



Water abstraction, salinity and tanneries: The Ranipet CETP, a complete solution

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A combination of reverse osmosis (RO) and evaporation/condensation has ensured that 95% of the volume of effluent entering the Ranipet CETP plant is returned to the tanners as high quality water for reuse in a massive closed loop. No liquid is discharged from the plant, and the operation has almost completely stopped the abstraction/use of potable water for leather manufacture in the district.



All of the treated effluent from Ranipet CETP is returned to the tanneries as high quality water for leather manufacture.

Commissioned in 1995, the Ranipet Tannery Effluent Treatment Company Ltd (RANITEC) common effluent treatment plant (CETP) originally provided full primary and secondary effluent treatment for 77 tanneries (now 90 tanneries with an additional 13 tanneries of MELTEC CETP) followed by discharge of the treated effluent into surface waters. However, since May 2012, the company has adopted a policy of zero liquid discharge and ceased the discharge of any form of liquid effluent from the site.

The technology that has been developed enables 95% of the effluent received by the plant to be recycled as pure water at 500 mg/l TDS back to the tanneries for reuse, and dry but impure salt.

The recovered water is returned to the tanneries using a fleet of water tankers, but this will be replaced by a 25 kilometre pipe line that is on the point of completion. This massive closed water-loop avoids the problems of:

- Water provision/abstraction for a very significant concentration of tanneries.
- Inland discharges of saline treated effluent into surface waters.
- Issues concerning increasing salinity in groundwater.

The technology operates in three stages:

Stage 1: The raw wastewaters generated by each tannery are subjected to in-house pre-settling and screening before discharge and delivery to the CETP through underground pipelines. This untreated effluent received by Ranipet can be characterised as shown in the following table:

On receipt the effluent is first fine screened, settled and equalised. It is then subjected to chemical dosing using aluminium salts, lime and polyelectrolytes to remove chrome, suspended solids and part of the organic load. This stage is followed by activated sludge treatment using fine bubble diffusion aerators to degrade

Parameter	Mg/l
Chemical Oxygen Demand	2,800 – 3,200
Biochemical Oxygen Demand	1,200 – 3,000
Suspended solids	2,500 – 3,000
Total Dissolved Solids	12,000 – 15,000
Volume	1,800 m ³ /day (design 3,000 m ³ /day)

organic materials and sulfides. This is followed by tertiary treatment where the treated effluent is chemically dosed followed by sand filtration.

Stage 2: After sand filtration the treated effluent is water softened by the lime-soda process using a reactivator clarifier, and then further filtered using multigrade filters. This is followed by ultra filtration (UF) in a system using hollow fibre membranes; this operates for 30 minutes, and is then followed by a backwash for one to two minutes. The ultra-filtered effluent is then polished in an organic scavenging unit before desalination in two stage RO units.

At this stage approximately 75% of the effluent has been recovered as high quality permeate from the RO operation and suitable for return to the tanneries for further use. This stage of the operation uses electrical power from the grid for 14 hours of the day, and 10 hours from generators.

Stage 3: There are many examples of air evaporation of the concentrate following RO treatment of effluents. When using this technique dry salts are recovered, but all of the water is lost by evaporation.

However, this process is different as the remaining 25% concentrate is force evaporated using a steam generating plant that operates using 10-12 tons/day of firewood as fuel +/- biomass briquettes of dried solids from the activated sludge treatment process.

The steam generated is circulated under pressure through steam coils to evaporate the water from the concentrate. This takes place in a seven-stage stainless steel evaporator plant, with the evaporate recovered as pure water using a condenser unit. This recovered water is added to the permeate from the RO operation for return to the tanneries for use in leather processing. Any water losses are due to normal surface evaporation associated with effluent treatment, and no liquids are discharged from the site.

The salt laden solid residue from the evaporation plant – mainly sodium chloride, sulphate and persistent organic compounds – is finally recovered via a centrifuge, and is stored in polypropylene bags. A huge storage facility is under construction to hold this salt long term; uses are being investigated and include re-use for hide/skin preservation.



After extended tertiary effluent treatment, all remaining suspended solids are removed by ultra filtration.



Reverse osmosis treatment in three units as shown above provides approximately 75% permeate as high quality water suitable for processing leather.



The remaining concentrate from reverse osmosis is evaporated to dryness in a series of seven stainless steel evaporators (tops of the units shown in the image above).



The evaporated water vapour is condensed and cooled in the cooling tower, then mixed with the recovered permeate from RO in a holding tank.



The photograph shows the dry salts directly extruded from the recovery plant before being packaged in clearly marked heavy duty woven polypropylene bags for storage on site.



An additional storage facility is under construction for secure storage of the recovered salt. Investigations are taking place to find a use for this impure product.

The major steps in this operation are illustrated in the photographs.

A global first

This is the first plant in the world to operate in this manner, and the technology can be applied anywhere. It completely solves the problem of saline discharges into surface waters and

rivers for inland tannery clusters, although it is expensive technology both in terms of capital, operating costs and energy.

The cost for conventional treatment at this plant (primary, secondary and conventional tertiary) was Rs 30-40 /m³ (\$ 0.6-0.75), but this has now risen to Rs140-160/ m³ (\$ 2.6-3.0). However, the CETP is paving the way for saving abstracted groundwater to the extent of 3,000m³/day and has eliminated



Two CEPT employees standing near the wood and biomass steam generating plant that provides energy for the evaporation of concentrate.



The whole recovery plant is housed within the blue and white building. The five story part accommodates the seven evaporator units.

the risks of contamination of both surface waters and the aquifer through salinity. It also ensures the viability of tanneries in the cluster, and the livelihood of about 15,000 direct employees.

The funding was provided by a 50% grant-in-aid from the Department of Industrial Promotion and Policy, Government of India, 15% from the Ministry of Industry and Commerce, Department of Industry, Government of Tamilnadu, and 35% by the CETP (i.e. the tanners). The total cost was Rs 440 million, approximately \$8 million.

This can be considered a “world first”. A combination of

clean technology on behalf of the tanners, and considerable investment has created a massive water/tanning/effluent closed loop and set a global benchmark. 🌱

Legend

- Project: implemented by CEMCOT, a special vehicle created by Ranitec.
- Contractor: Hydroair Tectonics PCD Ltd, Mumbai, India.
- UF and RO units provided by Salcon, Singapore.
- Membranes from Hydranautics USA.
- Seven Stage evaporation towers supplied by Mojji, Pune, India.
- The whole system is automatic, controlled through SCADA.