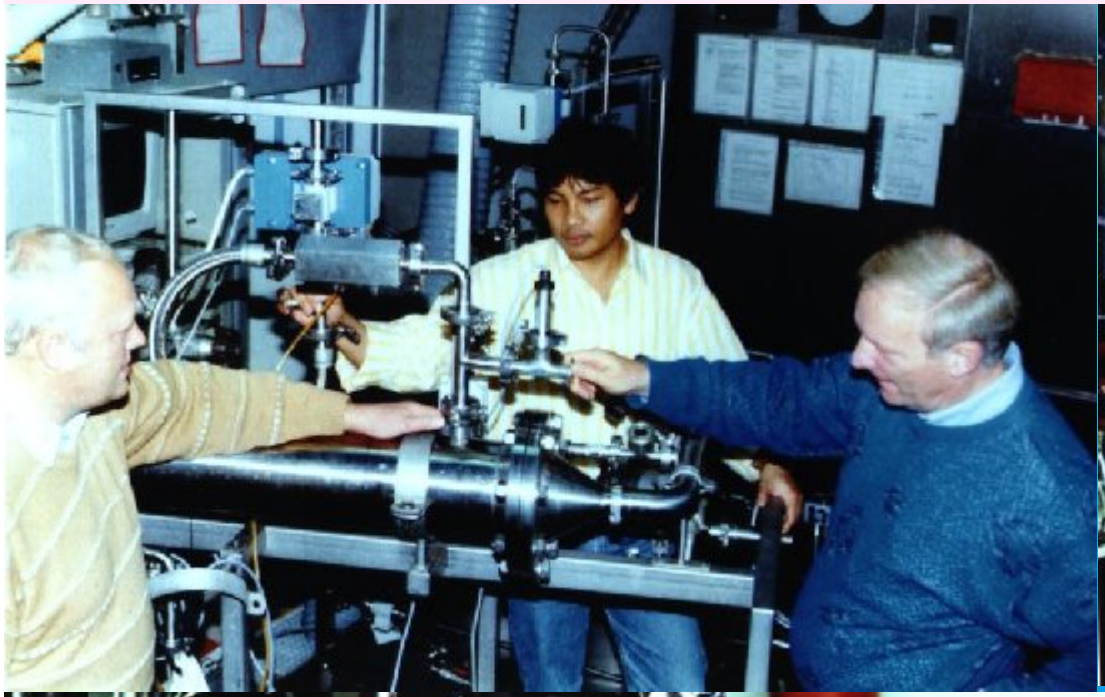
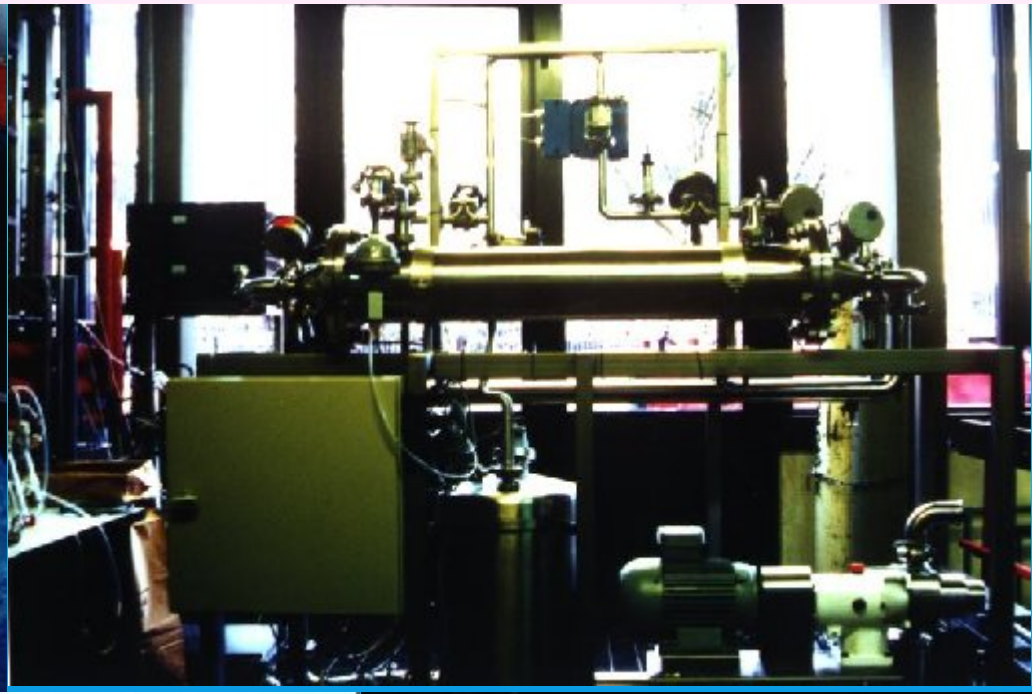
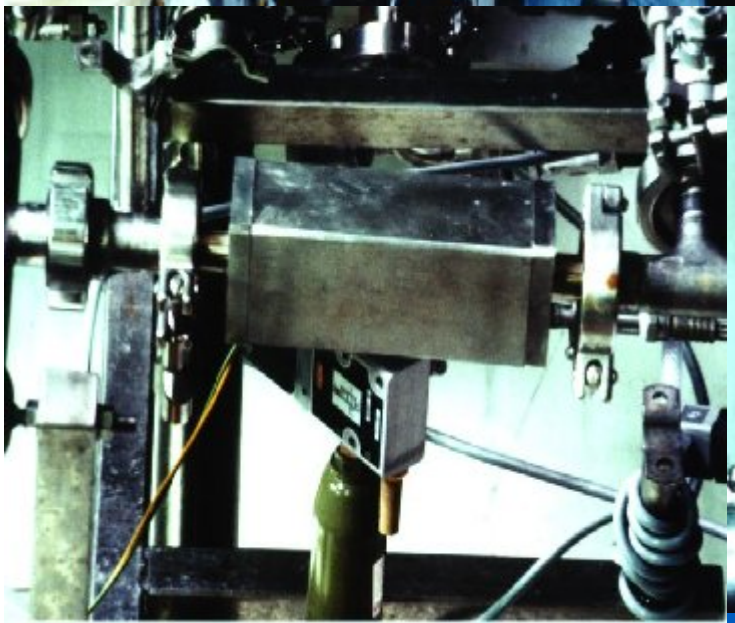
MENUMBUHKEMBANGKAN BUDAYA INVENTIF DAN INOVATIF

- Get Innovative or Get Dead !
- Masalah – Ide – Riset – Invensi – Inovasi
- Inovasi Nilai (Blue Ocean Strategy)
- Azas HKI (Reward, Recovery, Incentive, Risk, Economic)
- Manajemen HKI (Efisien, Sistematik, Sustain)
- Inovator (Profesional,Tajam, Gigih)
- Publikasi Lewat PATEN ?

THE BACKSHOCK PROCESS

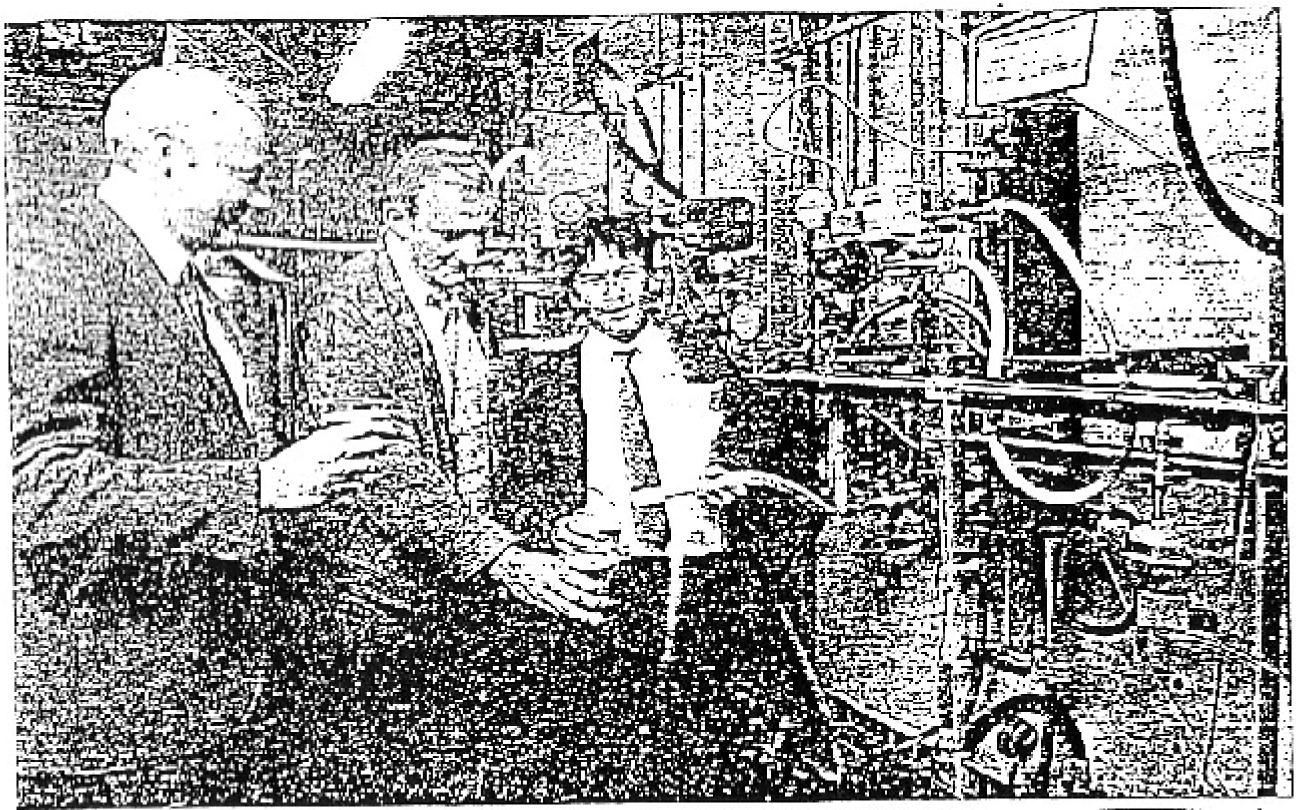






Bioteknologisk gennembrud - støttet af Danida

Forskning: Biokemikerne er et ombejlet folkefærd. Danske industrivirksomheder håndplukker ofte medarbejdere, inden de er færdige med studierne, men ingen skal regne med at kunne lokke indoneseren Gede Wenten til at blive i Danmark.



Gede Wenten og hans to vejledere, Alan Rasmussen (tv.) og Gunnar Johnsson, demonstrerer her det ny anlæg til membranfiltrering af øl.
Foto: Steen Jacobsen

Af LISE TAPK

Det var Wentens og supervisornes dag på DTH. »En verdenssensation.« »Den største revolution i bryggeriindustrien i 50 år.« Det er store ord, men efter interessen fra dansk industri at dømme, var der noget om snakken.

Den lille indoneser fyldte ikke meget i mængden af forskere, studerende og industrifolk, mens han med et genert smil og sved på panden forsøgte at demonstrere interessen ved en ny filtreringsteknik, han har udviklet under sine studier i Danmark. Han var tydeligt benovet over virakken og menneskemyldret i kælderen under blok 223, hvor pilot-anlægget står.

Gede Wenten kom til Danmark i 1988 med en bachelorgrad fra universitetet i Bandung. På rekordtid – 15 måneder – tog han sin mastergrad, inden han gik i gang med forskningsprojektet, der kulminerer med en Ph.D-grad til foråret, når han har forsvaret sin afhandling.

Men intet tilbud så umodståeligt tilbud fra en dansk virksomhed kan lokke Wenten til at blive i Danmark.

»Jeg har nu været her i fem år, og glæder mig til at rejse hjem til foråret. Men kontakten fortsætter til DTH, hvor jeg stadig vil spille en rolle, både som forsker og gæsteimerer,« siger Gede Wenten, som regner med at få sin egen bioteknologiske afdeling på universitetet i Bandung ved Djakarta.

Den unge biokemikers uddannelsesforløb har været tilrettelagt af Undervisningsministeriets internationale kontor, som eksporterer danske uddannelsessystemer, og DIS – Denmark's International Study Program. Gede Wenten kom til Danmark via et Verdensbank-projekt, »Second University Development Project«, og har gennemført DTH-studierne med økonomisk støtte fra Danida.

Wenten siger dog ikke endeligt farvel til Danmark, når han rejser hjem til Indonesien i april. DTH har nemlig indgået aftale med Wentens universitet, Institut Teknologi Bandung, om overførsel af know-how, og fælles forskergruppe skal sikre videreudvikling af det frugtbare samarbejde, bl.a. med udveksling af gæsteprofessorer og studerende.

Gennembrud

I samarbejde med to vejledere fra DTH, Alan Rasmussen og Gunnar Johnsson, har Wenten gjort et forskningsmæssigt gennembrud inden for membranteknologi. Alan Rasmussen, som er civilingeniør og tidligere brygmester på Wibroe bryggerierne i Helsingør, har stået for den organisatoriske del af forskningen, mens Johnsson har bidraget med kreative ideer.

»Men hovedæren er Wentens,« siger Alan Rasmussen. »Det er hans store energi og viden, der har givet det fornemme resultat.

Når vi har koncentreret os om ølfiltrering, skyldes det nok min baggrund som brygmester hos Wibroe, fordi jeg dengang fornemmede et enorme behov for at udskifte den nuværende kiselgurfiltrering med en mere miljøvenlig teknik. Vi kunne lige så godt have valgt læskedrikke, vin, mælk eller andre produkter, som skal filtreres.«

Instituttet for Bioteknologi ved DTH har øremærket penge fra en særlig fond til procesforskning og levnedsmiddelforskning, og det er her, man har hentet penge til opbygning af en »pilot-plant« i Lundtofte.

Meningen er, at anlægget skal udbygges i samarbejde med industriens samarbejdere inden for brygning, gæring, filtrering og fermentering. DTH har allerede indgået en slags bioteknologisk broderskab med store nabovirksomheder som Novo Nordisk, Chr. Hansens Laboratorium, Alfa-Laval og Danisco.

Kiselgur

Gennem mange år har man filtreret øl ved hjælp af kiselgur – et mælkehvidt pulver, som også bruges af private til bl.a. rensning af svømmebassiner. Men der er en række miljøproblemer knyttet til dette stof – både på affaldssiden og arbejdsmiljøsiden.

Med den ny teknik presses øllet gennem en særlig plastmembran, der nærmest ligner et bundt spaghetti, og man undgår helt brugen af det miljøbelastende kiselgur. Samtidig forbedrer man øllets kvalitet, idet der ikke går et eneste protein tabt under filtreringsprocessen. Endelig kan man regne med at spare på regningen af miljøafgifter.

Pilot-anlægget på DTH er opbygget i moduler, som hurtigt kan omstilles fra én produktion til en anden. Kemiingeniørens eget Legosæt.

Membranen fremstilles af det hollandske firma X-Flow, som for 14 uger siden har indsendt patentansøgning på opfindelsen. Ifølge aftalen med producenten skal 30 procent af royaltyindtægterne tilfalde ... [illegible] ... procent går til at styrke det videre samarbejde mellem DTH og Wenten. De danske vejledere ved DTH deler 25 procent, mens de sidste 45 procent af royalty-pengene via en DTH-fond skal gå til investeringer i nyt bioteknologisk udstyr.

Wentens opfindelse var det store samtaleemne på den internationale bryggeri-messe »InterBrau« i München for tre uger siden, fortæller George Dinau, X-Flows agentur i Danmark.

»Nyheden spredtes som en løbeild på messen. Vi havde netop samme dag indleveret ansøgning om patent og kunne derfor ikke svaret for den ny filtreringsteknik.«

Fra 8. til 11. november holder DTH et seminar for verdens førende specialister om emnet.

Brygmester og civilingeniør Alan Rasmussen og Gede Wenten viser her den specielle membran til ølfiltrering.
Foto: Steen Jacobsen

Fra Bali til ung opfinder på DTH

The Filtration Society

SUTTLE AWARD

the Suttle Award is made every two years for the most meritorious paper presented by an author younger than 31 years of age.

awarded to I Gede Wenten

for his paper entitled Mechanisms and Control of Fouling in Crossflow Microfiltration

presented by Cyril Smith

Date 20th September 1994

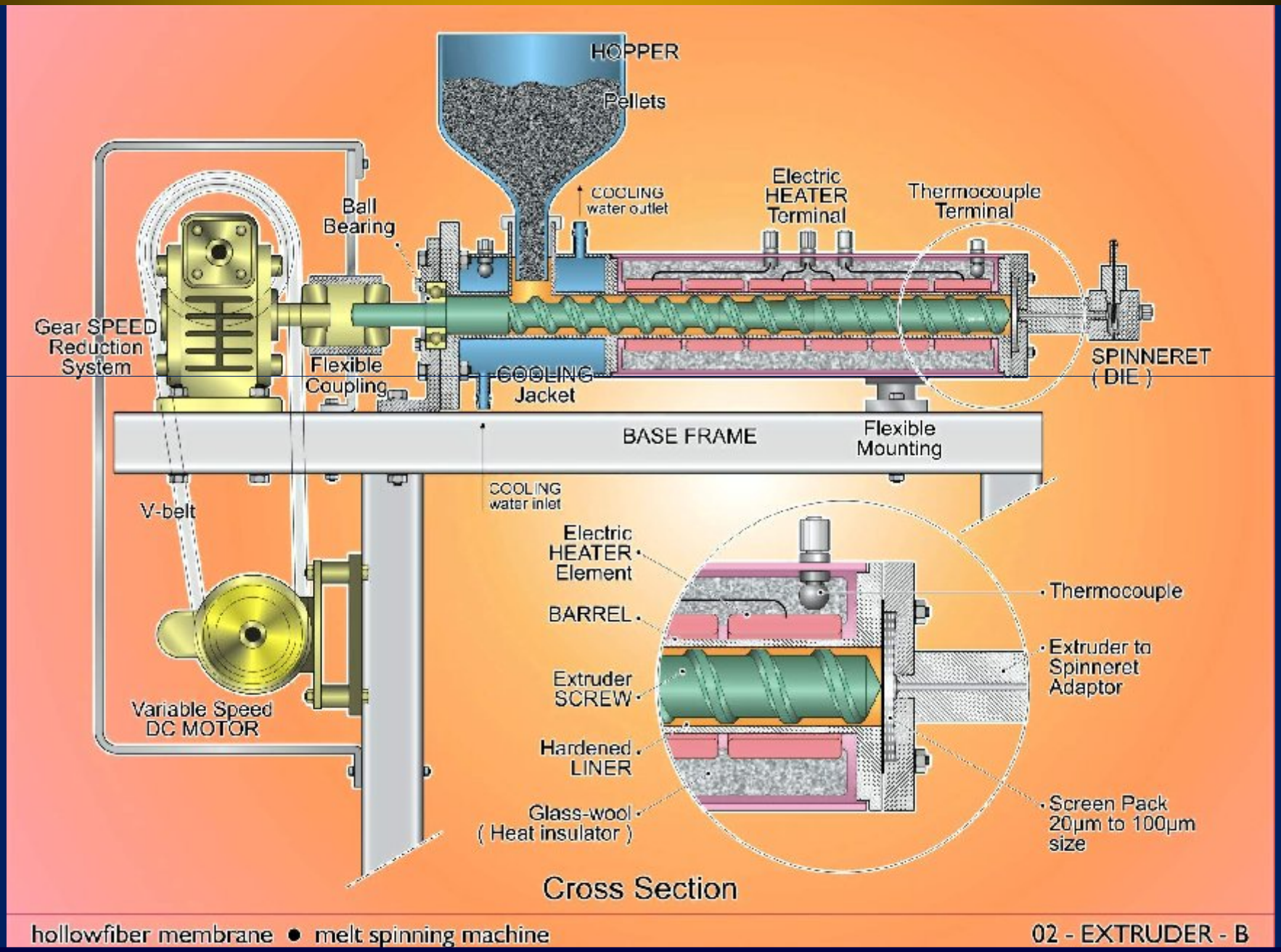
C. Smith.

Chairman of the Filtration Society, London.

IGW

Membrane Fabrication – Melt Spinning

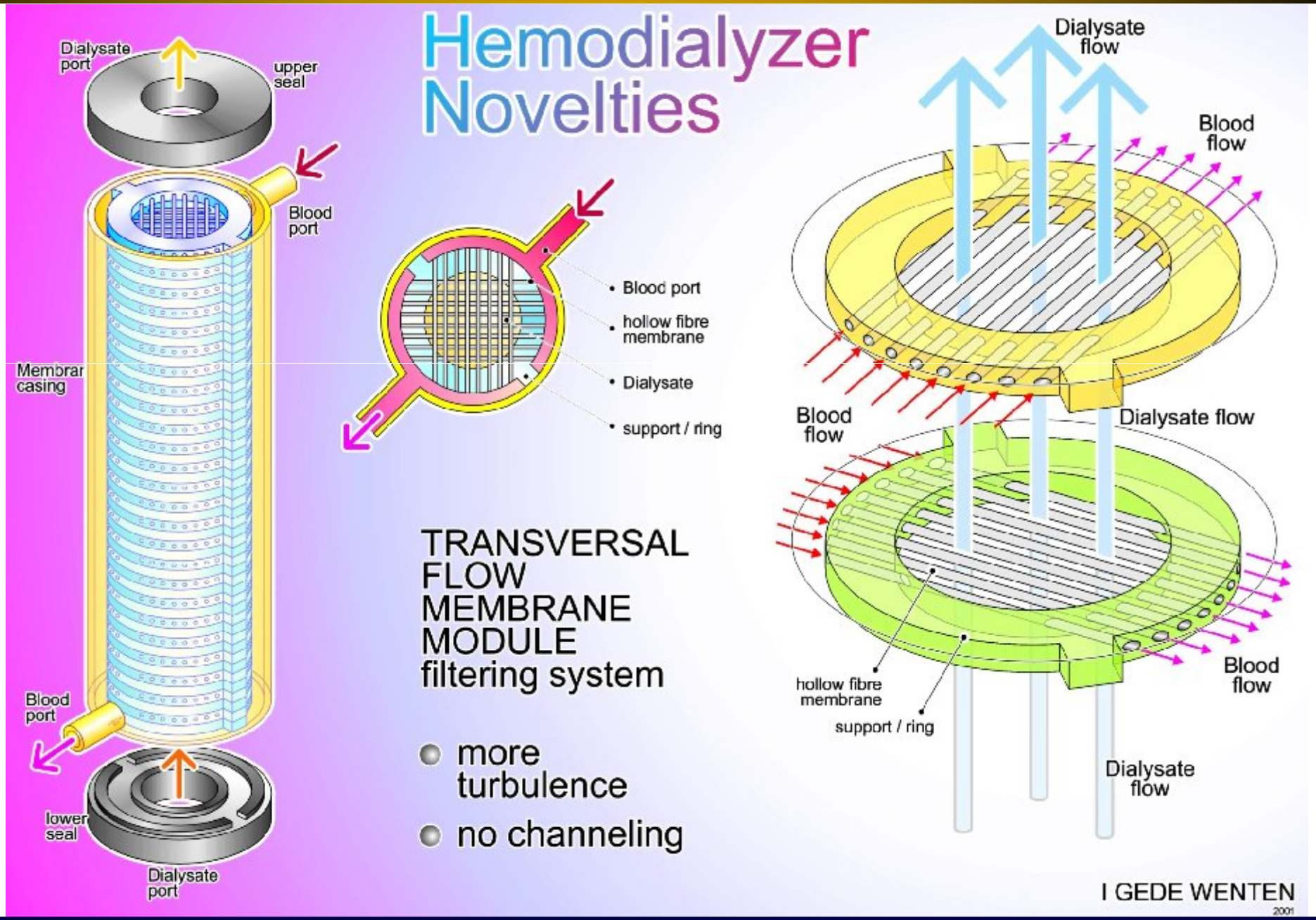
MEMBRANE FABRICATION



IGW

DIATEK : FUTURE HEMODIALYZER

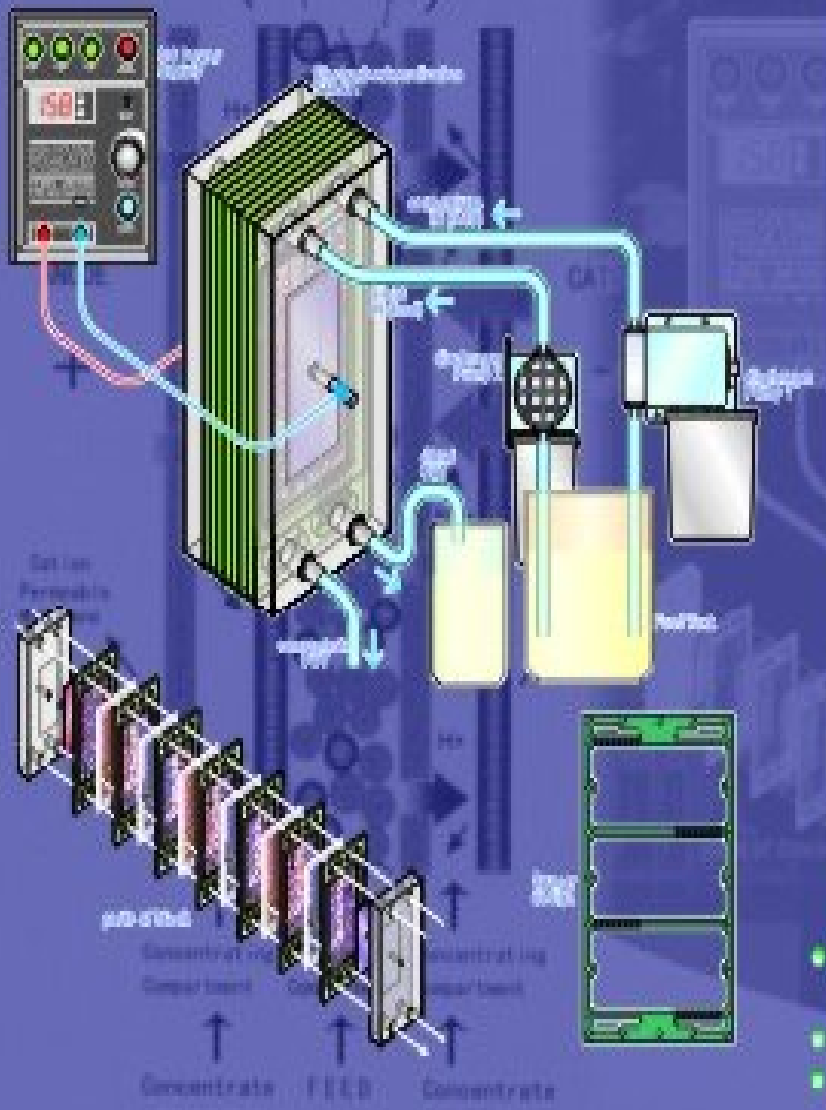
MEDICAL APPLICATION

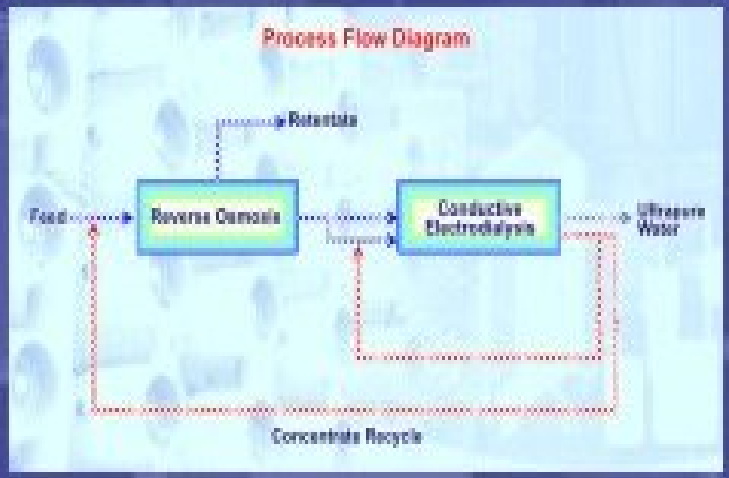


CONDUCTIVE ELECTRODIALYSIS

CED TECHNOLOGY :

NO MORE CHEMICAL REGENERATION FOR ION EXCHANGE





The most common method for producing ultrapure water which has resistivity higher than 10 MΩ-cm is chemically regenerated ion exchange. In addition to requires a large amount of chemicals, the method is high cost for labour and produces a large volume of wastewater. Environmental awareness in recent years has led to include environmental consideration in production routes to ensure minimum waste generation.

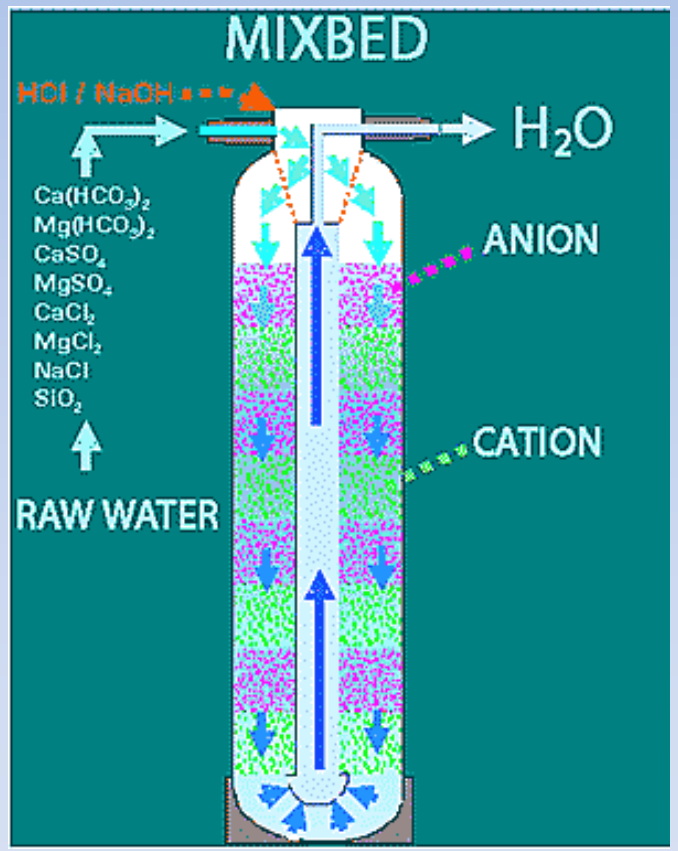
conductive electrolysis (CED), well known as electrodeionization (EDI) or continuous deionization (CDI), is a novel technology of an electrically driven membrane process combining ion exchange and electrodialysis. A CED stack consists of diluted compartments, concentrated compartment, and electrode compartments. Earlier configuration, the mixed ion exchange resins are only filled in the diluted compartments, which enhance the ions transport from diluted compartments toward concentrated compartments under the force of direct current. The later configuration, both diluted and concentrated compartments are filled with mixed ion exchange resins.

For ultrapure water production, CED should be combined with reverse osmosis (RO) to prevent membrane scaling and to reduce production cost. The feed water is pretreated by RO to produce water having conductivity less than 40 µS/cm prior to be treated by CED.

The advantages of the CED technology compared to the conventional ion exchange :

- The mixed ion exchange resins are continuously regenerated by an electrical current so that virtually eliminate the chemical cost and hazardous wastewater
- Offer continuous and simple operation with predictable product quality and dramatically reduce operators interference.
- Smaller unit for similar capacity

MIXED BED ION EXCHANGE

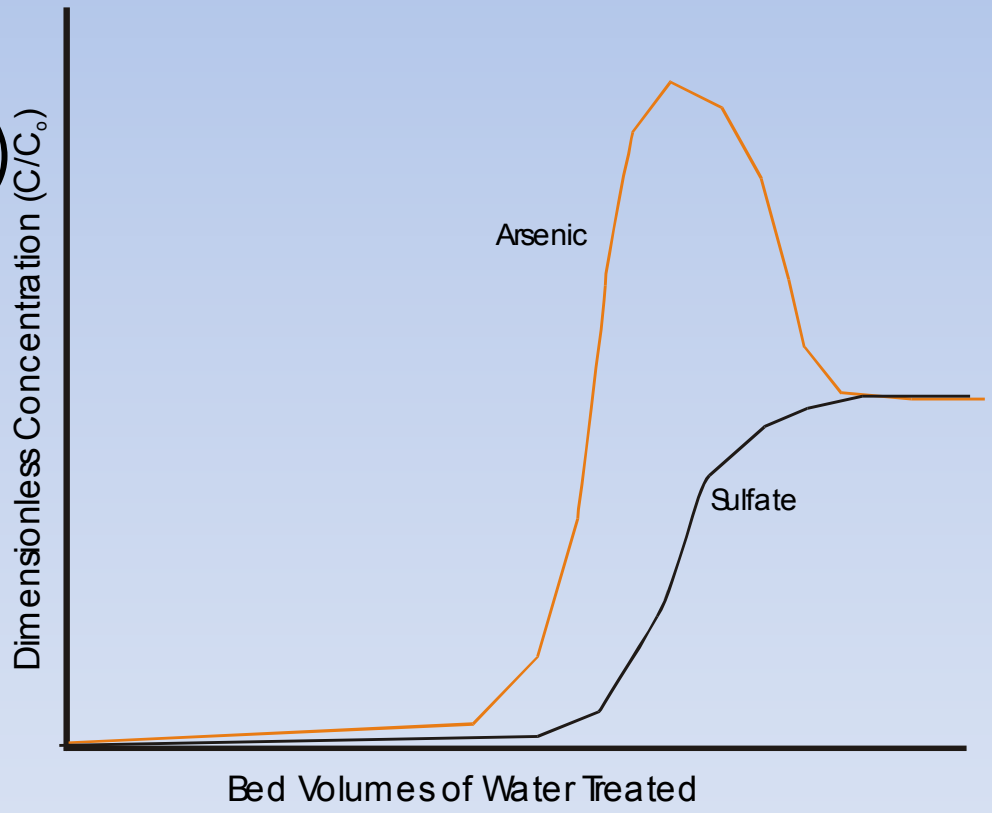


KINETIC OF ION EXCHANGE

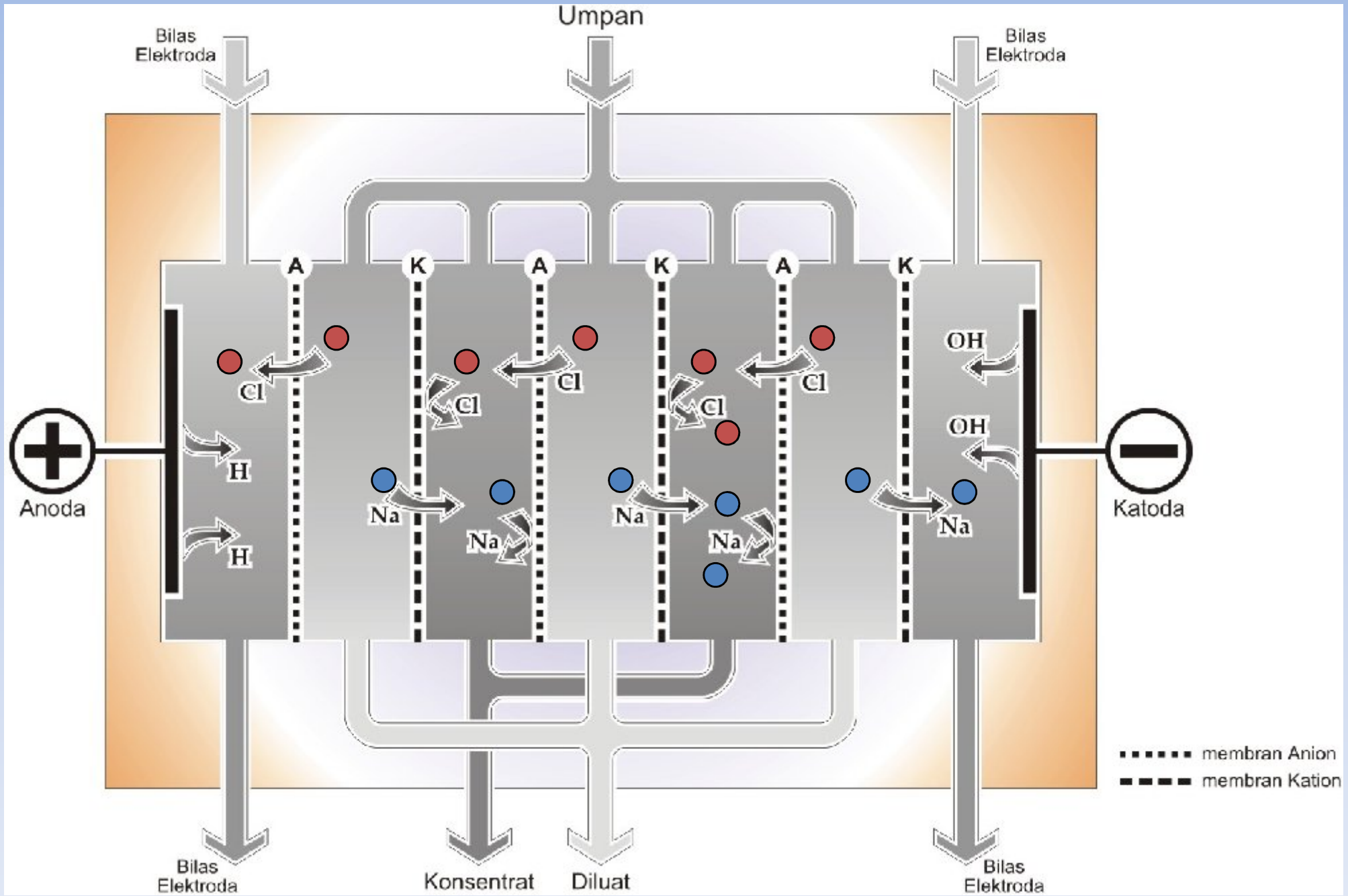
- Exchange kinetics are rapid and internal mass transport limitations are small
- Empty Bed Contact Time (EBCT)

$$EBCT = \frac{\text{Vol. of Empty Bed}}{\text{Flow Rate}} = \frac{V}{Q}$$

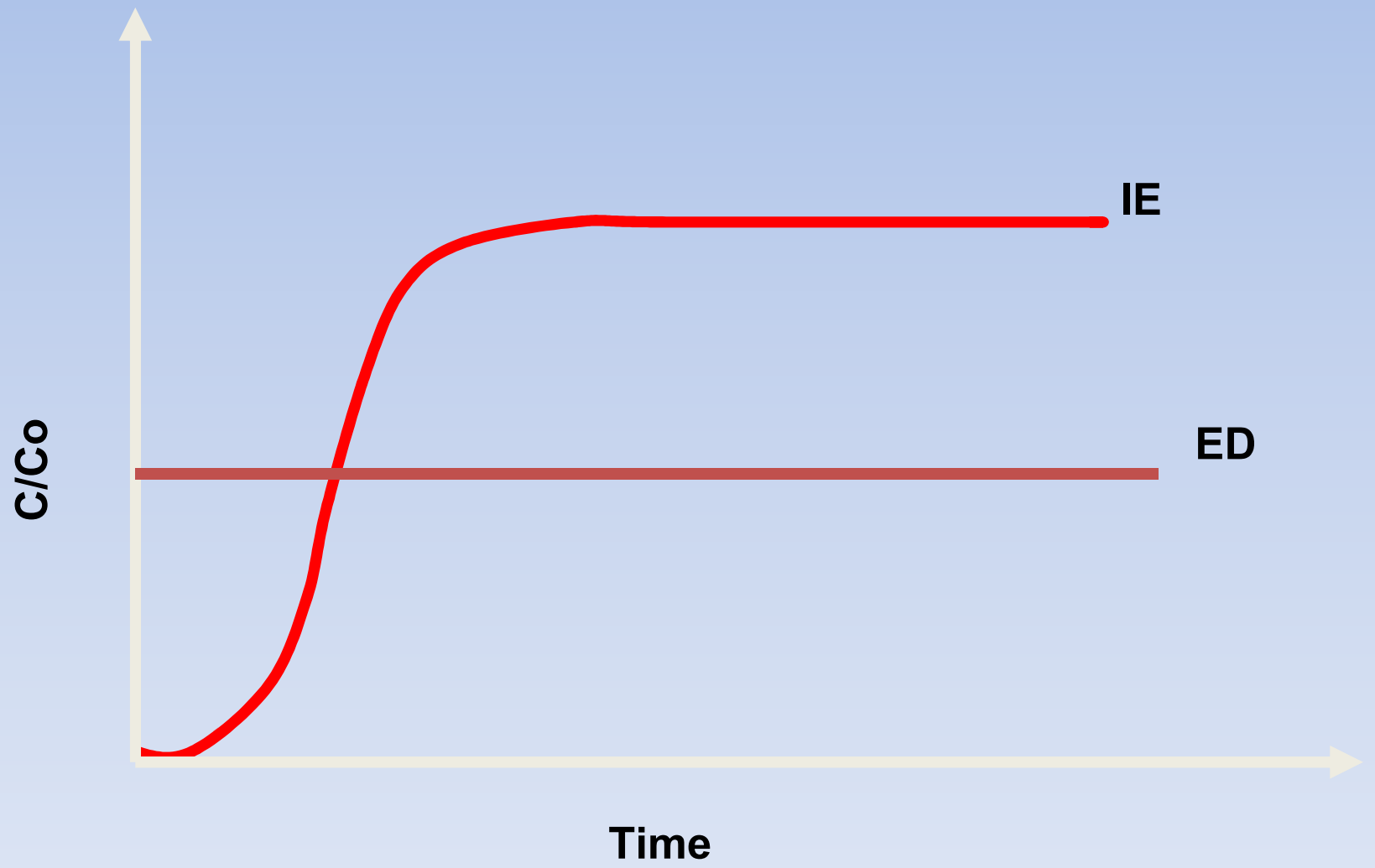
  - **$EBCT_{min}$ = 1.5 min**
- Breakthrough is sharp & leakage is low



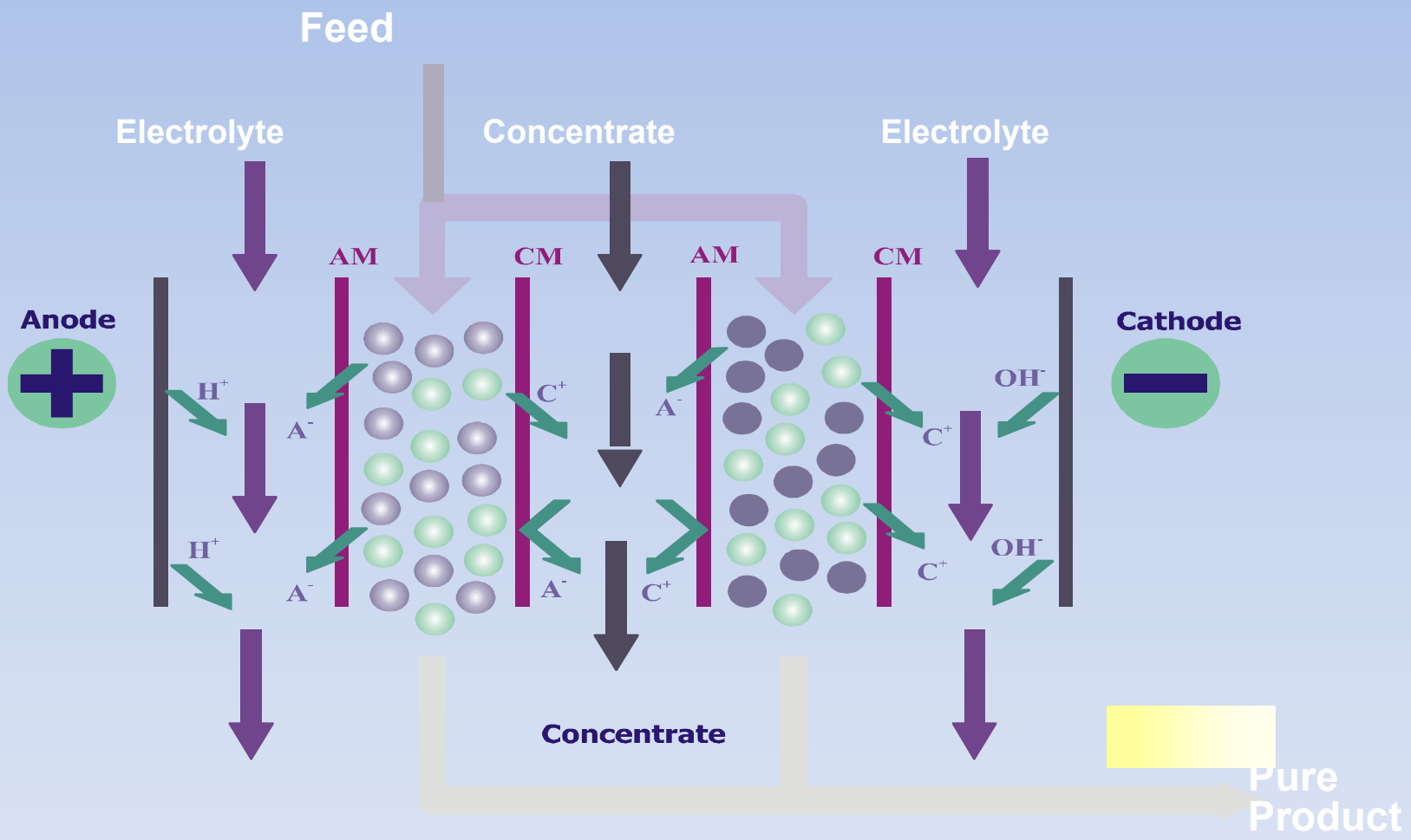
Elektrodialisis



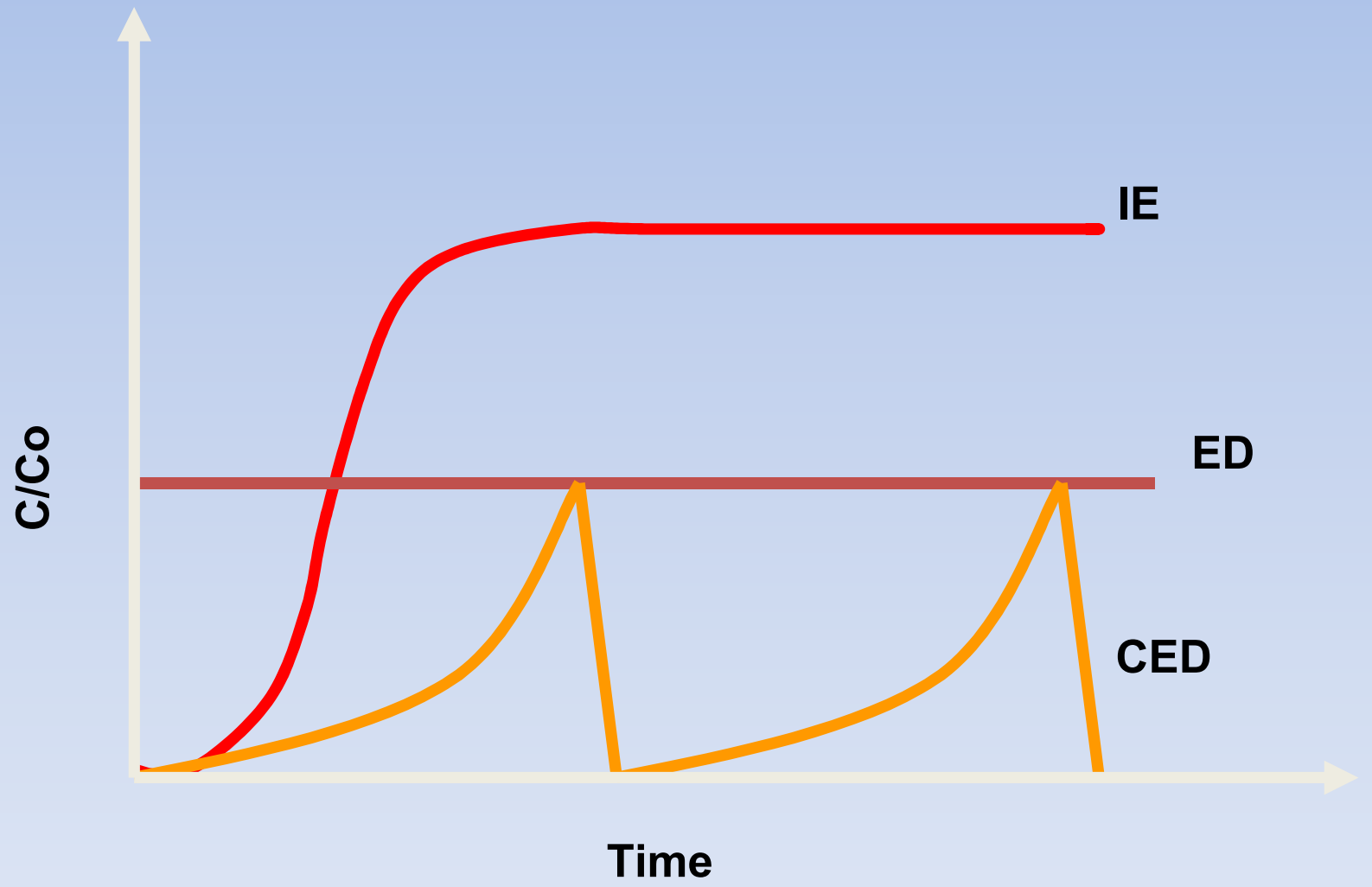
IE VS ED



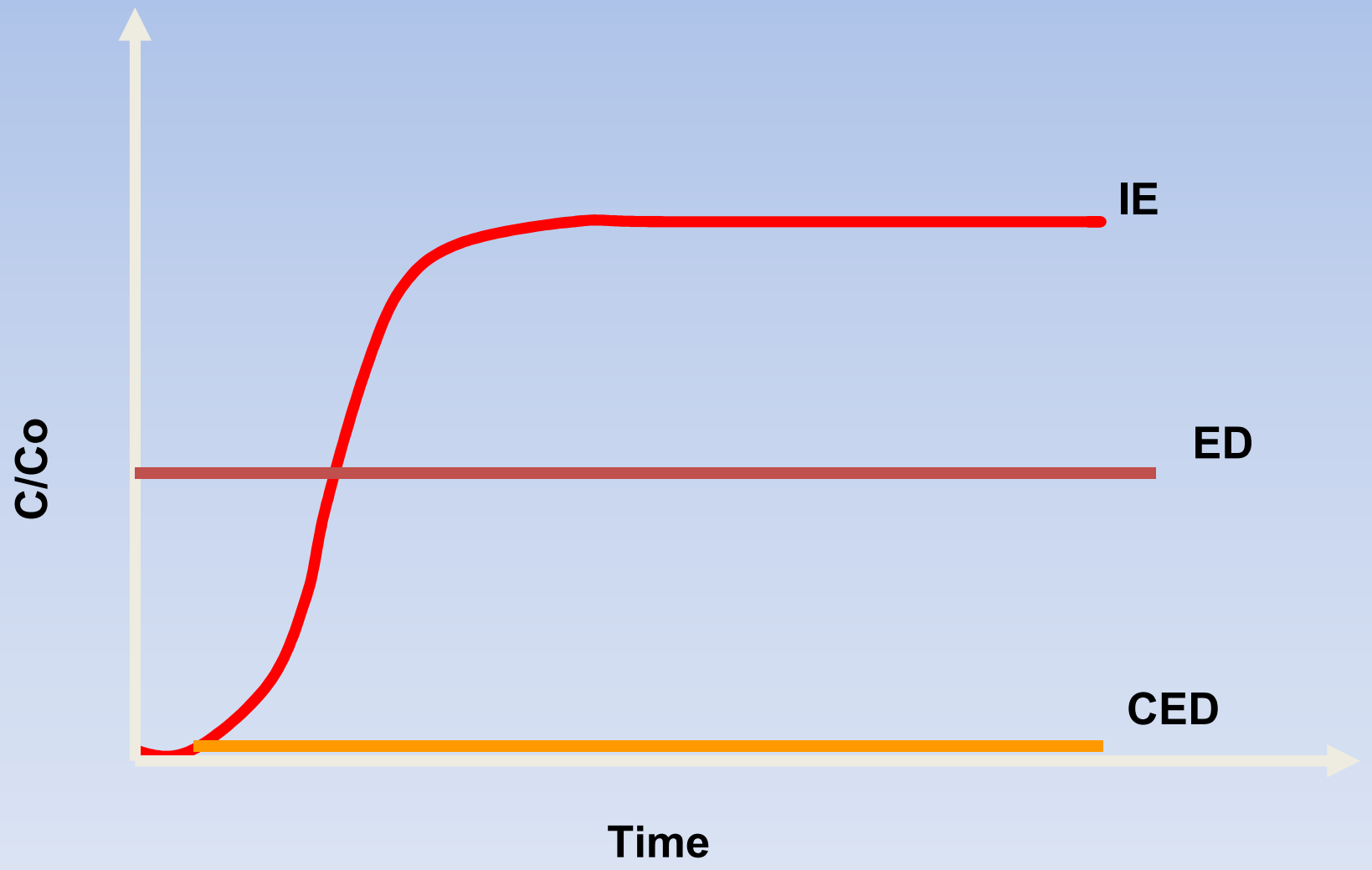
Conductive Electrodialysis



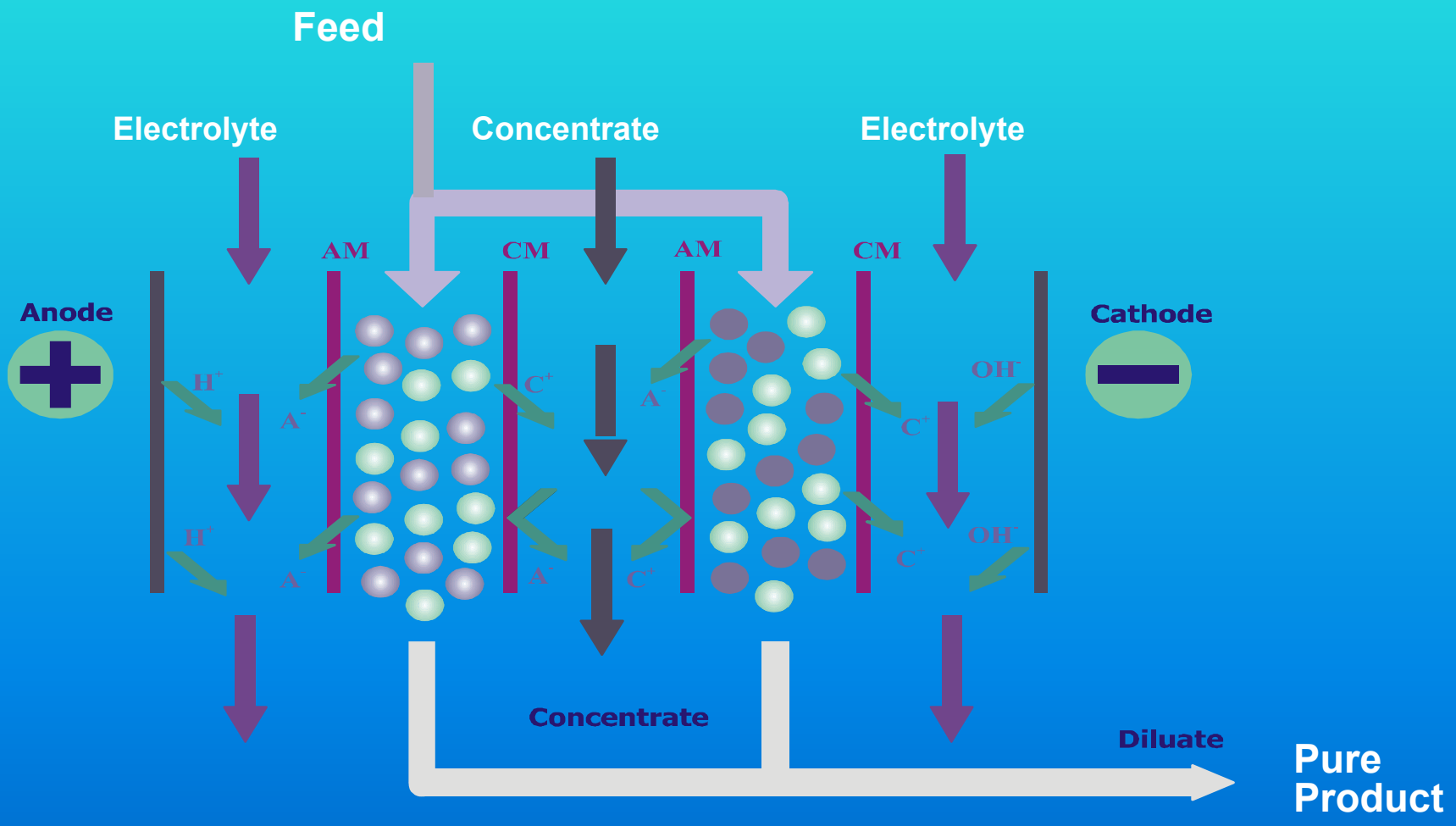
PREDICTED PERFORMANCE



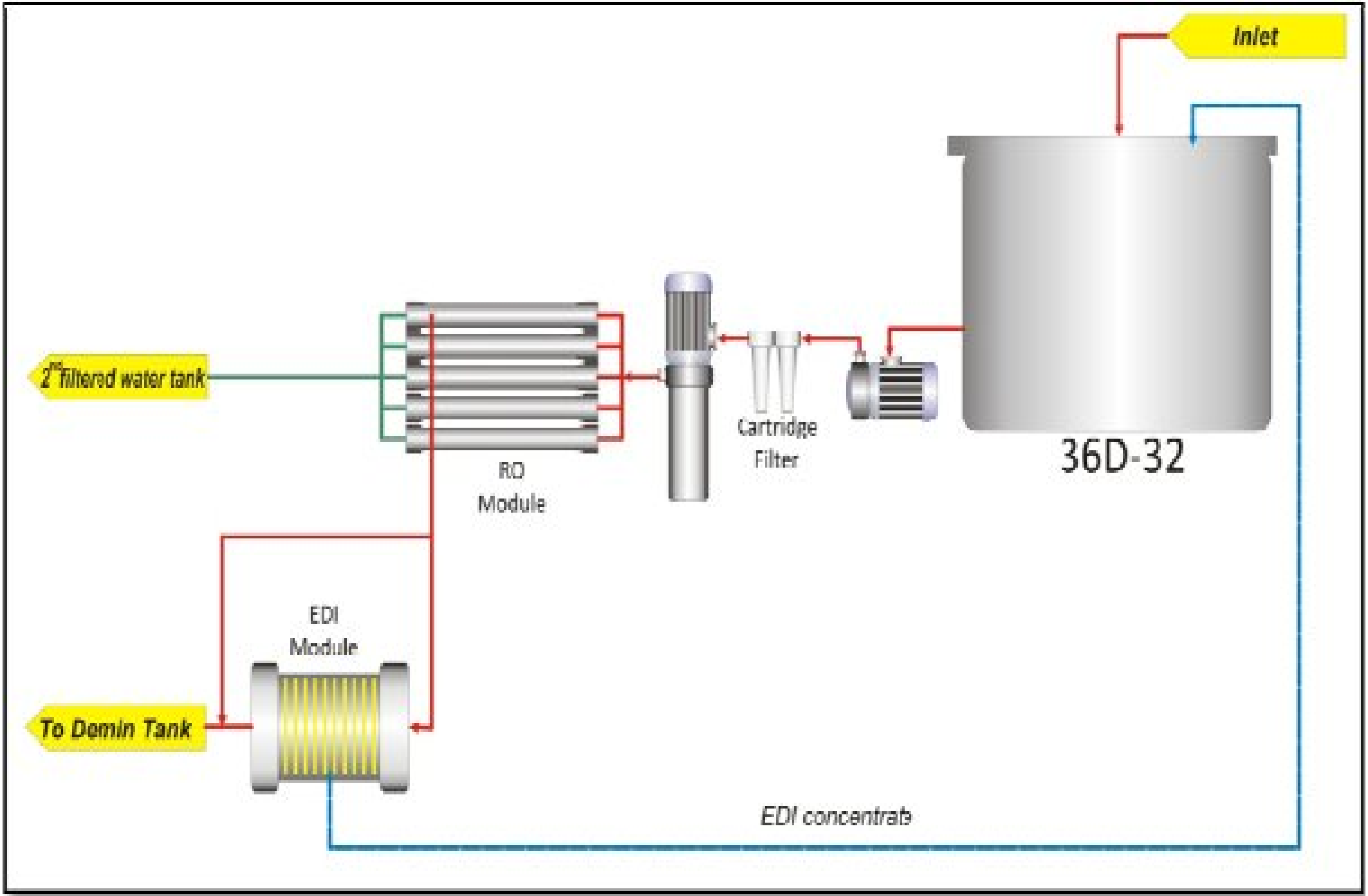
IE – ED - CED



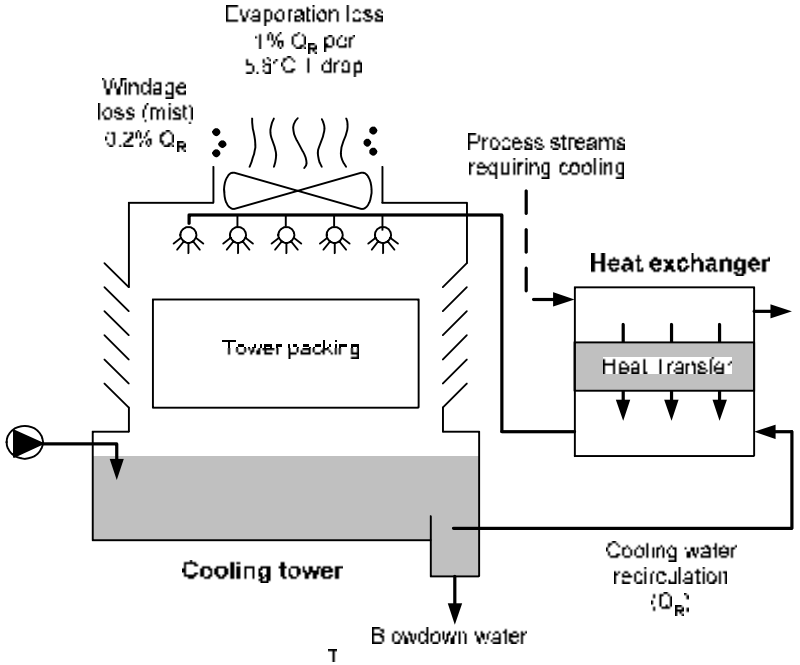
THE IONIC BRIDGE THEORY

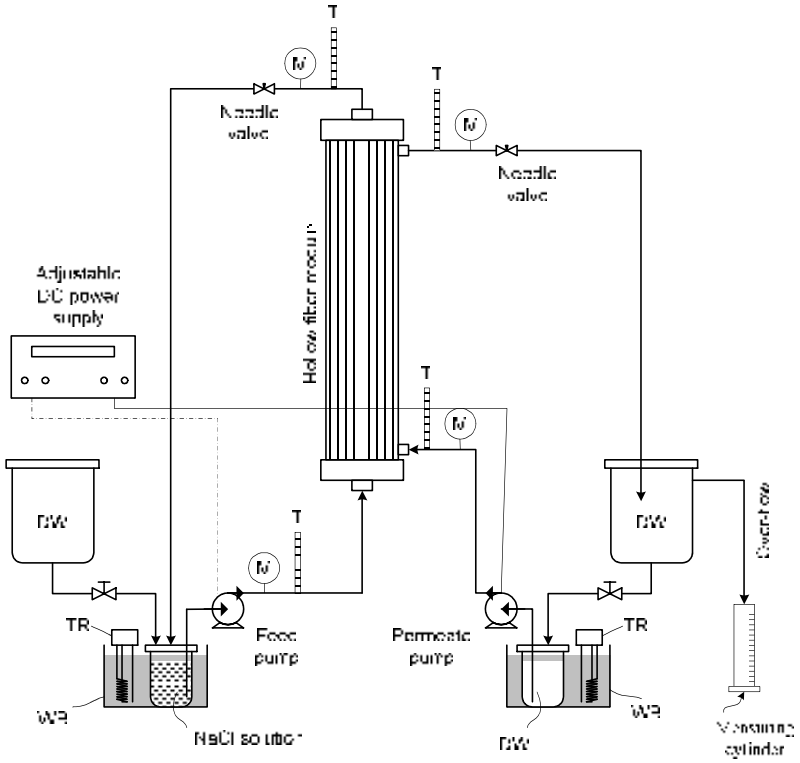


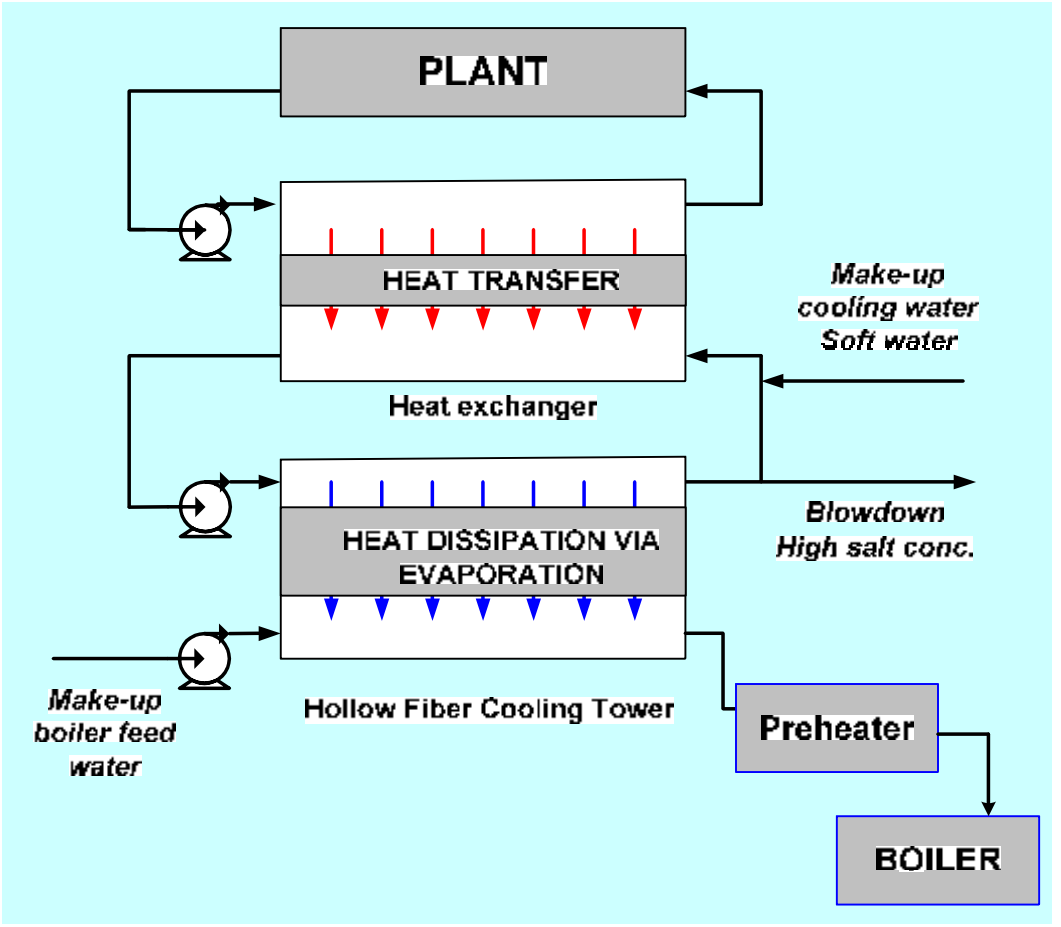
RO-CED PILOT PROJECT IMPLEMENTATION AT PTB

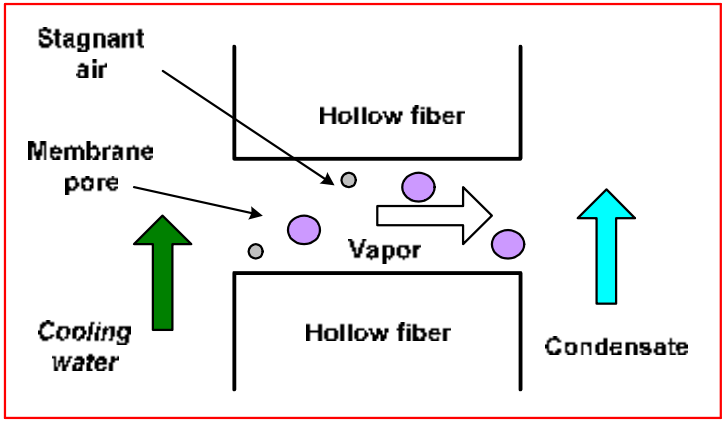


Hollow Fiber Cooling Tower

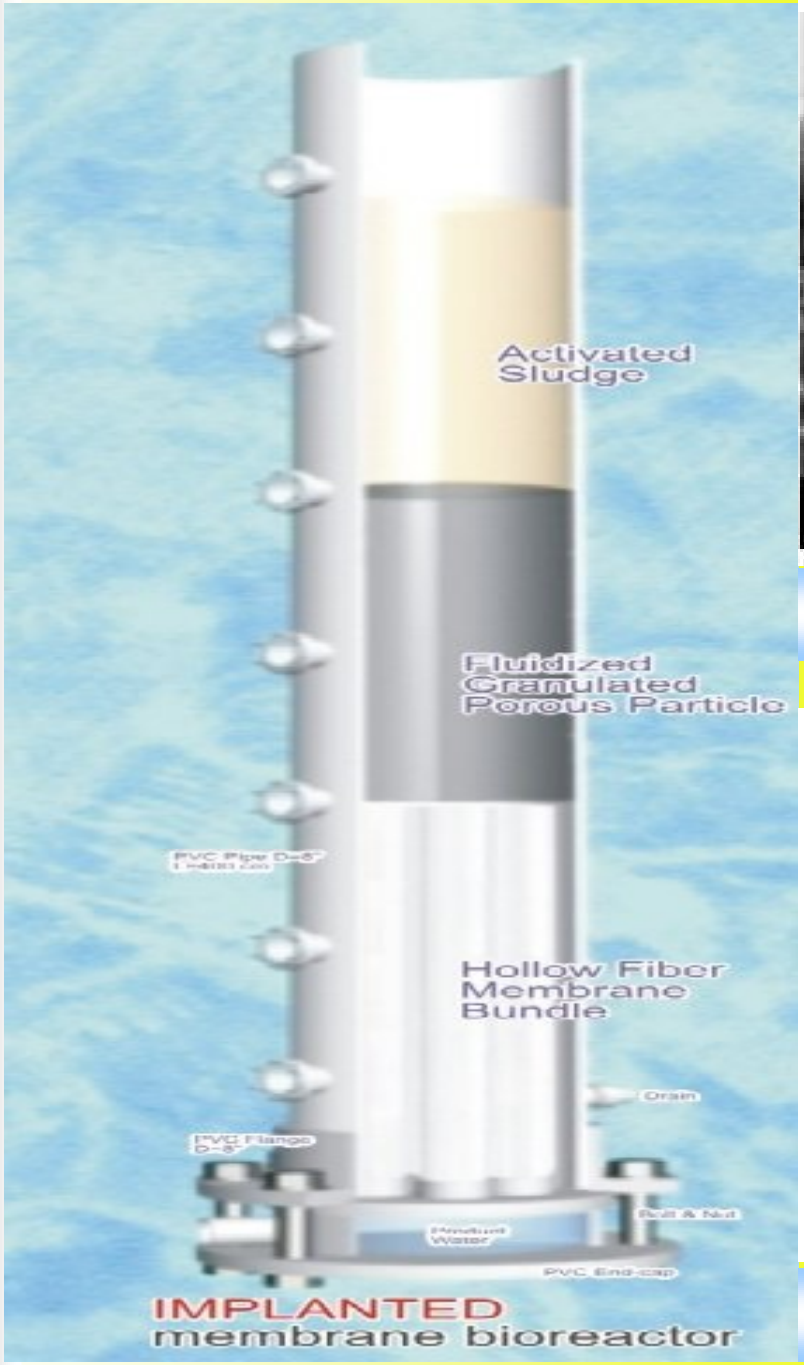


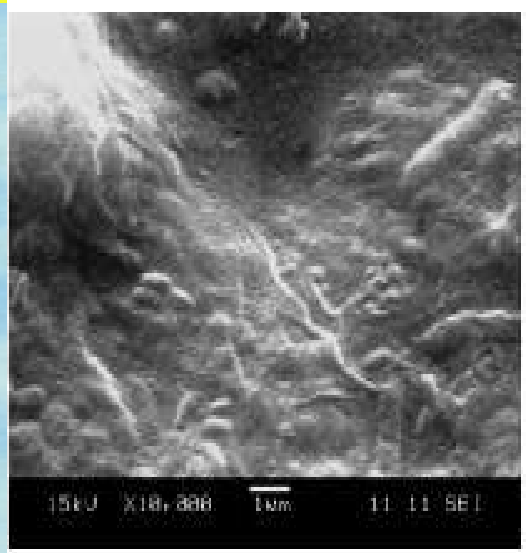




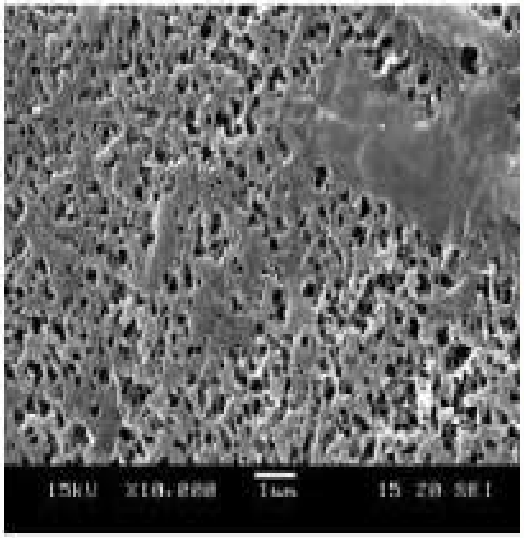


Ends-Free Implanted Membrane Bioreactor

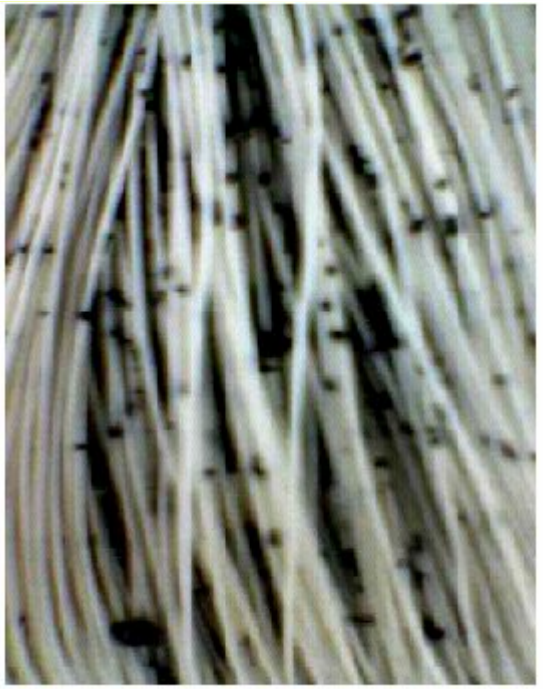




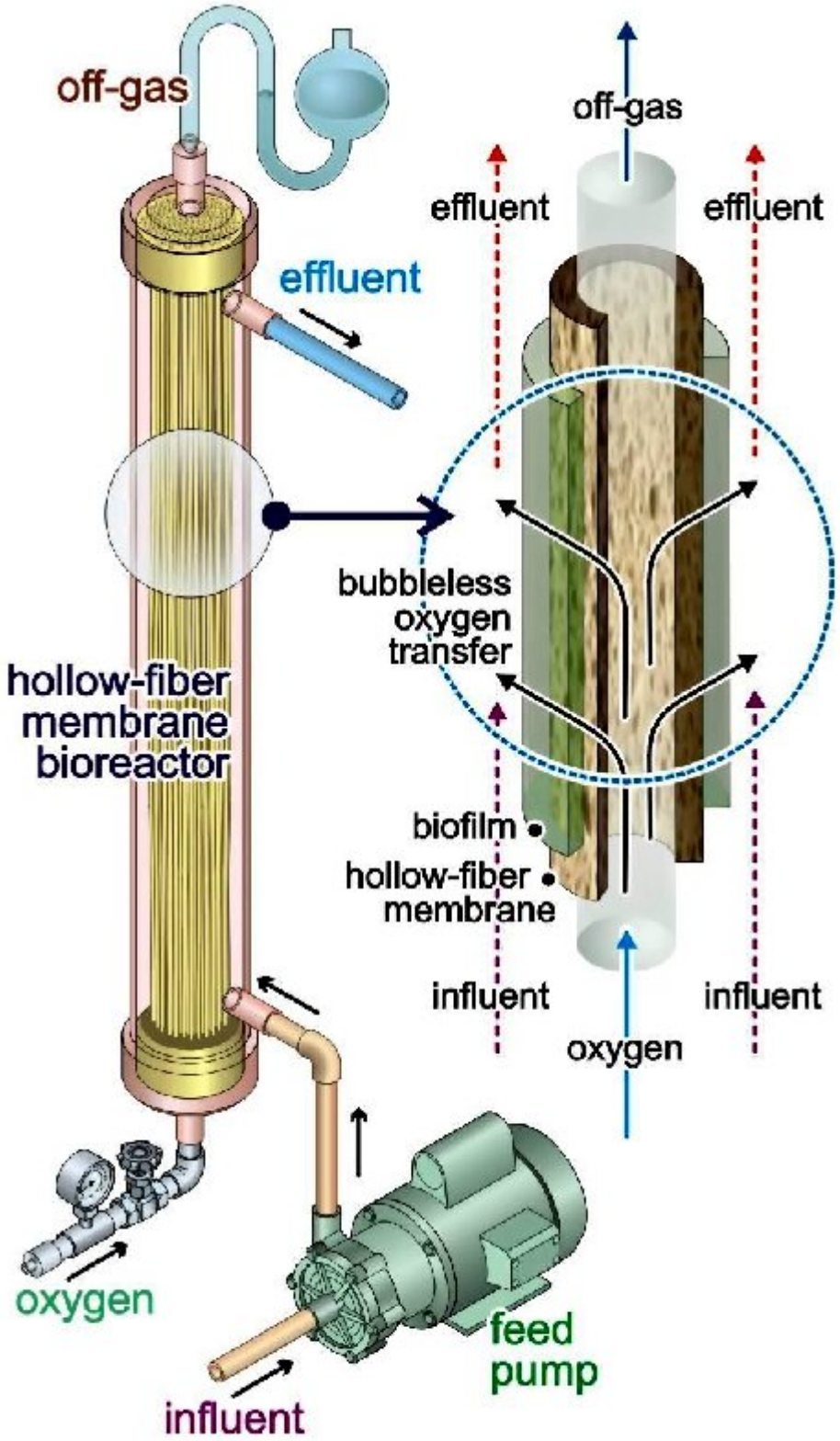
Submerged MBR

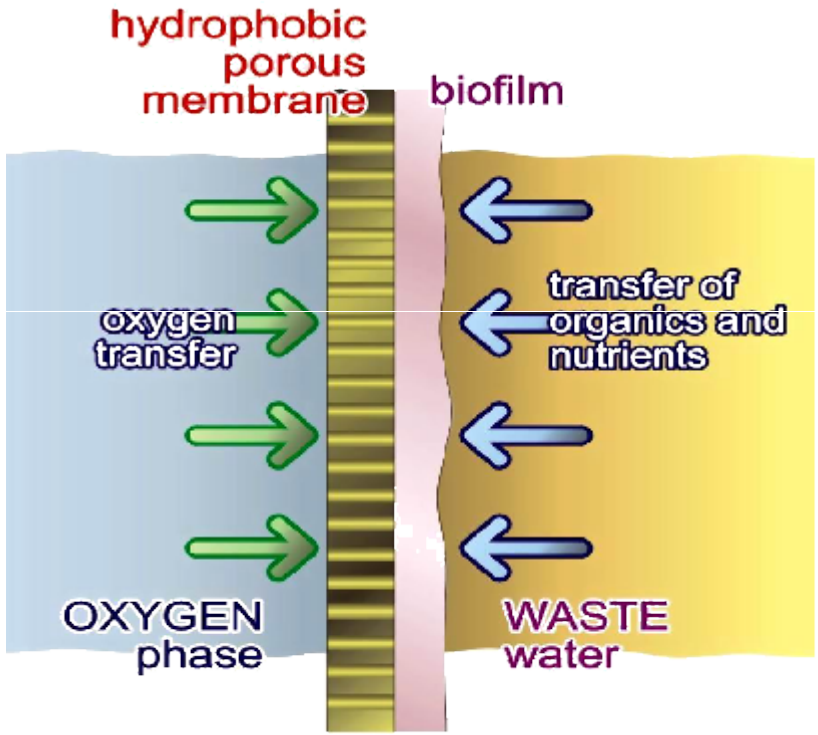


Implanted MBR

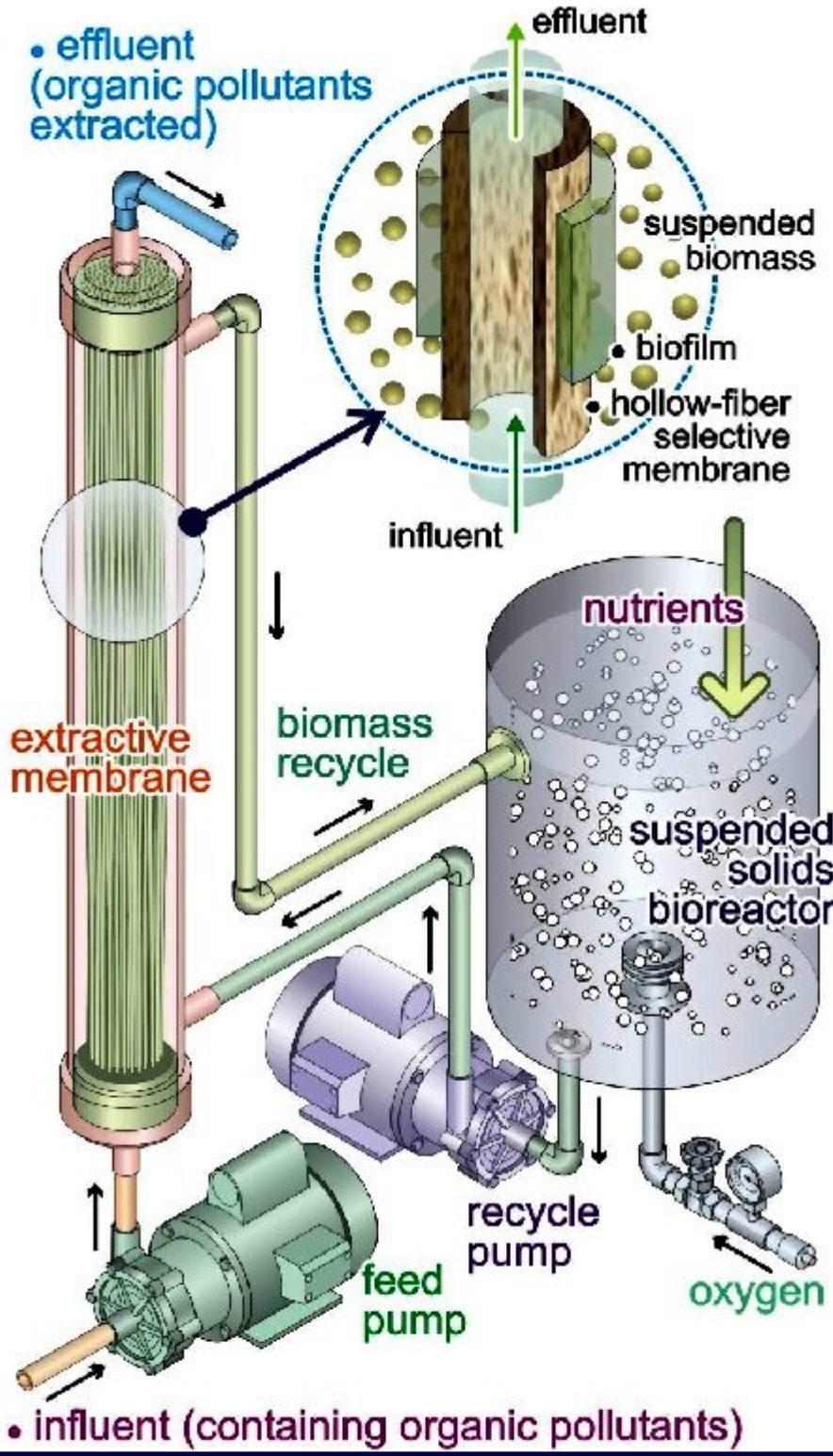


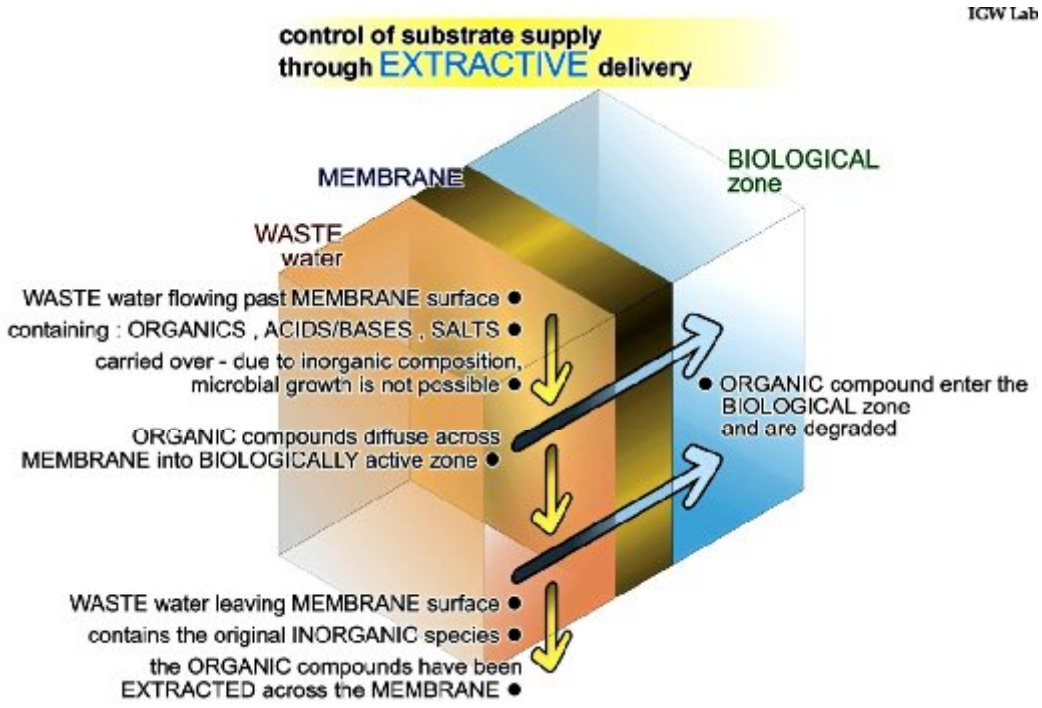
Aeration-MBR





Extractive-MBR



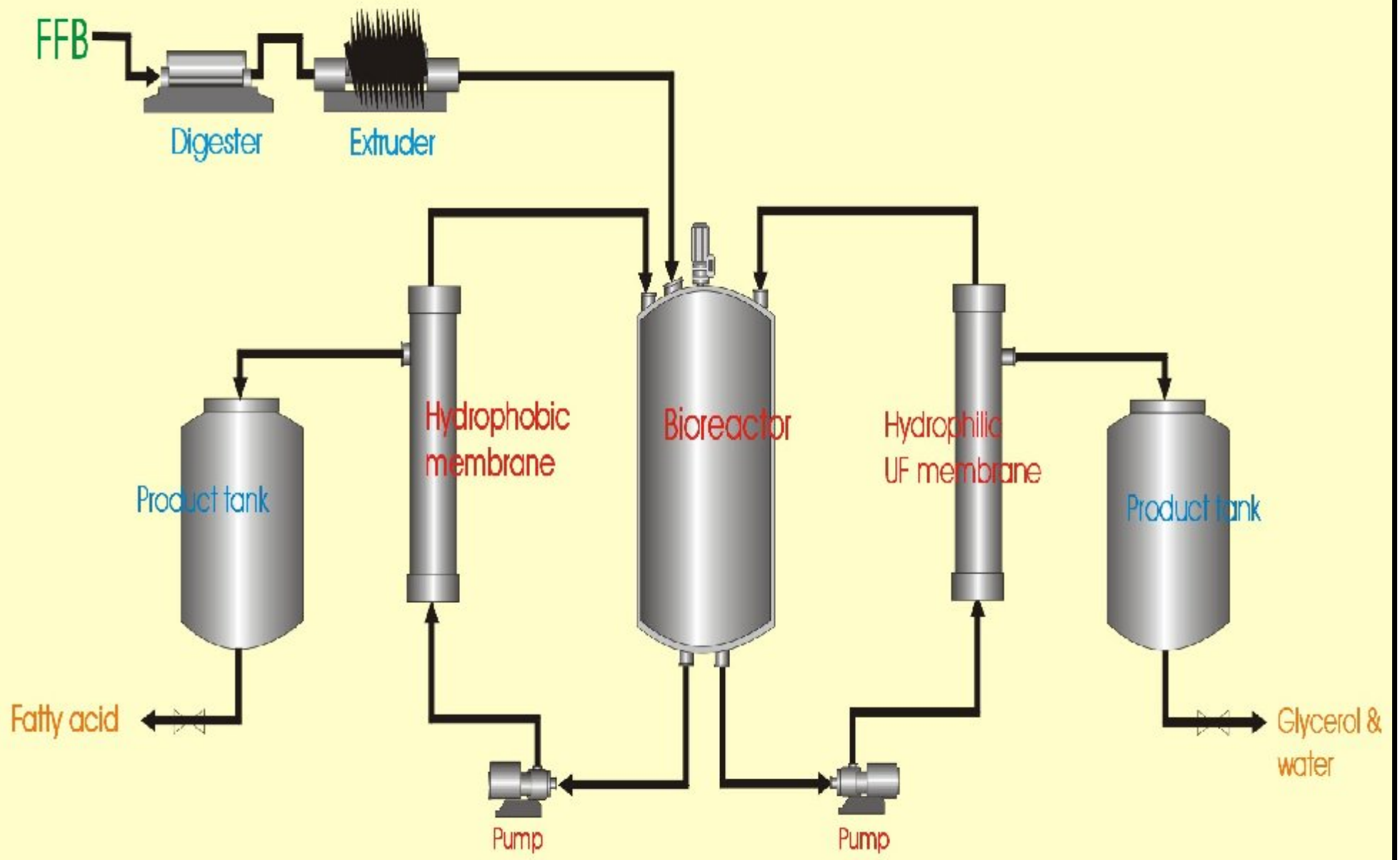


WORLD LARGEST CERAMIC MEMBRANE BIOREACTOR
ZERO SLUDGE PALM OIL MILLING PLANT

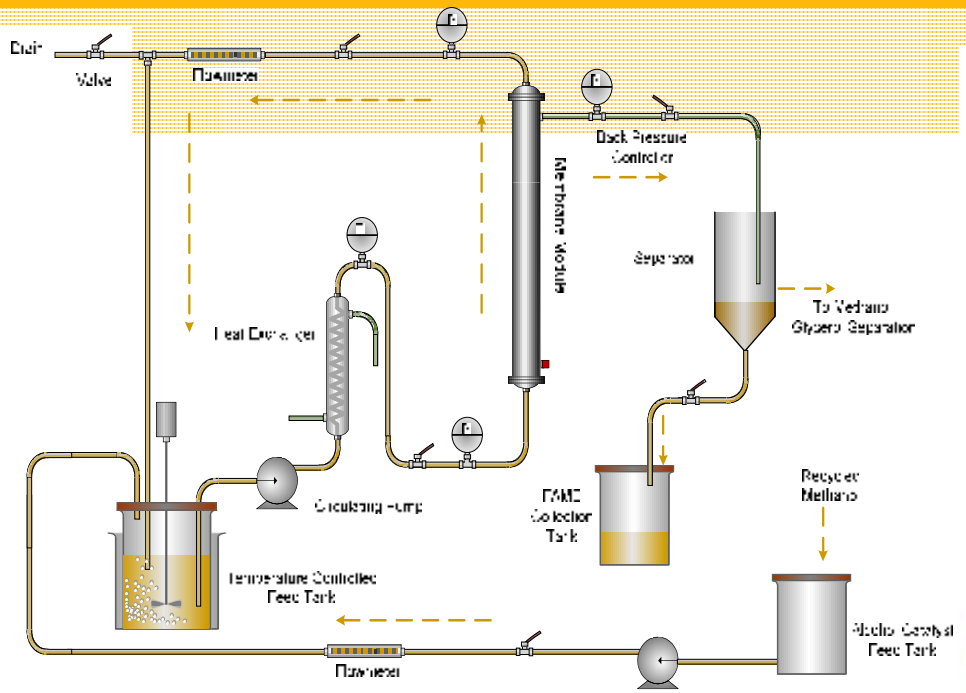
IGW

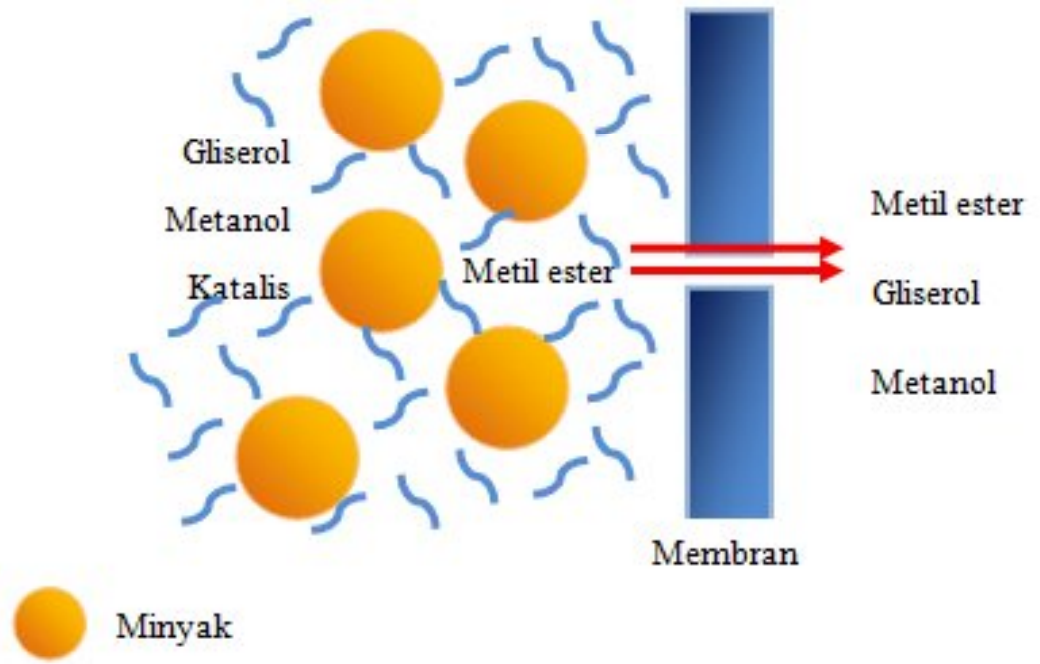
PALM OIL INDUSTRY

In-situ enzymatic conversion for CPO hydrolysis of fresh palm fruit

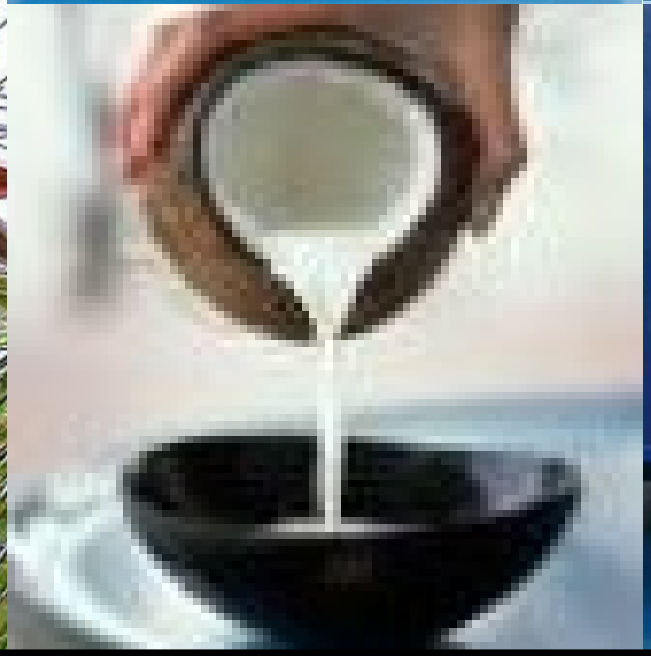


MEMBRANE REACTOR FOR METIL ESTER PRODUCTION AND MINOR COMPONENTS RECOVERY FROM CRUDE PALM OIL





Virgin Coconut Oil Clarification



IGW

SIMULTANEOUS CLARIFICATION AND DEGUMMING OF JATHROPA OIL

PALM OIL INDUSTRY

CONVENTIONAL CLARIFICATION

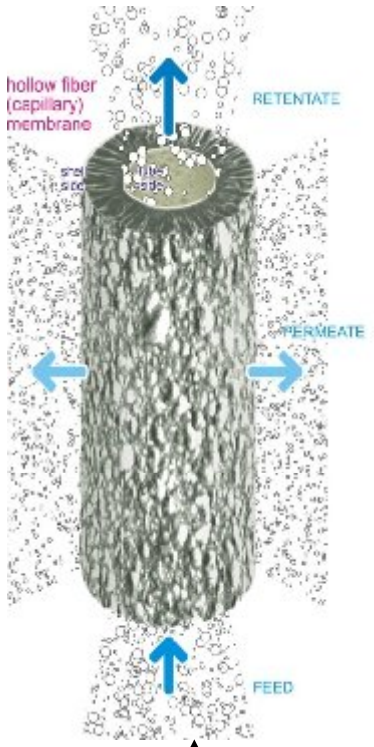
- Vibrating screen
- Clarifier
- Purifier

ACID DEGUMMING

Particles, dirt, gum

H_3PO_4

CPO



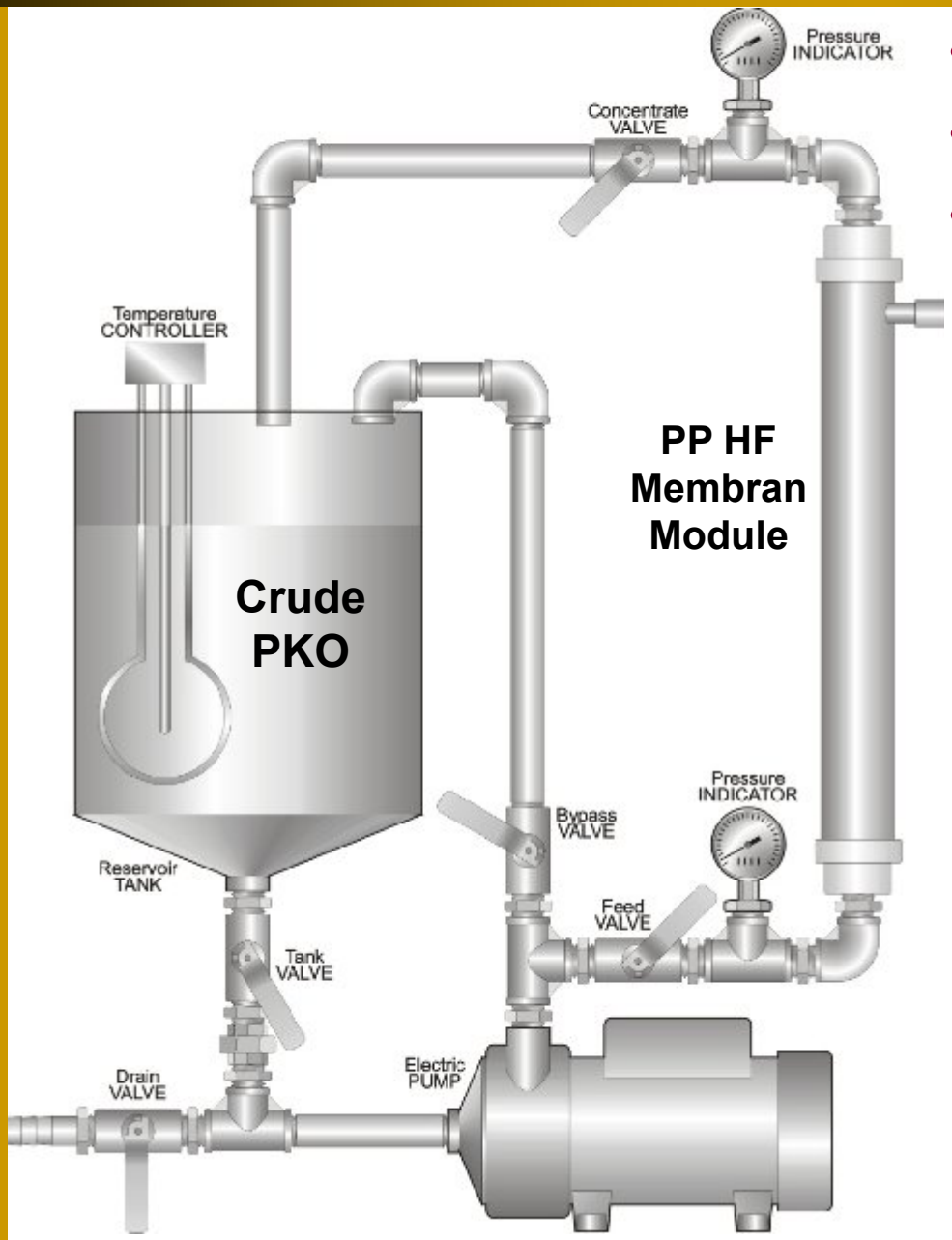
Clarified, de-gummed oil

ONE STEP CLARIFICATION AND DEGUMMING PROCESS

IGW

PALM OIL INDUSTRY

Natural Palm Kernel Frying Oil

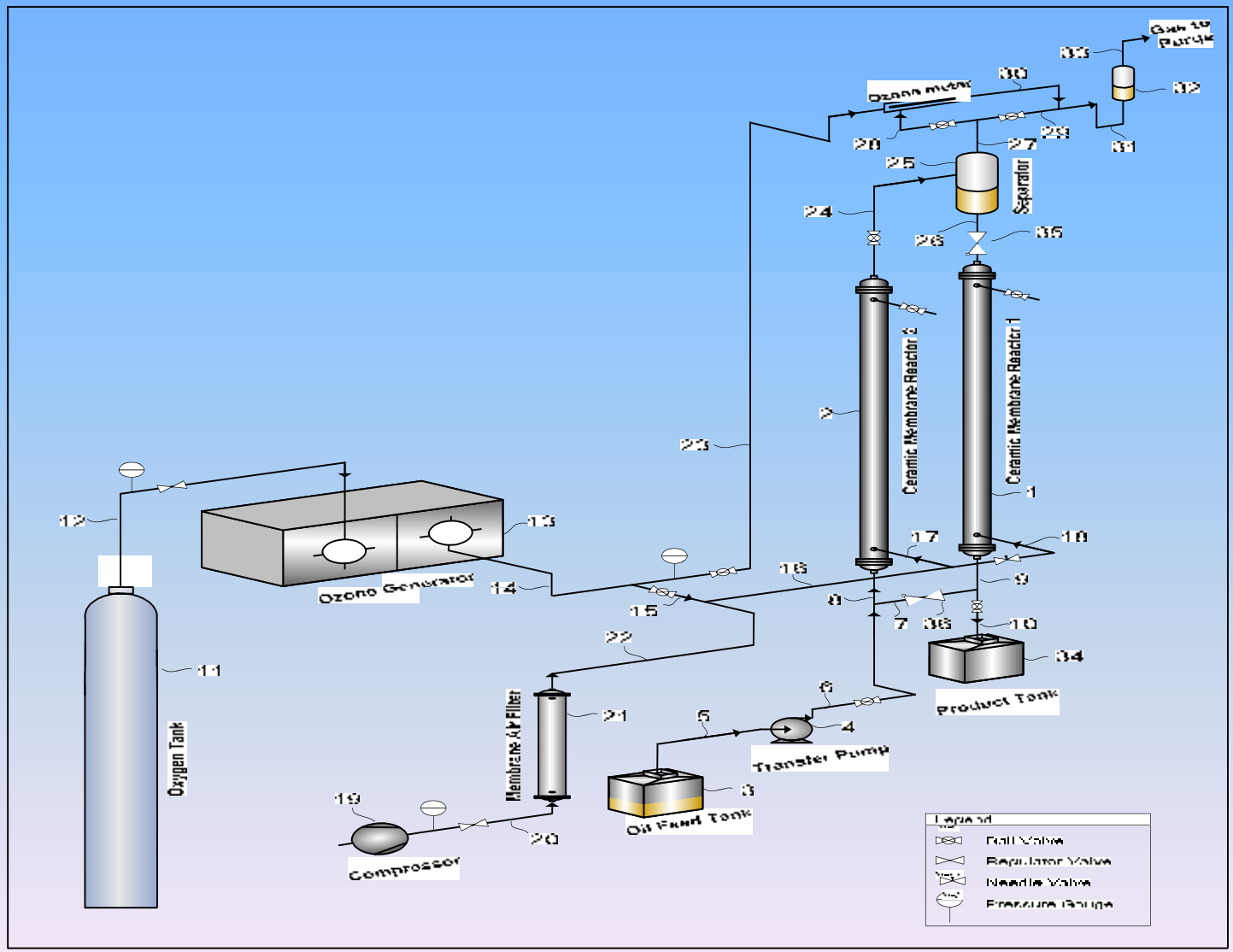


- 1 Step clarification process
- No chemical consumption
- Environmentally friendly process

Clarified PKO

Feed (Crude PKO) **Retentate** **Permeate (Clarified PKO)**

OZONATED PALM KERNEL OIL



Waste Lube Oil Refining with Ceramic Membrane

FEED

PRODUCT

Gelatin Clarification

Feed Product

IGW

Temulawak Extraction

- **High strength**
- **Crystal Clear**
- **Powder or Capsule**

BEVERAGE

Ultrafiltration of Coconut Juice

IGW

CANE SUGAR JUICE CLARIFICATION

SUGAR INDUSTRY

IGW

Cane Sugar Juice Beverage

SUGAR INDUSTRY

PALM (LONTAR) JUICE PROCESSING

Fig. 8

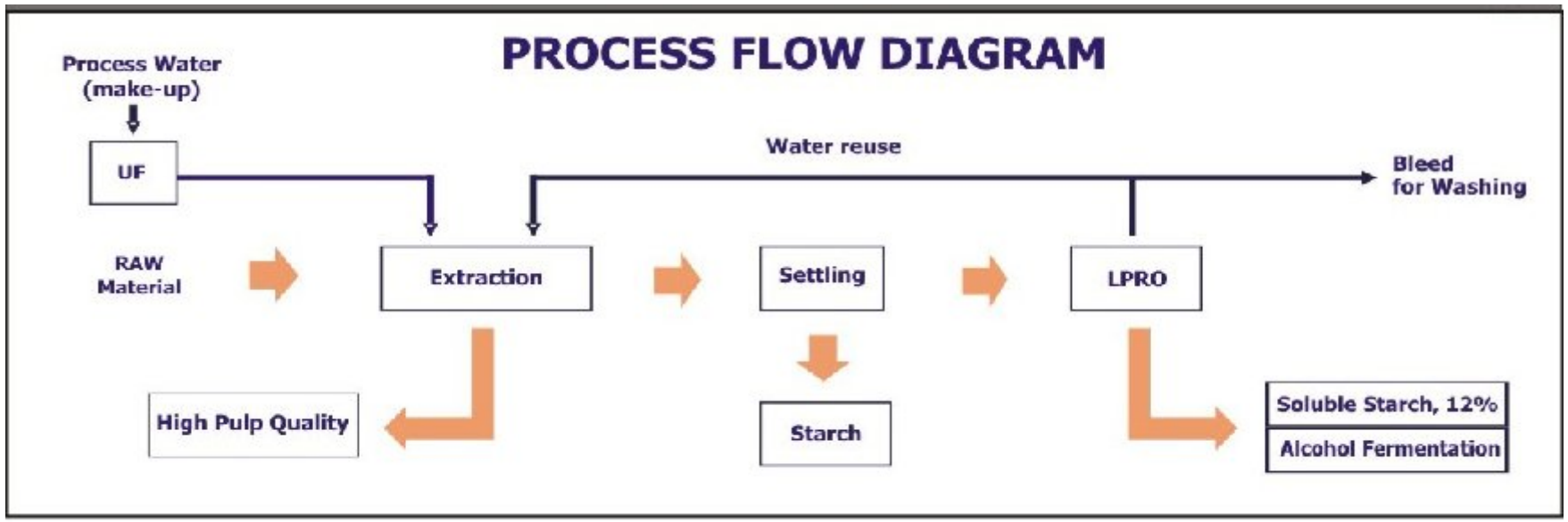
Fig. 10

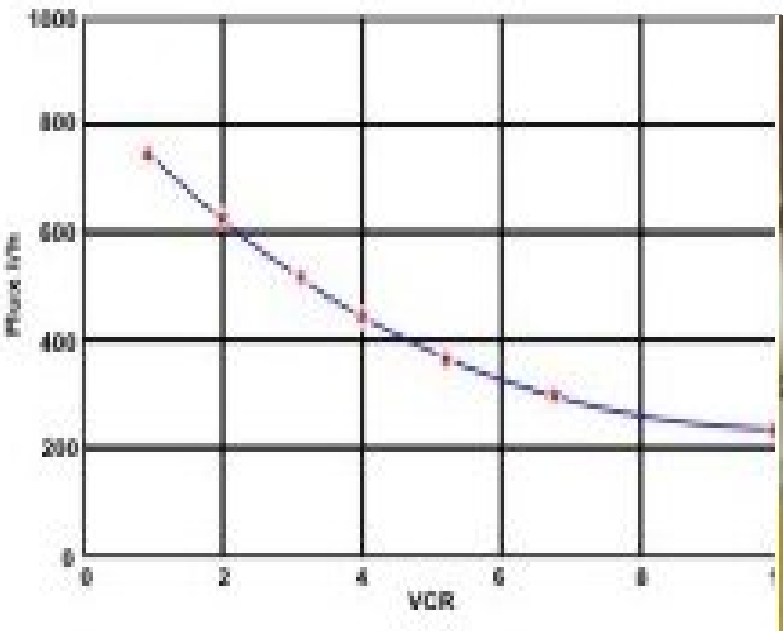
Ultrafiltration (UF)

Reverse Osmosis (RO)

- Concentrated Juice
- High quality drinking water

CLEAN PRODUCTION IN STARCH INDUSTRY





Component	Cassava Composition (%)	Waste water (%)
Water	70.25	98
Insoluble starch	21.45	0.1
Soluble starch and sugars	5.13	1.1
Protein	1.12	-
Fats	0.41	-
Fibers	1.11	-
Ash	0.45	0 - 1

APPLICATION OF UF IN SHRIMP AQUACULTURE:
From Lab to Full Scale Capacity

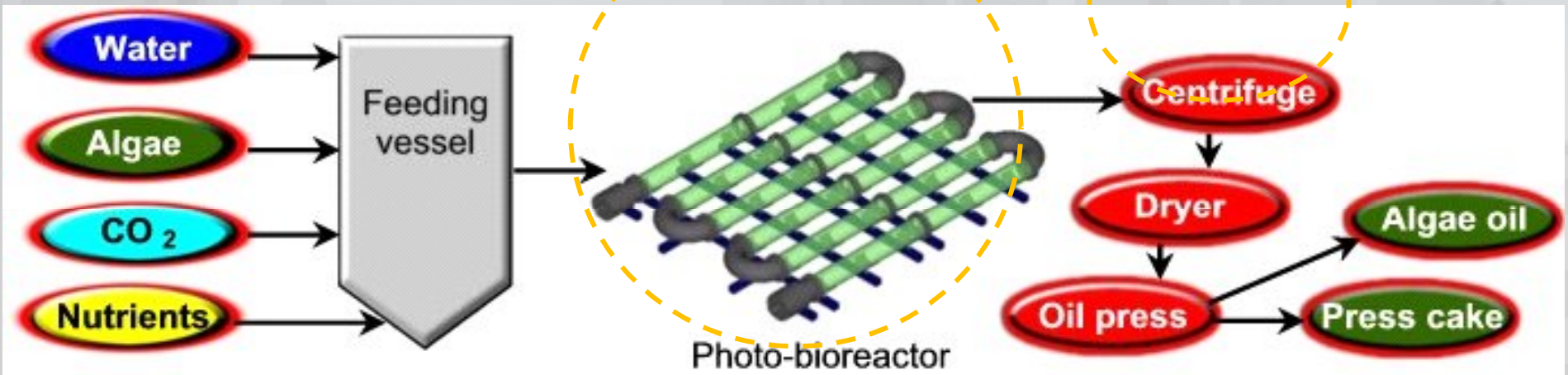
Harvesting	Average Flux ($l.m^{-2}.h^{-1}$)	Bacteria Removal (%)	Survival rate (%)
I	90	99	93
II	90	98	90
III	90	98	94
IV	90	98	91

UF 20,000 Da

- Hatchery
- Grow-out

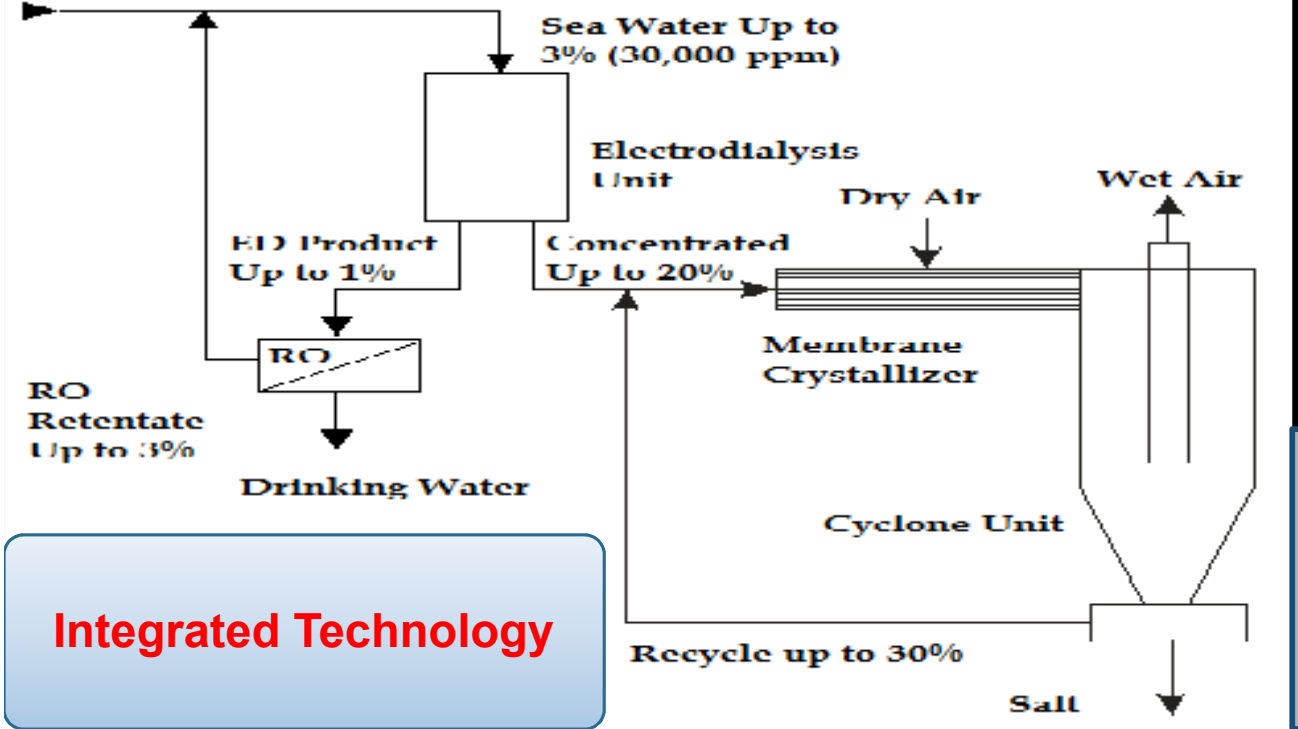
BIODIESEL FROM MICROALGAE

Potential Use of Membrane

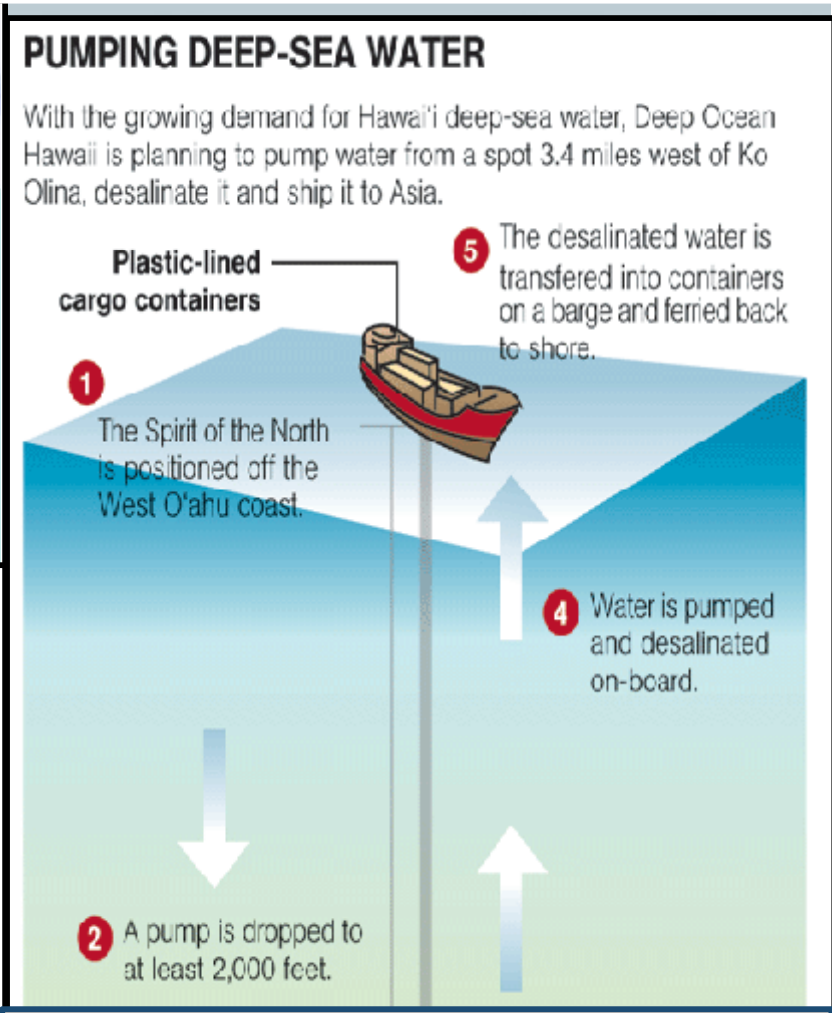


Membrane Bioreactor = Bioreactor + Separation System

DEEP SEAWATER POTENTIALS

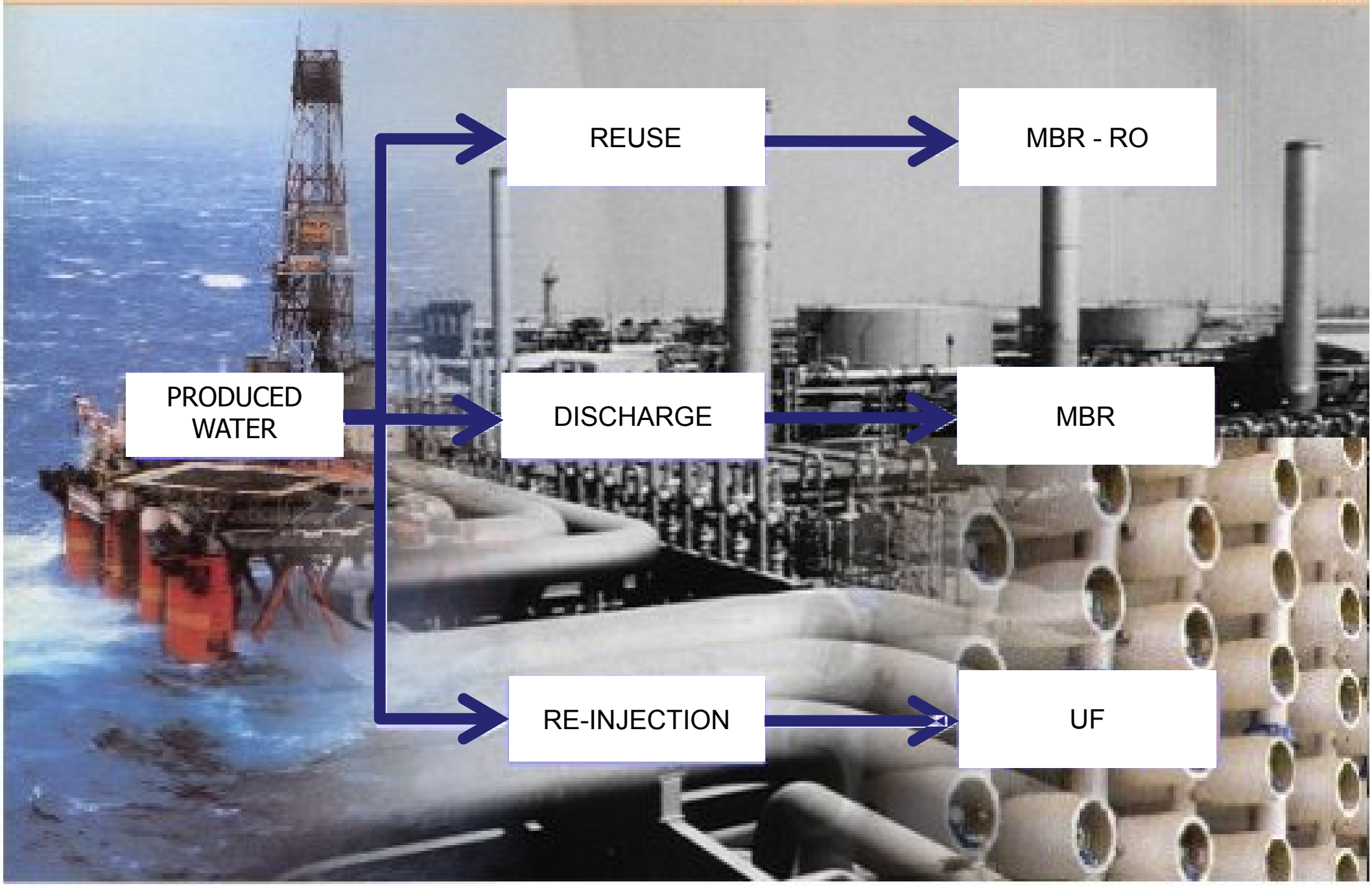


Integrated Technology

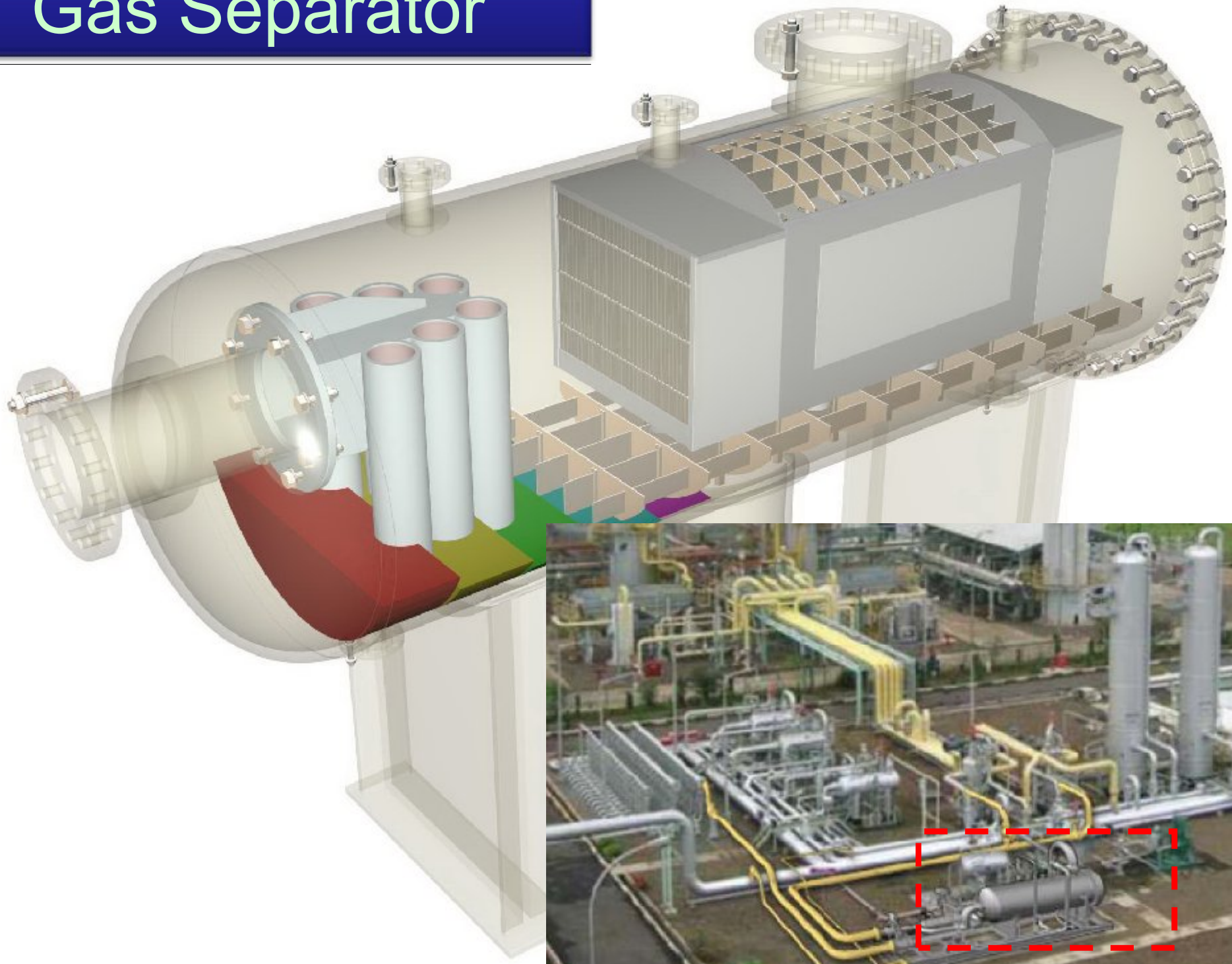


FRESH WATER AND SALT FROM SEA WATER

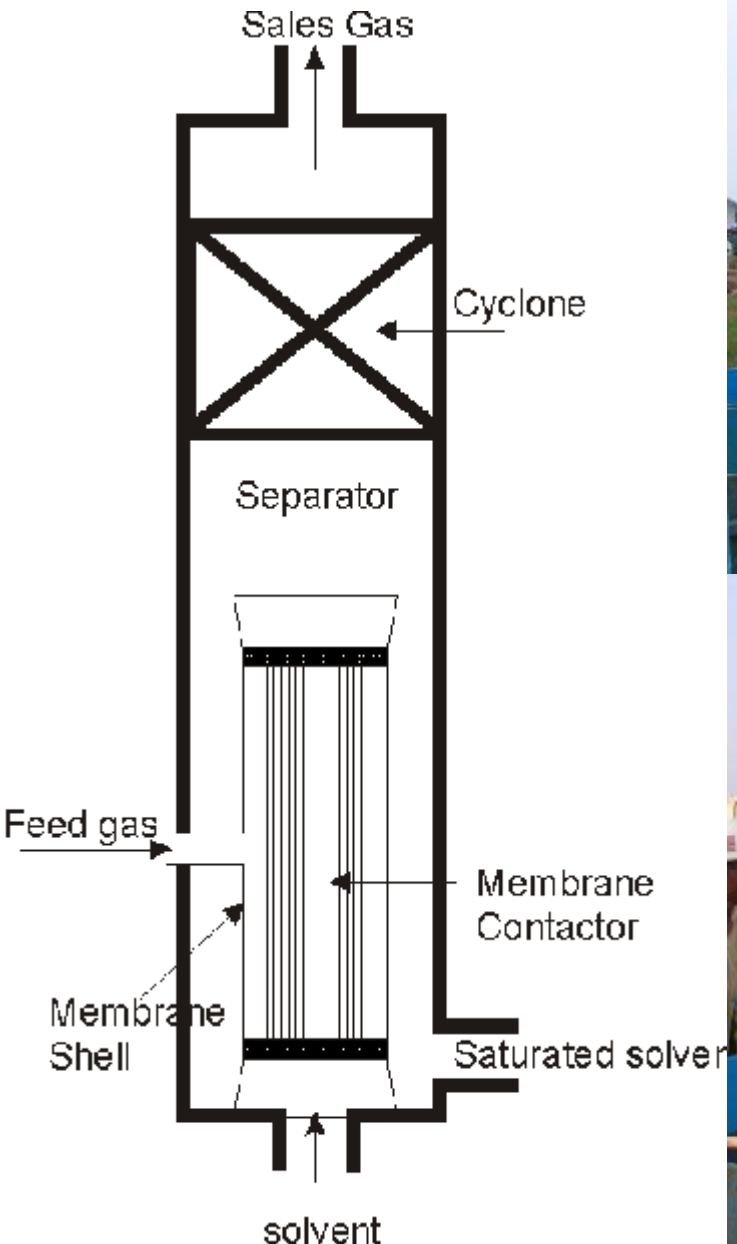
PRODUCED WATER MANAGEMENT IN OIL & GAS INDUSTRIES



Gas Separator



Membrane Cyclone, CO2 Removal Patent App. P00200900263



OXYGEN ENRICHMENT

Air separation

N2

- 95% non permeate stream (one stage)

O2

- 30-40%

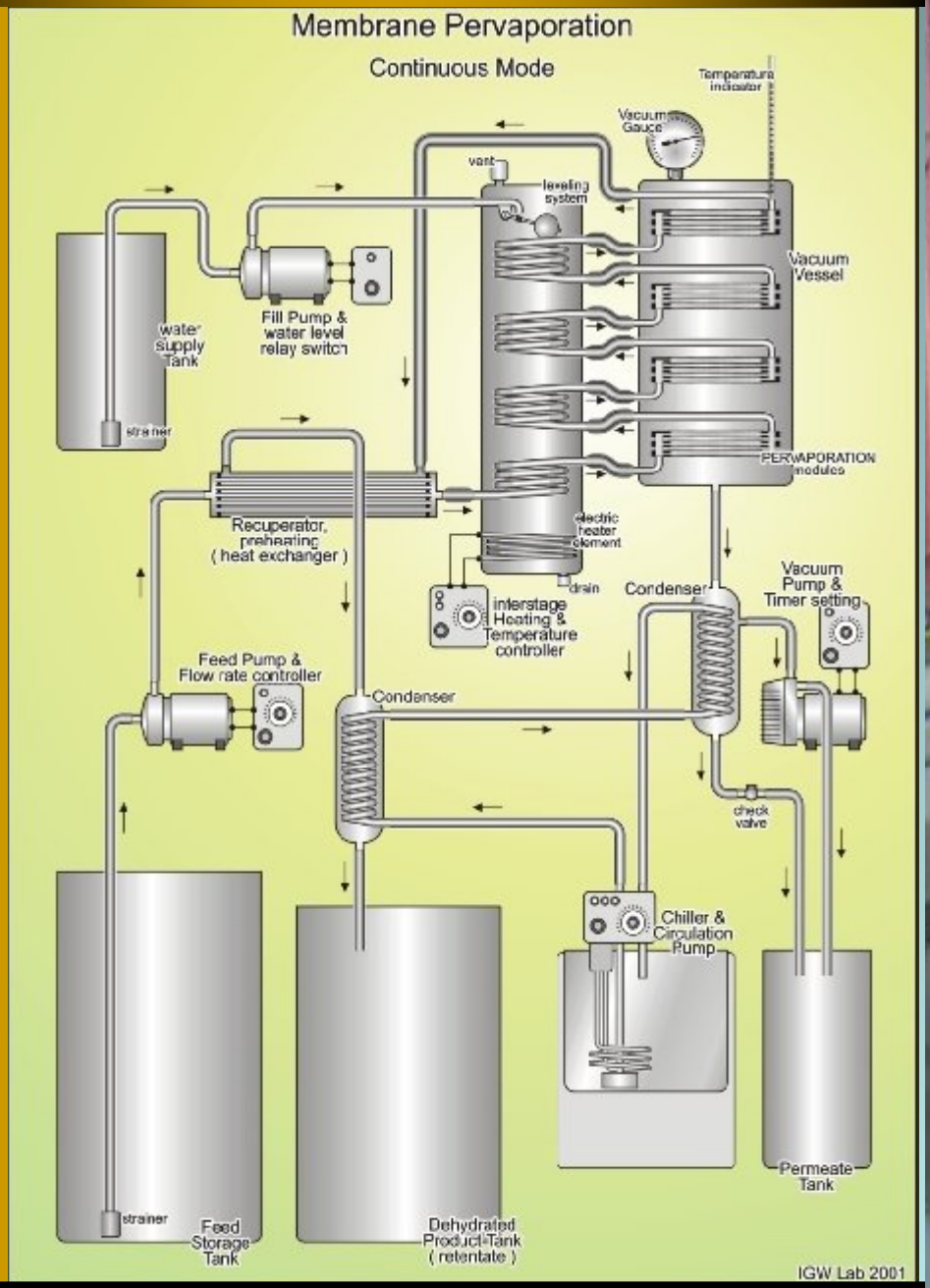
Table 11.6 Production of 10 tons/day of 35% O_2-enrichedair

	Membrane	PSA
Capital costs ($ × 10^3)	288·0	552·0
Running costs ($/day)	280·0	423·0
Running costs ($/ton)	28·0	42·3

IGW

PV Technology for Fuel Grade Alcohol

BIOTECHNOLOGY



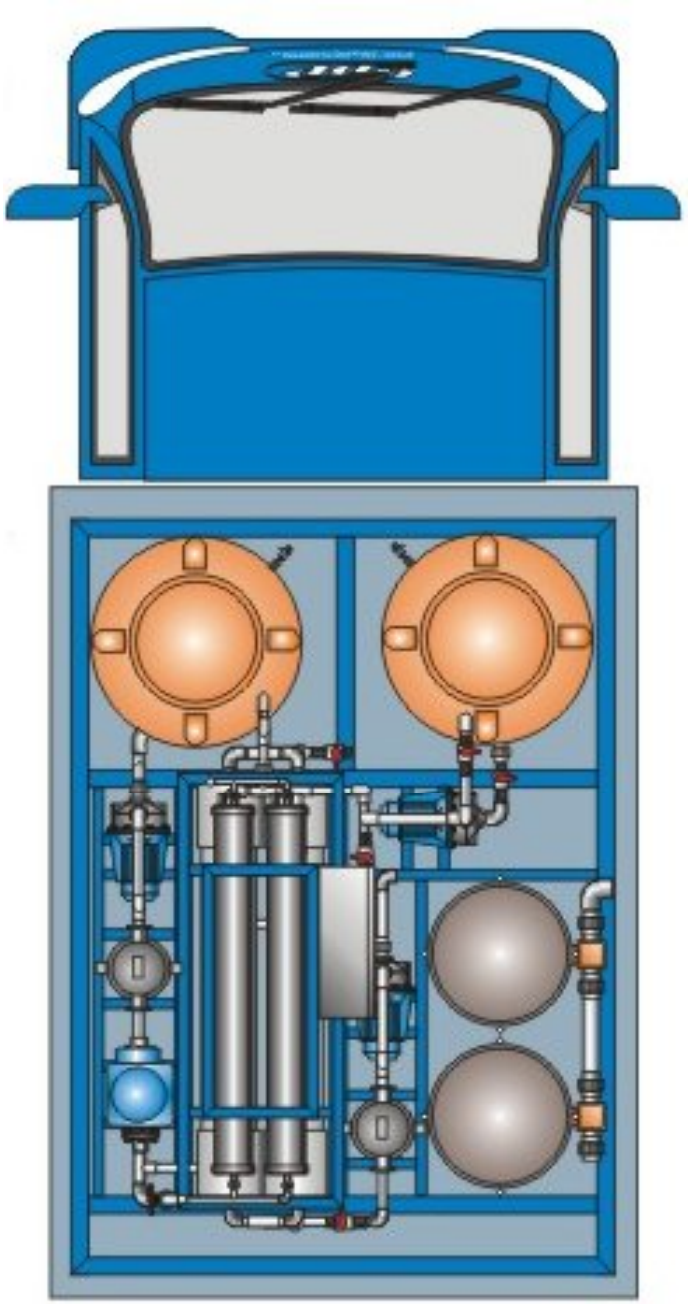
mobile ■ reverse osmosis water filtering technology

land rover defender & spiralwound membrane

land rover defender 110
pick up, modification
rear pto driver

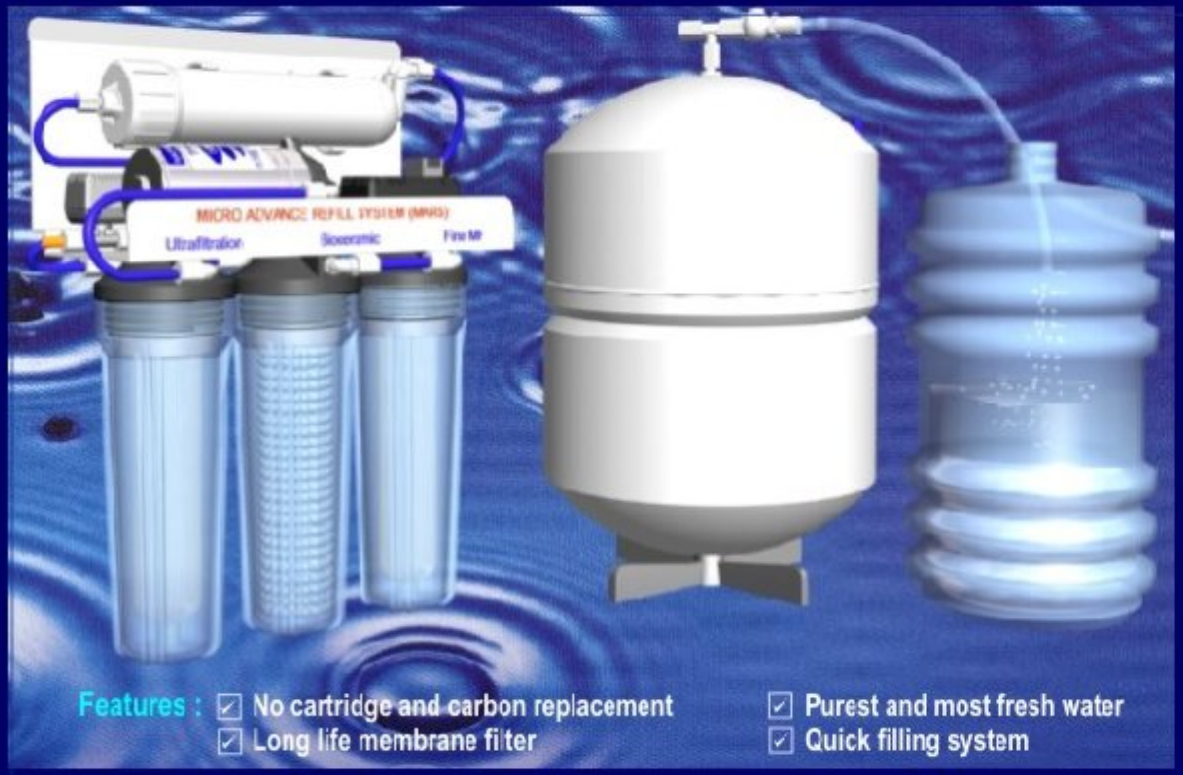
spiralwound membrane package
high flowrate pump
self cleaning screen filter
vibration units
high pressure pump
ro membrane module
fitting system
pressure regulator & gauge
rigid bracket & mounting

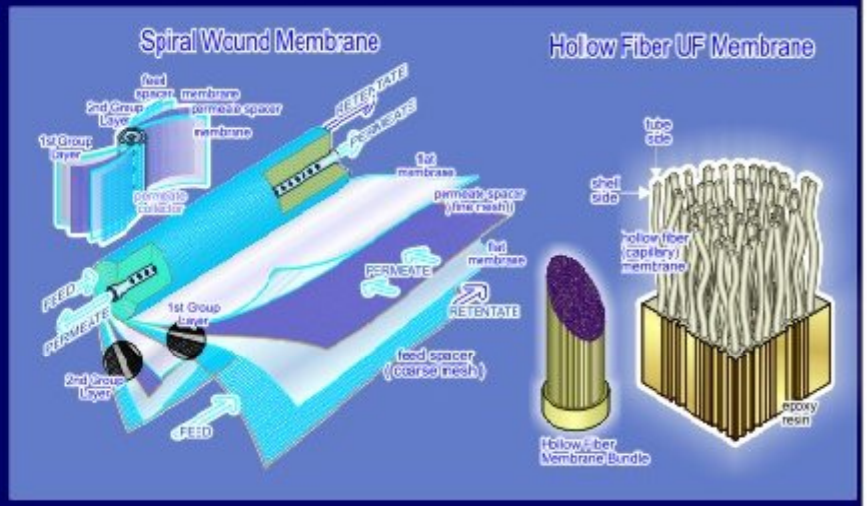
COMBINED UF-RO MOBILE UNIT



INTEGRATED MEMBRANE SYSTEM (IMS)

High Quality Drinking Water Machine





The increasing amount and variety of contaminants such as heavy metals, pathogens, bacteria, and viruses in sources of water, set a limitation for the treatment according to the conventional processes. This issue drives us to new challenges to produce a constant safe and pure water. Integrated Membrane System is our latest innovation to solve the above problem. Still maintaining the compact, easy to operate feature, and high product quality, we introduce our new product, a combined ultrafiltration (UF)-reverse osmosis (RO)-bioceramic-microfiltration (MF) drinking water machine.

This high quality drinking water machine integrates 4 (four) separate operations into one system; (1) Handwashable UF vastly reduces dirt, sand, sediment, colloid, bacteria, and viruses, (2) The Reverse Osmosis Membrane removes organics,viruses, disolved solids, as well as heavy metals, (3) Post Bioceramic for water mineralization and odor removal, (4) Final polishing with hollow fine fiber microfiltration (MF), an efficient and exceptionally long life filter element. This integrated technology represent the latest and most advance develcpment in water purification.

No Cartridge and Carbon Replacement

The use of tight-UF membrane to replace cartridge and carbon filter in conventional RO pretreatment, enable surface filtration with handwashable membrane. It is an anti clog filter.

Post Bioceramic

Bioceramic releases trace soluble essential minerals such as Ca, Mg, K, P, etc; removes odor in the water; transform the water into its natural state like spring water; and break the water into smaller ISO-ENERGETIC biowater molecules.

Hollow Fine Fiber MF

Hollow Fine Fiber MF provides final polishing to remove any particulate materials from processed water prior to storage tanks. It is a long life filter element because of the complete protection of RO.

Quick Filling System

This machine is equipped with pressurized storage tank for quick filling of approximately 20 liters.

Aceh Tsunami Relief






Decentralized Water Reclamation System
'The Indonesian Experience'

IGW Pump


Screen Filter
Pump

FURTHER INTENSIFICATION IN MEMBRANE ENGINEERING

I G. Wenten

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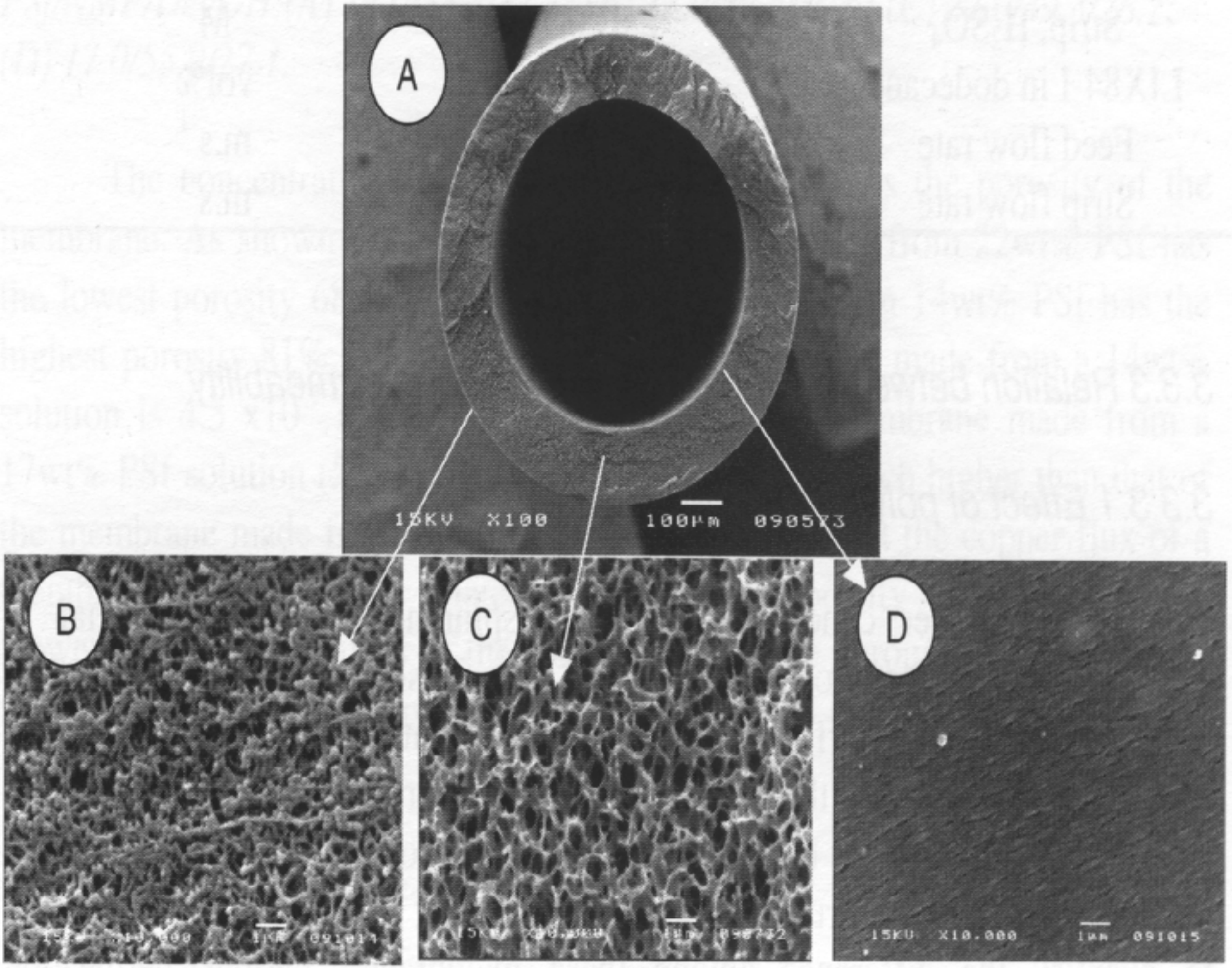
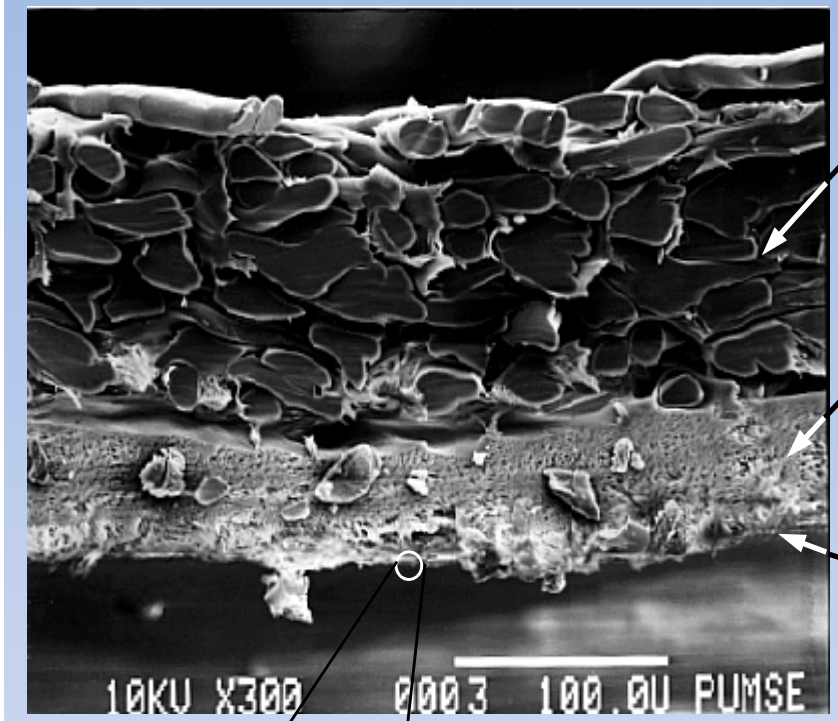
Institut Teknologi Bandung
Jl. Ganesha 10, Bandung 40132
Email: igw@che.itb.ac.id


A
15KV X100
100µm 090573
B
C
D
15KV X10.000 1µm 091015

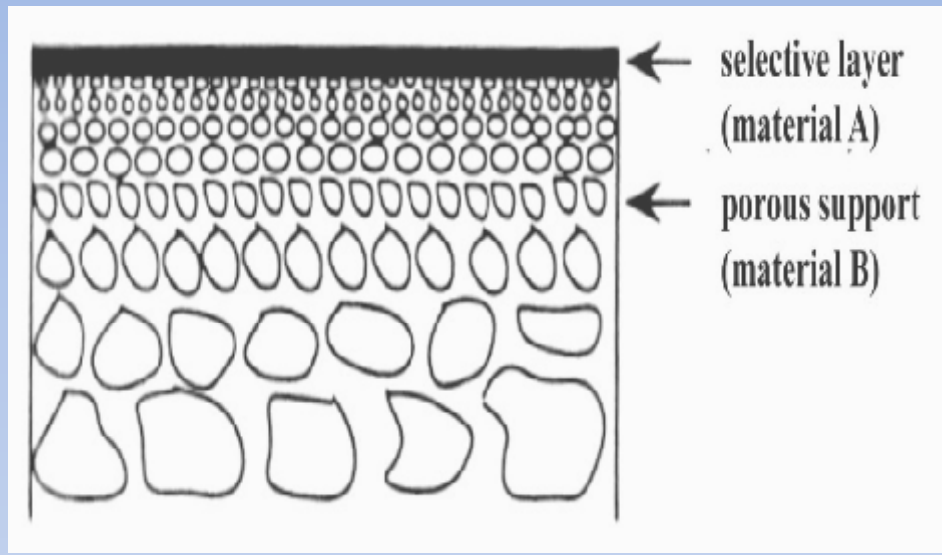
RO/NF Pore Structure



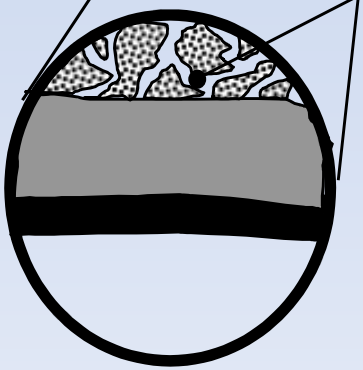
Fiber Backing
~120 um

Polysulfone
Support 50 um

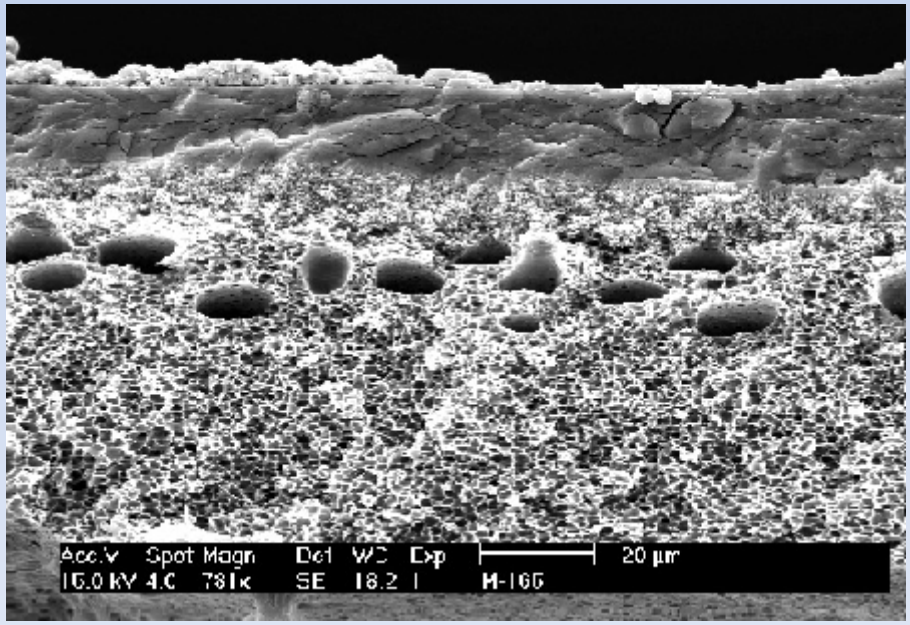
Active Layer



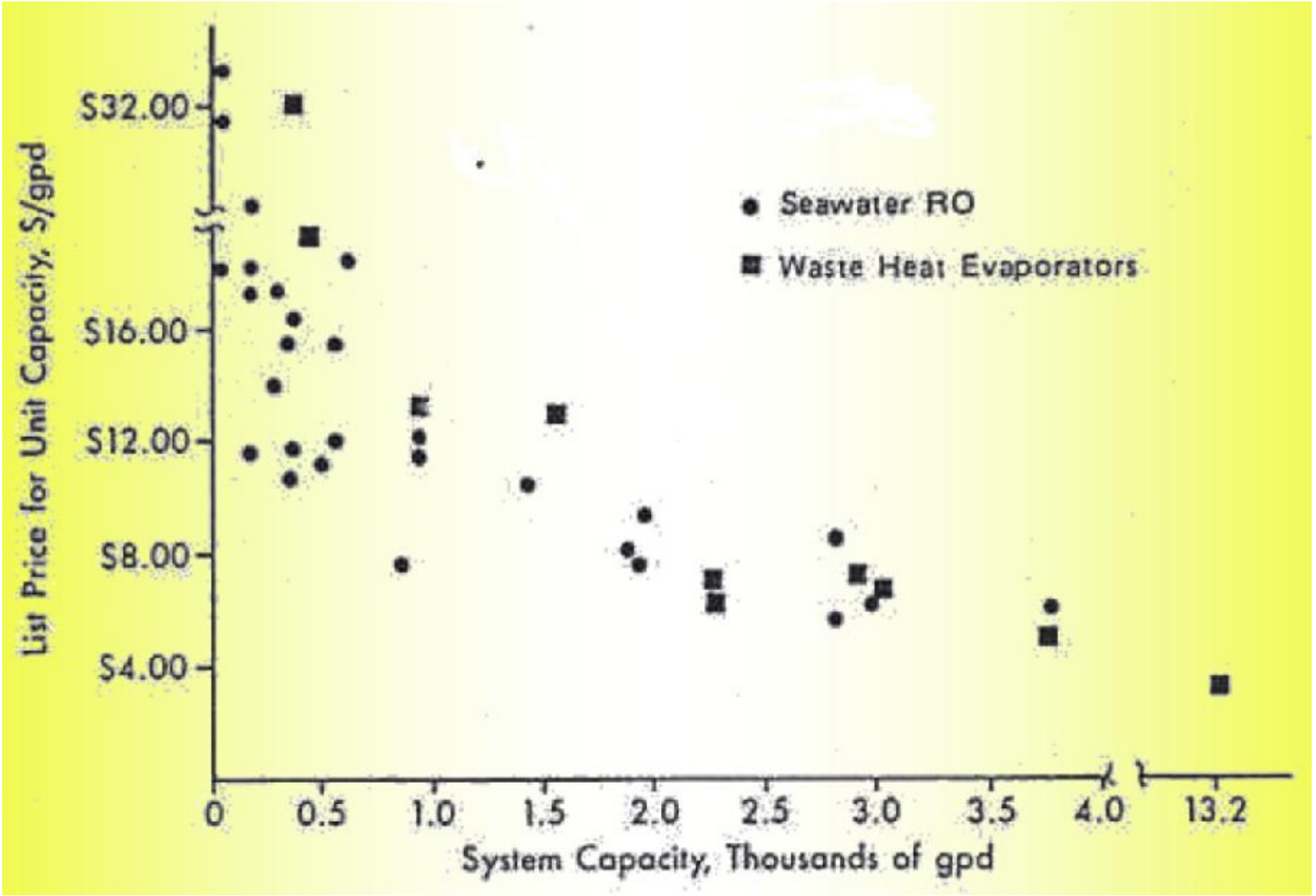
Polysulfone Layer
Pore Size 20 – 30 nm



Active Layer
~50 – 250 nm



The Economic of Modularity



NO MORE MODULARITY IN MEMBRANE

Patent Indonesia P00201000408