CO-COMPOSTING OF EDMONTON’S SEWAGE SLUDGE AND MUNICIPAL SOLID WASTE. – EFFECT OF WATER CONTENT ON COMPOST RESPIRATION

By

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Presentation Outline

- Introduction
- Environmental Significance of Metals
- Objective
- Materials and Methods
- Results
- Conclusions
- Recommendations
- Acknowledgments
Introduction

- TransAlta to design, build and operate an Edmonton co-composting facility
- Pilot plant operated from Aug To Dec, 1997
- Pilot plant used a Bedminster in-vessel digester
- Materials used were Edmonton MSW and dewatered sewage sludges
Compost Maturity Measures

- Respiration ($< 150 \text{ mg } O_2/\text{kg VS/hr}$)
- C:N ratio ($\leq 25$)
- Seed germination and plant growth
- Temperature
- Time for curing
Respiration

- A measure of biological activity in both soil, aquatic and wastewater treatment systems
- Considered a measure of soil health
- Aquatic and wastewater based measurements use biological oxygen demand (BOD)
- Soil based measurements use respiration rates under varying water content
Objective

- To assess the use of a soil based method for the measurement of respiration rates of compost materials with changes in compost age, source and water contents
Materials and Methods

- Compost samples were obtained from field windrows.
- Compost materials were air dried and sieved to < 2 mm.
- Water was added to compost (50 g) and incubated in sealed 2 L mason jars.
Materials and Methods

- Air samples (5 ml) were withdrawn from the sealed jars (using a septum inserted in the lid)
- $\text{CO}_2$ evolution and $\text{O}_2$ consumption were measured in the air samples using MTI M200 GC containing Haysep and Mol Sieve columns
Results

- Compost properties
- Compost respiration changes with water contents and incubation time
- Respiration during incubation of summer and winter composted samples
# Compost Properties

<table>
<thead>
<tr>
<th>Material</th>
<th>Bulk Density (g/cm³)</th>
<th>Moisture (%)</th>
<th>Total C (%)</th>
<th>Total N (%)</th>
<th>Total S (%)</th>
<th>C:N Ratio</th>
<th>Ash (%)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW</td>
<td>0.12</td>
<td>44.1</td>
<td>41.7</td>
<td>1.20</td>
<td>0.17</td>
<td>43</td>
<td>10.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Sludge</td>
<td>0.76</td>
<td>67.4</td>
<td>22.2</td>
<td>2.64</td>
<td>1.02</td>
<td>8</td>
<td>54.4</td>
<td>7.4</td>
</tr>
<tr>
<td>Compost</td>
<td>0.70</td>
<td>40.1</td>
<td>16.0</td>
<td>1.00</td>
<td>0.41</td>
<td>16</td>
<td>66.3</td>
<td>7.8</td>
</tr>
</tbody>
</table>
Changes in CO₂ Evolution With Water Contents and Incubation Time
Changes in Mean CO$_2$ Evolution With Compost Water Contents
O₂ Consumption During Incubation of a Summer Composted Sample
O$_2$ Consumption During Incubation of a Winter Composted Sample
Conclusions

- Respiration of compost samples exhibited a maxima at intermediate water contents.
- Respiration rates declined with time both under field and laboratory conditions.
- Soil based procedures exhibit “stability” at a respiration rate congruent with regulatory needs ($< 150 \text{ mg } \text{O}_2/\text{kg VS/hr}$).
Recommendations

- Soil based respiration procedures should be considered for adoption as another measure of compost maturity
- Assessment and comparison of existing and soil based respiration procedures are needed
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