

### Membrane Bioreactors:

The technologies most commonly used for performing secondary treatment of municipal wastewater rely on microorganisms suspended in the wastewater to treat it. Although these technologies work well in many situations, they have several drawbacks, including the difficulty of growing the right types of microorganisms and the physical requirement of a large site.

The use of microfiltration membrane bioreactors (MBRs), a technology that has become increasingly used in the past 10 years, overcomes many of the limitations of conventional systems. These systems have the advantage of combining a suspended growth biological reactor with solids removal via filtration.

The membranes can be designed for and operated in small spaces and with high removal efficiency of contaminants such as nitrogen, phosphorus, bacteria, biochemical oxygen demand, and total suspended solids.

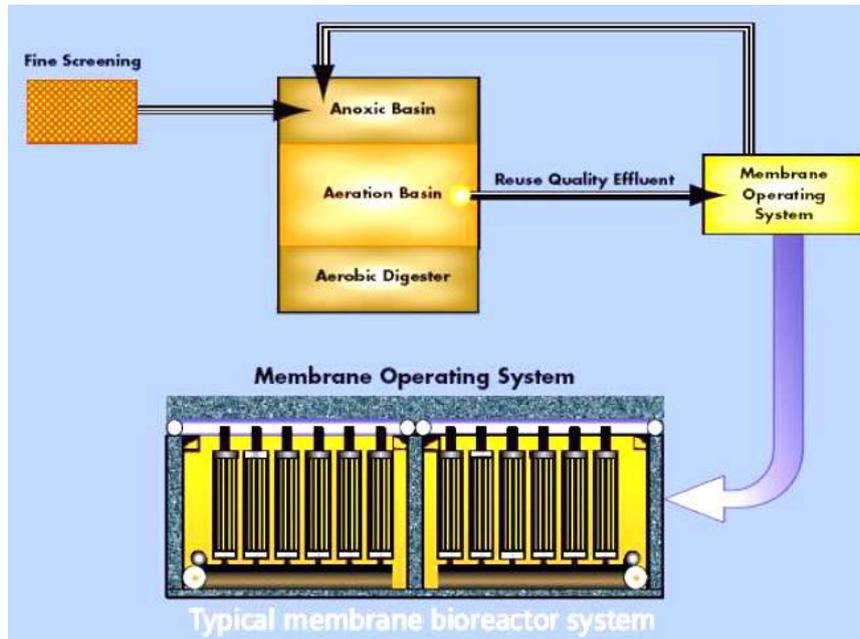
The membrane filtration system in effect can replace the secondary clarifier and sand filters in a typical activated sludge treatment system. Membrane filtration allows a higher biomass concentration to be maintained, thereby allowing smaller bioreactors to be used.

#### Applicability

For new installations, the use of MBR systems allows for higher wastewater flow or improved treatment performance in a smaller space than a conventional design, i.e., a facility using secondary clarifiers and sand filters.

Historically, membranes have been used for smaller-flow systems due to the high capital cost of the equipment and high operation and maintenance (O&M) costs. Today however, they are receiving increased use in larger systems. MBR systems are also well suited for some industrial and commercial applications.

Although MBR systems provide operational flexibility with respect to flow rates, as well as the ability to readily add or subtract units as conditions dictate, that flexibility has limits. Membranes typically require that the water surface be maintained above a minimum elevation so that the membranes remain wet during operation.



### Membrane Care

The key to the cost-effectiveness of an MBR system is membrane life. If membrane life is curtailed such that frequent replacement is re-quired, costs will significantly increase. Membrane life can be increased in the following ways:

- Good screening of larger solids before the membranes to protect the membranes from physical damage.
- Throughput rates that are not excessive, i.e., that do not push the system to the limits of the design.

### Advantages and disadvantages

The advantages of MBR systems over conventional biological systems include better effluent quality, smaller space requirements, and ease of automation.

Specifically, MBRs operate at higher volumetric loading rates which result in lower hydraulic retention times. The low retention times mean that less space is required compared to a conventional system.

The primary disadvantage of MBR systems is the typically higher capital and operating costs than conventional systems for the same through-put.

O&M costs include membrane cleaning and fouling control, and eventual membrane re-placement. Energy costs are also higher because of the need for air scouring to control bacterial growth on the membranes.