Reducing the cost of water re-use in the textile sector

Kalol, India

water scarcity impact

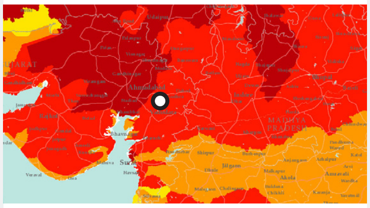
Reduced withdrawal	Main
Reduced consumption	
Improved water quality	
Increased productivity	
Net basin benefit	

volumetric impact
5 035 606 m³/yr

capital cost
$19 800 000 (confidence: Low)

estimated unit cost of water
170 ¢/m³ (confidence: Low)

Water Stress
Kalol, India



- Arid & low water use
- Low (<10%)
- Low to med (10-20%)
- Med to high (20-40%)
- High (40-80%)
- Extremely high (>80%)
- No data available

Water Stress Map:
F. Gassert, P. Reig, T. Shiao, M. Luck and M. Landis, 2015. "Aqueduct Global Maps 2.1."

Confidence level
Low Medium High

Water Scarcity Impact Key
Main Minor

Credits
We wish to acknowledge the input of Mr Abhishek Bansal of Arvind Group in the preparation of this case study.

Project Overview

The textile industry forms a critical part of the Indian economy contributing 4% of total GDP and employing over 45 000 000 people. The processing of textiles is, however, a significant user of freshwater and poses significant pollution challenges in the disposal of its wastewater.

The Arvind textile mill located near Kalol, Ahmedabad District, India uses over 6.5 million m³ of process water per year. Limitations on groundwater extraction coupled with the lack of a nearby location for effluent discharge led to the implementation of a complete water reuse system.

The total water available from the local aquifers is approximately 1.5 million m³/yr with the rest of the process water being provided through wastewater re-use. The unit cost of re-using process waste water was between $4-6 /m³ which is a very high unit cost particularly when compared to ground water abstraction rates.

In order to reduce the unit cost of recovered water the operators installed a new thermal evaporator using simplified vapour compressors and polymeric film surfaces. This reduced the unit cost of recovered water to less than a third of the original cost. The principal reduction in unit cost has been achieved through an 80% reduction in energy demand. The capital cost of the polymeric film surfaces is significantly lower than conventional alloys and has also reduced the operating and maintenance costs.

Key Elements

- Four-stage waste water treatment and re-use comprising of filtration, reverse osmosis, falling film thermal evaporation and crystallisation.
- Use of simplified vapour compression.
- Replacement of conventional metal alloy heat exchangers with polymeric materials.
- Utilisation of waste chemicals from nearby industries as process reagents.

Key Outcomes

- Approximately 80% of process water retained and reused thus negating the need to withdraw 5 035 606m³ per year.
- Reduction in energy demand of up to 80%.
- 65% reduction in operating costs.
- Salts abstracted from the crystalliser and re-used in the dyeing process.

Intervention Features

¬ Wastewater reuse in textile industry

Project Levers

(1) Zero liquid discharge

Effluent water is pre-treated with an anti-scalant solution and fine filtration at an effluent treatment plant before being passed through the reverse osmosis system.

94 - 96% of water produced is of a high quality and is reused as process water within the mill. The remaining 4 - 6% is put through a brine concentrator and crystallizer to reduce to a dry solid and distillate water. Usable salts produced are reused in the dyeing process and residual waste sent to landfill.

(2) Implementation of new evaporation technology

With spiralling operating costs a new system was implemented utilising evaporators based on simplified vapour compressors and polymeric film heat exchangers instead of conventional metal/alloys. An energy source for the system is created as latent heat is released when the vapour evaporated from wastewater is condensed. This reduces operating costs to a third of the original costs.

(3) Utilising waste from other industries

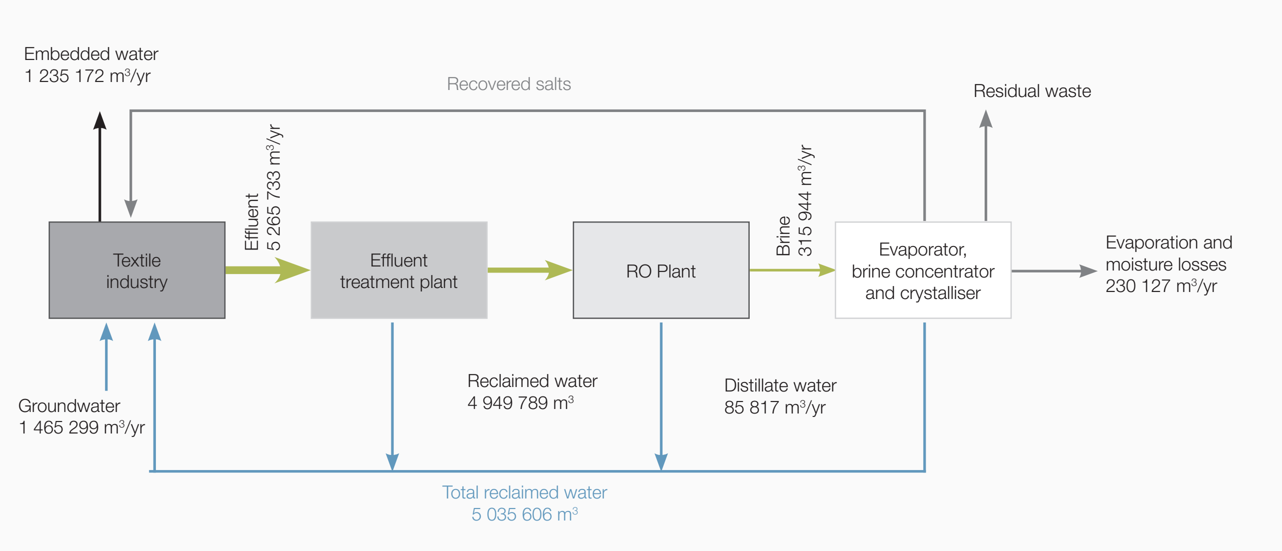
Chemical input through the treatment process utilises waste material from nearby pharmaceutical industries. This includes powdered activated carbon (PAC) for colour removal of wastewater as well as spent acid and aluminium chloride. This in turn reduces operating costs further.

Outcomes and Challenges

Net withdrawal from groundwater is limited to losses during the textile process, evaporation losses and moisture remaining in sludge dispelled at the end of the process. This amounts to approximately 22.5% of total process water.

Trials using electron chemical oxidation technology are currently ongoing, which would lead to elimination of biological sludge after the process. This will result in a further reduction in operational costs by eliminating landfill charges.

This case study demonstrates the effective utilisation of polymeric heat exchangers within the textile industry; similar units have been installed at a number of other locations.



Above: Process flow diagram