A Reconversão de ETAR existentes em Unidades Geradoras de Recursos
*The Conversion of existing WWTPs to Resource Generating Units*

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DI(FH) Dr. Simon Jabornig
7th February 2018
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1. Technologies C-MEM, C-TECH and C-ION

2. Case Study 1: Reconstruction of industrial WWTP of Bimbo-Tijuana – Reuse of treated water for washing and irrigation

3. Case Study 2: Reconstruction of industrial WWTP of biomass heating plant Flachau – Reuse of treated water for internal use and heat recovery
SFC and AQUASMART ACTIVITIES

- Water & wastewater treatment
- Engineering/Contracting worldwide
ADVANCED TECHNOLOGIES AVAILABLE

- C-MEM membrane ultrafiltration for potable water and wastewater
- C-TECH process for tertiary wastewater treatment, market leader
- C-ION non-thermal plasma oxidation for special applications
High-rate Ultrafiltration System
WHAT DOES C-MEM STAND FOR?

- C-MEM™ is a hollow fibre ultrafiltration system

- Pore size 20.1 nm

- Materials
  - Fibre: High Density Polyethylene HDPE
  - Cartridge: PE reinforced/PP reinforced/U-PVC /ABS
MEMBRANE

Hollow fibre membranes with 3-D membrane pores
CARTRIDGE

- High packing density
- Safety for membranes
- Higher flux and better CIP efficiency
PRINCIPLE

FILTRATION CYCLE
- Clear Water
- Raw Water
- Sludge

BACKWASH CYCLE
- Clear Water
- Air Bubbles
SUBMERGED SYSTEM

C-MEM Submerged
Treated water is sucked by vacuum pump through the hollow fibre membranes.
ADVANTAGES

✓ Permanently hydrophilic

✓ High mechanical strength (QC-pressure test with 4 bar)

✓ Chlorine resistant

✓ Effective mechanical safety for membranes

✓ High packing density

✓ Membrane bundles are replaceable
ADVANTAGES

✓ Technical disinfection
  (removal of bacteria and viruses up to log - 6)

✓ Pressure applicable from -0.9 to 3 bar

✓ Low maintenance demand

✓ Very low operational costs (e.g. 10 sec aeration per 5 min.)

✓ Very effective chemical cleaning of cartridge

✓ Fully automated system
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Case Study 1: GRUPO BIMBO
Case Study 1: GRUPO BIMBO

Raw water composition

1. Industrial WW from food production
2. Flow of 1 – 1.5 l/sec
3. High loads of COD up to 25,000 ppm – good biodegradability
4. High loads of oil, fats and grease
5. Lack of nutrients
Case Study 1: GRUPO BIMBO

Existing industrial WWTP:

Reason for reconstruction:
1. Increased capacity
2. High operating costs
3. Process problems (Floating sludge)
4. No reuse of water

Goals for reconstruction:
1. Use of existing concrete structures
2. Reuse quality
3. Lower operating costs
Reconstruction of industrial WWTP:

Process design:
1. Redesign to complete continuous flow system after pre-treatment
   → Balancing will be done in raw water collection tank with flow controlled lifting pumps
   → Savings of pumping costs

- Raw water collection tank
- Screen (incl. storage tank)
- DAF (incl. storage tank)
- SBR (incl. storage tank)
- Sandfilter, Multimedia Filter
- Chlorination
Case Study 1: GRUPO BIMBO

Reconstruction of industrial WWTP:

Process design:
2. Redesign of DAF (Dissolved air flotation)
   → Increase of COD removal
   → Increase of fat, oil and grease removal
   → Savings of electrical consumption through high efficiency equipment
Case Study 1: GRUPO BIMBO

- Raw water tank
- Screen
- DAF
Case Study 1: **GRUPO BIMBO**

**Reconstruction of industrial WWTP:**

**Process design:**

3. Redesign of biological process to C-MEM MBR (Membrane bioreactor) incl. selector
   - Improve of sludge quality by selector
   - Increase of efficiency through nutrient dosing (UREA and phosphoric acid)
Case Study 1: GRUPO BIMBO

- Raw water tank
- Screen
- DAF
- Selector
- MBR
Case Study 1: **GRUPO BIMBO**

Reconstruction of industrial WWTP:

**Process design:**

3. Redesign of biological process to C-MEM MBR (Membrane bioreactor) incl. selector

→ Reuse of existing SBR tank

→ Installation of membrane modules inside bioreactor
Case Study 1: GRUPO BIMBO

- Raw water tank
- Screen
- DAF
- Selector
- MBR
- Treated water tank
- C-MEM

SFC Umwelttechnik
Clean water for the world
Case Study 1: GRUPO BIMBO

- Raw water tank
- Screen
- DAF
- Selector
- MBR
- Treated water tank
Case Study 1: **GRUPO BIMBO**

Reconstruction of industrial WWTP:

**Process design:**

3. Redesign of biological process to C-MEM MBR (Membrane bioreactor) incl. selector

→ Savings of electrical consumption through full process automation (OUR control) and high efficiency equipment

→ Technically disinfected effluent by ultrafiltration
# Case Study 1: GRUPO BIMBO

## Treated water quality:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effluent after C-MEM MBR</td>
<td></td>
<td>up to 130 m³/d</td>
</tr>
<tr>
<td>BOD₅</td>
<td>mg/l</td>
<td>≤ 25</td>
</tr>
<tr>
<td>COD</td>
<td>mg/l</td>
<td>≤ 200</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/l</td>
<td>≤ 1</td>
</tr>
<tr>
<td>N organic</td>
<td>mg/l</td>
<td>≤ 1</td>
</tr>
<tr>
<td>NH₄-N</td>
<td>mg/l</td>
<td>≤ 2</td>
</tr>
<tr>
<td>NO₃-N</td>
<td>mg/l</td>
<td>≤ 15</td>
</tr>
<tr>
<td>T-P</td>
<td>mg/l</td>
<td>≤ 3</td>
</tr>
<tr>
<td>SDI</td>
<td>-</td>
<td>≤ 3</td>
</tr>
</tbody>
</table>

## Power consumption:

- 500 – 600 kWh/day
- 50% less compared to original plant
1. Technologies C-MEM, C-TECH and C-ION

2. Reconstruction of industrial WWTP of Bimbo-Tijuana – Reuse of treated water for washing and irrigation

3. Case Study 2: Reconstruction of industrial WWTP of biomass heating plant Flachau – Reuse of treated water for internal use and heat recovery
Case Study 2: **FLACHAU**

**Raw water composition**

1. Industrial WW from biomass heating plant (condensate)
2. Flow of up to 5 m³/h
3. High loads of TSS (ash), heavy metals, nitrogen
4. Low amount of carbon (BOD, COD)
5. High temperature of up to 50°C
Case Study 2: FLACHAU

Existing industrial WWTP:

Reason for reconstruction:
1. High sewage fees
2. No further permit for municipal sewer
3. No reuse of water

Goals for reconstruction:
1. Use of existing concrete structures
2. Reuse of water and heat – or direct discharge
Case Study 2: FLACHAU

Reconstruction of industrial WWTP:

Process design:
1. Adding of cooling system for heat recovery and cooling of water
   → Heat will be used for heating of streets in winter
   → Water temperature in further process of less than 30°C required

Diagram:
- Raw water collection tank
- 1st Sedimentation tank
- Neutralisation with NaOH
- Cooling system
- 2nd sedimentation tank
- Effluent to sewer system
Case Study 2: **FLACHAU**

Reconstruction of industrial WWTP:

**Process design:**

1. Redesign of 2\textsuperscript{nd} sedimentation tank to C-MEM MBBR (Membrane moving bed biofilm reactor)
   
   \rightarrow Reuse of existing tank

   \rightarrow Installation of membrane modules inside bioreactor

   \rightarrow Reuse of treated water of direct discharge to river – no sewage fees

- Raw water collection tank
- 1\textsuperscript{st} Sedimentation tank
- Neutralisation with NaOH
- Cooling system
- C-MEM MBBR
- Reuse or effluent to river
Case Study 2: FLACHAU

Treated water quality:

<table>
<thead>
<tr>
<th>Effluent after C-MEM MBBR</th>
<th>up to 70 m³/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD₅</td>
<td>mg/l ≤ 3</td>
</tr>
<tr>
<td>COD</td>
<td>mg/l ≤ 10</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/l ≤ 1</td>
</tr>
<tr>
<td>NH₄-N</td>
<td>mg/l ≤ 1</td>
</tr>
<tr>
<td>NO₂-N</td>
<td>mg/l ≤ 1</td>
</tr>
<tr>
<td>T-P</td>
<td>mg/l ≤ 1</td>
</tr>
<tr>
<td>Heavy metals (zinc, copper, mercury, ...)</td>
<td>mg/l ≤ 1</td>
</tr>
</tbody>
</table>

Heat recovery:

→ Saving of equivalents of 40 tons of wood per year!

Amortization:

→ Due to savings of sewage fees it is less than 2 years!
PROJECTS

Condensate wastewater treatment with C-MEM Moving Bed Biofilm Membrane Reactor (MBBR)

References:

- Holzwärme Flachau (Austria)
- R+Z Klagenfurt (Austria)
- Pfeifer Kundl (Austria)
- Utrecht (Netherlands)
For more information please visit our webpage

www.sfcu.at

Thank you very much for your attention.
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