



ULTRA-FLO[®] MEMBRANE BIOREACTOR

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International
Water Association





BACKGROUND INFORMATION

- ❖ Since the beginning of 20th century, activated sludge processes have been used as biological treatment for industrial and municipal wastewater treatment and reuse processes.
- ❖ Biological processes are designed to accumulate microorganism which oxidize organic and mineral pollutants and the efficiency depends on the biomass concentration in the reactor and specific conversion rate of the microorganism.
- ❖ After 100 years, there were only marginal improvements to conventional activated sludge processes. In recent years, membrane bioreactor (MBR) emerges as an economical alternative for reliability, compactness and excellent treated water.



MEMBRANE BIOREACTORS

- **DEFINITION:**

- ❖ MBR is a combination of two basic processes – biological degradation and membrane separation – into a single process where suspended solids and microorganisms responsible for biodegradation are separated from the treated water by membrane filtration unit.

- **GENERAL OPERATION:**

- ❖ The influent enters the bioreactor, where it is brought into contact with the biomass. The mixture is pumped from the bioreactor and then, under pressure, filtered through the membrane. The permeate is discharged from the system while the entire biomass is returned to the bioreactor. Excess sludge is pumped out in order to maintain a constant sludge age and the membrane is regularly cleaned by backwashing, chemical washing, or both.
- ❖ The entire biomass is confined within the system, providing both perfect control of the residence time for the microorganism in the reactor (sludge age) and the disinfection of the effluent.

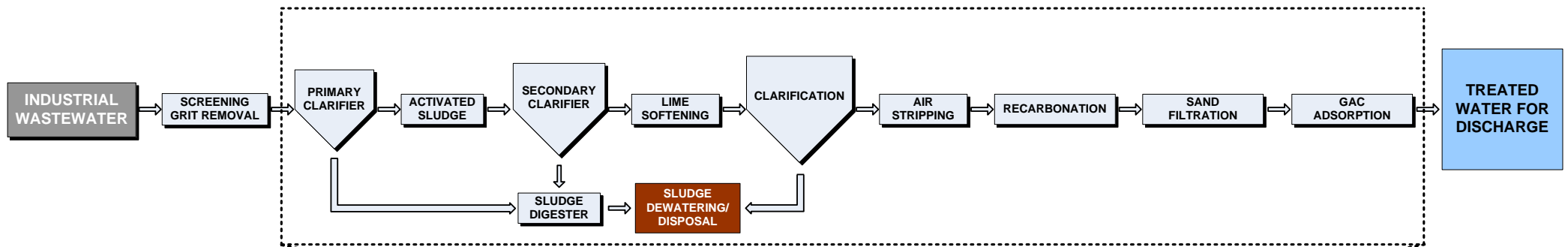
MBR UNIQUE FEATURES

Advantages over other biological processes:

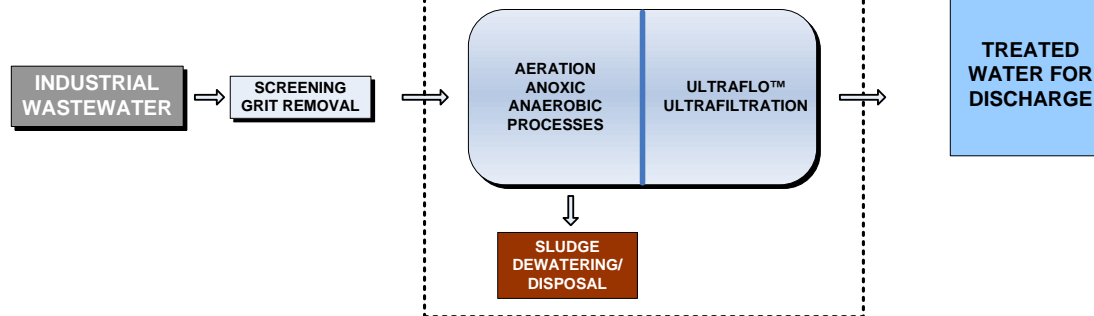
- ❖ Capable of simultaneously biologically treating and disinfecting the effluent;
- ❖ Complete separation between the HRT (hydraulic retention time) and the suspended SRT (solids retention time) provides optimum control of biological reactions and greater reliability and flexibility in use;
- ❖ Ability to absorb variations and fluctuations in the hydraulic and organic load to the system;
- ❖ Complete control of the sludge age is important to allow the development of slow-growing microorganisms such as nitrifying bacteria;
- ❖ Process intensification through high biomass concentrations;
- ❖ Reduced sludge production compared to other aerobic processes;
- ❖ Ability to treat high strength wastes with smaller footprint.

WATER TREATMENT PROCESS TRAIN

CONVENTIONAL ACTIVATED SLUDGE PROCESS



MEMBRANE BIOREACTOR



MEMBRANE BIOREACTOR PROCESS

* The above replacement process is applicable for both municipal sewage water and industrial wastewater



ULTRA-FLO[®] MEMBRANE BIOREACTOR

- ❖ **Efficient Low Pressure Ultrafiltration without Fouling**
- ❖ **Compact Design with Small Footprint**
- ❖ **Low System and Operating Cost**
- ❖ **No offensive odour**
- ❖ **No chemicals needed**
- ❖ **High Loading Rate Capability**
- ❖ **Low/Zero Sludge Production**
- ❖ **Complete Solids Removal**
- ❖ **Removal of COD, Solids and Nutrient in a single unit**
- ❖ **No problems with sludge bulking**
- ❖ **Operate at low DO (Oxygen Demand)**
- ❖ **Rapid Startup**
- ❖ **Modular/Retrofit**



Ultra-Flo[®] MBR SIDESTREAM SYSTEM

Advantages Over Immerse System

- ❖ No fine bubble diffuser maintenance
- ❖ Easier to clean membranes chemically without upsetting the biological process in the tanks
- ❖ No unnecessary movement, hence less stress on hollow fibers during permeate process
- ❖ Ability to control environment around the membrane modules better
- ❖ Higher fluxes with smaller footprint using less membrane surface area



ULTRA-FLO[®] MBR MARKET TARGETS

Ranging from 100 m³/day to 1,000 m³/day for disposal and recycling:

- ❖ Industrial wastewater with high BOD and COD:
 - Tannery
 - Abattoir
 - Food
 - Pharmaceutical
 - Landfill
- ❖ Decentralized municipal sewerage
- ❖ Small industrial estates
- ❖ Hotels and Resorts
- ❖ Condominiums
- ❖ Remote residential communities



ULTRA-FLO[®] PILOT PLANT

Location	:	Bedok Sewerage Treatment Plant
Commissioned	:	May 2004 – January 2008
Pilot Plant	:	Water Reclamation Plant with UF Membrane System 8m³/hr at 98% Recovery NF Membrane System 4m³/hr at 75% Recovery
Feed Water	:	Primary Sewage Effluent
Purpose	:	Reduction of COD and BOD to meet discharge standard Recycling of sewage water for general use except for drinking

PANORAMA VIEW OF ULTRA-FLO® MBR PILOT SITE AT BEDOK SEWERAGE



COMPARATIVE FOOTPRINT WITH OTHER PILOT SITES



ULTRA-FLO[®] PILOT PLANT

Location	:	Jurong Water Reclamation Plant
Commissioned	:	Jan 2008 -
Pilot Plant	:	Water Reclamation Plant with UF Membrane System 3m³/hr NF Membrane System 2.4m³/hr at 75% Recovery
Feed Water	:	Primary Industrial Effluent
Purpose	:	Reduction of COD and BOD to meet discharge standard Recycling of industrial waste water for general use except for drinking

PILOT PLANTS AT JURONG WATER RECLAMINATION PLANT



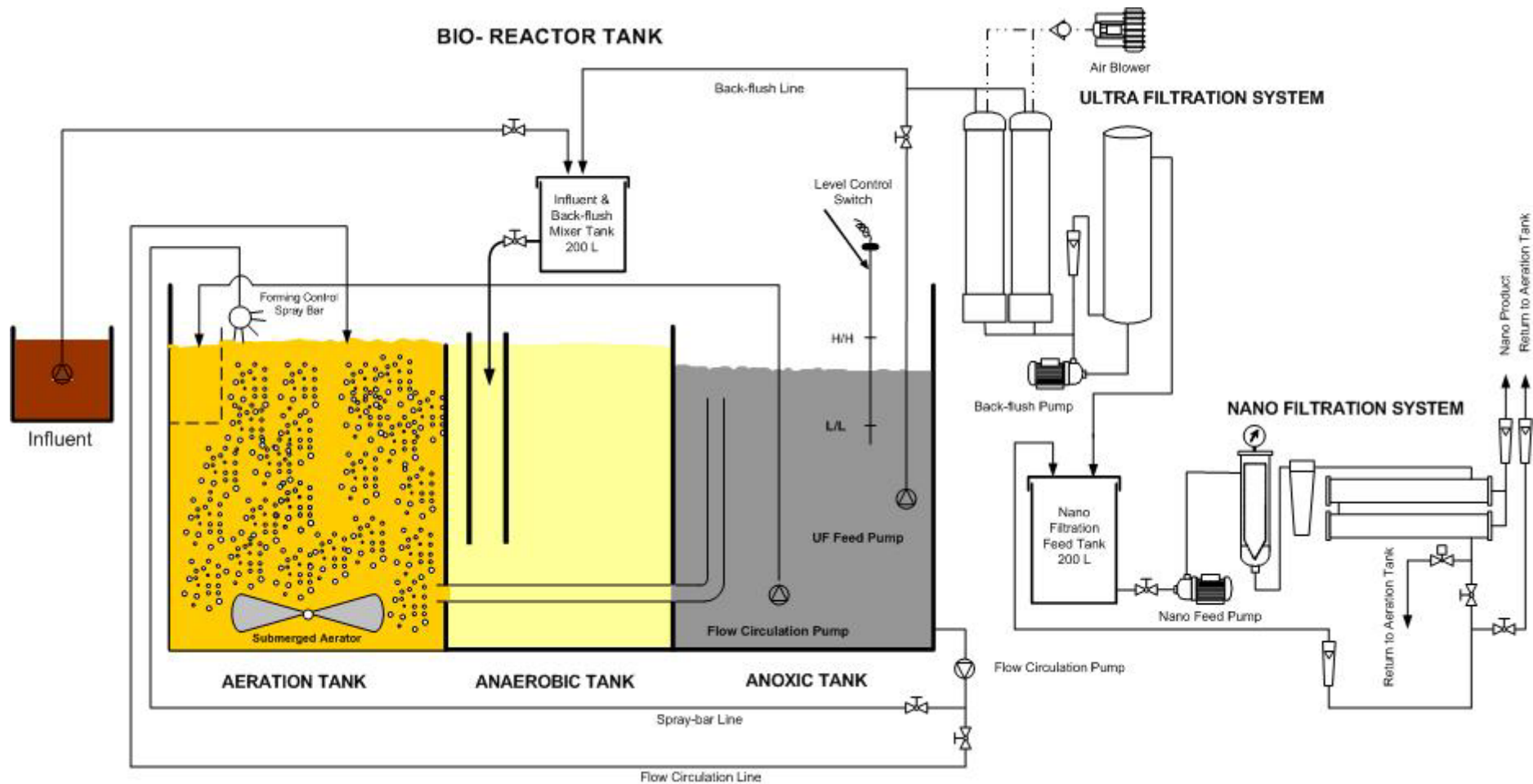
NORIT X-FLO

ULTRA-FLO

HUBER



ULTRA-FLO[®] MBR SCHEMATIC



ULTRA-FLO[®] MBR PROCESSES



Stage 1
Incoming Industrial Waste from Clarifiers



Stage 2
Influent entering into aerobic tank



Stage 3
Anoxic Tank



Stage 4
Anaerobic Tank

Test results based on 4 hours retention time:

Av. Energy Consumed	: 1.0 kWh/m ³
Av. Permeate Flow	: 3 m ³ /hr
Pressure Differential	: 0.5 bar
Incoming COD	: < 2,000 ppm
Product COD	: < 60 ppm



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ULTRA-FLO[®] MBR SYSTEM AT BVLGARI HOTEL RESORTS BALI



**RECYCLING OF SEWAGE WATER FOR
GENERAL USE SUCH AS TOILET FLUSH
AND GARDENING AT THIS 7 STAR
INDONESIAN RESORT COMMISSIONED
IN 2007**

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ULTRA-FLO[®] MBR SYSTEM AT ANANTARA RESORT, MALDIVES



FEED WATER TANK FOR AERATION BEFORE MEMBRANE TREATMENT



MU08-6 ULTRAFILTRATION

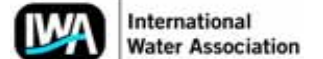


NANOFILTRATION



PERMEATE WATER FEED WASTEWATER

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ULTRA-FLO® MBR SYSTEM AT FULL MOON & BAROS RESORT, MALDIVES



MU08-6 FOR FULL MOON RESORT



MU04-6 FOR BAROS RESORT

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International Water Association



Water Quality Association



ULTRA-FLO® MBR SYSTEM AT SILVER LINE TRAILER WASHOUT, IOWA

SILVER LINE
LIVESTOCK TRAILER
WASHOUT



20ft container with MBR system for treatment of livestock washout wastewater in trailers to meet discharge standards and re-cycling for non-potable use



FEED PERMEATE REJECT



Mr. Mike Smith Mr. Vern Johnson



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BIOREACTOR



ULTRAFILTRATION



NANOFILTRATION



VISIT TO BEDOK MBR PILOT PLANT BY DR. YAACOB IBRAHIM SINGAPORE MINISTER OF ENVIRONMENT ON 30 MAY 2005



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