Environmental & Waste Water Treatment Technologies in Asahi KASEI Gr.

November 1, 2006

Ikuro Matsuo
Asahi Kasei Chemicals Corporation
### Profile of Asahi KASEI Gr.

<table>
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<tr>
<td>Asahi Kasei Chemicals</td>
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<td>Plastics, Chemicals, Specialty products Microza™ (Membrane) etc.</td>
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<td>Asahi Kasei Fibers</td>
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<td>Synthetic fiber, Nonwoven fabric, Artificial leather</td>
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<td>Asahi Kasei Life &amp; Living</td>
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<td>Packaging products (Wrap, Film...</td>
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<td>Asahi Kasei Construction Materials</td>
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<td>ALC board, Pile</td>
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<td>Asahi Kasei Homes</td>
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<td>Hebel Haus™ home</td>
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<td>Asahi Kasei EMD</td>
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<td>Electro material and devices</td>
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<td>Asahi Kasei Pharma</td>
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<td>Pharmaceutical, Dialyzer</td>
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<td>Services &amp; Engineering</td>
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<tr>
<td>Asahi Kasei Engineering, etc.</td>
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</tbody>
</table>
- Asahi Kasei Engineering Corp. (AEC)
- Asahi Kasei Chemicals Corp.
  Microza & Water Processing Division
  Asahi Kasei Clean Chemicals Co., Ltd.
Medicine, Fiber, living product, resin, Electronic material, perfume, paint, etc.
Technologies for Environmental Measures

**Waste gas treatment**
- Solvent recovery system: ASOAR 600
- Deodorizing system: EGI & CCS
- Exhaust gas desulfurizer: ASOAR 103 (magnesium hydrate type)

**Wastewater treatment**
- Waste liquid incineration unit
- Fluorine, boron high efficiency adsorption system: READ-F, As
- Activated sludge treatment system
- Coagulation/sedimentation system
- Dissolved air flotation system
- Bioreactor

**Recycle System**
- Membrane, water reclaim system
  - AQUA VALUE
- Solvent recovery system:
  - ASOAR 600, Distillation

**Resource recovery**
- Solid, sludge incineration system
Activated Carbon Adsorption (Activated Carbon Adsorption)
Membrane Systems

<Typical Applications>

- Precision component cleaning, pure water recovery system
  Oily water separation membrane + UF + AC + RO + IX

- Electronic substrates cleaning wastewater recycle system
  UF + RO + Biorize
Electronic Substrates    Cleaning Wastewater Recycle Systems

Electronic Substrates    Cleaning Wastewater Recycle System

MF Membrane Filtration

Biological Treatment (Biorize)

RO Membrane Filtration
System to treat hardly degradable COD: This is BIORIZE by AEC!

Basic Flow of BIORIZE

- Wastewater tank
- Feed pump
- Bioreactor
  - Catalyst support
  - Bacteria settles here!
- Circulation pump
- Circulation tank
- Blower
- Treated water

No outflow of bacteria! Bacteria grows!
BDRIZE References

FRP Reactor
BIORIZE References

Reinforced concrete

[Image of reinforced concrete structure]
BIORIZE References

Nippon Paint CO. Ltd.

Installed: August, 2001
Capacity: 23m³/day
Water soluble paint wastewater
(Containing N, surfactant)
Removal of fluorine, boron from water

- **READ-F** reduces fluorine ion concentration to below 0.8mg/L (Below environmental standard)

- **READ-B** reduces boron ion concentration in the water to below 0.5mg/L (Below waste discharge standard)

Fluorine Treatment System Example
Fluorine, Boron Removal Process Flow
Microza & Water Processing Division
Water Treatment Technologies

UF / MF Membrane application for
Water and Biologically treated waster water.
限外ろ過

※マイクローザ®UFには一部ダブルスキン構造ではないものが含まれています。
※Note: Some Microza UF membranes do not employ “double skin” construction.

精密ろ過
Asahi KASEI

Feature of microza MF membrane module

1. High permeate Flux
   - High permeate membrane.
   - Large size module (6” * 2mL) and Large membrane area (50m2)
   - Small footprint.

2. High physical and chemical compatibility
   - Physically and chemically tough PVDF membrane
   - Long Life  Low R.C.

3. Good permeate qualities
   - Narrow pore size distribution (0.1 μm)
   - Sufficient rejection of SS
Main Application of UNA-620A

Production of municipal drinking water, rejection of *Cryptosporidium.*

- Raw water
- Coagulation
- Sedimentation

Reuse of Sewage (Treatment of second effluent)

- Sewage
- First Sedimentation
- Activated Sludge
- Second Sedimentation

Reuse
- RO
Pretreatment for desalination of sea water

Sea water → RO → Raw water

Removal of Fe and Mn ion

Raw water → NaClO → Catalytic Oxidation

Crud removal in condensate of boiler water

Pure Water → Chiller → Turbine

Boiler → Turbine → Chiller → Polisher

Polisher

Pure Water
Asahi Kasei Chemicals manufactures 1,500,000 m² of MF membrane per year for water clarification.
### Microza installation for Water clarification

<table>
<thead>
<tr>
<th>No.</th>
<th>Raw</th>
<th>水素界 (m 2)</th>
<th>污染物質</th>
<th>供給</th>
<th>形式</th>
<th>UF</th>
<th>MF</th>
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*Note: Further details not visible in the image.*
<table>
<thead>
<tr>
<th>No.</th>
<th>Raw</th>
<th>Plants (m²)</th>
<th>Treatment</th>
<th>UF</th>
<th>MF</th>
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Total number of Microza™ Plants for water clarification is more than 400 all over the world.
Reclamation of Secondary Effluent

**Secondary Effluent**

Contaminations
- Turbidity
- Inorganics
- Virus
- Bacteria
- Protozoa
- Organics

**Pre-treatment for RO**

- MF
  - Removal
    - Turbidity
    - Inorganics
    - Virus
    - Bacteria
    - Protozoa
    - Organics

- RO
  - Removal
    - Turbidity
    - Inorganics
    - Virus
    - Bacteria
    - Protozoa
    - Organics

**High Grade Water**

- SDI < 3
- Turbidity < 0.1-0.2 NTU
- TSS < 1 mg/L
- Particle

**Microza MF (PVDF)**

Capacity: 191,000 m³/日

Ulu Pandan Newater Pj. (Singapore)
PLANT LAYOUT

- NEWATER TREATMENT PLANT BUILDING
- UV SYSTEM
- NEWATER STORAGE TANKS
- ALTERNATIVE FEEDWATER LINE
- FEEDWATER FROM SOUTHWORKS
- PRE-TREATMENT SYSTEM (Microza MF UNA-620A)
- EQUALISATION TANK
- PRE-TREATMENT FEED PUMP STATION
- DISCHARGE PIPE LINE
- NEWATER and INDUSTRIAL WATER PUMP STATION

Asahi KASEI
Westminster waterworks (USA)

- **Capacity**: 56,850 m³/D
- **Module**: USV-6203 (PVDF, MF, 50m²)
- **Number**: 656 modules (82 modules x 8 racks)
- **Supplied population**: 143,000
Bakersfield (CA, USA)

Capacity: 75,700 m³/D
Module: USV-6203 (PVDF, MF, 50m²)
Number: 726 modules (66 modules x 11 racks)
Supplied population: 190,000
Abilene (TX, USA)

Capacity : 30,280 m³/D
Module    : USV-6203 (PVDF, MF, 50m²)
Number    : 552 modules
Supplied population : 75,000
Pittsburgh waterworks (USA)

Capacity: 76,000 m³/D
Module: USV-6203 (PVDF, MF, 50m²)
Number: 530 modules
Supplied population: 190,000
Microza & Water Processing Division
Water Treatment Technologies

MF Membrane application for waster water treatment

(Membrane Bio Reactor : MBR).
Advantages of MBR process

MBR system can
- dispenses sedimentation tank by using MF membranes
- diminishes aeration tank by higher MLSS concentration
- discharges treated water without SS and colon bacillus and recycle water
- dissolves bulking problem
Calculation example - Required tank capacity -

Influent Water: BOD 200mg/l, Treatment capacity 1,000m3/day

Activated sludge
MLSS: 3000
F/M ratio: 0.15

MBR
MLSS: 10000
F/M ratio: 0.07

MBR system can perform space saving at WWT facilities.
### Cross-section of Hollow fiber

### Surface of Hollow fiber

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td><strong>Surface of Hollow fiber</strong></td>
<td>[Image of surface]</td>
</tr>
<tr>
<td><strong>Cross-section of Hollow fiber</strong></td>
<td>[Image of cross-section]</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>PVDF</td>
</tr>
<tr>
<td><strong>Membrane Thickness</strong></td>
<td>0.1 m</td>
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<tr>
<td><strong>Surface Area</strong></td>
<td>25 m²</td>
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<tr>
<td><strong>Module Length</strong></td>
<td>6 m</td>
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**Aspect of MBR module**
Location of MBR project in China (Hainan, Daya bay)
Hainan project (10800CMD)
Daya-Bay project (25000CMD)
<table>
<thead>
<tr>
<th>Week</th>
<th>Asahi-kasei MBR</th>
<th>Commercial application of Asahi-kasei MBR</th>
<th>CMD</th>
<th>Status</th>
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Asahi Kasei Clean Chemicals Co., Ltd.
Waste Water Treatment Technologies

SEASS
(Super Efficient Activated Sludge)
Advantage over Std. Activated Sludge

1) Minimal excess sludge
2) No bulking
3) Easy maintenance
4) Suitable for high BOD Waste Water
BS carrier: Microbiology friendly, adherent material and configuration

BSB: BS carrier block
Food Chain

- Worm, Water Flea, Rotifer
- Vorticella

Categories:
- BACTERIA
- PROTOZOA
- METAZOA

ORGANICS
Multi – Vessel Treatment

1st
Treated water

Bacteria

2nd

Protozoa

Bacteria

3rd
Micro metazoa

Protozoa
Bacteria

4th
Metazoa

Micro metazoa
Protozoa
Bacteria

Raw water

BOD treatment

BOD treatment + Food chain (prey)

Vorticella
Rotifer
Worm, water flea

BOD

Raw water

1st
2nd
3rd
4th
References

Micrographs

- Small sludge flock (near disintegration)
- Granulated sludge flocks

Activated sludge

SEAS
References

BS carrier with worms (after cleaning of sludge)
Small Packaged Plant (10m³/d)
References

Aeration tank
### Process Flow

**Std. Activated Sludge**

- **Activated sludge**
- **Blower** 37 kw X 2
- **Thickener**
- **Cake hopper**

**1270 m³**

- **Dewater**
- **Coagulant**

- **Carrying out**

**SEAS**

- **BS tank**
- **Blower** 37 kw X 2
- **BSB**

**500 m³**

**Design parameter**

- Raw water volume 500 m³/d
- Raw water BOD 2,000 mg/L
  - Treated water BOD 20 mg/L
## Economics: Std. Activated Sludge vs SEAS

<table>
<thead>
<tr>
<th></th>
<th>Std. Activated sludge</th>
<th>SEAS</th>
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<td><strong>Aeration tank (m³)</strong></td>
<td>1270</td>
<td>500</td>
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<tr>
<td><strong>Blower</strong></td>
<td>37 kw X 2</td>
<td>37 kw X 2</td>
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<tr>
<td><strong>Excess sludge</strong></td>
<td>4 m³/d</td>
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<td><strong>Man-hour</strong></td>
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<tr>
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<td>5 d/w</td>
<td>2 d/w</td>
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Thank you for your attention

Breakthrough-Together