



DYNA-LIFT MBR

New tubular membrane arrangement minimizes power cost

There is much interest and ongoing research around the world regarding a new wastewater treatment process called the Membrane Bio-reactor (MBR). The process was developed in the late 1970s in North America, Japan and South Africa concurrently. The process combines high rate activated sludge with ultrafilter membranes for solids separation. In the beginning, the process was somewhat limited to small flow wastewater treatment applications where high quality effluent was required. The limitation was mainly due to the cost of the system and, specifically, the capital and operating cost of the membrane filters as compared to other processes. With the ever increasing pressures on higher effluent quality, as well as the advent of the immersed hollow fiber membrane for the MBR process, MBR's are very much in demand and are being applied in larger municipal projects.

Over the past five years, a new membrane arrangement using tubular membranes has been developed for use in the MBR process in Germany, Japan and Holland due to the desire for an economical MBR that uses external tubular membranes to compete with the hollow fiber and flat sheet type of membranes. The fact that tubular membranes have required significant pumping power to create the high velocity inside the tubes to scour the foulants from the membrane surface has been a negative in applying tubular membranes in the MBR market as compared to other types of membranes. The fact that tubular membranes are more robust than alternatives like hollow fiber membranes, and that tubular membranes can be placed outside of a tank for easy maintenance, as well as their longer life, has identified them as a type to consider even though the power costs are higher.

“Having your cake and eating it too”

A unique membrane arrangement has been identified as a way to use tubular crossflow membranes to save power and compete with immersed membrane systems. By placing the tubular modules vertically, and actually limiting the amount of permeate taken out of the membrane, it has been found that membrane fouling is manageable using much less pumping power than in a conventional crossflow system. Air is injected at the bottom of the module creating an airlift effect that increases the velocity inside the tubes. A cyclical backwash of the membrane maintains consistent flux.

The flux is slightly less than a standard crossflow membrane arrangement, but the power required is only about 10%-20% of the standard crossflow tubular arrangement. With the tubular airlift membrane arrangement, the flux is lower but the trans membrane pressure (TMP) is saving significant power.

Cleaning is achieved by periodically injecting cleaning solutions with the backwash water. This effectively keeps the membrane flux at the required level indefinitely.

Significant Benefits

- Allows MBR's to be applied to larger municipal plants
- “Dyna-Lift” membrane arrangement saves power
- Robust tubular membranes reduces replacement costs
- Safe cleaning procedure with clean-in-place (CIP) system

Applications

- Municipal Plants
- Industrial
- Decentralized
- Commercial
- Retrofits to increase existing plant capacities

Technology

- PVDF 5.2 mm tubular membrane
- PLC based control minimizes operator labor
- Pre-assembled “six-packs” or “twelve-packs” minimizes installation costs
- MBR consistently produces high quality effluent

Cutaway drawing of tubular membrane module.



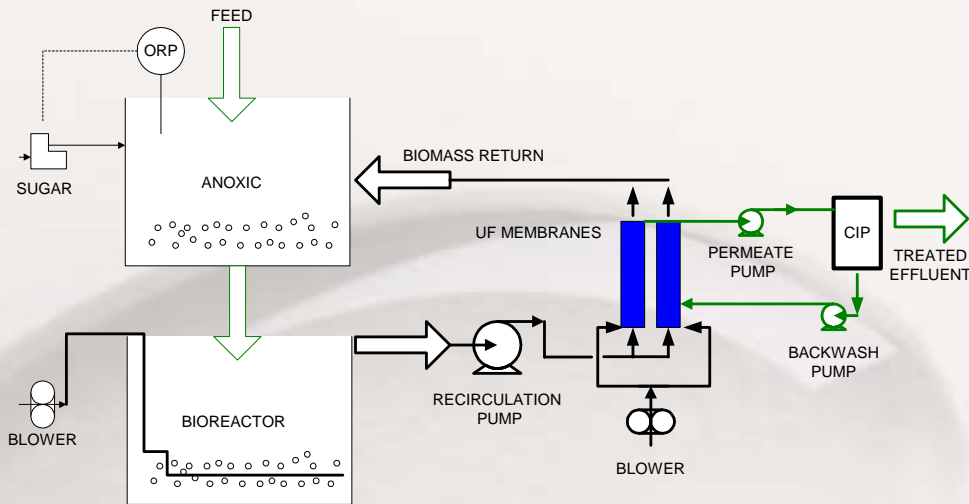
Picture shows vertical arrangement of membrane elements



System Description

System Operation

The system operates on a continuous basis and is controlled by permeate (treated water) pumps that control the rate of flow from the membrane modules. A recirculation pump feeds mixed liquor from the bioreactor to the bottom of each module where air is injected. This, in effect, acts as an airlift pump increasing the velocity that aids scouring inside the membranes. The scouring mixture discharges from the top of each module and is returned to the bioreactor (or the anoxic zone, if denitrification is taking place). Backflushing with permeate water is initiated on a timed cycle to each bank of six modules to prevent cake from forming on the inside of the membrane tube and causing fouling.



Advantages

- Uses robust tubular PVDF membranes that require less frequent replacement.
- Power requirements comparable with immersed hollow fiber systems.
- External membrane configuration provides a safer working environment for the operator since maintenance cleaning does not require moving the membranes with hoists and trolleys.
- Minimizes operator exposure to wastewater and potential health impacts.
- Significant power reduction when compared to conventional tubular crossflow arrangements.
- Lower installed capital cost – no additional tanks, sludge recycle pumps, hoists or trolleys are required.
- Compact footprint that does not require additional tanks.

Summary

The Dynatec Systems' "Dyna-Lift" Membrane Bio-Reactor system is a compact, easy to control Membrane Bio-Reactor system requiring minimal operator interface. The system is among the most economical to operate and maintain, and produces high quality effluent with significant lifetime cost advantages over other MBR systems.

Twelve membrane module "Dyna-Lift" pack saves space. The packs can be either six, twelve, or series of six and twelve to provide the required treatment volume.