Resource Recovery from Kitchen Garbage by Using Microbial Fuel Cell

M. Azizul Moqsud & Kiyoshi Omine
Department of Civil Engineering
Kyushu University
Japan
moqsud@gmail.com

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What is **waste**?

**Waste** can be defined as useless, unwanted and discarded materials coming from production and consumption.

Such as **kitchen garbage**, Bio-degradable municipal waste (BMW), municipal solid waste (MSW) etc.
• **Solid waste management** has become a serious environmental problem all over the world.

• **Resource recovery** from solid waste and **Recycling** is considered as a viable management option.
• **Recycling** is a key component of **3R** the "Reduce, Reuse, Recycle" waste hierarchy.
Characteristics of residential waste:

A Large Portion of Total Waste is Biodegradable waste both in Developing and Industrialized countries.
According to Power Ministry, Bangladesh produces up to 4,000MW of electricity everyday against a minimum daily demand for 6,000MW.

In the rural areas the demand stands at some 2,400 MW per day but the Rural Electrification Board (REB) can supply barely half of that.

In the world, 1.4 to 1.6 billion people according to the U.N. live without electricity!!
Energy, in any form, plays the most important role in the modern world. We need energy especially **Green** electrical energy in our daily needs.
Purpose of study

- To develop a Microbial Fuel cell by using the kitchen garbage (KG) for bio-electricity generation

- To convert/recycled KG for soil conditioner by Hybrid composting method as a by-product of bio-electricity.
Microbial Fuel Cells (MFC)
What is MFC???

Microbial fuel cell (MFC)s are bio-electrochemical devices which convert biomass into electricity through the metabolic activity of the microorganisms.

Living Bacteria generate electricity in the normal course of metabolizing nutrients. This metabolic process delivers sustainable, renewable, commercially valuable electricity.
Schematic diagram of the laboratory test of MFC

- Cathode (carbon fiber)
- Anode (carbon fiber)
- Paper filter & activated carbon
- Arcylic container
- Biomass from kitchen garbage
- 10 cm
<table>
<thead>
<tr>
<th>Materials (Gram)</th>
<th>EM</th>
<th>Leaf Mold</th>
<th>Kitchen Garbage</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>15</td>
<td>120</td>
<td>120</td>
<td>80</td>
</tr>
</tbody>
</table>
Methods
Data captured during Laboratory test

- Voltage in every 20 minutes
- Temperature (Deg. Cel) in every 20 minutes

At room temperature at 25 Degree Celcius.
Total Test Duration 45 days
Peak Voltage (590 mV) reached around 21 days
Variation of Power density with duration
Various Parameters showing the performance of MFC

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{max}}$ (mV)</td>
<td>590</td>
</tr>
<tr>
<td>Current at $V_{\text{max}}$ (mA)</td>
<td>11.56</td>
</tr>
<tr>
<td>$P_{\text{max}}$ (mW)</td>
<td>6.82</td>
</tr>
<tr>
<td>Power Density (mW/m$^2$)</td>
<td>682</td>
</tr>
<tr>
<td>Current Density (mA/m$^2$)</td>
<td>1156</td>
</tr>
</tbody>
</table>

N.B: $V=I \times R$, $P=V \times I$,
Nutrients presence in different samples of compost in in-vessel composting reactor and MFC
Conclusions

- MFC by using Kitchen Garbage is proved to be a good way for bio-electricity generation

- Sustainable, Renewable, Green energy.

- The by-product of the electricity generation by MFC can be used as soil conditioner
ENVIRONMENTAL AND HEALTH PROBLEMS IN URBAN AREAS DUE TO UNMANAGED WASTE

ORGANIC MATTER DEPLETION IN THE SOIL OF RURAL AREAS

ADDRESSING 3 MAJOR PROBLEMS

- Bio-electricity generation from organic waste
- Converting Organic Waste Into Compost
- Use of Compost/Enriched Compost in Agriculture
Think globally but act locally and personally to make beautiful world for the future generation...

Thank you so much for your attention..

17th December 2010