Ceramic Membrane Based Solutions For Wastewater Recycle

Nandan Prabhune: Head - Technology and Innovation Group

Sayali Jadhav: R&D Executive - Technology and Innovation Group

Water and Waste Solutions, Thermax Limited

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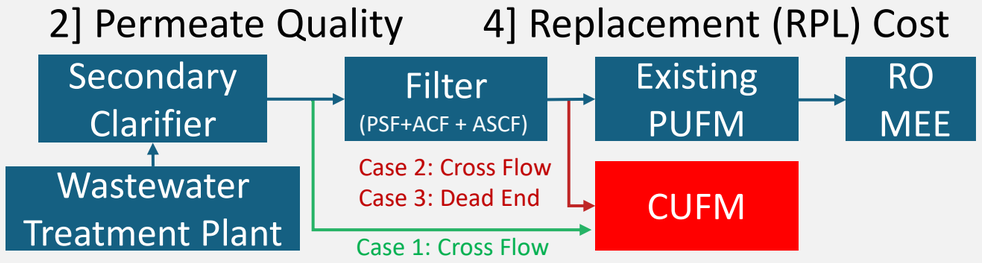
ABSTRACT

Wastewater Recycle and Zero Liquid Discharge (ZLD) plants widely use Polymeric Ultrafiltration Membranes (PUFM). Ceramic Ultrafiltration Membranes (CUFM) could be considered as an effective alternate to PUFM as it has longer life and higher flux. The performance of CUFM was validated using pilot system at ZLD plant of a leading textile manufacturer in India. Higher flux upto 2 to 3 times could be achieved using CUFM. For treatment capacity of 1.2 MLD, approximately 5400 $/year could be saved on operations. The frequency of membrane replacement governed the operational cost and related savings. Sizing, operational parameters and related economics have been defined.

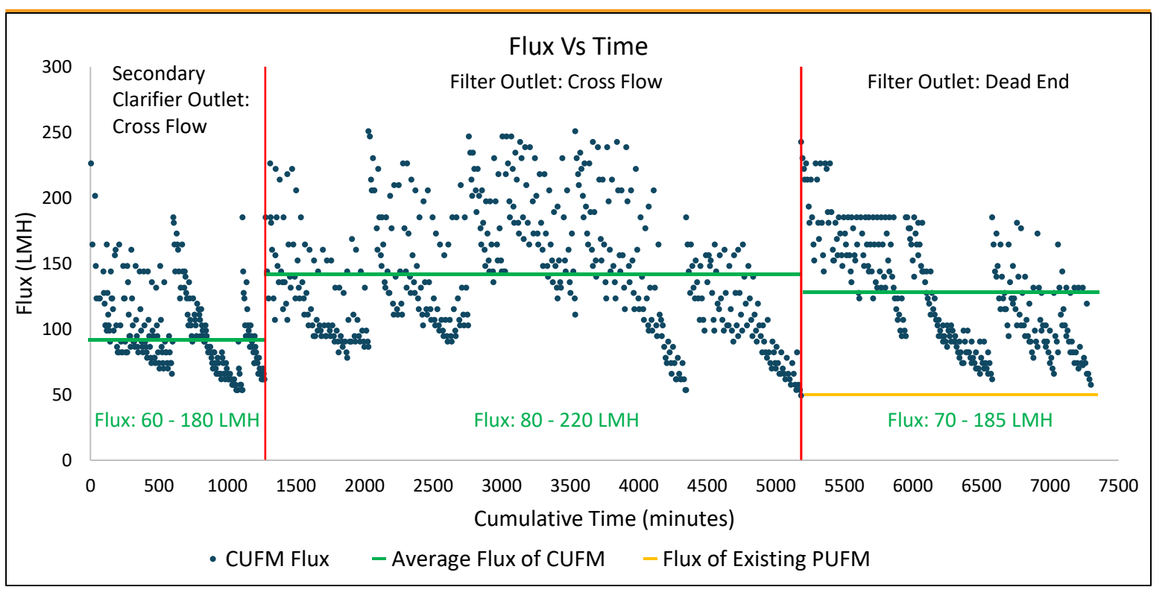
BACKGROUND & OBJECTIVES

ZLD plant was in operation for last 7+ years using Polymeric Hollow Fiber Membranes (In to Out). Multichannel Ceramic Membrane was tested using pilot system to define

1] Flux
2] Permeate Quality
3] Cleaning Frequency
4] Replacement (RPL) Cost



RESULTS & DISCUSSION



OPERATING PARAMETERS

Location	Mode	Feed Flow	Permeate Flow	Feed Pressure	Feed	Permeate
Secondary Clarifier Outlet	Cross Flow	7.0 m^3/hr	3.0 m^3/hr	0.9 – 3.0 kg/cm^2	20 NTU	< 0.1 NTU
Filter (PSF + ACF + ASCF) Outlet	Cross Flow	8.0 m^3/hr	5.0 m^3/hr	0.6 – 3.0 kg/cm^2	12 NTU	
Filter (PSF + ACF + ASCF) Outlet	Dead End	5.0 m^3/hr	4.5 m^3/hr	0.5 - 3.5 kg/cm^2	12 NTU	NTU = Nephelometric Turbidity Unit

CONCLUSION

Type	Location	Flux (LMH)	Modules (Nos)	Cost ($)	Life (Yr)	RPL Cost ($/Yr)	Savings on RPL ($/Yr)	No of RPL 15 Yr Life	Investment for 15 Yr ($)
PUFM	Filter Outlet	50	18	28260	3	9420	0	5	141300
CUFM	Filter Outlet	140	17	60291	10 - 15	6030 - 4020	3400 - 5400	2 - 1	90436 - 60291
CUFM	Secondary Clarifier	100	23	81570	10 - 15	8160	Operated On ↑ Turbidity To Reduce Footprint	2 - 1	122355 - 81570

- PUFM can be replaced by CUFM saving 3400 – 5400 $/year on operations. Life of membranes is the critical parameter governing the feasibility. Capital costs are recovered within 6.5 Years of operations.
- After secondary treatment, CUFM could be operated at higher feed turbidity by maintaining 3 to 4 times higher flux. This will eliminate three filters (PSF, ACF and ASCF) saving 8 – 12% (approx. 140 m^2) of floor area.

CONTACT

Name: Mr. Nandan Prabhune
Company: Thermax Limited, Pune, India 411026
Email: nandan.prabhune@thermaxglobal.com
Telephone: +91 982 352 6190

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