

Dear Water Warriors,

Sewage treatment experts now gear up for more stringent treated water quality,  $BOD_5 < 5$  and that opens flood gates for the use of Membrane Bio Reactor.

MBR operation, since 100% automatic has its own challenges and skill sets. For small plants say up to 100 KLD the operation team is not skilled with automation, control and logic check etc.



In this edition of 'Waughter', we try to identify first the critical needs of MBR success and drawing experience out of these identify the Innovations need in MBR.

Nidhi Jain  
Civil Engineer

## Refresh from Previous Editions...

Membrane Bio Reactor : Process, Design Options, Automation and knowhow is already covered in our previous editions:

1. Waughter Vol 1 E12\_Micro & Ultra Filtration (MF & UF), Moving Bed Biofilm Reactor (MBR)
2. Waughter Vol 2 Edition 12\_Membrane Bio Reactor

Please read through above to enjoy this edition even more. If you do not have previous editions handy, you can download the same by installing our APP on your phone or computer.



Scan the QR code, accept security messages, provide your Contact ID and mail for our records to mail you any update in app.

## Listing Challenges: Fouling

Membranes used for filtration of bio-mass and water mixture (often referred as Returned Activated Sludge RAS) is always doing one job very efficiently; allowing clear water to pass.

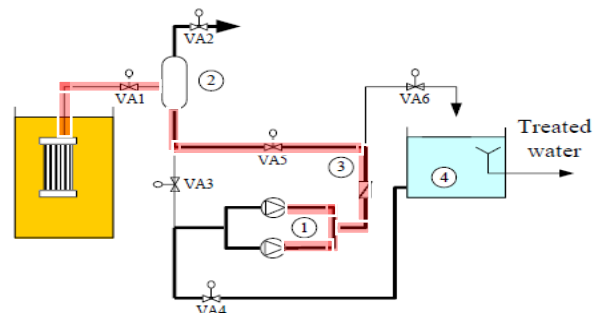
This means the "Surface" of the membrane accumulates the Solids that are rejected (not allowed) mainly MLSS, mineral Sludges and iTSS. This built up is "not allowed" and in most submerged MBRs this is controlled by many methods as below:

1. Constant Air injection below MBR
2. Marinating 3-5X flow through reactor to sweep away membrane foulant
3. Weekly Cleaning referred as "Maintenance Cleaning"
4. Quarterly cleaning referred as "Recovery Cleaning"

And some time taking the entire block out to clean it as if we are cleaning a Car.

## Listing Challenges: Degasification

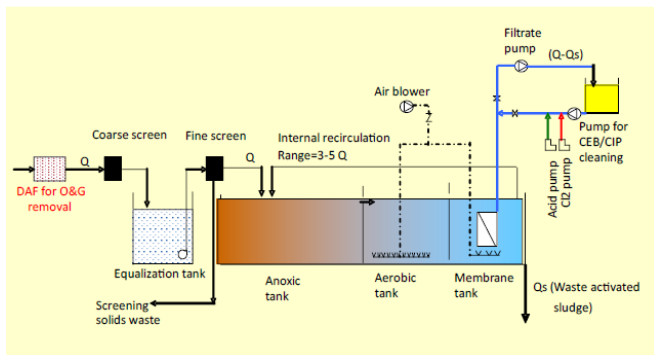
Unlike many unit operations in the plant, the **RED** highlighted portion of the plant below is operating under pressure lower than the atmospheric pressure:



The gases in Aeration Tank or Membrane Tank get sucked in these pipes and creates operational issues (drop in flow, need to remove air etc.) and are a challenging situation in small STPs

## Listing Challenges: De-nitrification

MBR is a combination of suspended growth biological treatment like activated sludge process followed by membrane filtration technique for separating out the biomass. This technology can replace the secondary clarifier and sand filter in a typical activated sludge process.



MBRs need a shear force over the membrane surface in order to avoid membrane fouling from the wastewater contents and is critical in maintaining a desired permeate flux.

Typically, the feed to MBR tank has DO > 2.0 mg/l and invariably due to excess air in MBR to control fouling the DO reaches 2.4 mg/l and above in waste water returning to anoxic tank.

Many plants therefore report poor sizing of anoxic tank and non-performance of anoxic process and denitrification. In STPs that are installed in Industrial or Office Complexes N Control is very important as most cases the sewage is recycled to Toilet Flushing etc. with use of further technologies like UF and RO with or without ozonation.

Wish we can have a MBR where DO returning to Anoxic comes down to < 0.5 mg/l which is the case in conventional Activated Sludge Process that allows for enough retention time in clarifier (90 min) to achieve lower DO in RAS.

## Listing Challenges: Floating Debris

Majority of plant design in India for application of MBR follow the philosophy as hereunder:

1. Overflow from Aeration Tank to MBR Tank
2. Permeate Extraction
3. Return of water bio-mass mixer from bottom of MBR Tank to Anoxic Tank or Aeration.

Aeration Tank is open to atmosphere and collects debris, floating plastics and other unwanted floaters. These get directed to MBR Tank and remain struck there (no where to go) as providing screen becomes impractical for small STPs (creating hydraulic level differences).

This means not only cleaning the MBR top surface manually, increase the safety and operational challenges.

## Drivers of Innovation : MBR

The challenge above needs to be mitigated and MBR need to be simplified more so that everyone can operate the same with confidence. Some think “Handpump” an engineering marvel, designed so will that everyone can operate without any training or skill set. Thus, we focus on :

- External MBR
- Modular in a Casing
- No Air
- No -Ve Pressure operation but Pump to MBR design.
- Gravity Backwash by Pascal’s Siphon
- No Degasification or Ejector system.



Is it possible. Let’s see and try to design a MBR that is close to above idea. We may not succeed initially to answer all 6 points above, but let’s see how many can be addressed.

# Veolia's Membrane Bioreactor (MBR) For Effluent Water Treatment



## WHY VEOLIA MBR IS THE INDUSTRY STANDARD

Membrane Bioreactor (MBR) is the combination of a membrane process like microfiltration or ultrafiltration with suspended growth bioreactor. **Veolia Water Technologies is a world leader in MBR technology and the ZeeWeed 500D & 500S models are installed in thousands of systems all across the world.**



**Reinforced Fiber -**  
Highest tensile strength in the industry(>600N)



**Consistent Quality -**  
Consistently high quality effluent



**Compact System -**  
Requires lesser space than other technologies



**Shock-load Resistant -**  
Our MBR can handle sudden shock-loads



## MBR : the new Design Idea

The MBR Designed below is now in advance sage of implementation and 2 such facilities are coming up in India. We are yet to establish performance and operational experience on the same but have designed it for following features:

- No Permeate Extraction Pumps – In fact the RAS feed Pump supplies energy for filtration ( +Ve Pressure)
- No membrane Aeration
- No Priming or Degasification Need
- External Tubular MBR mounted out side Aeration Tank on skid just like a UF.
- Biomass and Water mixture fed from bottom of Aeration tank to MBR Module. No ingress of floating debris.
- No O&G or accidental Oil Scum can enter MBR ever.
- Protected membrane Fibers.

## MBR : the new Design Idea - Optimization

The operation philosophy considers simple cross flow filtration with permeation limited to 5-8% of feed only to ensure:

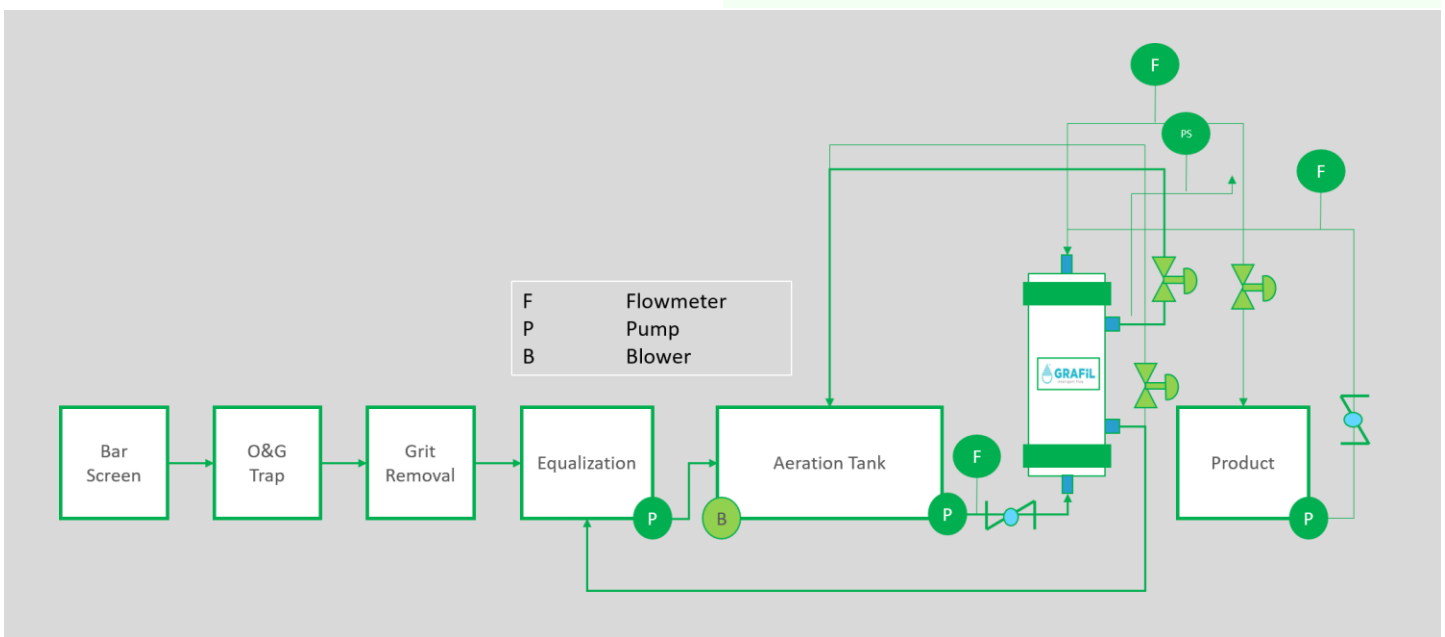
- Low Pressure Feed Required
- Self-cleaning Shear Velocity
- Periodic backwash to support cleaning

In longer run our priority is to estimate:

- Cycle time (Operation, Backwash, CIP & Recovery Clean)
- Right Flux for Backwash

In distance future, try to eliminate the Backwash pump also and see if “Pascal’s Siphon” can be adapted to either RAS Pump or BW Pump. The next generation engineers can take clue from a WTP product called “Auto Valveless Gravity Filter”

All the best.



## जल जीवन जननी !!

On Dec 23, 23 Team Aktion Waughter visited Exhibition titled “Net Zero Water in Built Environment” organized by Indian Plumbing Association at YMCA, Ahmedabad



**Nidhi Jain** · You  
Civil Engineer  
2w · 🌐

Had an insightful time at the 29th Indian Plumbing Conference in Ahmedabad!

Engaging discussions, innovative solutions, and networking with industry leaders made the event truly enriching. Grateful for the opportunity to stay updated on the latest trends in the plumbing sector. Looking forward to implementing these learnings in our projects!

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Leave your thoughts here...

 Post

It was a time well spend with several new knowledge areas in Kitchen Drain Design, Modular Tanks, high Pressure UPVC Pipe & Fitting and GRP ladder & Manhole. In subsequent editions we shall cover the same.

## Highlight of the Month

In this section, we shall highlight the new achievements of our team. In case you wish to have more details on the same, please let us know:

- Organized a Corporate training for “Alembic Pharmaceuticals Limited” for EHS teams of 3 units on Waste Water Treatment & Recycle.
- Inclusion of “REMONDIS Aqua – Mumbai” into team “The Waughter Planet” marching an step forward in “Stronger together” journey.
- Taken GRAFIL UF to new customers through our additional dealer at Gujarat.
- Completed Commission of MBR & ZLD at PepsiCo Bangladesh

## Our World is Waughter

The technical knowledge share attempt of Aktion Consultancy and the contents in the magazine shall be qualified by Sanjeev Srivastava our Technology Lead. The purpose is purely education and empowerment of engineers.

Our next edition focuses on: “Handyman 2024 with Support XLS ”

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