Aerobic, High Temperature Compost
Tairo Oshima
## Advantages of Composting over Burning

<table>
<thead>
<tr>
<th></th>
<th>Composting</th>
<th>Burning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is Oil necessary?</td>
<td>No (self-heating)</td>
<td>Yes</td>
</tr>
<tr>
<td>Cost</td>
<td>Cheap</td>
<td>Expensive</td>
</tr>
<tr>
<td>CO$_2$ generated</td>
<td>Fewer</td>
<td>Larger</td>
</tr>
<tr>
<td>Pollution</td>
<td>No toxic gas generation</td>
<td>NO x, SO x, dioxin etc will be produced</td>
</tr>
<tr>
<td>Utilization of the final products</td>
<td>Fertilizer</td>
<td>Useless</td>
</tr>
<tr>
<td>Wide space, Long time</td>
<td>Necessary</td>
<td>No</td>
</tr>
</tbody>
</table>
Microbes can eat “almost” everything

• Toxic substances such as KCN, dioxins

• Substances hard to digest such as bones, skins, papers, woods, etc

• However, microbes cannot (or can only slowly) eat heavy metals, salts, most of synthetic plastics, etc
Composting has a long history
An example of old fashioned compost
### Uniqueness of Composting Invented by Sanyu Company (=our compost)

<table>
<thead>
<tr>
<th></th>
<th>Old fashioned</th>
<th>High Temp., Aerobic, Composting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature inside Degrading power Sterilizing power</td>
<td>~70°C Normal Low</td>
<td>&gt; 95°C Higher High</td>
</tr>
<tr>
<td>Aerobic Air supply Bad smell Methane production Reduction of mass</td>
<td>Partially anaerobic No Strong Yes Moderate</td>
<td>Strongly aerobic Compulsory Almost no No Remarkable</td>
</tr>
<tr>
<td>Additives (Chips, Straw, etc)</td>
<td>Required</td>
<td>Not necessary</td>
</tr>
</tbody>
</table>
Temperature inside is over 100°C
Structure of a compost pile

* Air is constantly supplied through holes of 2–3 pipes buried in the floor of each fermentation compartment.

* Physical parameters such as water content, pH, temperature, etc, and chemical compositions such as nitrogen and carbon contents, are changeable depending upon sites and composting stages and other conditions.
Advantages of our aerobic, high temperature composting

• Aerobic $\rightarrow$ smell can be reduced
  no production of dangerous substances

• High temperature $\rightarrow$ rapid degradation
  safe
  kill pathogenic bacteria
  kill seeds of weed
Microbes in compost piles

• How many? More than 100, 000,000,000 per 1 g and 1,000 different species. But no one knows exactly. Why?

  Because compost is a 「super-organism」

  1  Co-operation of too many organisms
  2  99% of them can not grow in a lab
  3  Changeable depending on time, place, operation, low materials, and so on

• We started to analyze using the state-of-the-art technology=DNA technology
Microbial analysis using DNA technologies

On an aeration pipe

- Anoxybacillus sp.
- Planifilum yunnanensis
- Sulfolobacillus sp.
- Bacillus sp.
- Thermoanaerobacter sp.

On the middle of two aeration pipes

- Geobacillus toebi
- Anoxybacillus toebi
- Ureibacillus thermosphaericus
- Bacillus licheniformis
- Planifilum sp.
- Planifilum fimeticola
- Geobacillus sp.
We discovered new thermophilic bacteria

One example is *Calditerricola satsumensis* YMO81

The strain is the championship holder in terms of the highest growth temperature among the soil microorganisms.
We devised “Laboratory Reactors” in which fermentation processes inside of our compost piles are reproduced.

2 liter reactor

8 liter reactor
Dead bodies of rats disappear within a day

Three dead bodies of rats were added in the morning.

After 1 H

In the evening of the day
Recently we treated dead bodies of cow which were contaminated with radio active Cs in Fukushima due to disaster of the Atomic Power House.

- We collected cows in the evacuation zone near-by the Atomic Power House in Fukushima (Next slides)
- After radio-activities were measured, the dead bodies were treated in our compost piles
Dead bodies of cow were disappeared after 8 weeks

After 1 week

After 4 weeks

After 8 weeks, I could see only nose rings!
Thank you for your kind attention.
The building is my research institute.