Plant assessment of composting and MBT facilities

Sanitisation, odour management, risk of health and safety

Compost Systems

design and build, process management, site management, Software development
Project:

- Client: New Earth Solutions Ltd
- Site Location: Wimborne South England
- Material: MSW

Targets:

- System development
- Process validation
- Emission control validation
- Economical aspects
- Risk management
Process:

- Housed windrows
- Fully enclosed
- Air cleaning
  - Wireless process monitoring
  - Computer control
  - Automatic documenting
Special aspects:

- Investment
- Treatment cost
- Suitability to treat Animal Byproducts

Process:
- Cleaning procedures
- Reliability
- Versatility
- Max. 4 weeks treatment time
- Optimal digestion loss
- Upscaling capability
Results:

- **Product quality:**
  - Oxygen demand AT4
  - TOC eluate
  - Mass balance
    - Total mass
    - Dry matter
  - Sanitisation of material

- **Process quality**
  - Health and safety
  - Reliability
  - Upscaling capability

- **Emissions**
  - VOC exhaust air
  - Biofilter performance
  - Leachate
Pretreatment process:

High Torque Shredder – Screener 80mm
Mass balance – fresh matter

- Fresh matter balance
  - With high calorific fraction (batch 18)
  - Without high calorific fraction (batch 20)

- Total fresh matter loss [%]
  - Batch 18
  - Batch 20

- Aerated phase
  - Total

- Composting period [days]: 0, 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84

- Total fresh matter [Mg/batch]
  - With high calorific fraction
  - Without high calorific fraction
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Mass balance – dry matter

![Graph showing dry matter balance over the composting period](graph.png)

- **Dry Matter Balance**
  - Red line: with high calorific fraction (batch 18)
  - Blue line: without high calorific fraction (batch 20)

- **Vertical Axis:**
  - Total dry matter [Mg/batch]

- **Horizontal Axis:**
  - Composting period [days]

- **Values:**
  - 60.5, 52.9, 39.2, 40.2, 38.7, 35.6

- **Aerated Phase:**
  - Batch 18: 24.0, 35.2
  - Batch 20: 26.9, 41.2

- **Total:**
  - Batch 18: 41.2
  - Batch 20: 41.2
Respiration rate

<table>
<thead>
<tr>
<th>Respiration rate [mg O₂/g]</th>
<th>Composting period [days]</th>
</tr>
</thead>
<tbody>
<tr>
<td>68.4</td>
<td>AT4</td>
</tr>
<tr>
<td>50.5</td>
<td></td>
</tr>
<tr>
<td>31.1</td>
<td>with high calorific fraction (batch 18)</td>
</tr>
<tr>
<td>23.0</td>
<td>without high calorific fraction (batch 20)</td>
</tr>
<tr>
<td>16.6</td>
<td></td>
</tr>
<tr>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>3.8</td>
<td></td>
</tr>
</tbody>
</table>
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TOC eluate in the solids

TOC eluate

- with high calorific fraction (batch 18)
- without high calorific fraction (batch 20)

TOC concentration [mg/l]

- 3120
- 2350
- 879
- 247
- 187

Composting period [days]

0 7 14 21 28 35 42 49 56 63 70 77 84

TOC eluate in the solids
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VOC in the exhaust air from the aeration of the windrow

VOC concentration

VOC concentration (mg/m³N)

0 0,5 1 1,5 2 2,5 3 3,5

time (days)

0 500 1000 1500 2000 2500

1688 1420 750 616 178 163 139 136 99
Performance of the biofilter-system

- **N2O**: 0,0 %
- **NH3**: 100 %
- **CH4**: 7,8 %
- **VOC**: 41,8 %

**Concentration [mg/m³]**
Performance of the biofilter-system

The graph illustrates the VOC concentration in mg/m³N over time, with the period of permanent aeration in days as the x-axis. The y-axis represents the level of VOC reduction. The biofilter input and output are shown with separate bars, and the level of reduction is indicated by the bars' color and position. The data shows a significant reduction in VOC levels over time, with 76.8% reduction at 1 day and 60.2% reduction by 2 days after starting the process.
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Tomato seeds tests
Temperature and tomato seeds inactivation

![Graph showing temperature and tomato seeds inactivation](image)
## Bioaerosols impact:

### Sampling on 27/5/04 Bacteria

<table>
<thead>
<tr>
<th>Details of Sampling</th>
<th>cfu/m³</th>
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</thead>
<tbody>
<tr>
<td>In turner prior to turning</td>
<td>833</td>
</tr>
<tr>
<td></td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Attached to turner outside</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>83</td>
</tr>
<tr>
<td>In hall prior to turning</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>Attached to outside of turner during turning</td>
<td>+110,667</td>
</tr>
<tr>
<td></td>
<td>+132,667</td>
</tr>
<tr>
<td>In turner during turning</td>
<td>416</td>
</tr>
<tr>
<td></td>
<td>250</td>
</tr>
<tr>
<td>In large pipe during/after turning</td>
<td>1,750</td>
</tr>
<tr>
<td></td>
<td>1,750</td>
</tr>
<tr>
<td>Biofilter during/after turning</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>1,166</td>
</tr>
</tbody>
</table>

*Sample 4 overloaded, more likely over $10^7$*

### Sampling on 27/5/04 Fungi

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<th>Details of Sampling</th>
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<tbody>
<tr>
<td>In turner prior to turning</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Attached to turner outside</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>In hall prior to turning</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Attached to outside of turner during turning</td>
<td>+6,583</td>
</tr>
<tr>
<td></td>
<td>+7,583</td>
</tr>
<tr>
<td>In turner during turning</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>In large pipe during/after turning</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Biofilter during/after turning</td>
<td>&lt; 100</td>
</tr>
</tbody>
</table>

*Sample four overloaded, more likely $10^7$ (of A. fumigatus only)*
Real life suitability:

- Ideal site size: > 20,000t/year (solid household waste)
- (Research Site was expanded to approx. 80,000t)
- No moving or electrical parts in buildings
- Sufficient air handling
- Sufficient irrigation
- Sufficient process monitoring and control
References:
Thank you for your attention!
Dipl. Ing Bernhard Gamerith