

Membrane Introduction

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Membrane Introduction

- Membrane is a semipermeable membrane, is a thin layer of material.
- It needs pressure to drive membrane process.
- Classify three type membrane
 - Microfiltration (MF)
 - Ultrafiltration (UF)
 - Reverse Osmosis Membrane (RO)

Membrane Particle Separation

- MF-particle $> 0.2 \text{ } \mu\text{m}$
- UF-organics $> 10,000 \text{ MW}$, Virus, and colloids
- NF-Organics: $> 400 \text{ MW}$ and hardness ions
- RO-salts and low MW organics
- Particle: Giardia, Cryptosporidium, bacteria, and turbidity

Membrane System Design

- MF always be considered as a part of pretreatment to RO or NF to replace fouling potential.
- Both NF and RO are employed to desalt or remove hardness from ground water.
- System equipment components: prescreen, feed pump, cleaning tank, automatic gas backwash systems, air compressor, membrane integrity monitor, a back wash water transfer tank, pressure break reservoir, etc..

Membrane Separation Relative Cost Analysis

- MF < UF < NF < RO or ED/EDR
- If TDS removal > 3,000 mg/L, RO or ED/EDR may be less costly.

RO Consumables Typical Applications

反滲透膜商業應用

- Municipal Water 大都會
- Food & Beverage 飲食界
- Antifreeze Reclaim 抗凍
- Plating Facilities 電鍍
- Car Wash 汽車
- Military 軍事
- Boiler Applications 鍋爐
- Uranium Mining 铀礦
- Pharmaceutical 醫藥
- Electronic Industry Fluids
- Semiconductor 半導體
- Hemodialysis 腎解析
- Bottled Water 瓶裝水
- Power Plants 電力系統
- Waste Reclamation
- Bio-Tech 生化系統
- Petrochemical & Refineries 石化系統
- Process Water 流程水

反滲透膜污染物排除率功效

Typical Reverse Osmosis Contaminant Rejection

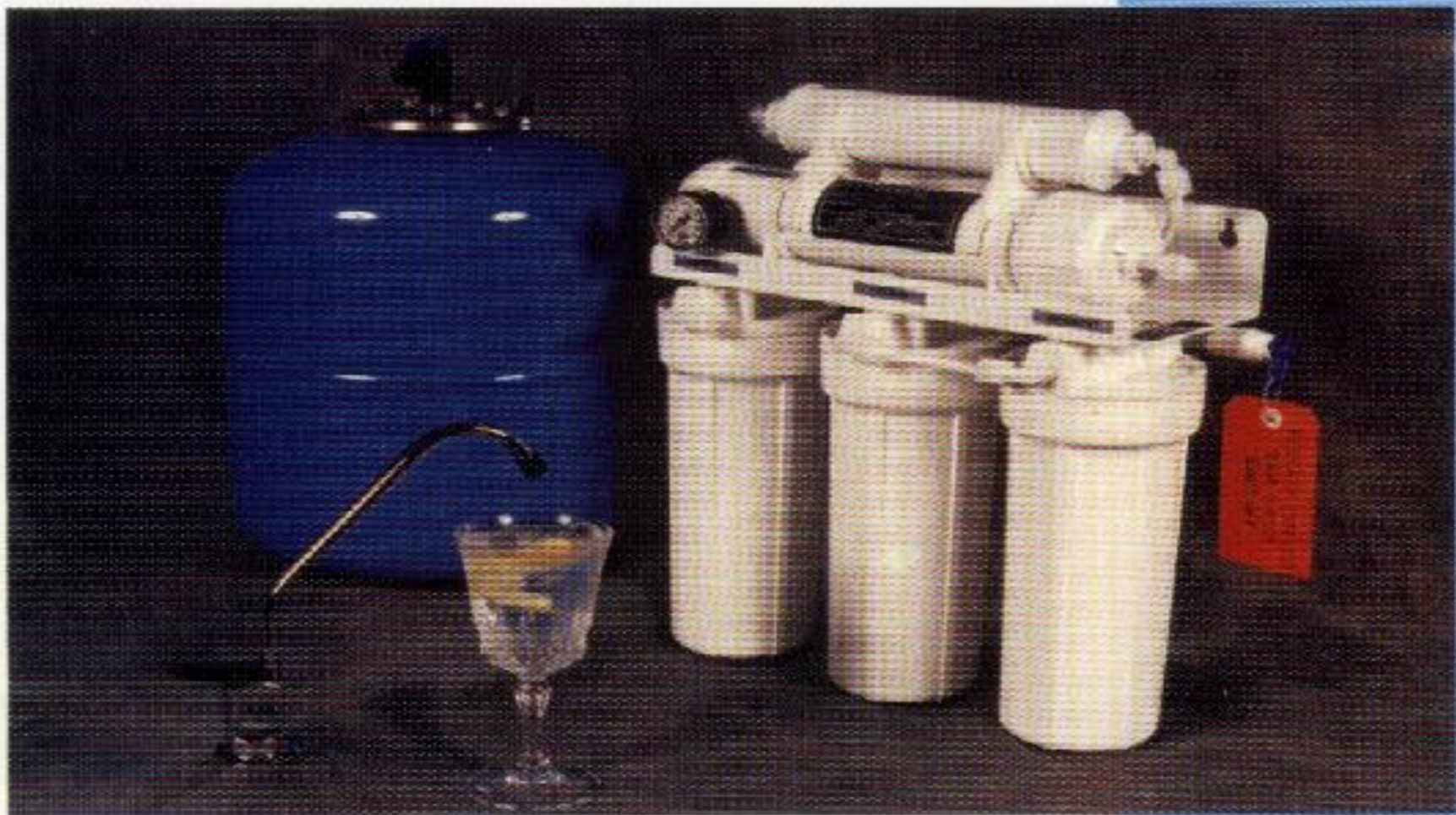
Contaminant	Rej. %	Contaminant	Rej. %	Contaminant	Rej. %
Sodium	85-93	Iron	95-98	Potassium	87-94
Aluminum	96-99	Magnesium	96-98	Fluoride	87-93
Lead	96-99	Zinc	98-99	Nickel	98-99
Copper	98-99	Chloride	87-93	Silver	93-98
Arsenic	94-96	Nitrate	60-92	Bicarbonate	90-95
Mercury	96-98	Silicate	85-90	Manganese	95-98
Sulfate	96-98	Cyanide	86-92	Ammonium	86-92
Calcium	96-98	Sulphite	98-99	Barium	96-98
Phosphate	96-99	Bacteria	99+	Chromium	96-98

家庭用四段過濾反滲透膜系統



4-Stage

家庭用五段過濾反滲透膜系統



5-Stage

RO Water for Boiler

Recycle water from RO

Bottled Water Unit

Bottled Water System

Kidney Dialysis RO Unit

Industrial Process RO

Assembly Manufacturer

Biological growth on RO Membrane
反滲透膜表面微生物成長顯微透視圖



Biological growth on membrane surface using scanning electron microscope (SEM). 35,000x magnification

反滲透膜表面水垢晶狀體形成圖案



Membrane scale at 35,000x magnification. Scale consists of calcium carbonate, calcium sulfate, silica, iron, barium and strontium sulfate.

Delamination of glue lines at edge of membrane 反滲透膜表面邊緣膠脫落



Note impressions left on membrane surface from the flowchannels from pressure. Delamination often occurs as a result of backpressure from the permeate side and can cause irreparable damage to the membrane.

Biological growth in membrane flow channels

反滲透膜內層管道微生物成長圖案



**Flow channels in
membrane
fouled with
biological
growth.**

Membrane fouled by humic acid using scanning electron microscope (SEM) at 35,000x magnification.

