Wastewater Characterization and Treatment in a Municipal Solid Waste Management Center

5th International Conference on Sustainable Solid Waste Management

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Athens, 21 June 2017
Project data

- **Project**: County Waste Management Centre (CWMC) “Marišćina”
- **Contractor**: Helector S.A. in consortium with GP KRK d.d.
- **Site location**: Primorsko - Goranska County, City of Rijeka, Viškovo municipality, Croatia
- **Area population**: 305,505 (County), 144,034 (City of Rijeka)
- **Scope of works**: Acceptance and treatment of 100,000 tpa MSW
- **Facilities included**: MBT, WWTP, Bioreactor Landfill
- **Design-construction**: 2013 - 2016
- **Operation**: Since 2016
Site works
Mechanical and Biological Treatment (MBT) plant consists of the following processes:

- Reception (bunker) of solid waste
- Mechanical pre-treatment
- Biological treatment ("HERHOF" bio-drying process)
- Mechanical refinement – Solid Recovered Fuel (SRF) production

After treating MSW in the MBT plant, the following treatment products are obtained:

- Solid recovered fuel (SRF)
- Recyclable metals (ferrous and non-ferrous metals)
- Biodegradable and rejected material
- Treated wastewater reclaim for all process uses
Mechanical Biological Treatment (MBT)
Wastewater production

- **Stream 1: MBT Technological wastewater**: 115 m³pd
  - Reception Leachate
  - Scrubbers – Biofilter Wastewater
  - Biodrying Wastewater
  - Cooling Towers Wastewater
  - Washings Wastewater
  - Wheel-truck Washings Wastewater

- **Stream 2: Sanitary wastewater**: 6 m³pd

- **Stream 3: Landfill leachate**: 239 m³pd

**Total**: 360 m³pd
## Wastewater characteristics

Table 1. Main characteristics of different wastewater streams according to design data

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<tr>
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<tbody>
<tr>
<td>BOD₅, mg/L</td>
<td>200</td>
<td>1,500</td>
<td>400</td>
<td>&lt;25</td>
</tr>
<tr>
<td>COD, mg/l</td>
<td>2,200</td>
<td>2,000</td>
<td>1,000</td>
<td>&lt;125</td>
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<tr>
<td>TSS, mg/l</td>
<td>250</td>
<td>150</td>
<td>200</td>
<td>&lt;35</td>
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<tr>
<td>NH₃-N, mg/l</td>
<td>1,000</td>
<td>400</td>
<td>70</td>
<td>&lt;10</td>
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<tr>
<td>NO₃-N, mg/l</td>
<td>2</td>
<td>150</td>
<td>0</td>
<td>&lt;2</td>
</tr>
<tr>
<td>TN, mg/l</td>
<td>1,350</td>
<td>550</td>
<td>100</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Conductivity, μS/cm</td>
<td>9,700</td>
<td>3,300</td>
<td>1,000</td>
<td>no limit</td>
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</table>
**List of treatment methods used:**

- Flow equalization and fine screening
- Anoxic and aerobic biological treatment
- Biomass membrane separation (Ultrafiltration)
- Reverse osmosis membrane separation
- Activated carbon adsorption
- Biological sludge thickening and dewatering
- Concentration evaporation
Figure 1. Flow chart of process / treatment steps of WWTP
Membrane Bioreactor (MBR)

- No. of biological trains: 2
- Anoxic / Aerobic tanks volume: 200 m³ / 416 m³ each train
- Ultrafiltration units: immersed type, low-pressure
- Membrane type: hollow fiber (pore size 0.04μm)
- No. of cassettes per train: 2
- No. of modules: 36 (20+16)
- Feed flow: 7.5 m³ph per unit (360 m³pd in total)

Membrane Fibers

Membrane Modules

Membrane Cassettes
Ultrafiltration
Reverse Osmosis

- Type: double-pass RO
- Feed flow: 18 m³ph
- Permeate yield: >75%
- No. of vessels in 1st pass: 4
- No. of vessels in 2nd pass: 3
- No. of membranes in 1st pass: 24 (= 4 x 6)
- No. of membranes in 2nd pass: 18 (= 3 x 6)
- Membrane type: spiral wound (polyamide)
Evaporation Unit

- Evaporation type: conveyed vacuum flash
- Evaporation conditions: pressure 70kPa, temperature 90°C
- Vacuum system: lobes rotary blower
- Flow rate: 55 m³pd (7,600 m³pa)
Sludge management

- Waste Activated Sludge and Foam collection
- Sludge thickening to picket fence thickener
- Thickened Sludge dewatering in centrifuge extractor
- Dewatered sludge conditioning with lime
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<tbody>
<tr>
<td>BOD$_5$, mg/L</td>
<td>1,000-18,000</td>
<td>70-380</td>
<td>4-400</td>
<td>&lt;5</td>
<td>&lt;1</td>
<td>&lt;25</td>
<td>99.9%</td>
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<tr>
<td>COD, mg/l</td>
<td>2,000-27,000</td>
<td>600-1,400</td>
<td>17-2,500</td>
<td>10-1,000</td>
<td>&lt;10</td>
<td>&lt;125</td>
<td>99.5%</td>
</tr>
<tr>
<td>TSS, mg/l</td>
<td>5-270</td>
<td>6-400</td>
<td>4-6,500</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;35</td>
<td>93.1%</td>
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<tr>
<td>NH$_3$-N, mg/l</td>
<td>60-750</td>
<td>50-200</td>
<td>4-100</td>
<td>0.3-80</td>
<td>&lt;1</td>
<td>&lt;10</td>
<td>99.8%</td>
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<tr>
<td>NO$_3$-N, mg/l</td>
<td>4-60</td>
<td>0.1-30</td>
<td>0.1-30</td>
<td>0.1-75</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>97.0%</td>
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<tr>
<td>TN, mg/l</td>
<td>180-1,300</td>
<td>60-300</td>
<td>6-90</td>
<td>5-120</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>98.1%</td>
</tr>
<tr>
<td>Conductivity, μS/cm</td>
<td>330-21,000</td>
<td>730-1,400</td>
<td>200-3,800</td>
<td>270-2,500</td>
<td>5-70</td>
<td>no limit</td>
<td>99.4%</td>
</tr>
</tbody>
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Research opportunities

- Characteristics and treatability of wastewater arising from MSW treatment processes
- By-product disposal (reverse osmosis and evaporator concentrate, dewatered biological sludge, screenings)
- Optimization of wastewater blending for efficient treatment
- Minimization of leachate quantities and control of landfill processes
Thank you for your kind attention!