Findings from Co-Composting Operations at a Fecal Sludge Treatment Plant (FSTP), Devanahalli, India
BACKGROUND

TOWN PROFILE

Devanahalli
30000 Population

Need for FSM

FSM INTERVENTION

6 KLD FSTP

Anaerobic System + Dewatering

END PRODUCTS

Treated Water

Dried Sludge

CHALLENGES

Helminths in dried sludge
METHODOLOGY / PROCESS

Assessment of Options
- Thermal Heating
- Co-composting
- Solar drying or lime addition

Feasibility
- Co-composting – Less capex and readily available bulking agent
- Market Value for end product

Co-composting methodology
- Aerobic Windrow method
- Proportioned (MSW:FS ratio)
- Periodical turning
OBJECTIVE OF THE STUDY

- Co-Composting
  - Process Suitability
  - Helminth Deactivation
    - Lab Analysis – QA/QC
    - Different Bulking agents
    - Different MSW:FS
    - Optimize Composting environment (Temp)
  - Increase Carbon Content
    - Frequency of Turning
    - Reducing the process duration
  - Process Optimization
CO-COMPOSTING PROCESS

FEED STOCKS USED
1. Municipal Solid waste (Segregated)
2. Coconut Coir
3. Paddy Straw
4. Faecal Sludge
5. Leaf Litters

PARAMETER CONTROLLED:
1. Temperature
2. Moisture content
3. FS:MSW ratio
4. Turning frequency

Windrow of 6 feet
TURNING PROCESS

Key Observations

1. Due increase in temperature, heat was released as fumes while turning
2. Frequent turning – 7-10 days interval
3. Ensured faster degradation of waste
4. Faster Reduction of volume
**RESULTS**

**Variation in Temperature**

Key observations
Temperature above 60ºC helps in deactivation of Helminth eggs

<table>
<thead>
<tr>
<th>MICRO-ORGANISMS</th>
<th>DURATION FOR THE Thermal Inactivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escherichia coli</td>
<td>Death within 1 hour at 55°C and within 15-20 minutes at 60°C</td>
</tr>
<tr>
<td>Salmonella Sp.</td>
<td>Growth ends at 46°C, death within 30 minutes at 55-60°C and within 20 minutes at 60°C</td>
</tr>
<tr>
<td>Entamoeba histolytica Cysts</td>
<td>Death within a few minutes at 45°C and within a few seconds at 55°C</td>
</tr>
<tr>
<td>Taenia saginata</td>
<td>Death within few minutes at 55 °C</td>
</tr>
<tr>
<td>Ascaris Lumbricoides Eggs</td>
<td>Death is less than 1 hour at temperature over 50°C</td>
</tr>
</tbody>
</table>
## ANALYSIS VALUES OF WINDROW

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Organic compost (FCO, 2009)</th>
<th>Results of 88 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.5 – 7.5</td>
<td>7.07</td>
</tr>
<tr>
<td>Conductivity (as dsm⁻¹), not more than</td>
<td>4</td>
<td>1.24</td>
</tr>
<tr>
<td>Moisture % by weight, max</td>
<td>15 – 25</td>
<td>30.2</td>
</tr>
<tr>
<td>Bulk density (g/cm³)</td>
<td>Less than 1.0</td>
<td>0.77</td>
</tr>
<tr>
<td>Total Organic Carbon, % by weight, minimum</td>
<td>12</td>
<td>18.2</td>
</tr>
<tr>
<td>Total N % by weight, minimum</td>
<td>0.8</td>
<td>0.23</td>
</tr>
<tr>
<td>Total P205 % by weight, minimum</td>
<td>0.4</td>
<td>0.2</td>
</tr>
</tbody>
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<tr>
<td>Total P205 % by weight, min</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Total K20 % by weight, min</td>
<td>0.4</td>
<td>0.98</td>
</tr>
<tr>
<td>C:N ratio</td>
<td>&lt;20</td>
<td>12.1</td>
</tr>
<tr>
<td>Lead (mg/kg)</td>
<td>100</td>
<td>84.9</td>
</tr>
<tr>
<td>Chromium (mg/kg)</td>
<td>50</td>
<td>31.1</td>
</tr>
<tr>
<td>Cadmium</td>
<td>5</td>
<td>0.37</td>
</tr>
<tr>
<td>Nickel (mg/kg)</td>
<td>50</td>
<td>23</td>
</tr>
</tbody>
</table>

### Key observations
All the parameters are meeting the FCO standards
DURATION OF THE PROCESS = 80-90 days
## ANALYSIS VALUES OF MICROBES

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treated faecal sludge</th>
<th>15 days of compost sample</th>
<th>60 days of compost sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal coil in CFU/ml</td>
<td>$60 \times 10^5$</td>
<td>12000</td>
<td>$70 \times 10^5$</td>
</tr>
<tr>
<td>E.coil in CFU/ml</td>
<td>$29 \times 10^5$</td>
<td>Absent</td>
<td>$10 \times 10^5$</td>
</tr>
<tr>
<td>Helminth Eggs in EPG</td>
<td>100</td>
<td>Absent</td>
<td>Absent</td>
</tr>
</tbody>
</table>

### Key observations
Due to increase in the moisture content E.coil and Fecal coil forms count has increased.
TOTAL FAECAL COLI FORMS AND E.COLI COLONIES
Key observations
Percentage of feedstock recovery lies between 30-33%
CONCLUSION

• Maintaining optimum moisture content and turning frequencies of 7 days achieved maximum deactivation of pathogens.
• FS : MSW Ratio of 1:1.5 and 1:2 was found to be the optimal process.
• On application of EM and cow dung slurry, windrow with EM has high composting rate than cow dung.
• Seeding of EM in windrows has met the pathogen reduction within the permissible limits.
• Pathogen reduction on seeding of cow dung slurry has not met standards.
• Might be due to presence of microbes in cow dung slurry caused/impacted to increase the E.coil and Faecal coliforms count.
KEY LEARNINGS

• The provisions for various parameters to guide the quality of the manure are too stringent

• Need for policy recommendations with an aim to correct short comings to benefit the farming community for co-compost utilization

• Need a ‘Policy Brief’ to consider Faecal sludge byproducts as organic manure by providing evidences through study findings