

Tanneries doing Chrome Tanning Process have installed Chrome Recovery Units in their premises. These tanneries segregate the chrome liquor and collect in a tank for precipitation of the chrome by adding magnesium oxide solution. The precipitated chrome slurry is added with sulfuric acid to regenerate chrome and filled in carboys. Thus the chrome is recovered and mixed with fresh basic chromium sulphate for re-use in the tanning process.

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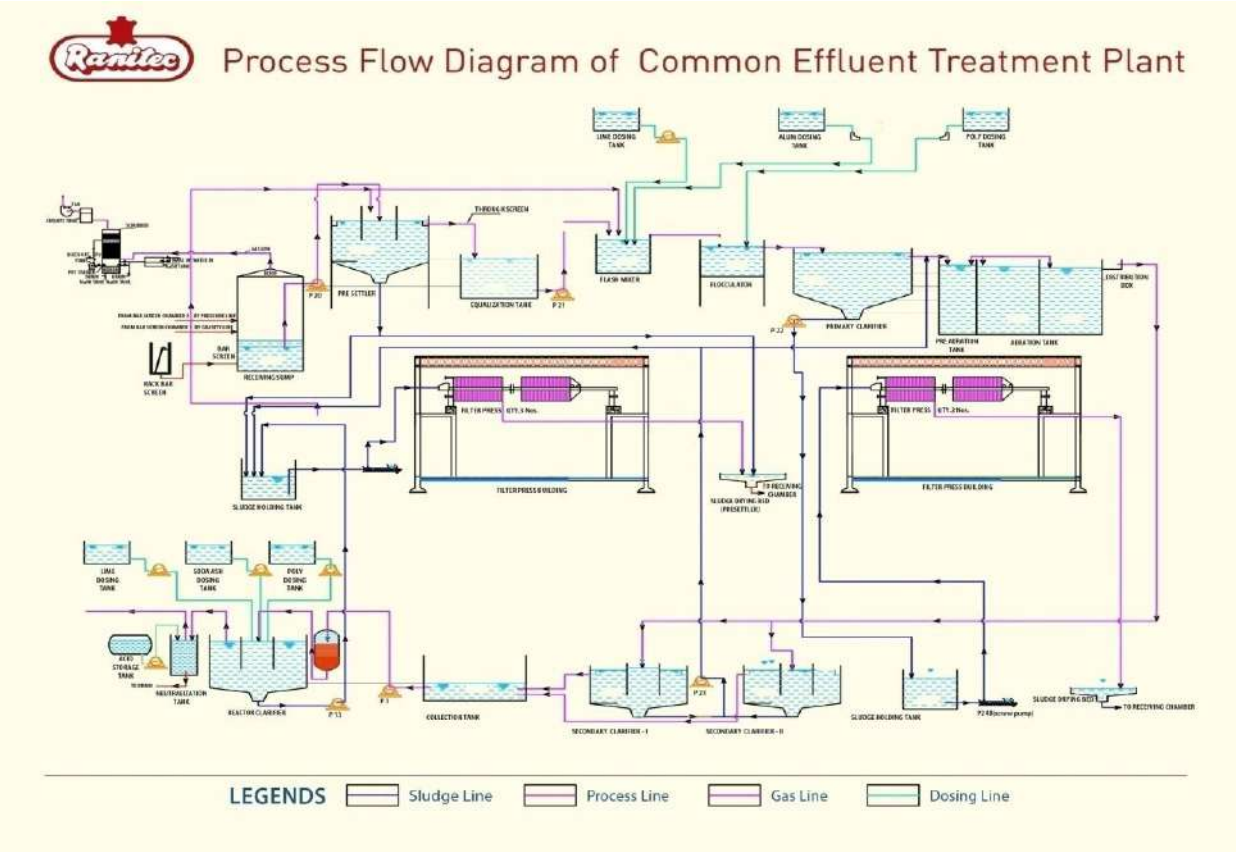
Process Description



The effluent from different tanneries flow through a Mechanized Rake Bar Screen to the Receiving Sump, wherein 1No of Submersible mixers is installed for complete mixing befores transferred to the presettler units for removal of easily settleable coarse solids. The overflow from this unit is passed through a rotary fine screen (which screens solids < 3 mm) before discharge into the Equalization Tank with 2 Nos of Aspirators and 3 Nos of Blowers for the coarse bubble mechanism are installed for homogenous mixing of the effluent.

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The effluent from the Equalization Tank is chemically treated with lime and alum in the flash mixer and polyelectrolyte is added in the flocculation to facilitate coagulation and flocculation of solids which is sedimented in the Primary Clarifier and conveyed to the Filter Press for dewatering the sludge. A pH of 8.0 to 8.2 is maintained in the Primary Clarifier to precipitate the chromium(Cr^{3+})present in the effluent as chromium hydroxide.

The above-mentioned primary treatment removes 65-70% and 40-45% of incoming suspended solids and BOD as well as precipitating most of the chromium. The overflow from the Clarifier is further treated in the Pre-aeration tank for removal of Hydrogen Sulphide using Liquid Oxygen with Mixflow system before entering in to an Extended Aeration Type Activated sludge process in Aeration tank I & II (1.2 days HRT) with Diffused Aeration System, in aeration tank I EPDM Tubular Diffusers is replaced with Original Hydrodynamic Reaction (OHR) aJapanese technology.Three blowers of 7000 m^3/hr capacity of each have been installed to maintain a D.O between 1.5 to 2.0 mg/lit. The outflows from the Clarifiers have a BOD of around 30 mg/l. To further improve the effluent characteristics and colour, the effluent is passed through Pressure Sand Filters after the addition of Alum and polyelectrolyte in the flash mixer and flocculation in the flocculator.

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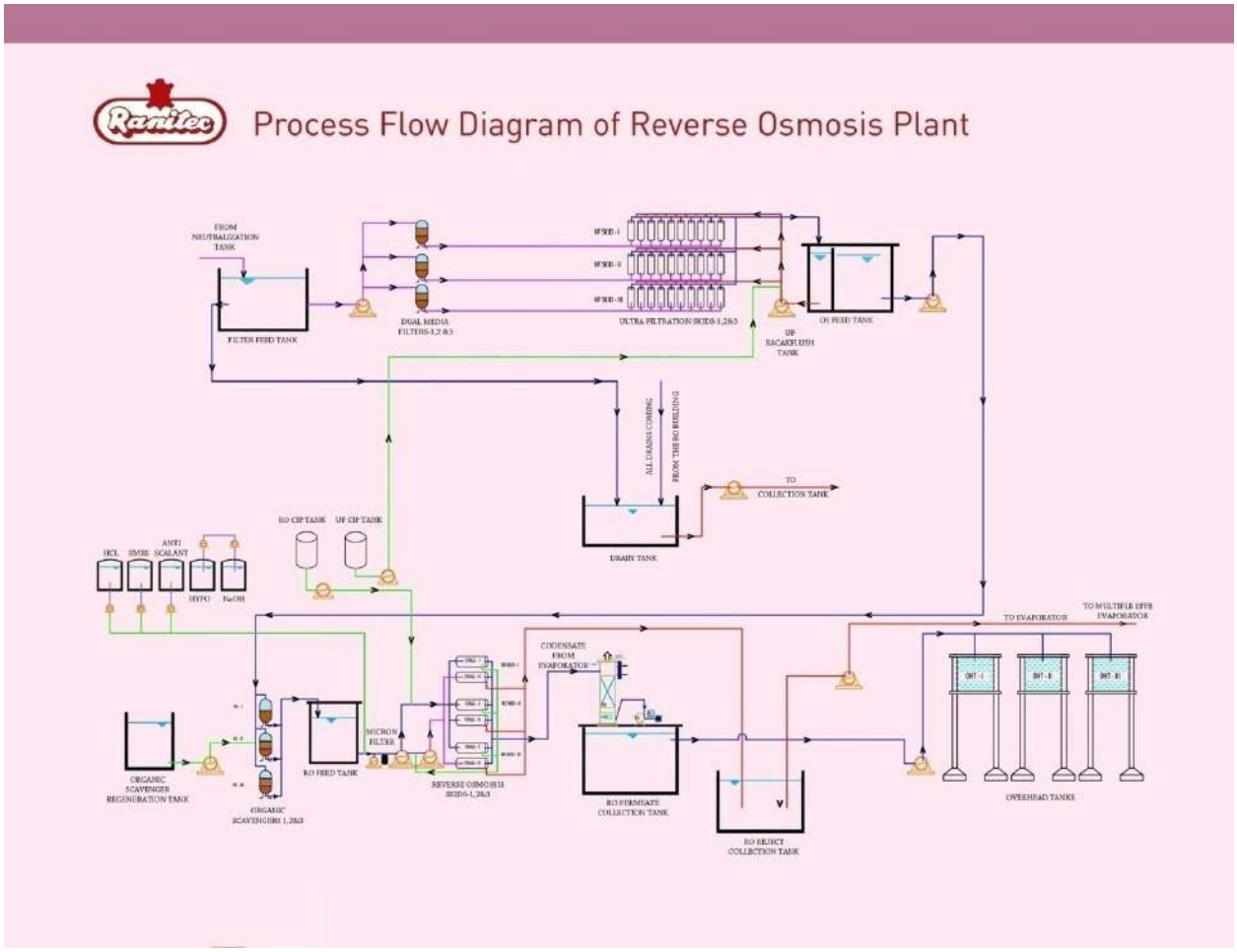


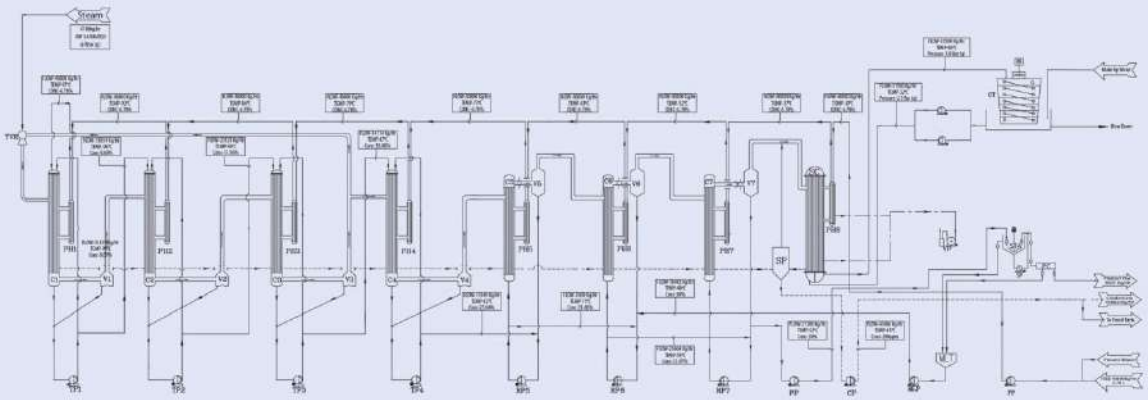
The treated effluent reaching the RO system is first subjected to softening through lime-soda process in a reactivated clarifier. The softened effluent is further filtered in the dual media filters and very fine filtration is obtained in an ultrafiltration system engaging hollow fibreUF membranes. The ultra-filtered effluent is then polished in organic scavenger before it is desalinated in two stages Reverse Osmosis unit. The entire UF and RO skids are made from USAand is automatic, controlled through SCADA.

The reject from the RO are again subjected to third stage High Pressure RO to recover additional permeate and thereby reduce the volume of reject fed to the seven stage Multiple Effect Evaporator with four stages of falling film and three stages of forced

circulation evaporation towers (calandrias). The fuel used for producing steam is firewood and biomass briquette. The salt-laden solid residue is separated out in a pusher centrifuge.

The permeate from RO system and the condensate from evaporator are combined and distributed back to the tanneries for use in manufacturing process through a recovered water conveyance system with three Over Head Tanks at different locations in the cluster.

Process Flow Diagram of Multiple Effect Evaporator Plant



CODE	DESCRIPTION
FP	FEED PUMP
SC	SPRAY CONDENSOR
PH	PRE-HEATER
C	CALENDRIA
V	VAPOUR SEPARATOR
TP	TRANSFER PUMP
CP	CONDENSATE PUMP
VP	VACUUM PUMP
TVR	THERMO VAPOUR COMPRESSOR

CODE	DESCRIPTION
ICP	INSTRUMENT CONTROL PANEL
MCC	MOTOR CONTROL CENTER
AC	AIR COMPRESSOR
STA	SETTLING TANIK
PC	PUSHER CENTRIFUSE
SP	SCREW PUMP
MLP	MOTHER LIQUOR PUMP
SWP	SEALING WATER PUMP
PHE	PLATE HEAT EXCHANGER

CODE	DESCRIPTION
SWT	SEALING WATER TANK
MLT	MOTHER LIQUOR TANK
HWT	HOT WELL TANK
RP	RECIRCULATION PUMP
PP	PRODUCT PUMP
CWSP	COOLING WATER SUPPLY PUMP
CWRP	COOLING WATER RETURN PUMP
CT	COOLING TOWER

The salt-laden solid residue is stored in bags and a huge salt storage yard has been constructed for the purpose. Efforts to re-use the salt in preservation of hide / skins and purification system is underway.

The Sludge from the Primary, Secondary clarifiers and Reactivated clarifier are discharged to the mechanical dewatering. The back washing effluent from Sand filters is discharged back to the Receiving Sump and Back washing from Dual media filters, OS and RO are recycled back to the Secondary Effluent Collection Tank. The dried sludge is then disposed of to the Secure Land Fill (SLF) system.

The CETP meets the Zero Liquid Discharge standards of Tamil Nadu Pollution Control Board (TNPCB), and the Electro Magnetic Flow Meters connected to the CARE AIR Centre of TNPCB at Chennai for online monitoring.

Unique Features of the CETP

- *The plant is designed to handle about 4500 cum/day of effluent, making it one of the Largest Common Effluent Treatment Plant (CETP) for tannery wastewater in the country. Some of the other unique features of this treatment facility are:-*
- *World first CETP to achieve the highest International Standard for Environmental Management System - the ISO standard. The CETP achieved ISO 14001 Certificate on 29th January 2014 certified by DET NORSKE VERITAS (DNV) , The Netherlands.*
- *India's first CETP to achieve the highest International Standard for Quality - the ISO standard. The CETP achieved ISO 9002 Certificate on 15th November 1999 and is currently ISO 9001: 2008 certified by DET NORSKE VERITAS (DNV) , The Netherlands.*
- *The CETP was installed Zero Liquid Discharge (ZLD) System with partial assistance from Govt. of India and Govt. of Tamilnadu under the Up-gradation and Installation of Infrastructure for Environmental Protection in the tanning*

industry of the Department of Industrial Policy & Promotion (DIPP), Ministry of Commerce and Industry (MoC&I) under the ILDP scheme at a cost of Rs.460 million of 11th Five Year Plan.

- *The ZLD project was implemented by Chennai Environmental Management Company of Tanners (CEMCOT) as SPV. Under this scheme new equipment like Extended Diffused Aeration System, Reactivated Clarifier, Reverse Osmosis Plant, Multiple Effect Evaporator with Boiler, Lab and Administrative Building, Salt Storage Yard, Replacement of Raw Effluent Conveyance System and Recovered Water Conveyance System.*

- *The CETP was connected to CARE AIR CENTRE of Tamilnadu Pollution Control Board (TNPCB) for online monitoring. The plant operating with computerized operations management system.*

- *The CETP was up-graded with partial assistance from Govt. of Tamilnadu under the ASIDE scheme at a cost of Rs. 16.7 million with technical assistance from Central Leather Research Institute (CLRI). Under this scheme new equipment like submersible Mixers, Diffused Aeration System, additional Secondary Clarifier, Pressure Sand Filters and Activated Carbon Filters and Plant Automation works were carried out Anaerobic lagoon and Degassifier tank were removed from the process scheme.*
- *The CETP has been selected under the HRD mission of Govt. of India for conducting Tannery waste management courses for over 1050 professional including CETP / IETP managers, workers, faculty and students of universities in the next three years. A MoU has been signed between CLRI, All India Skin and*

Hide Tanners and Merchants Association (AISHTMA) and RANITEC for this purpose.

- *India First and the only Tannery CETP to have installed Electromagnetic flow meters in all operating member tanneries and implemented flow based maintenance charges since 1999. This also complies with the Charter for Corporate Responsibility for Environmental Protection (CCREP), 2003*

- *This plant was Co-sponsored by the United Nations Industrial Development Organization (UNIDO) until 2001 and considered a model CETP for the South East Asian region, under an agreement signed by RANITEC and UNIDO's Regional program office in Chennai.*

- *The CETP constructed a secure landfill system with the partial assistance from Govt. of Tamilnadu under the ASIDE scheme at a cost of Rs.81.81 million with the technical assistance from Central Leather Research Institute (CLRI). The capacity of secure landfill system is 65000 Cu.m.*

Best Practices adapted in the CETP:

1. *Installation of coarse bubble mixing system in the Equalization tank to facilitate homogeneous mixing of effluent, reducing of Hydrogen sulphide (H_2S) and controlling of odour in the atmosphere.*
2. *Using High Purity Lime with CaO of 70 to 75%, Ca (OH) of 90-95% and Silica less than 2% to reduce the generation of sludge in the Primary treatment.*
3. *Installation of Liquid Oxygen sytem in the Pre-aeration to remove Hydrogen sulphide (H_2S) and other toxic gases present in the effluent, thereby avoiding shock load to the biological system.*

4. *Installation of Disc Micron Filters ahead of Ultra-filtration system for protection its membranes*
5. *Installation of High Pressure RO to recover additional permeate and thereby reduce the volume of reject fed to the seven stage Multiple Effect Evaporator.*
6. *Installation of Steam Flow meter at the outlet of Boiler for measurement of consumption of steam in the Evaporator, thereby optimizing fuel consumption.*
7. *Installation of Condensate Recovery System to increase the temperature from 35° C to 60° C of feed water in the Boiler for reducing the consumption of fuel in the Boiler.*

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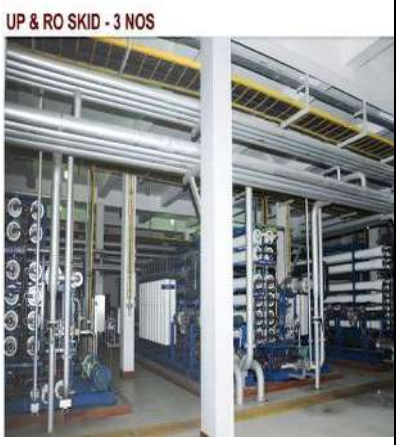
<td> 
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Thank You