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RECLAIMING PUBLIC DRAIN WASTEWATER USING INTEGRATED MEMBRANE TECHNOLOGY

Case study

Cost-Effective Treatment of Wastewater from Industrial Cluster in Malaysia with HYDRAsub MBR and LFC3-LD RO Membranes

The PROBLEM

Reclaiming wastewater for reuse by industries is becoming a necessity in Malaysia. One such example is in Selangor state of Malaysia. The state houses different types of water consuming industries such as Food & Beverages, Electronics and Life Sciences.

While some industrial clusters faced water shortages, others faced high raw water costs, and some both.

These problems made expansion to existing capacities difficult, unless an alternate supply of raw water was available. Industries sought a less expensive and environment friendly alternate treatment solution.

Location	Selangor, Malaysia	*Start-up date*	March 2018
Feed water source	Public drain wastewater	*MBR Design*	HYDRAsub2400 ES, 5 nos.
Application	Open drain wastewater recycle	*RO design*	LFC3 LD, 182 nos.
Capacity	120 m^3/h		

The SOLUTION

One particular cluster chose to recover wastewater from a public drain that was being discharged to the sea. This drain contained treated wastewater from some industries, untreated sewage and wastewater from automobile, mechanical and other workshops. Being an open public drain, there was no control on quality and quantity of wastewater or debris discharged into it.

To keep costs down, the industries sought a simple and cost-effective treatment scheme. This was a difficult task because neither the nature nor quantum of contaminants was controlled in the open drain wastewater. Hydranautics offered an integrated solution comprising of HYDRAsub MBR followed by RO membranes for treating this unpredictable wastewater.

The treatment scheme comprised of a 1 mm diameter opening screen to remove hard sand particles from raw wastewater. An extended aeration bio-chemical process consisting of anoxic and oxic tanks followed the screen. Together these tanks removed BOD and nitrogenous compounds by converting them to CO_2 and N_2 gases respectively. While anoxic tank contents were mixed thoroughly with a motorized mixer, continuous aeration was done to the oxic tank contents with air blowers.

Oxic tank treated water then flowed into MBR tank that housed HYDRAsub MBR submerged modules. Compressed air was continuously supplied to the modules to keep them fairly clean. Return activated sludge pumps transferred the MBR tank sludge back to anoxic and oxic tanks to keep the anoxic tank DO level and MBR tank MLSS concentration under control. HYDRAsub MBR filtrate was taken to storage tanks for further treatment in the RO train.

The RO train comprised of a high-pressure pump and a set of pressure vessels and membranes. RO permeate was transferred to storage tanks for further distribution to the industries. Please refer to the plant block diagram in Fig. 1, system operation information in Table 1 and system design information in Table 2.

The plant has completed almost two years of successful operation. During this period some of the challenges faced were:

1. During night time some industries discharged high TSS containing effluents. While on one day feed water containing red oxide paint floated on the water whereas on the other day the Fe content was extremely high at 40 mg/l. Then during night time the feed TDS showed an abnormal increase. So as a precautionary measure RO plant was shut on many nights to protect the membranes.

2. During heavy rains, which is common in Malaysia, the feed water TDS, COD and BOD values dropped significantly. In order to keep the aeration tank bugs active, sugar solution was dosed as a carbon food source.

3. Aeration tank MLVSS level was controlled using WAS valve between 1,500 to 2,500 mg/l range.

4. Maintaining anoxic tank DO level in the range 0.4 to 0.8 ppm has been a challenge. Because the raw wastewater did not contain high amount of ammoniacal nitrogen, there has been no negative impact of the DO control in anoxic tank.

MBR filtrate turbidity varied between 0.07 to 0.45 NTU . The turbidity sensor required manual cleaning, otherwise the instrument showed increased turbidity. Maintenance clean was performed every week with 500 ppm of sodium hypochlorite solution. Recovery clean was performed every three months with 5,000 ppm of sodium hypochlorite solution with one to two hours of soaking.

LFC3-LD RO membranes have worked well. Because of rains the feed conductivity values were seen decreasing during rainy season, but they go up when there are no rains.

The plant required to produce permeate of maximum 200 ppm TDS. During initial two-month period, two CIPs were performed on RO. But later for seven months no CIP was required. This is quite extraordinary for the plant that treated wastewater from an open public drain.

Fig. 1 Plant Block Diagram

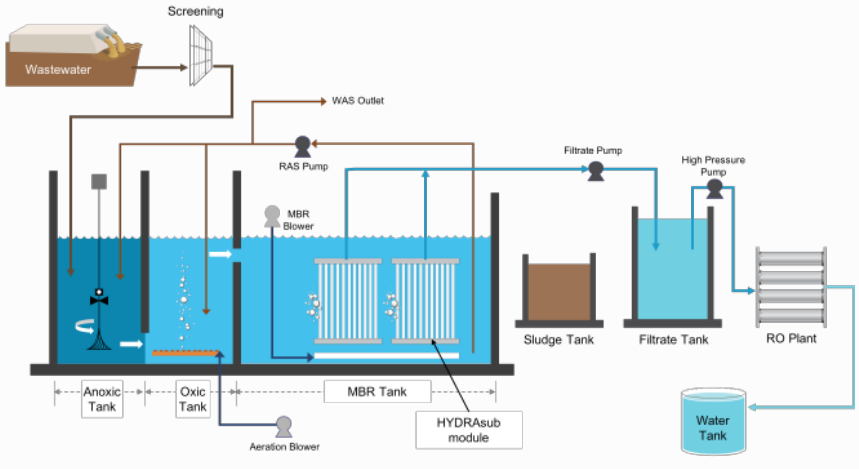

Table 1: System Operation Information

Parameter	MBR	RO
Filtrate turbidity	0.07 – 0.45 NTU	-
Trans Membrane Pressure (TMP)	-0.1 to 0.4 bar	-
Feed conductivity	-	250 – 2200 µS/cm
Permeate conductivity	-	25 – 100 µS/cm
Permeate BOD	< 5 ppm	Non Detectable
Permeate COD	21 ppm	6.5 ppm
Maintenance clean frequency	Once a week	-
Recovery clean frequency	Once every three months	Once every three months*

**RO train was operated for seven months without any CIP*

Table 2: System Design Information

Parameter	MBR	RO
Filtrate flow	206 m^3/h	120 m^3/h
Recovery	99.7%	75%
Feed TDS maximum	-	1,000 ppm
Permeate TDS maximum	-	200 ppm
Permeate COD maximum	-	15 ppm
Number of stages	-	2
Membrane module	HYDRAsub 2400 ES	LFC3-LD
Module area	2,400 m^2	37 m^2
Module quantity	5	182
Operating flux	17.1 lmh	17.8 lmh

The IMPACT

With this plant, the industries have been reusing treated RO permeate. HYDRAsub membranes proved once again that these are the best treatment option in treating difficult and variable waste waters before RO.

Operating cost of this plant comprising of MBR-RO operation, manpower, consumables like electricity, chemicals was RM 0.98 per m^3 of RO permeate.

Cost of raw water received from the government. is RM 2.5 per m^3. This states that the plant is not only recovering water but also industries are successfully saving costs from its operation and reusing treated water.

Author

SATISH CHILEKAR
Water Management Advisor

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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