MICRODYN NADIR
ADVANCED SEPARATION TECHNOLOGIES

Arguments MBR vs CAS

Introduction

The decision making process which treatment concept to use for a new waste water treatment plant is important, especially for large plants. This Document lists the advantages of Membrane Bio Reactor (MBR), Conventional Activated Sludge Plants (CAS) and Mixed/Moving Bed Bio Reactor (MBBR) to assist the planner in choosing the system which suits his needs best.

Advantages of MBR

- The membrane acts as a physical barrier between the water and the sludge, retaining not only the sludge, but also bacteria and most viruses.
- The full retention of solids allows better biological control through retaining and growing biomass that is better suited for application.
- Conventional processes rely on sludge settling that is a slow process and very sensitive to fluctuations in water quality and other process conditions. The MBR systems have much better tolerance to process fluctuations and easy to control.
- Effluent quality is much better in MBR plants than in MBBR or CAS. The effluent is particle free and fulfills the current legislation for reuse and discharge in sensitive waterways. Additional options like the usage of powdered activated carbon (PAC) to remove micro pollutants are possible without any changes to the overall plant design.
- MBR plants have a higher MLSS content in the aeration tank, up to 4x higher than CAS plants. This can be achieved because the sedimentation in the secondary clarifier is no longer required.
- The higher MLSS leads to approximately 40% smaller aeration tanks and overall smaller plants.
    - Figure based on MBR plants with complete BOD removal, denitrification and a sludge age of 21 days versus a standard CAS with partial BOD removal, denitrification and a sludge age of 13 days.
- No secondary clarifiers are required for MBR plants, leading to smaller plants and no CAPEX/OPEX for clarifiers
- In MBR plants, the sludge thickening process is easier; the excess produced sludge has higher concentrations of up to 4 times resulting in less costs associated with sludge thickening.
- Chemicals added to the biological process (e.g. coagulants for phosphorus removal) are 100% retained in the aeration tank, increasing the efficiency and reducing cost for chemicals.
- Not meeting the discharge limits for nitrogen during winter is common for CAS plants. The high MLSS in MBR plants allows for a better nitrification/denitrification performance at low temperatures. Discharge limits are met even in winter.

Additional Points regarding CAS

- CAS has been the standard process for wastewater treatment for over a century. The basic technology did not change significantly until the commercialization of MBR systems over 40 years ago. There are thousands of MBR systems operating worldwide offering users the benefits of the most advanced and reliable technology in the market.
- While CAS CAPEX and OPEX costs were lower historically, the MBR suppliers have advanced their technologies to a point that MBR costs are similar or in cases of reuse MBR systems have lower actual water cost compared to conventional technologies.
- CAS systems look simpler and easier to set up. However, in reality they are harder to operate and maintain over time. The MBR systems have been engineered and standardized over years for ease of operation and control.
- Pretreatment is less demanding for CAS than MBR. MBR systems required additional fine screening. However, one needs to look at the total plant cost and actual water cost and quality to user. The additional pre-treatment ensures longer membrane life and higher fluxes which in turn will reduce the actual water cost.
- CAS processes don't have any unique technology such as membranes. Membranes require special systems to operate and maintain. This is the heart of the technology delivering all the benefits of the MBR processes. The MBR systems have been engineered to allow proper use and handling of membranes. The total system is easy to operate and maintain.

Additional Points Regarding MBBR

- MBBR systems are intended for high COD wastewater applications. Feed COD levels between 2000 – 7000ppm can be treated by MBBR. For higher COD values an anaerobic treatment is recommended. MBBR systems don't offer the higher quality water and the opportunity for reuse. Membranes are needed to achieve these goals and ever more stringent water quality requirements. Membranes can be used in conjunction with other biological treatment systems including MBBR to handle very high COD content wastewaters.

Conclusion

CAS is a standard process and makes sense for most plants, economically. The driving factor for the MBBR system is a high COD in the feed water, which would lead to unreasonably large aeration tanks if using CAS.

MBR is the system of choice if space is scarce, and/or if the effluent discharge limits are very high. MBR is the only option for waste water reuse, as the effluent fulfills the feed water quality of a RO system.

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