Effective Wastewater Recycling Solutions in Rural Area of Hong Kong

Dunwell Engineering Co. Ltd.
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What's Black and Greywater

Black and Greywater = Solids + Dissolved Organic

= Bacteria + Water
Membrane Bioreactor/ Bio-toilet

Tertiary Treatment – Membrane Bio-reactor (MBR)

COD : < 30mg/L           BOD$_5$ : < 10 mg/L
SS : < 0 mg/L                TN : < 15 mg/L
E. Coil : < 1 counts/100ml
MBR/Bio-toilet Working Principle

- Membrane Filtration
  - Separation of activated sludge (bacteria) and treated effluent
  - Membrane Surface has pores in 0.04 micron to separate bacteria & organic matter from treated effluent effectively (Size of E.coli : 0.45 micronmeter)
MBR/ Bio-toilet Treatment
### Discharge/Reuse Standards in HK

**Inland Standard**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>GP A</th>
<th>GP B</th>
<th>GP C</th>
<th>CP D</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.5-8.5</td>
<td>6.5-8.5</td>
<td>6-9</td>
<td>6-10</td>
</tr>
<tr>
<td>SS</td>
<td>10 (5)</td>
<td>30</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>BOD</td>
<td>10 (5)</td>
<td>20</td>
<td>15 (10)</td>
<td>20</td>
</tr>
<tr>
<td>COD</td>
<td>50 (20)</td>
<td>80</td>
<td>15 (10)</td>
<td>80</td>
</tr>
<tr>
<td>COD</td>
<td>2200 (2000)</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>O&amp;G</td>
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<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>DO</td>
<td>≥ 4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TP</td>
<td>0.7 (0.5)</td>
<td>10 (8)</td>
<td>10 (8)</td>
<td>10 (8)</td>
</tr>
<tr>
<td>NH3</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>TN</td>
<td>15 (10)</td>
<td>30 (20)</td>
<td>30 (20)</td>
<td>30</td>
</tr>
<tr>
<td>E.Ceil</td>
<td>&lt;1</td>
<td>100</td>
<td>1000</td>
<td>1000</td>
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</table>

GP A: Water Gathering Ground, B: Irrigation, C: Fish Pond, D: General Amenity

x < 1,000 m³/day (~ 3,500 pe)
Bio-Cell Membrane

- Combines the advantages of hollow fibers and flat sheet/plate constructions
- Insensitive against braiding and sludge deposition
- No laminar flow at the boundary of the membrane sheet
- High package density due to the thin self-supporting membrane sheet
Bio-Cell Membrane
Disinfection

• UV Disinfection System
• Chlorination System
UV Disinfection System

- Installed after membrane for water reuse application

AFP sleeve (not quartz)

UV Lamp
Chlorination System

- Static Mixer
- Dosing Tank
  - < 5 mg/L
  - 4 log reduction
- Contact Chamber
Smart City?

**Smart City Council**: a smart city as one that has digital technology embedded across all city functions.

**Wikipedia**: A **smart city** (also **smarter city**) uses digital technologies or information and communication technologies (ICT) to enhance quality and performance of urban services, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens. Sectors that have been developing smart city technology include government services,[2] transport and traffic management, energy,[3] health care,[4] [water](#) and waste.
2008 Summer
Where is it?
Nice for visit
Not for Work
Technical Feasible?

~ 10 km
Economic Feasible?

- Costs Comparison
  - Sewer Building Cost in 2011: HK$10 - 35 million/km
  - Dunwell Bio-plant cost (15 years life cost): < HK$2 million
- Other Advantages
  - Reuse of treated water for irrigation and flushing
Advantages of MBR

• Save Space (In general, save at least 30% of space comparing the traditional system)

• Fully Automatic
Dunwell MBR in HK

About 140 systems completed in last 6 years
MBR at Sai Kung, Tuen Mun, Yuen Long & North District

Bio-toilets at Kwong Shan Tsuen, Tuen Mun

Bio-toilets at Fui Sha Wai, Yuen Long

Bio-toilets at Ham Tin, Sai Kung

Bio-toilets at Shan Wo Hang N104, North District
MBR Job Reference

- Capacity: 60m³/day
- Group A (Water Extraction Zone) Inland Discharge
MBR Job Reference

- Stonecutters Island DSD - 200m³/day
- Sham Tseng DSD - 110m³/day
- To Kwa Wan DSD - 60m³/day
Altira Macau - 300m$^3$/day,

Membrane Module

Anoxic Zone

Control Instrument

Ozone Disinfection
Tai Po Tsai Residential Development -
700m$^3$/day (ave), 87.5m$^3$/hr. (peak)
ICT helps?

Yes!
Remote Monitoring and Control

Plant operator can monitor and control plant operation via internet and iphone.
24 hours System Monitoring and Recording
Remote monitoring and control system can easily show the location of failure sewage treatment plant.
Monitor the system via site camera
On/OFF line reporting
Thank you