

Dear Water Warriors,

Sewage, has an impression in our mind; COD Suspended Matter, BOD, Colour, Odour etc. Most Municipal Sewage treatment system designs revolved around them to manage treated water to dispose. Urbanization threw a new challenge. Treat your own sewage and don't give it to Municipality. This needed re-thinking and focus shifted to reuse.



To treat Sewage thus the new thinking is towards No Smell, No Colour, Hygiene, and no offense to use or user. Thus, focus shifts to Impurities.

The issue of 'Waughter', let's make sewage fit to reuse.

Nidhi Jain – Civil Engineer

Sewage: Is Everything Same?

Off-course yes, till you look from the eyes of a Municipal engineer as everyone in town sends their waste from Kitchen, toilets, washrooms etc.

Today, when we have different institutions viz. Schools, Multiplex, Corporate Park, Airport, Hospitals etc. an engineer needs to get into detail of their sewage.

Airports Have more N content in sewage and low C

Hospitals: Have antibiotics in sewage and may be more dangerous materials to retard biology in Aeration.

Collages, Schools Do not produce sewage in evening and weekends.

Corporate Parks Have weekly sanitation protocols in food court and have lots of green cover that needs recycled water. So, odour control is top priority.

Sewage Treatment: What Authorities Expect?

India has well defined environmental objectives and authority do their role in directing, what's needed. Few highlights here and more need to be studied by an engineer based on local guidelines:



Sr No	Parameter	Required Standards
1	pH	6.5-8.5
2	BOD(5th day)	< 10 mg/l
3	COD	< 50 mg/l
4	Suspended Solids	< 10 mg/l
5	Ammonical Nitrogen	< 5 mg/l
6	Total Nitrogen	< 5 mg/l
7	Fecal Coliform	< 100 MPN/100 ml

STP installations in Basement are not allowed but underground plants are OK if entry is from ground level. Technology guidelines are available. Nitrification and denitrification are required. Consent to Establish and Consent to operate is in place to ensure compliance.

“Recycle to Toilet Flush Gardening and Utility is encouraged.”

Project Background – Case Study

Our customer here is well known group in Mumbai with several world class office infrastructures that support many global companies 24 * 7 office environment with well-designed food court, parking, walkways, parks etc.

Mumbai, where space is premium, 2 projects were operational when we came to design the 3rd STP in the same premises but this time with a new condition that the STP cannot be in basement of the buildings.

This 3 tier 550 m³/d STP, is completely underground and hides itself in beautiful landscape producing water that is used back for Cooling Tower, Toilet flushing and gardening.

While Moving Bed Biofilm Reactor was the core technology to achieve Nit-Denit, we used electro coagulation as well as automatic helminths filtration system to add shine and sparkle to Waughter.



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Challenges in Current Projects

Since the customer was already operating STPs in similar situations in existing 2 STPs, it was easy to throw the challenges:

- COD fluctuations with high COD on Monday.
- Presence of helminths in treated water tank, occasional odour post toilet flushing.
- Presence of worms on toilet seats. Very common.
- Clear Colour in Recycled water in comparison to Fresh water while flushing toilets gave impression that the earlier person using toilet has not flushed it.
- Foaming in MBBR after weekend.
- DAF Scum removal a challenge.
- Odour while watering plants.
- High Ammonia in treated effluent not allowing it's reuse in Cooling Tower.

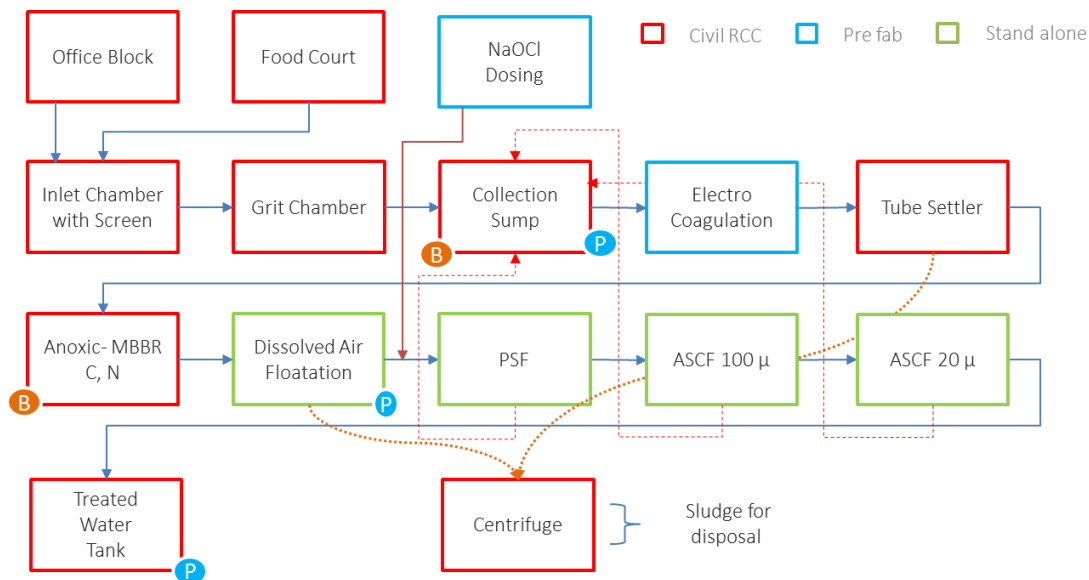
The Scheme of Future

N control needs **Autotrophs** to be happy and they are sensitive to Oil, Grease, Filth, Upsets etc and need more clean Sewage.

Primary Clarification with EC therefore helps in guarding MBBR. The sludge from MBBR now needs to be separated and though customer had a reluctance, was explained that DAF is best equipment post MBBR as carefully just skims the floating slime and biomass.

In tertiary treatment we deployed state of the art self-cleaning filters with short cycle 15 min filtration and 20 seconds cleaning. Two in series 100 & 20 micron. The Particulate free water was polished by Activated carbon filter to manage colour CODs that still escape the process.

A part of treated water is softened before use in Cooling Tower.



Electro Coagulation

Helped in managing all pCOD, inorganic P and occasional burst of Surfactants and Toxicity during Cleaning of food court and office complex over weekend. It can be Switched off Monday eve till Thursday as the Sewage would not be that harsh during weekdays. EC acts as Guard to MBBR.

MBBR

The inner layer of Biofilm in MBBR do not get O₂ as it cannot diffuse through the slimy biomass. NO₃⁻ do not have such restrictions. In 2 tank MBBR design with C, N Tank and recirculation of NO₃⁻ from N tank to C Tank, we can achieve de-nitrification in MBBR tank itself.

For small projects this can be done in single tank.

The Odour Control Effort

Activated carbon filter removes colour as well as smell of humic and fulvic substances present in naturally occurring water. They can also reduce the OA value of drinking water (organic content).

But do we know what's the cause of bad odour in treated sewage water? Why this Odour is present even if the treated water is purified further using MBR, UF or even RO?

The answer lies in understanding the root cause of odour.

1. Unlike WTPs, the Suspended solids referred in tertiary treatment are not SS but MLSS, a large portion of them is organic Biomass and cell debris.
2. Sand Filtration thus often is source of odour if not backwashed frequently.
3. The chief reason for odour is Nematode eggs that break and cause smell along with other SH group compounds.
4. Since Odour/Smell can be in gaseous form, they are not removed by tighter membranes e.g., UF or even RO.

Since one cannot remove odour, the best way is to avoid formation of odour.

Auto self-cleaning filters used in the project remove the MLSS of up-to 100 microns in First Filter in short cycle of 15 mins, thereby not allowing for septic conditions on filtration surfaces.



The Helminths – Nematode Eggs



The size of nematode egg ranged from 40 μm to 150 μm . Such fine impurities pass through conventional sand filters but cannot pass through a 20 μ filter with SS mesh. Thus, we can be sure of Zero helminths eggs in treated water.

Otherwise, these eggs hatch in treated water tank and can easily be pumped back to toilet flushing water giving very offensive look and sense of poor hygiene.

Chlorination cannot kill this life, while in egg and though we may create conditions where we kill nematode using oxidation or excessive chlorine, the dead bodies become food for growth our other bugs and biomass.

Thus, their removal from the treated sewage, quickly and keeping the SS screens neat and clean is the only option to control odour in treated water.

Overall, by implementation of the scheme as given in this case study we addressed:

1. Issues related to cyclic load variations over weekend.
2. Control of worms in treated water.
3. Odour Control
4. No colour as premium grade Carbon with high Iodine value is used with focus on colour removal only.
5. Low sludge from MBBR.
6. Better Sludge management with use of Decanter Centrifuge in place of filter press.

Finally, the entire plant is located below ground not visible to people moving nearby. The ventilation and exhaust systems included in building design means the plant is neat, clean and operation friendly, just like any other process plant.

It's time STPs are considered as our own Water Factory.

Interns ... in Aktion

Our interns are doing good, they have some specific assignments for which they will write project reports and submit to their HOD as a final work before graduating.



Ms Saumya Kumari is pursuing Chemical Engineering and is currently working as Technical Support at a MBR based ETP plant in Punjab. She is responsible to learn step by step commissioning of a MBR facility that has API, Primary Clarifiers, DAF, Aeration and Membrane Bio Reactor.

As an Environmental Engineer, Ms Shital Kamariya desired to work on optimization of energy in Aeration system for COD removal in a Textile processing unit. In addition to above she got an opportunity to work on a live consulting project featuring MBR and MVR based Zero Liquid Discharge



Ms Aparna Ashutosh is pursuing Chemical Engineering and is currently working as Technical Support at a site in UP. Her role is to understand NaOH and Soda Ash dosing optimization for removal of Ca & MG prior to high salinity water being fed to ZLD evaporators to achieve Zero Liquid Discharge. Additionally, she is learning lab testing for COD, BOD, MLSS, MLVSS etc.

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Nidhi Jain · 1st
Civil Engineer
1w · 🌐

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You and 101 others

3 comments

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.

Our next edition focuses on: "Precipitation Control for Feed water to RO & ZLD to avoid Scaling"

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