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HYDRANAUTICS

# TREATING TEXTILE WASTEWATER USING REVERSE OSMOSIS TECHNOLOGY

*Case study*

*Treating wastewater containing chemicals, dyes, and solids using PRO-XP1 membranes at a CETP textile plant in Tirupur, India*

## The PROBLEM

The textile business generates vast quantities of polluting wastewater containing a high level of toxicity, high organics, and total dissolved and suspended solids concentration. Although challenging, treatment of textile wastewater streams is necessary to eliminate negative environmental impact.

Tirupur, a textile hub in Tamil Nadu, India, has experienced severe water pollution caused by the discharge of colored effluents from textile bleaching and dyeing plants for over three decades. A textile CETP in Tirupur struggled to maintain the evaporator efficiency, which is the final unit operation before the solids are discharged — operating the evaporators round-the-clock increased operating costs.

The primary objective was to reduce the amount of wastewater fed into the evaporator to decrease operational costs.

The evaporator was fed with a RO reject stream at the flow rate of 12 $m^3/h$. The CETP wanted to reduce this flow to the evaporator to improve its efficiency while simultaneously operating it optimally. This was difficult with the high reject volume that the evaporator had to treat.


## The SOLUTION

Hydranautics recommended the addition of the sixth stage with ultra-high-pressure reverse osmosis membranes that could reduce the total volume of the wastewater being fed into the evaporator. However, this wasn't easy. Several challenges had to be eliminated before the implementation of this stage for the desired benefits. The challenges that were faced were:

- Maintaining the feed water temperature per design guideline.
- Reducing the high turbidity of the feedwater streams.

The existing plant had conventional pretreatment before the Reverse Osmosis system. The plant consisted of several RO stages with Hydranautics SWC5LD membranes.

Based on the site survey, Hydranautics Technical Team identified a good potential for plant operation improvement. They suggested the following changes.

- Install an Ultrafiltration unit prior to the RO to reduce the turbidity levels to stage 6.
- Install the sixth RO stage with Hydranautics' PRO-XP1 membranes to reduce the final reject being fed to the evaporators.
- Install a heat exchanger to ensure the feedwater temperature stays within the design range.

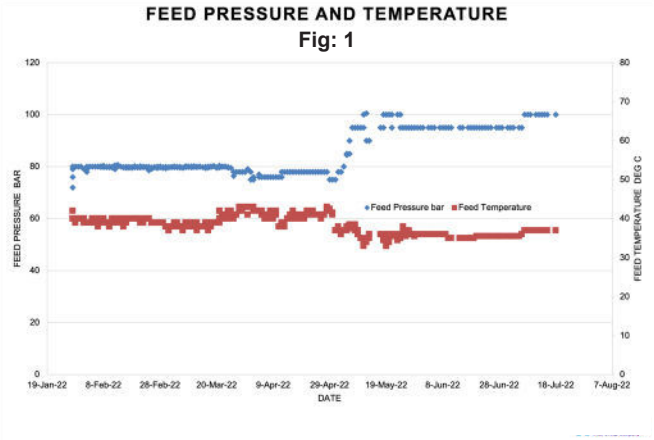
| Parameter - Stage 3 | Feed | Permeate | Reject |
|---|---|---|---|
| *pH* | 7 | 6.35 | 7.29 |
| *TDS, ppm* | 105,000 | 250 | 145,400 |
| *Total Hardness, ppm $CaCO_3$* | 300 | Not measured | 500 |
| *Total Alkalinity, ppm $CaCO_3$* | 785 | Not measured | 950 |
| *Chloride, ppm* | 8,300 | Not measured | 11,050 |
| *Sulphate, ppm* | 63,330 | Not measured | 85,701 |
| *COD, ppm* | 2,840 | BDL | 3,920 |

## *The* IMPACT

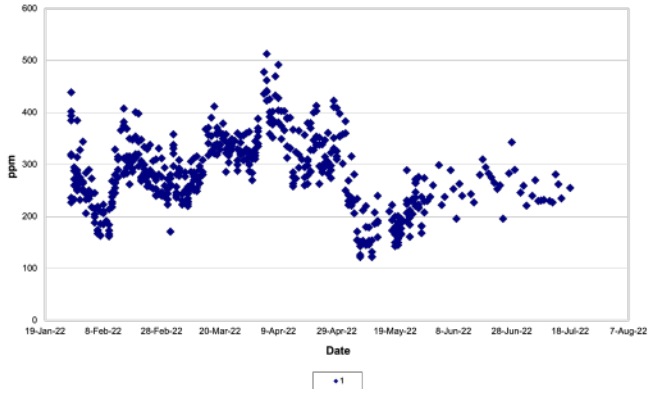
In one-of-a-kind, highly complex wastewater treatment plants, with the improvements suggested by Hydranautics and implemented by the CETP, the below noticeable and measurable impacts were noted:

- With the installation of a 6th Stage with the Hydranautics PRO-XP1 membranes, the final reject volume to the evaporator was reduced from 12 $m^3$/h to 8 $m^3$/h. *(fig. 1)*
- Earlier, treating RO reject cost USD 11 per $m^3$/h to the CETP. With the reduction of the reject volume, this cost was reduced to one-third.
- The permeate TDS achieved was consistently below 300 ppm, and the reject TDS was 145,000 ppm at 30% recovery at 100 bar feed pressure. *(fig 2)*
- The project started towards the end of January 2022, and by May 2022, the CETP had already achieved savings of USD 21,700 due to the reduced feed load on the evaporator.
- Currently, the evaporator can stay idle until the feed volume reaches the acceptable load that needs to be fed into the evaporator, thus enabling the plant to schedule maintenance activity that wasn't possible previously.
- The industry sought 140 gpl of brine for reusing it in the dyeing process. Stage 5 reject stream was only 80 gpl that the industry had to send to an evaporator to increase its concentration to 140 GPL. However, after implementing the Hydranautics recommended solution, the industry could directly use stage 6 reject as brine in the dyeing process. Reduction in the evaporator cost was an added and welcome benefit.

**FEED PRESSURE AND TEMPERATURE**
**Fig: 1**




**PERMEATE CONCENTRATION**
**Fig: 2**



| Stage-6 Cost Savings | |
|---|---|
| *Permeate recovered in RO* | 4 $m^3/h$ |
| *Reject flow before installation of Stage-6* | 12 $m^3/h$ |
| *Reject flow after installation of Stage-6* | 8 $m^3/h$ |
| *Evaporator operating cost per hour* | 850 $INR/m^3$ |
| *Evaporator operating cost before Stage-6 installation* | 10,200 INR/h |
| *Evaporator operating cost after Stage-6 installation* | 6,800 INR/h |
| *Cost saving per hour* | 3,440 INR/h |
| *Annual saving (consider 300 days and 20 hours operation per day)* | 20,400,000 INR/Annum |
| *Stage 4-6 permeate flowrate* | 17.5 $m^3/h$ |
| *Stage 6 power consumption* | 8.25 kWh |
| *Stage 6 permeate flowrate* | 4 $m^3/h$ |
| *Power cost for Stage 6 ( INR 8.5 per kWh)* | 70.1 INR/h |
| *Annual power cost (300 days and 20 hours operation per day)* | 420,750 INR/Annum |
| **Net Saving** | **19,979,250 INR/Annum** |
| *Payback period* | 3 months |

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For more information about Hydranautics case studies, contact us at **hy-marketing@nitto.com** or visit our website at **membranes.com**

**About Hydranautics**

Since our founding in 1963, Hydranautics has been committed to the highest standards of technology research, product excellence and customer fulfillment. Hydranautics entered the Reverse Osmosis (RO) water treatment field in 1970 and is now one of the global leaders in Integrated Membrane Solutions. Hydranautics became a part of the Nitto Group in 1987. Nitto is Japan's leading diversified materials manufacturer. The group offers over 13,000 high value specialty products worldwide including optical films for liquid crystal displays, automotive materials, reverse osmosis membranes for desalination and transversal drug delivery patches.

As leaders of high quality membrane solutions, we believe our commitments extend beyond manufacturing and selling our products. Our skilled staff of technicians, engineers and service professionals assist in designing, operating and maintaining a robust, reliable and efficient membrane system to meet your requirements and exceed your expectations.

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