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Environmental Technologies





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ROCOD

BEST AVAILABLE TECHNOLGY FOR WASTE RECYCLING AND REUSE : ROCOD

ROCOD Water Recycling and Reuse
The Environmental and Economical Benefits

The motivations for recycling of wastewater are manifold. Most often stated are those pertaining to increasing pressures on water resources. Reuse of wastewater conserves the supply of freshwater, and this presents clear advantages with respect to environmental protection. More pragmatically, wastewater reuse may result directly from legislation, which can constrain the discharge of polluted water by making this option onerous or else for bid such discharges altogether, or it may simply be favoured economically regardless of regulatory stipulations.

Water recycling is reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes and toilet flushing. Water recycling offers resource and financial savings. Wastewater treatment can be tailored to meet the water quality requirements of a







Planned reuse. Recycled water for landscape irrigation requires less treatment than recycled water for drinking water. No documented cases of human health problems due to contact with recycled water that has been treated to standards, criteria, and regulations have been reported.

The types of membrane elements commonly used in wastewater treatment

Structure	Types
Ceramic	Flat sheet, Hollow fibers, Tubular,
Polymer	Flat sheet, Hollow fibers, Tubular, Spiral-wound cylinders

Applications for Membrane Technologies in Wastewater Treatment

APPLICATIONS	DESCRIPTION
MICROFILTRATION AND ULTRAFILTRATION SYSTEMS	
Aerobic biological treatment for discharge or reuse	Membrane is used to separate the treated wastewater from the active biomass in an activated sludge process. The membrane separation unit can be internal immersed in the bioreactor or external to the bioreactor. Such processes are known as MBR processes.
Anaerobic biological processes	Membrane is used to separate the treated wastewater from the active biomass in an anaerobic complete-mix reactor.
Membrane extraction biological treatment	Plate and frame, tubular, and hollow membranes are used to transfer high purity oxygen to the biomass attached to the outside of the membrane. Such processes are known as membrane aeration bioreactor processes.
Effluent reuse	Used to remove residual suspended solids from settled secondary effluent or from the effluent from depth or surface filters to achieve higher effluent quality and/or effective disinfection with either chlorine or UV radiation for reuse applications.
Pretreatment for nanofiltration and reverse osmosis	Microfilters are used to remove residual colloidal and suspended solids as a pretreatment step for additional processing.
NANOFILTRATION	
Effluent reuse	Used to treat prefiltered effluent (typically with microfiltration) for indirect potable reuse applications such as groundwater injection. Credit is also given for disinfection when using nanofiltration.
Wastewater softening	Used to reduce the concentration of multivalent ions contributing to hardness for specific reuse applications.



REVERSE OSMOSIS

Effluent reuse	Used to treat prefiltered effluent (typically with microfiltration) for indirect potable reuse applications such as groundwater injection. Credit is also given for disinfection when using reverse osmosis.
Effluent dispersal	Reverse osmosis processes have proved capable of removing sizable amounts of selected compounds such as N-nitrosodimethylamine.
Two-stage treatment	Two stages of reverse osmosis are used to produce water for boiler use suitable for high-pressure boilers.



WHAT IS MEMBRANE BIO REACTOR ?

Membrane bioreactor (MBR) is generally a term used to define wastewater treatment processes where a perm-selective membrane, eg. microfiltration or ultrafiltration, is integrated with a biological process − specifically a suspended growth bioreactor.

MBRs differ from ‘polishing’ processes where the membrane is employed as a discrete tertiary treatment step with no return of the active biomass to the biological process.

Almost all commercial MBR processes available today use the membrane as a filter, rejecting the solid materials which are developed by the biological process, resulting in a clarified and disinfected product effluent.

A membrane bioreactor is essentially a version of the conventional activated sludge (CAS) system. While the CAS process uses a secondary clarifier or settlement tank for solid/ liquid separation, an MBR uses a membrane for this function. This provides a number of

FILTRAN HOLLOW FIBER MBR MODULES

Hollow fibre (hollow fiber) configurations comprise one of the three main configurations for membrane bioreactor technology.

Hollow fibre (HF) membranes are normally vertically oriented with the aerators integrated either with the module or frame.The element is most commonly referred to as a ‘module’. The fibres are usually provided with some slack, to allow them to move laterally in the flow of air bubbles, which also air lift the sludge through the fibre bundle.

Water flows from outside to inside the individual fibres and is collected from the fibre ends potted either at one or both ends and fed into a collection chamber or manifold. For some products, the fibres are reinforced with a braided core to which the membrane is bonded.
Hollow fibre membranes are used almost exclusively for immersed MBRs, both for industrial and municipal applications, where they are often favoured for larger installations on the basis of their lower membrane aeration energy demand.

Biological pre-treatment

The first stage in the treatment of many sewage is biological pre-treatment which breaks down organic compounds, and removes nitrogen through anaerobic and anoxic treatment.

Filtran submerged ultrafiltration (S-UF) plant, as part of a membrane bioreactor, can be used as part of the activated sludge process. S-UF separates the pre-treated sewage from the activated sludge, the latter being recycled. S-UF replaces the settlement tank in the traditional biological pre-treatment process, and has a number of advantages:

- S-UF is easier to control and operate; thus requiring lower manpower levels and lower maintenance.
- S-UF allows a higher recovery of biomass and the denitrification/nitrification tanks are thus reduced to about one third of their normal size.
- These factors combined result in significant savings in space.





FILTRAN TUBULAR MBR MODULES





Tubular Membranes have high anti-pollution, high operational flux and exchangeable membrane components. They are widely used in leachate MBR, industrial wastewater MBR, fermentation broth filtration, juice filtration, oil-water separation, wastewater treatment and emulsion treatment process. There are hundreds of projects so far.

- Suitable for a variety of separation applications, including fermentation filtration, juice filtration, sidestream MBR, heavy metal water filtration, and oily wastewater filtration)
- High operational flux, long lifespan
- Tubular membrane diameter: 4, 6, 8, 10, 12 and 24 mm
- MWCO: 10k-250k Dalton
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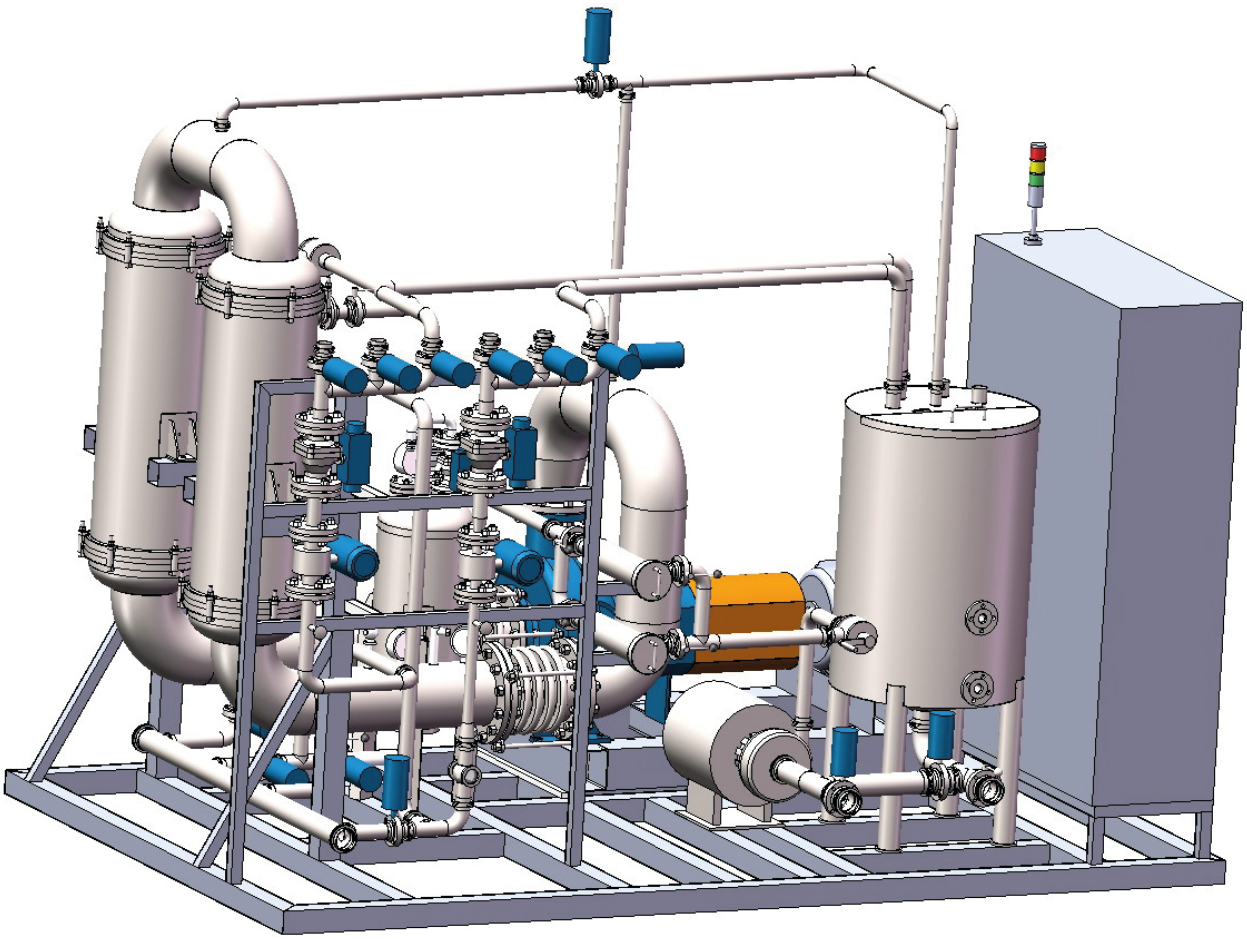
Membrane materials: polyvinylidene fluoride (PVDF), polysulfone (PS)

- Innovative Exchangeable Membrane Element and Module Housing Design
- Savings on Replacement Cost,reusable stainless steel membrane surface casing
- User friendly, users can replace it on site
- When a single membrane module fails, it will not affect the operation of the entire system
- The membrane module has many specifications, from DN65 to DN250, and the area ranges from 1.1㎡ to 72㎡.
- It can meet different requirements, optimized design of the entire system
- Membrane modules can be up to 4.0 meters in length, with standard lengths of 3.0 meters and 3.66 meters
- Customized Design

FILCER CERAMIC TUBULAR MODULES

Ceramic membrane is a porous fine ceramic filter which is sintered from Alumina, Titania or Zirconia under ultra high temperature. Ceramic membrane normally has an asymmetrical structure with porous support active membrane layer. The macro porous support ensures the mechanical resistance while the active layer functions separation ranging from Microfiltration, Ultrafiltration and even Nanofiltration (from 10nm down to 1KD). Ceramic Membrane always runs at a CROSS FLOW FILTRATION mode.

The turbid fluid goes through membrane layer inside the single channel or a multichannel at a high velocity. Driven by TransMembrane Pressure(TMP), the clean liquid with micro-molecule pass through the membrane layer vertically to permeation, the solid and big molecule is rejected in retentate. The feed fluid is thus clarified, concentrated and purified.



FILCER CERAMIC FLAT SHEET MEMBRANE BIOREACTOR (FILCER)

The ceramic flat sheet membrane is a new highly efficient multi-porous membrane for water treatment. As it is an inorganic membrane, it has the advantages of chemical resistance, long life, good anti-fouling performance etc. compared to organic membrane. Compared to tubular ceramic membrane, it has advantages such as lower cost, lower power consumption, smaller space requirement.

Apps

* Industrial wastewater treatment
* Domestic wastewater treatment
* Membrane bioreactor
* Reverse Osmosis pre-filtration
* Wastewater recovery
* Drinking Water Treatment
* Seawater treatment

Properties

* Strong mechanical strength, good chemical stability, small pore size range, good anti-fouling ability.
* High separation efficiency and filtration precision, small TMP, low operating power consumption.
* Convenient maintenance, automatic operation, online cleaning and production, long life.
* Very little additional pre-treatment, very little space required.
* Wide application, combination with multiple processes to achieve highly efficient comprehensive wastewater treatment



ROCOD HIGH COD WASTE WATER REVERSE OSMOSIS MEMBRANES

The ROCOD Module uses reverse osmosis for molecular separation, desalination and purification of liquids.

The module involves a total reverse osmosis system resulting in a module that operates effectively and economically even at increased turbidity and Silt Density Index levels.

Compared with standard RO, it can work stably with high TDS and COD wastewater.

Application

- Leachate treatment
- Dyeing waste water
- Seawater desalination
- Paper production waste water
- Dairy waste water etc.



ROCOD WASTE WATER RECYCLING PLANT

DTRO REVERSE OSMOSIS MEMBRANES



This module consists of a pressure tube and hydraulic discs which are held by a center tension rod. Octagonal membrane cushions lie between every two discs. Owing to this special construction, open flow channels are formed between the hydraulic discs and the membrane cushions where the raw solution concentrates. The individual channels are joined together by openings in the discs, which are arranged in annular pattern, so that the feed water flows radial across the membrane cushions, alternately from the inside towards the outside.
The membrane cushions are made of two single membrane discs with an inter-mediate layer (spacer). The membranes are manufactured from modified polyamide, the material of intermediate layers is polyester. Using the ultrasonic welding technique the medium can not come into contact with other materials (membrane glues, etc.).
Beside various reverse osmosis membranes also nanofiltration membranes are deliverable.

Reverse osmosis is a cross-flow filtration process, i.e. driven by pressure: untreated water flows across an active layer (membrane) at high velocity and the filtrate flow passes through the membrane in vertical direction.
Membrane separation is a quite physical process, i.e. the components to be separated undergo neither thermal, nor chemical, nor biological changes. Reverse osmosis allows the separation of low-molecular substances and inorganic salts. For this reason reverse osmosis has proven its suitability in most different fields of application, such as:

- purification of landfill **leachate**
- effluent from **pharmaceutical industry**
- purification of **industrial waste water**
- **desalination** of sea water for drinking water production
- **reject treatment** from Spiral RO
- effluent treatment from **textile industry** and **dyeing process**
- **tannery** effluent treatment
- waste water treatment from **distilleries**
- treatment of **compost plant** waste water



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