

The background of the slide is a light blue gradient with various chemical structures overlaid. These include a large blue sphere on the left, several skeletal structures of organic molecules, and specific functional groups like -OH, -COOH, -CHO, and -COCl. The structures are rendered in white and light blue lines.

'TORAY'

Innovation by Chemistry



Industrial Waste Water Treatment by MBR process using PVDF flat-sheet membranes Results from full scale systems

Peter Kueppers

Toray Membrane Europe, Switzerland

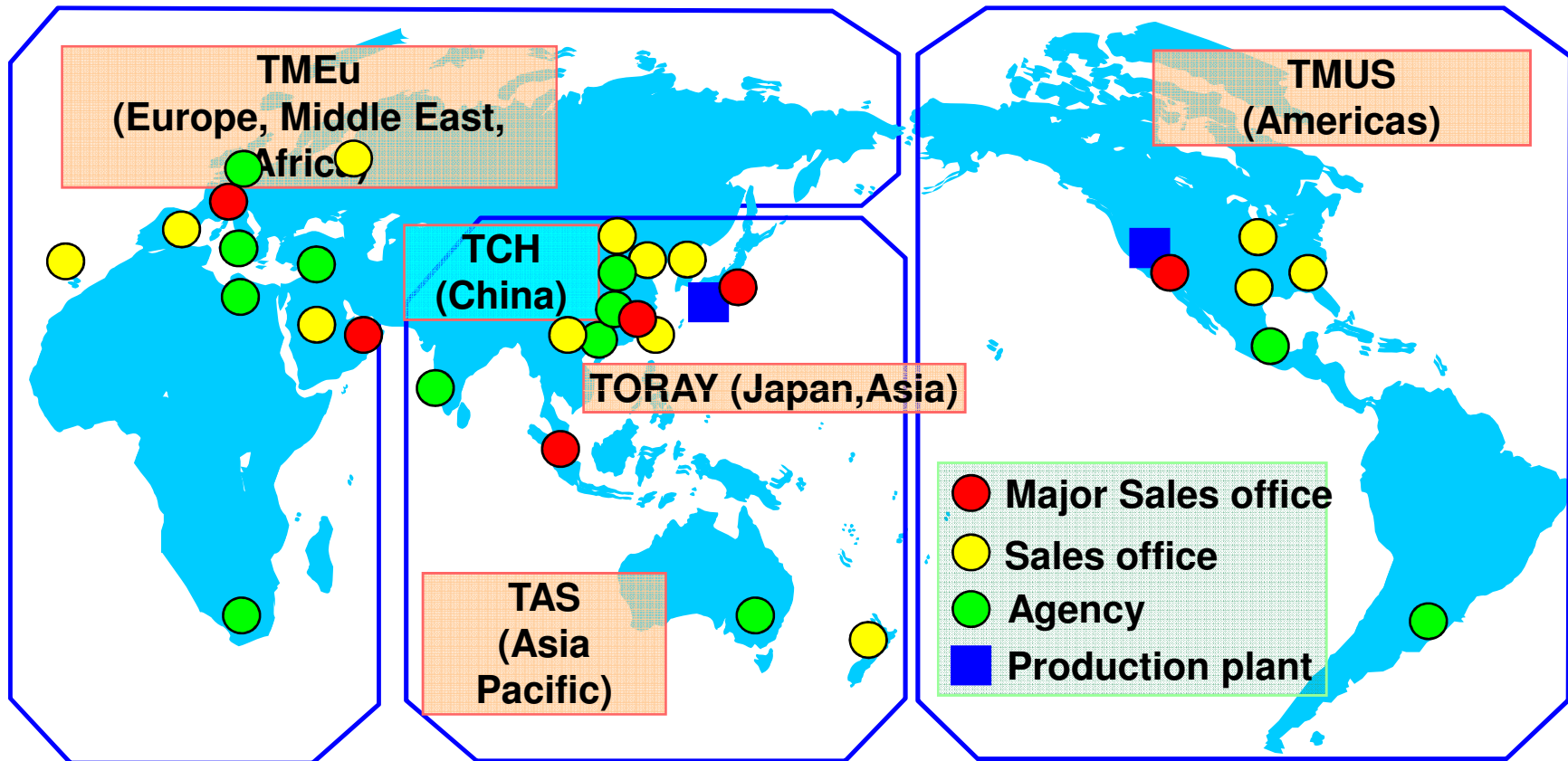
kueppers.peter@toraywater.com

WISA Conference Durban September 2011

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- 1. Introduction**
- 2. PVDF membrane for MBR**
- 3. MBR Modules**
- 4. Case Studies of Full Scale MBR Systems**

TORAY's Water Treatment Business



- Research, Development & Production of Membrane: Japan
- Production of Membrane Element: Japan/ USA / China
- Research: China & Singapore

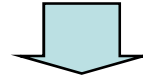
TORAY's membrane solutions across the entire water cycle

Purification of River,
Lake and Ground
Water



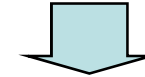
Hollow Fiber MF/UF

Desalination of
Seawater and
Brackish Water



RO Membrane

Reuse of Sewage and
Industrial WW



MBR Membrane

Job References for Toray MBR Membrane Modules



Scotland, UK
(Municipal, 1,975 m³/d)



Wales, UK
(Municipal, 950 m³/d)



Al Ain, UAE
(Sewage, 15,000 m³/d)



India
(Textile, 11,200 m³/d)

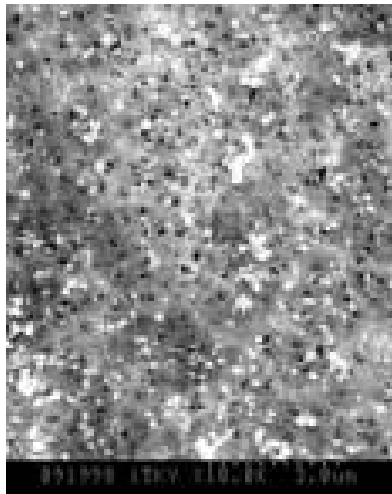


Netherlands
(Municipal, 2,400 m³/d)

Accumulated Plants Capacity:
477,000 m³/d (126MGD) (305
plants)
(as of April 2011)

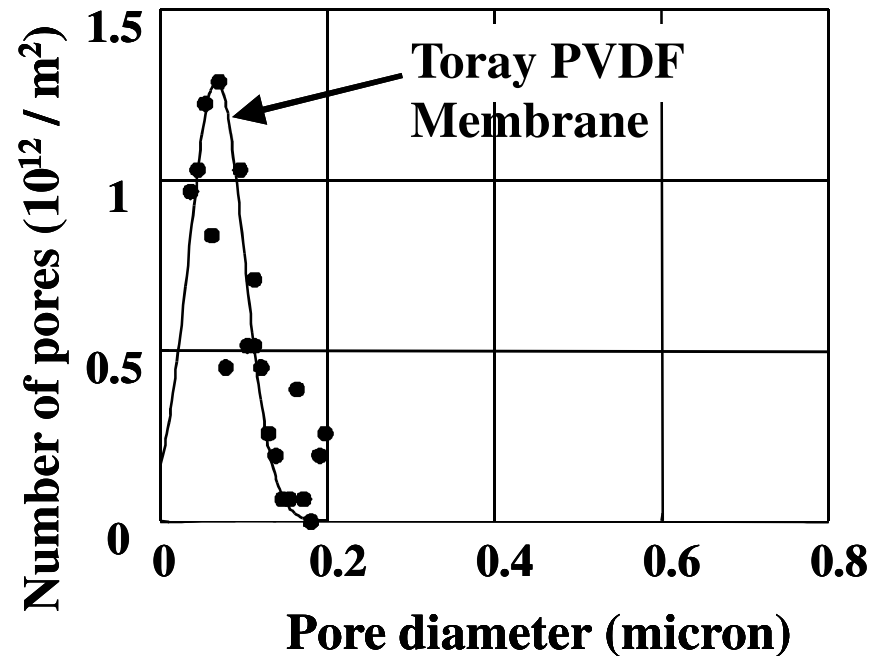
2. PVDF membrane for MBR

Membrane pore distribution



3.0 (micron)

SEM photographs of
Flat sheet membrane surface

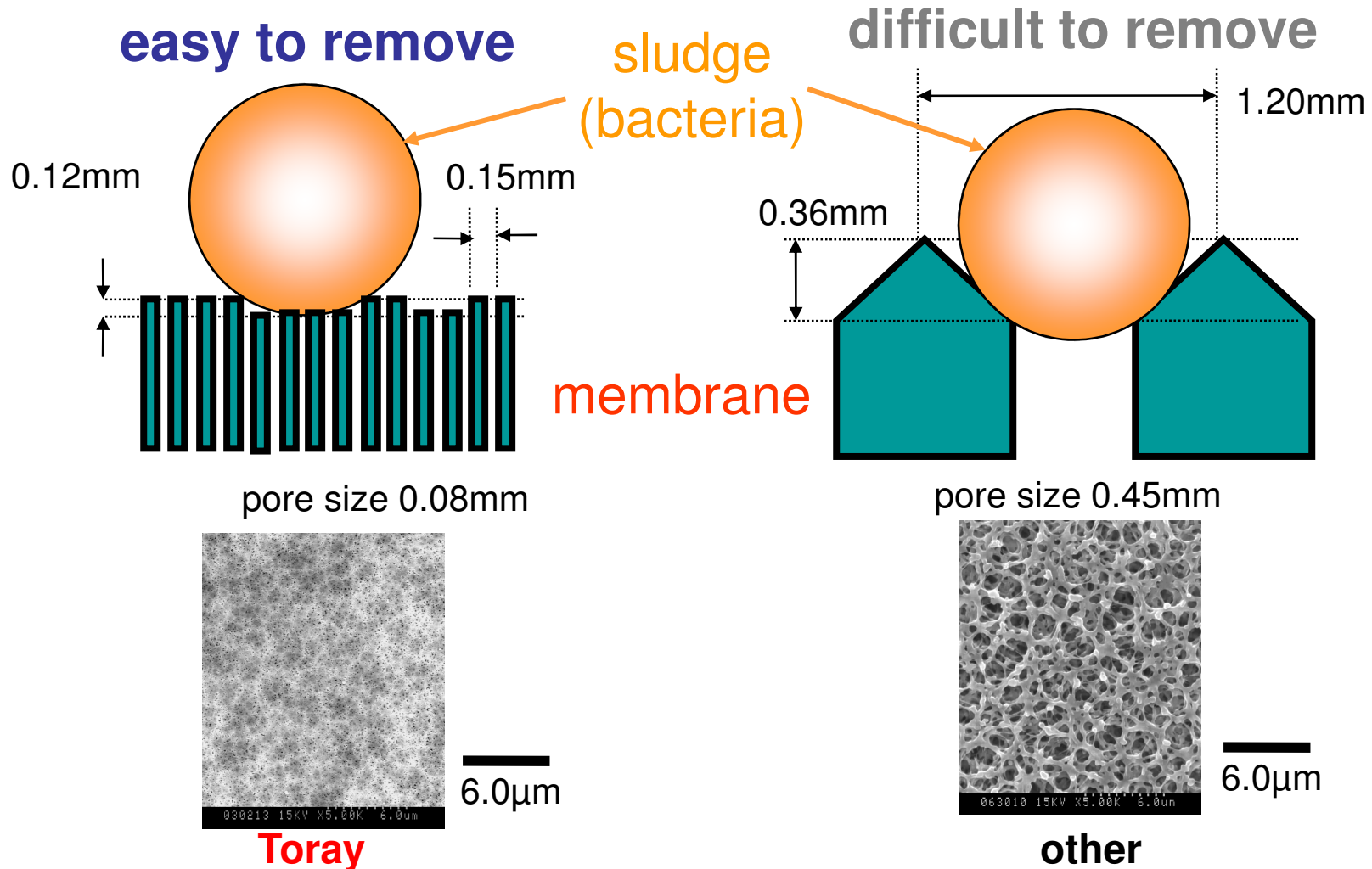


Pore diameter distribution of surface

The PVDF flat sheet membrane has small pores, high porosity and sharp pore size distribution.

2. PVDF membrane for MBR

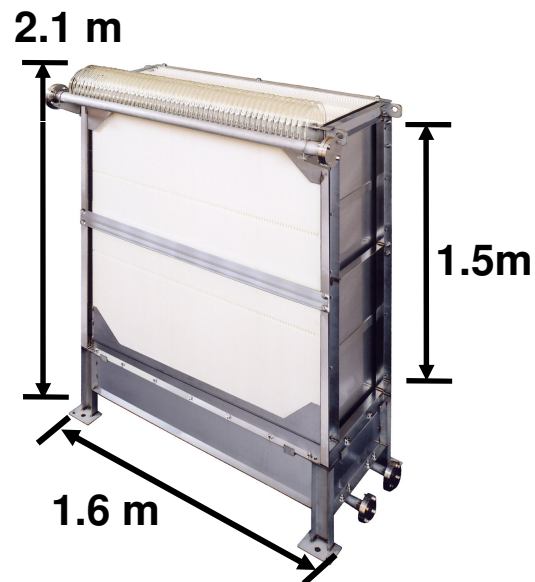
Membrane surface



Smooth membrane structure brings high filterability resulting to low fouling

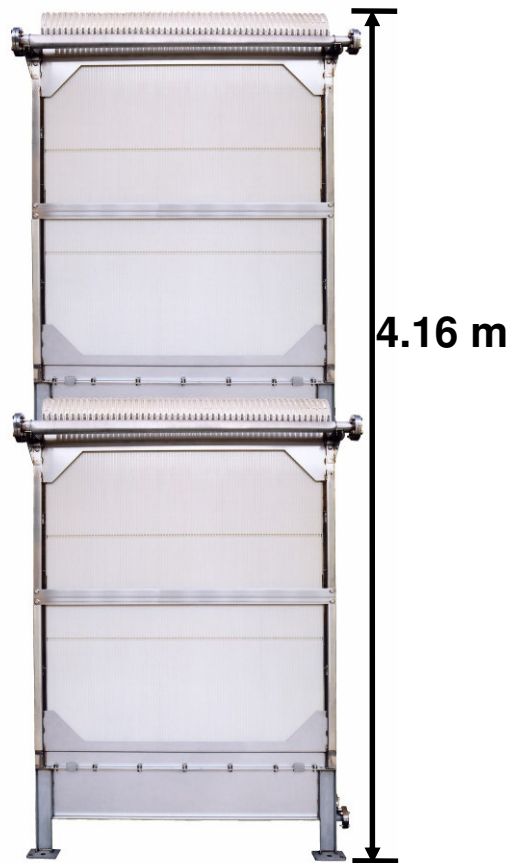
3. MBR Modules Product line up

TMR140 Series



TMR140-100S

Basic module

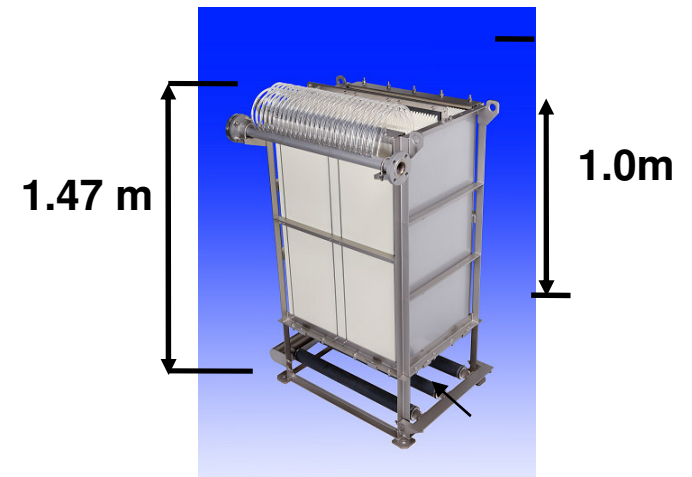


TMR140-200D

Double deck module

TMR090 Series

Small size module



fine bubble
rubber diffuser

TMR090-50S

3. MBR Modules

Membray™ Product Family TMR 140-series

Single Deck Modules



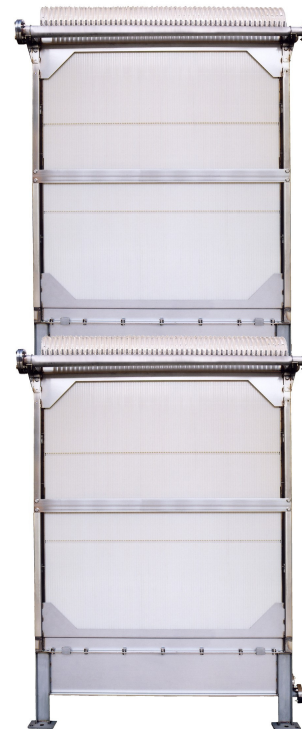
TMR140-100S
(140 m²)



TMR140-200W
(280 m²)

Double Deck Modules

TMR140-200D
(280 m²)



TMR140-400DW
(560 m²)



Galaxy Surfactants Ltd. India

Industrial Waste Water Treatment

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4. Case study of full scale MBR systems (Chem. Industry Waste Water)

Project background

○History of the plant

(1)Description of the old plant	Raw water→2nd stage activated sludge process →Sand filtration→Activated carbon filtration
(2)Reasons for installation of the MBR	Increasing the capacity of existing WWTP
(3)Time schedule	October 2009: Mechanical / Electrical Installation December 2009: Membrane installation and start-up Inauguration of the MBR plant

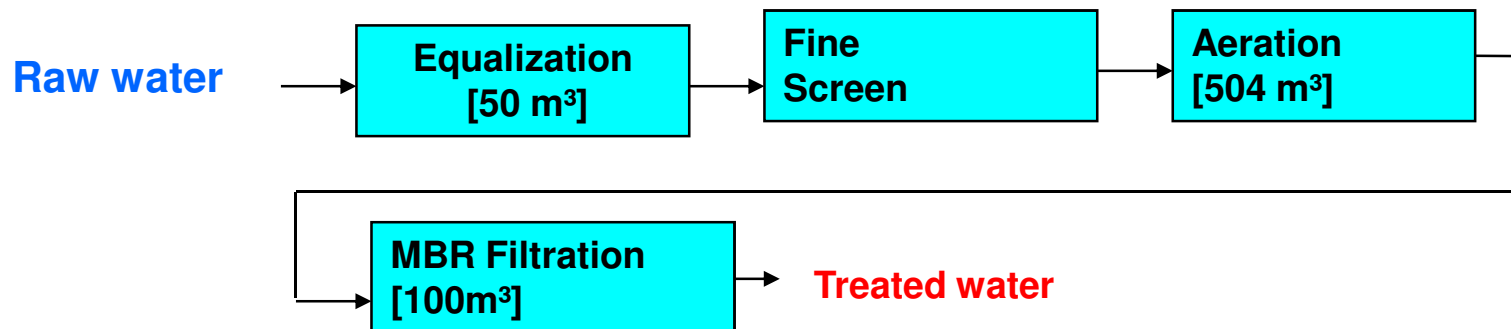
○Background of the projects

(1)Consultant	None
(2)Construction company	RIECO Industries Ltd, India
(3)End user	Galaxy surfactants Ltd Products: soaps and detergent
(4)The role of Toray	(1)Membrane supply (2)Supervisor for membrane installation

4. Case study of full scale MBR systems (Chem. Industry Waste Water) Design of the system (1)

Raw water	Wastewater from surfactant manufacturing industry
Capacity	310m ³ /day
Mechanical Pretreatment	Fine screen(2mm)
Biological Design	HRT 58 hours

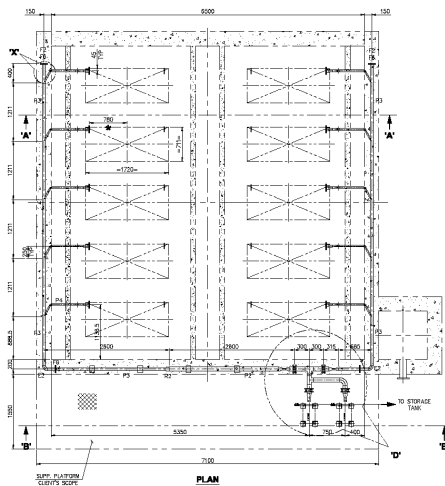
Process Flow Chart



4. Case study of full scale MBR systems (Chem. Industry Waste Water) Photographs



Treatment plant



MBR tank design



MBR tank

4. Case study of full scale MBR systems (Chem. Industry Waste Water)

Design of the system (2)

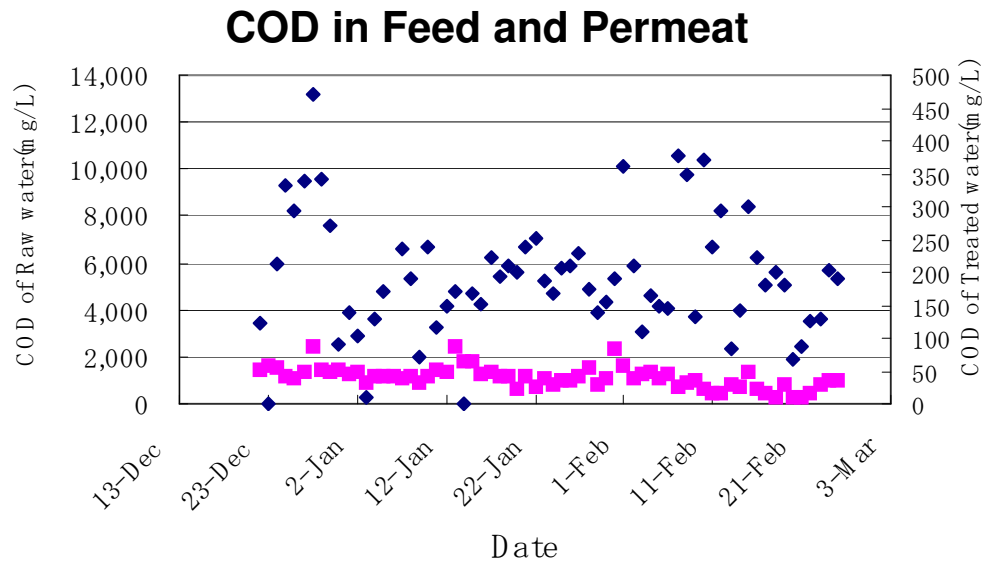
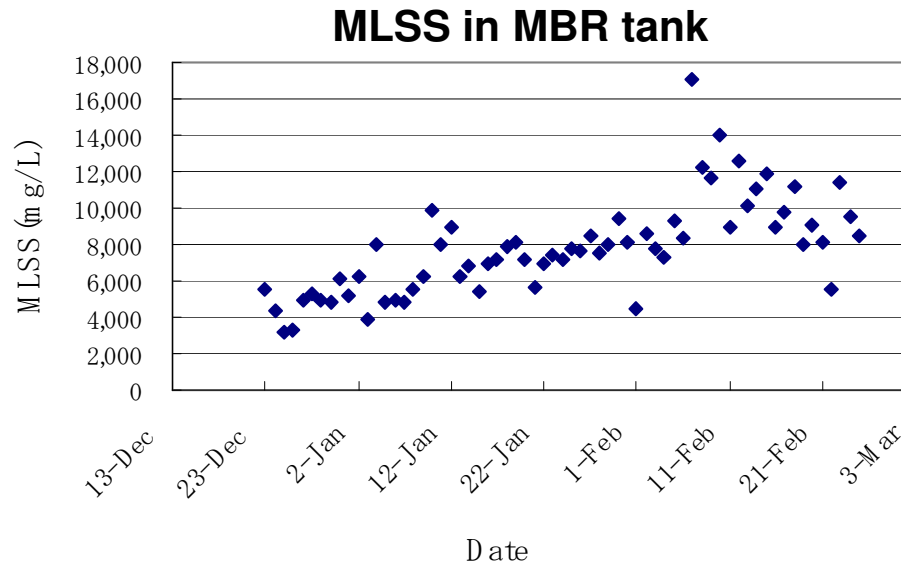
○Feed flow and loads

(1)Average Flow	310m ³ /day
(2)Peak Flow	No peak flow (peak will be absorbed by conventional STP)
(3)Design Parameter	Raw water BOD:1850mg/L、 COD : 3650mg/L SS : 200mg/L、 NH ₄ -N : 250mg/L、 pH : 7.5
	Permeate water (Target value) BOD:30mg/L、 COD : 100mg/L SS : 10mg/L、 NH ₄ -N : 10mg/L、 pH : 6.5~7.5 Turbidity: <1 NTU
	Sludge: MLSS 8~12g/L

○MBR filtration design

(1)Train design	10 modules TMR090-100S 2 trains
(2)Design flux	14LMH (=0.34m/day)

4. Case study of full scale MBR systems (Chem. Industry Waste Water) Operational data (1)

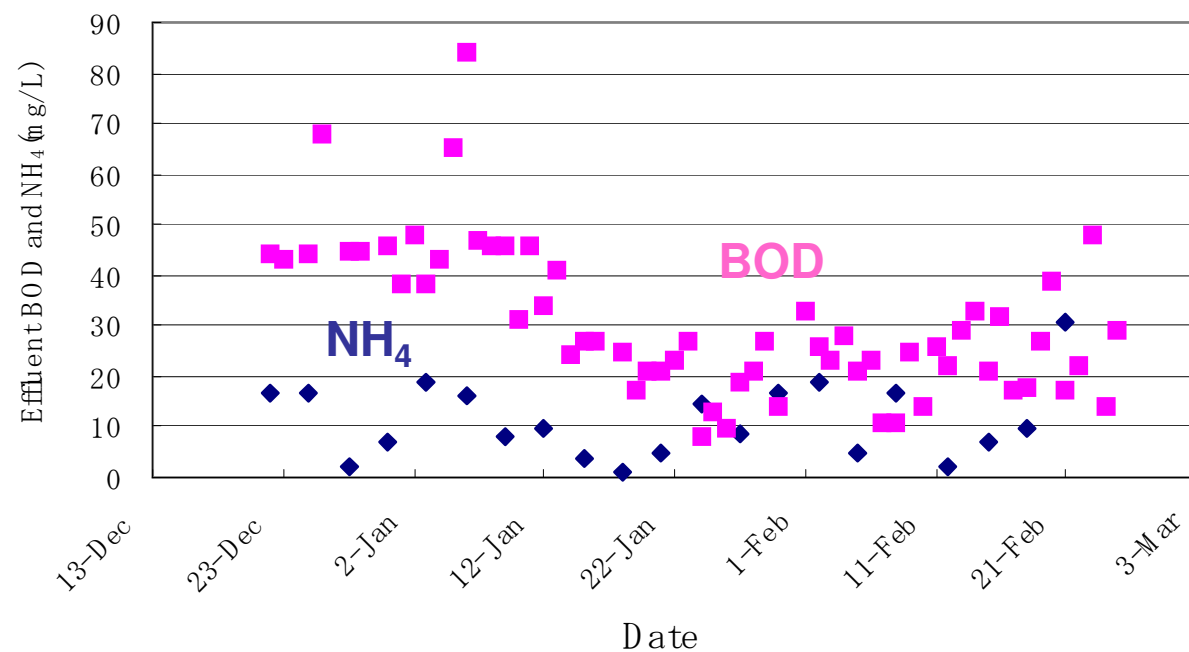


Treated
water

Raw water

4. Case study of full scale MBR systems (Chem. Industry Waste Water) Operational data (2)

BOD and NH₄ in MBR permeate



Borgmeier GmbH / Remondis Aqua GmbH

Poultry Meat Processing

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MEMBRANE EUROPE

4. Case study of full scale MBR systems (Poultry Meat Processing)

Project background

History of the plant

(1)Description of the old plant	Raw water→1mm screen→Aquatector® Micro Flotation→Municipal WWTP
(2)Reasons for installation of the MBR	Waste Water Treatment direct discharge quality and capacity increase
(3)Time schedule of the project until start-up	April-June 2010: mechanical&electrical installation July/August 2010: Biological &Membrane Start-up

Background of the projects

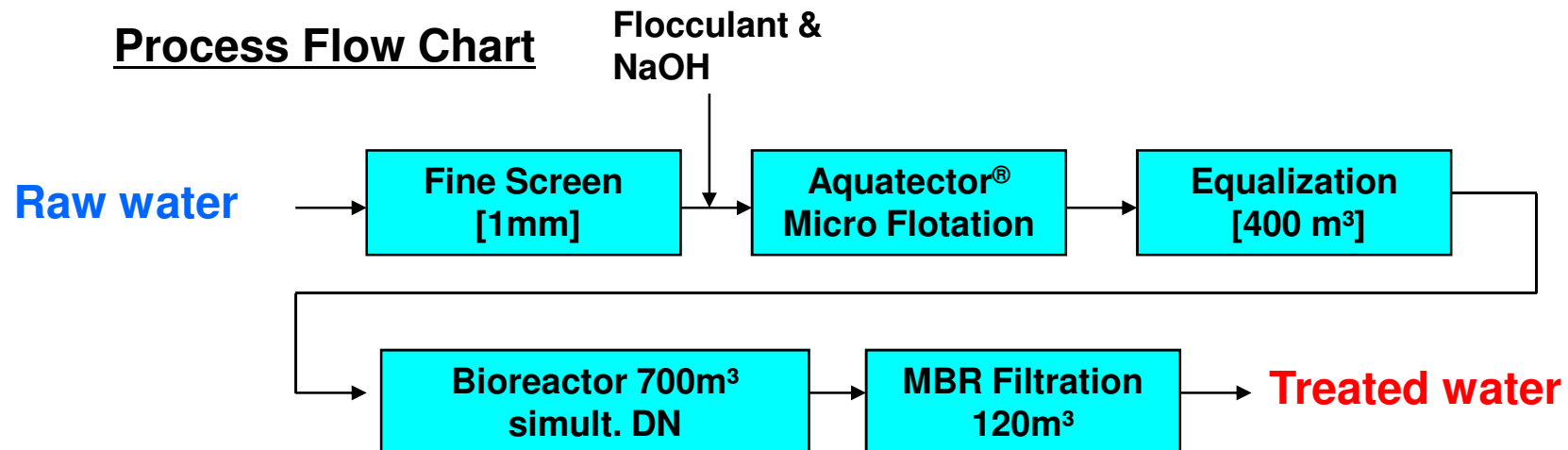
(1)Consultant	Enviplan GmbH, Germany
(2)Construction company	Bremer Pro Aqua GmbH, Germany
(3)Operating Contractor / End user	Remondis Aqua GmbH / Borgmeier GmbH Products: Poultry Meat products
(4)The role of Toray	(1)Membrane supply (2)Supervisor for membrane installation

4. Case study of full scale MBR systems (Poultry Meat Processing)

Design of the system

Raw water	Wastewater from surfactant manufacturing industry
Capacity	450-550 m ³ /day
Mechanical Pretreatment	Fine screen(1mm)
Biological Design	HRT > 30 hours Sludge Load : 0.1-0.15 kg/COD x d/ kg MLSS

Process Flow Chart



4. Case study of full scale MBR systems (Poultry Meat Processing) Photographs



Scouring Air Manifolds



**MBR filtration tank with
air diffusers**



Bioreactor

4. Case study of full scale MBR systems (Poultry Meat Processing)

Design of the system (2)

○Feed flow and loads

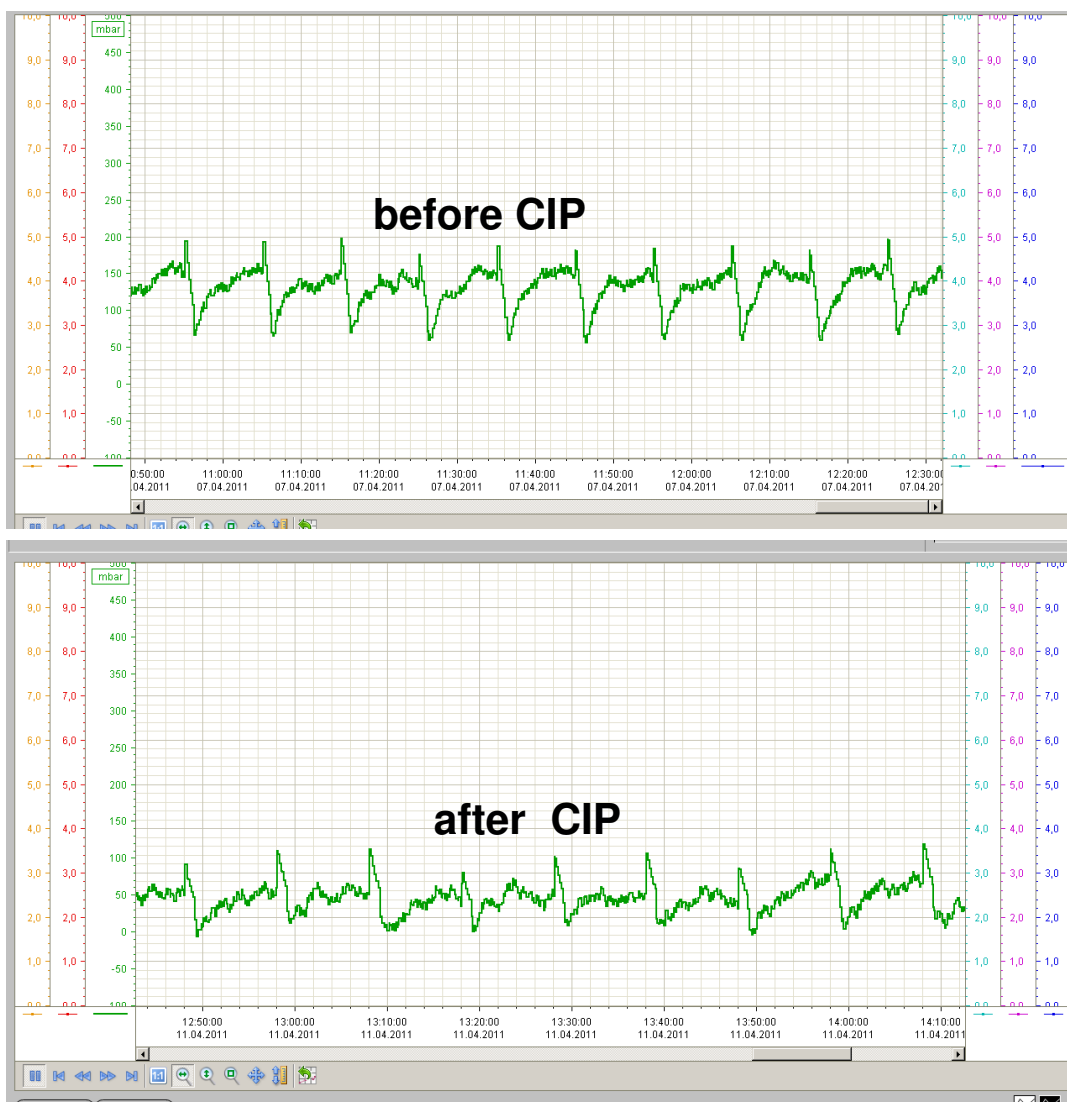
(1)Average flow	480m ³ /day
(2)Peak flow	25 m ³ /h
(3)Water quality for design	Raw water BOD:1,200mg/L、 COD : 1,700mg/L SS : 250mg/L、 TKN : 250mg/L、 pH : 6-9
	Permeate water (Target value) BOD:10mg/L、 COD : 60mg/L SS : 3mg/L、 NH ₄ -N : 10mg/L
	Sludge: MLSS 8~10g/L in bioreactor 12-15 g/ in MBR filtration Tank

○MBR filtration design

(1)Train design	TMR140-200D×5MD ×1 train
(2)Design flux-net	14LMH (=0.34m/day) peak 18 LMH (=0.41m/day)
(3)Scouring Air	0.27-0.32 Nm ³ /h x m ²

4. Case study of full scale MBR systems (Poultry Meat Processing) Operational data (1)

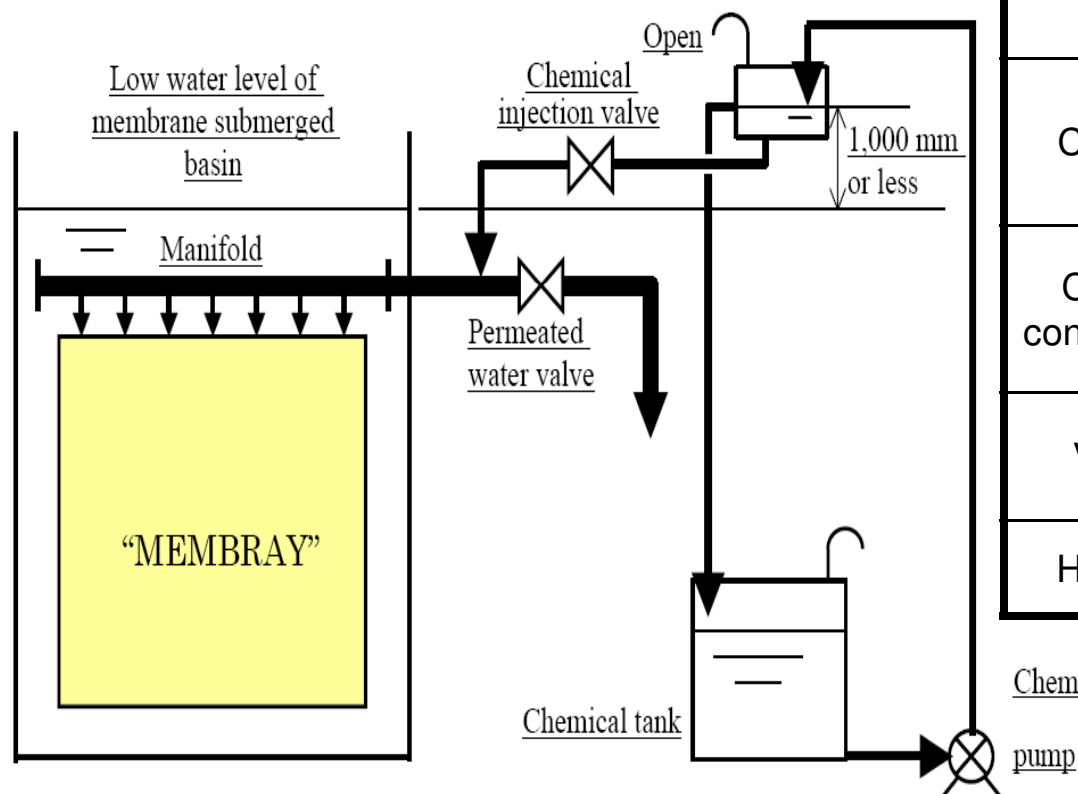
TMP before and after CIP



Q: Ø 22m³/h-
instant.
T : Ø 23°C
MLSS : 12-15g/L

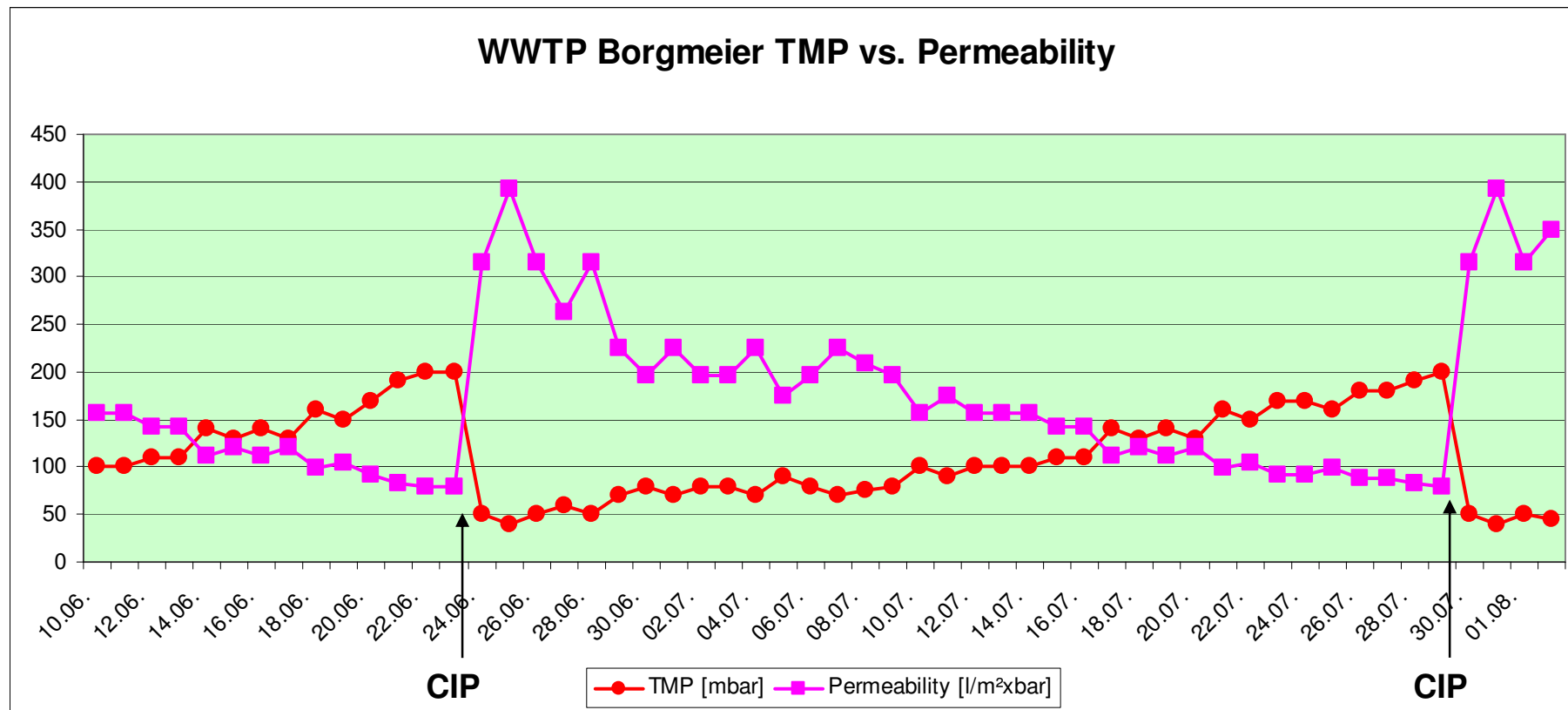
4. Case study of full scale MBR systems (Poultry Meat Processing)

Cleaning in Place



Fouling	Organic matter	Inorganic matter
Chemical	Sodium hypochlorid	Citric acid
Cleaning concentration	1 – 4 g/l	1 – 3 wt%
Volume	1,000 l / module TMR140-200D	
Hold time	3– 10 h	

4. Case study of full scale MBR systems (Poultry Meat Processing) Operational data (2)



Q: Ø 22m³/h- instant.
T : Ø 23°C
MLSS : 12-15g/L

Fuji Film Manufacturing Europe B.V.

Photo Film Production

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FUJIFILM

TORAY
MEMBRANE EUROPE



Keppel Seghers
Solutions for a Cleaner Future!

4. Case study of full scale MBR systems (Photo Film Manufacturing)

Project background

History of the plant

(1)Description of the old plant	Raw water→ activated sludge process
(2)Reasons for installation of the MBR	Recovery of Silver from Production Process / Re-Use of RO Permeate
(3)Time schedule of the project until start-up	Earlier 2004: Pilot Tests 2005: System Design and Installation Spring 2006: Membrane installation and start-up

Background of the projects

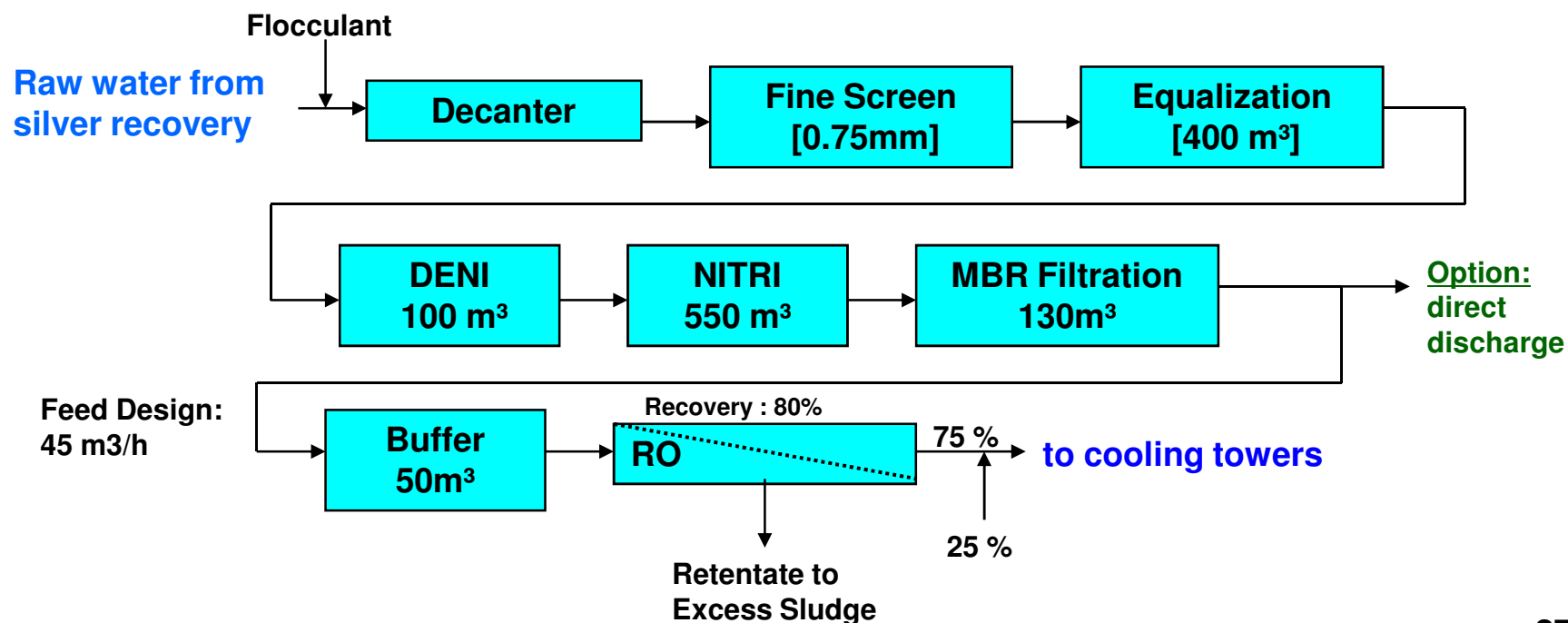
(1)Consultant	Witteveen&Bos
(2)Construction company	Keppel Seghers N.V. Belgium
(3)End user	FujiFilm Europe B.V. Tilburg/Netherlands Products: Photo Films & Papers
(4)The role of Toray	(1)Membrane supply (2)Supervisor for membrane installation

4. Case study of full scale MBR systems (Photo Film Manufacturing)

Design of the system (1)

Raw water	Wastewater from photo film production
Capacity	840m ³ /day max. 45 m ³ /h
Biological Design	0.05-0.1 kg/COD x d/kg MLSS HRT : 22 hrs

Process Flow Chart



4. Case study of full scale MBR systems (Photo Film Manufacturing) Photographs

MBR Tank



Treatment Plant



4. Case study of full scale MBR systems (Photo Film Manufacturing)

Design of the system (2)

○Feed flow and loads

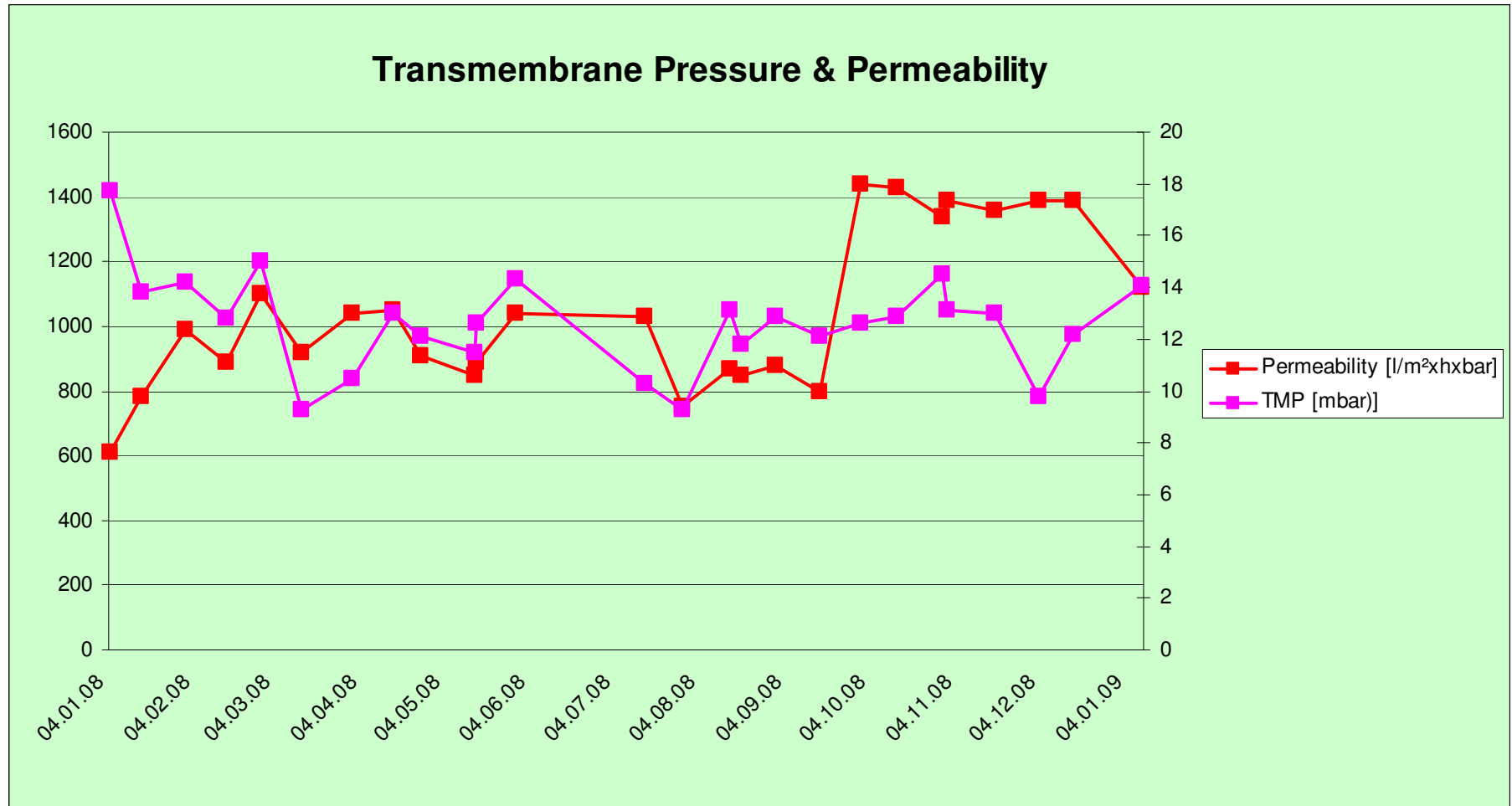
(1)Average flow	845m ³ /day - 35 m ³ /h
(2)Peak flow	45 m ³ /h
(3)Water quality for design	Raw water COD:1,730mg/L TKN : 70mg/L、 NH ₄ -N : 63mg/L、 pH:6.5-7.5
	Permeate water (Target value) COD : 30mg/L SS : 3 mg/L、 NH ₄ -N : 5mg/L
	Sludge: MLSS 8~12g/L

○MBR filtration design

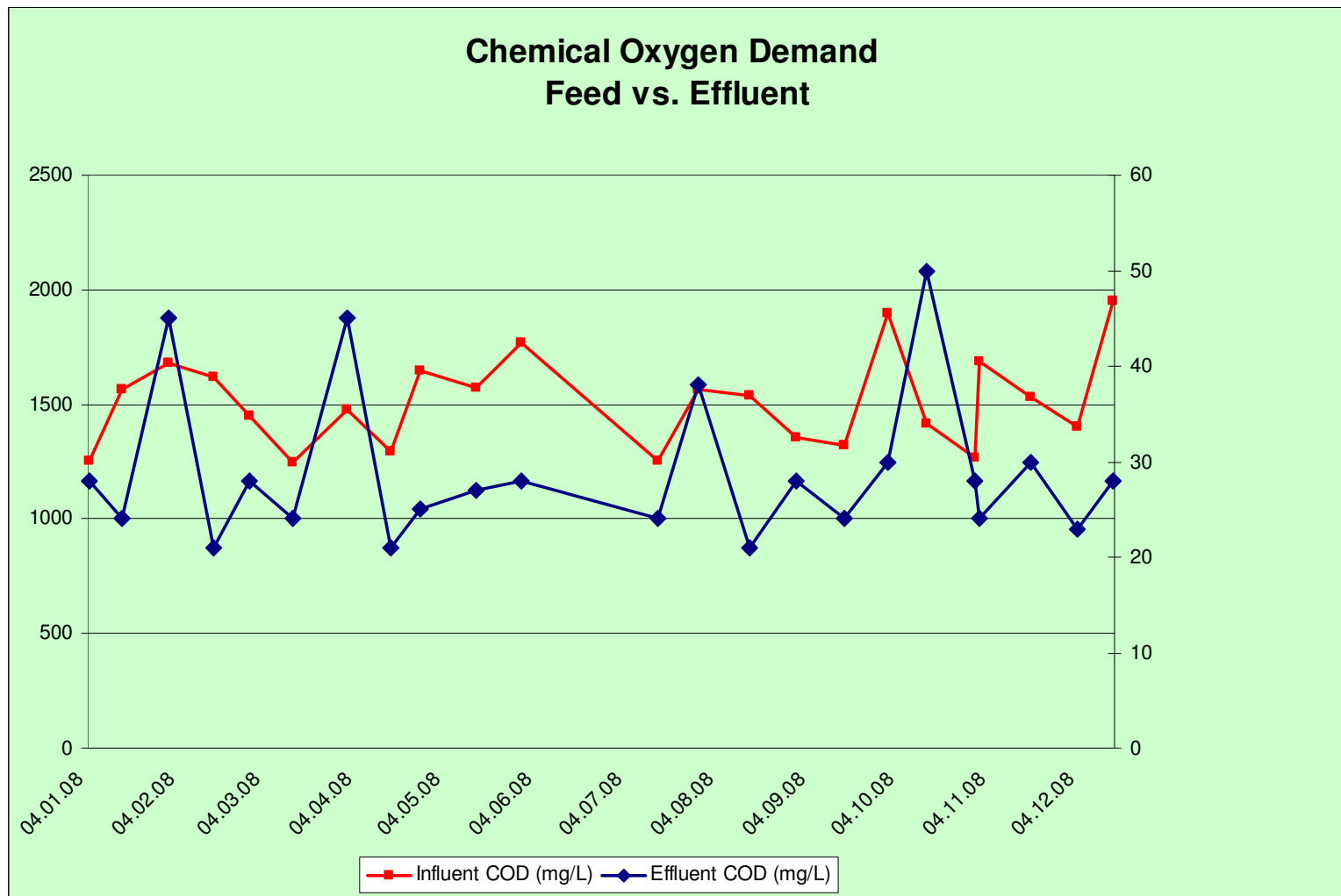
(1)Train design	TMR140-200D×3 MD ×2 train
(2)Design flux	20LMH (=0.48m/day)

4. Case study of full scale MBR systems (Photo Film Manufacturing)

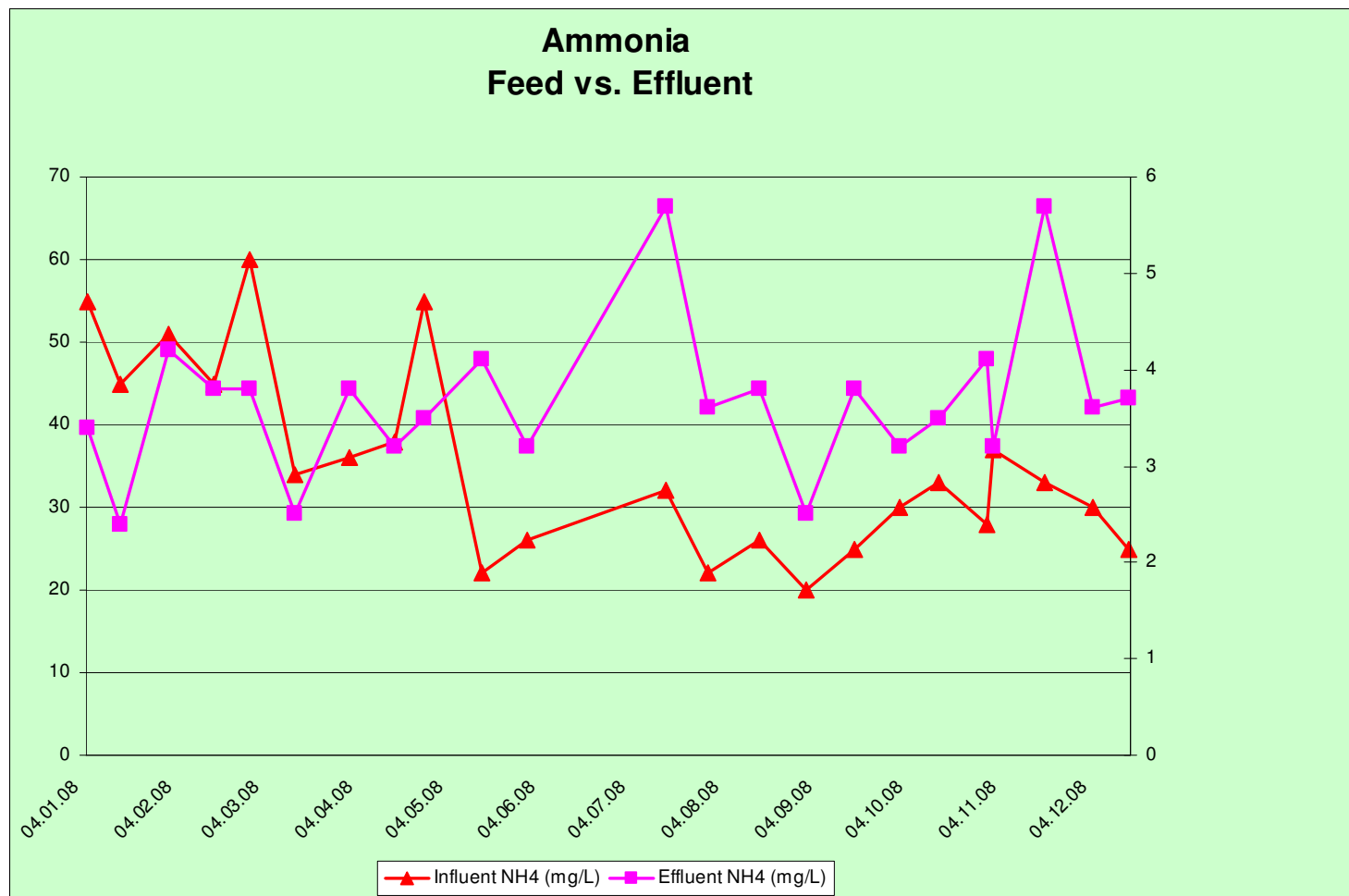
Operational data (1)



4. Case study of full scale MBR systems (Photo Film Manufacturing) Operational data (2)



4. Case study of full scale MBR systems (Photo Film Manufacturing) Operational data (3)



Aspen Pharmacare (Pty).Ltd. Nutritionals (Baby Food)

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4. Case study of full scale MBR systems (Milk Processing)

Project background

History of the plant

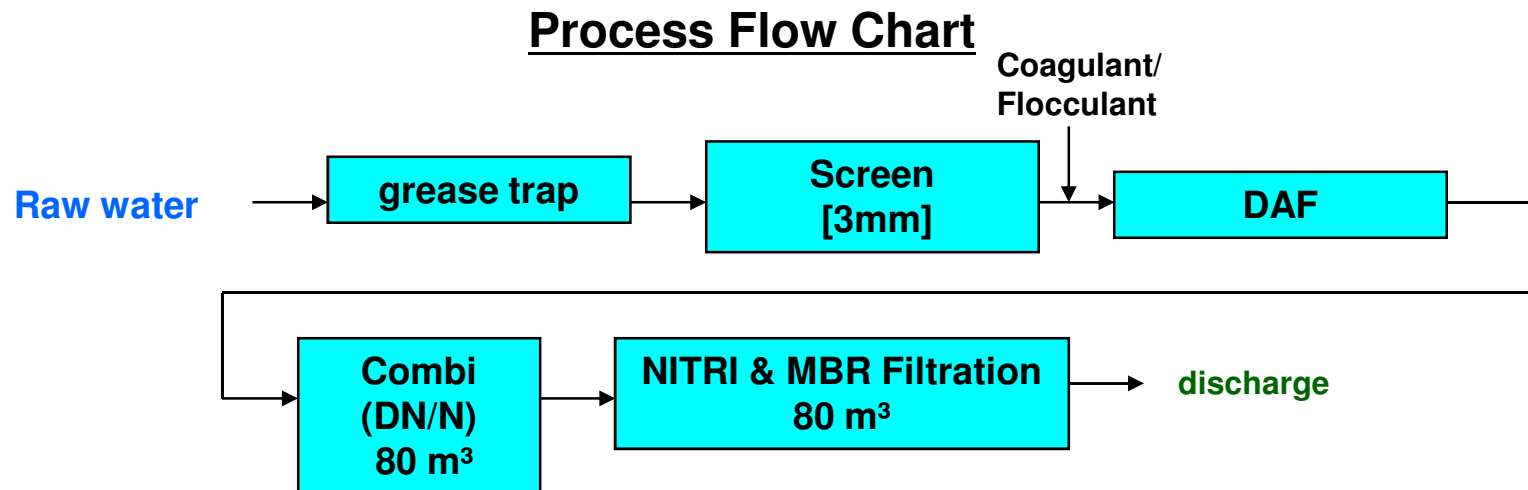
(1)Description of the old plant	Discharge to Municipal WWTP
(2)Reasons for installation of the MBR	Reduction of cost for discharging to Municipality
(3)Time schedule of the project until start-up	Earlier 2009: Initial Start Up using hollow Fiber Membranes Feb. 2011: Change of System Design to Flat Sheet Membranes April 2011: Membrane installation and start-up

Background of the projects

(1)Construction company	WEC Projects (Pty.)Ltd. Dainfern
(2)End user	Aspen Pharmaceuticals (Pty.) Ltd. Jo'burg SA Products: Baby Food (Milk processing)
(3)The role of Toray	(1)Membrane supply (2)Engineering Support

4. Case study of full scale MBR systems (Milk processing) Design of the system (1)

Raw water	Wastewater from Milk processing (baby food)
Capacity	144m ³ /day max. 6 m ³ /h
Biological Design	0.5-0.6 kg/COD x d/kg MLSS HRT : 26 hrs



4. Case study of full scale MBR systems (Milk processing)

Design of the system (2)

○Feed flow and loads

(1)Average flow	120m ³ /day - 5 m ³ /h
(2)Peak flow	6 m ³ /h
(3)Water quality for design	Raw water COD:9,000 mg/L TKN : 180mg/L、 TP : 50mg/L、 pH:6.5-7.5
	Permeate water (Target value) COD : <300mg/L (97% removal rate SS : <3 mg/L、 TKN : < 25 mg/L
	Sludge: MLSS 10~15g/L

○MBR filtration design

(1)Train design	TMR140-100S×3 MD
(2)Design flux	14LMH (=0.33m/day)



Thank you !

TORAY MEMBRANE EUROPE AG

www.toraywater.com

