



DYNA-LIFT MBR

New tubular membrane arrangement minimizes power cost

Much interest and ongoing development work is being carried out around the world regarding a wastewater treatment process known as Membrane Bio-reactor (MBR). The process was developed in the late 1970s in North America, Japan and South Africa concurrently. The process combines mixed liquor activated sludge, operating at high concentrations, with ultrafilter membranes for solids separation. In the beginning, the process was limited to small wastewater flows where high quality effluent was required, due to the high capital and operating costs when compared to other processes. With the ever increasing demands for higher effluent quality, as well as the advent of the immersed hollow fiber and flat sheet membrane for the process, MBR's are now very much in demand and are being applied in larger municipal projects.

Recently, a new tubular membrane arrangement has been developed in Germany, Holland and the United States for use in the MBR process. This is 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. Conventional use of cross-flow tubular membranes requires significant pumping power to create high turbulence inside the tubes in order to minimize fouling. Tubular membranes are more robust than hollow fiber and flat sheet membranes, and can be placed outside of a tank for easy maintenance. Their longer life has driven the market to find a way to use the external tubular product.

Unique Membrane Arrangement

By placing the tubular modules vertically, and limiting the amount of permeate withdrawn from the membrane, it has been proven that membrane flux is stable and fouling is manageable using much less pumping power than in a conventional crossflow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 turbulence inside the tubes. A cyclical backwash of the membrane modules maintains consistent flux.

The flux is less than a standard crossflow membrane arrangement and the power required is only about 10%-20% of a crossflow system. This power requirement is very competitive with immersed product systems. Low applied pressure and the extremely low trans-membrane pressure (TMP) minimizes the amount and the density of the solids boundary layer on the membrane surface. This produces very stable flux and low rates of fouling.

Flux stability is enhanced by a periodic backwash. Cleaning is achieved by either injecting cleaning solutions with the backwash water, or by circulating or soaking cleaning solutions through the membrane modules. This effectively keeps the membrane flux at the required levels for long periods of time.

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

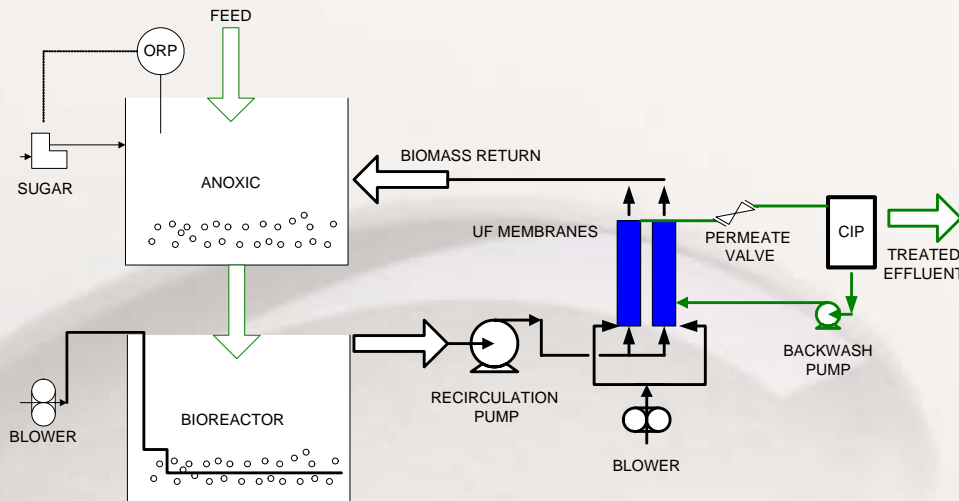


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System Description

System Operation

The system operates on a continuous basis by controlling the rate of permeate 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 de-nitrification is taking place). Back-flushing with permeate water is initiated on a timed cycle to each bank of modules. This removes any cake formed on the inside of the membrane tubes, thus maintaining flux rates.



"Dyna-Lift"
Denitrification MBR

Advantages

- **Robust tubular membranes** are more durable and require less frequent replacement. Membranes are double supported by a rigid backing that ensures no breakage or rupture.
- **Effluent integrity is assured**, since membrane rupture or breakage is not an issue.
- **Low power requirements** comparable with immersed hollow fiber and flat sheet systems.
- **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.
- **Lower installed capital cost** since no additional tanks, sludge, recycle or permeate pumps, hoists or trolleys are required.
- **Lower lifetime operating cost** due to lower power costs, fewer membrane replacements and lower labor costs.
- **Compact footprint** does not require additional tanks.
- **Better control of fouling** since 100% of the membrane surface area is continuously exposed to the circulating fluid without dead spots.
- **Thirty-year proven reliability** of the tubular product.
- **Resistant to chemical degradation** due to the use of high strength PVDF membrane chemistry
- **Efficient cleaning** in place without membrane removal being required.



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.