ELIMINATE CARBON EMISSIONS PRIVATE LIMITED

Date: January 9, 2012

Subject: *Request for quotation from NABL Certified Laboratory (preferably) to measure emissions of Methane generated from bio-composting of organic waste from a home composting system.*

Project Description:

Objective – Conduct methane emission testing to measure anticipated low-methane concentration levels (detection range of µL L^{-1}) from Organic Household Waste (OHW) to develop a Emission Factor (kg CH4/kg of kitchen waste composted) for the purposes of Ecolabelling (as per India's 'Green Signal' Ecolabelling body's methodology for composting products) the 'Daily Dump's (Client) Khamba Home-Composting Product.

Methodology: the methodology to be adopted for methane emissions measurement is the Static Flux Chamber Method as described in Sections 2.5 and 2.6 of the following research study (attached herewith):
"Greenhouse gas emissions from home composting of organic household waste"
J.K. Andersen *, A. Boldrin, T.H. Christensen, C. Scheutz, Department of Environmental Engineering, Technical University of Denmark, DK-2800, Kongens Lyngby, Denmark

Parameters for measurement:

Sr. No.	Parameter	Frequency / Range
1.	Qty. of OHW added per day	Daily, 0.5 to 1 kg/day for 2 to 3 weeks till unit ¾ full.
2	Mixing frequency	1 times / 3 days during active period and no mixing during maturation phase)
2.	Moisture content of waste	one sample per week
3.	Ambient and enclosed (within composting unit) air temperature	2 times/week
4.	Methane Concentration within contained air-space – daily cycle	1 time daily (6 minute period before addition of waste during active phase), 2 times/week during maturation phase
5.	Methane Concentration within contained air-space – weekly cycle	1 time per week (60 minute period after addition of waste during active phase)
6.	Air volume within Static Flux Chamber	Daily (before addition of waste)

Project time frame:
Active period – 2 to 3 weeks (with daily addition of OHW and 1 times/3 days mixing frequency))
Maturation period – 3 weeks (with no addition or mixing of OHW)

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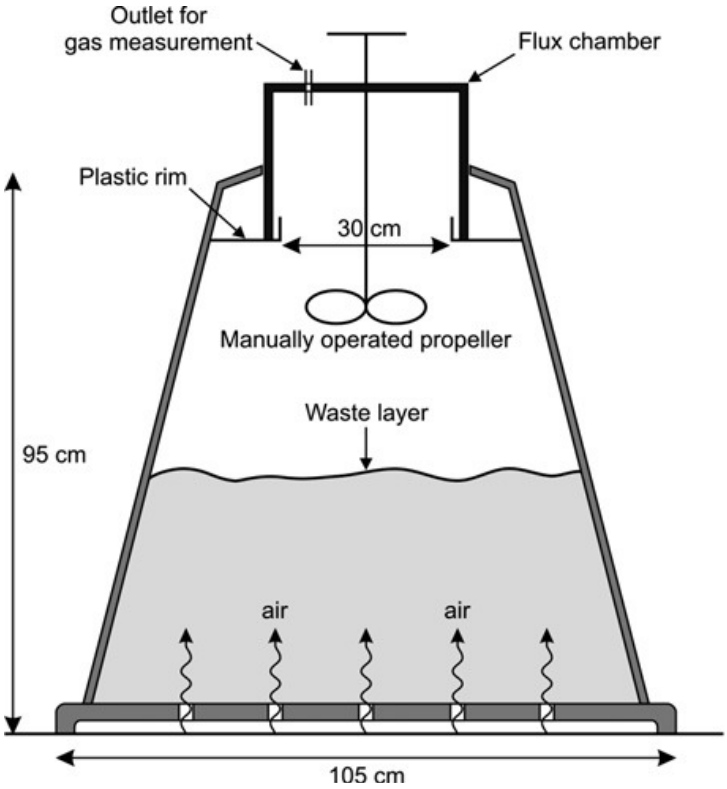
Experimental Setup:

The experimental setup for the project shall be approximately similar to the schematic presented below – with adequate customization to accommodate for the specific dimensions and design/operational principles of the earthen 'Gamla' product.



Data Analysis Protocol and Deliverables:

1. Methane concentrations will be analyzed using equipment equivalent to a photo acoustic gas monitor (INNOVA 1312, Lumasense Technologies) or Nondispersive Infrared Sensor (NDIR) sensor which measures concentrations in real time, has high accuracy over a broad concentration range and with minimal re-calibration requirements during the project period of 6 weeks. The calibration shall be in the range of 0.03–50 ppmv for methane measurements.

2. The data deliverable for the project shall consist of Emissions Flux (E_{CH4}) (in g/h) of CH4 plotted against time (for the entire duration of the project) where E_{CH4} is calculated using the following relationship:

$E_{CH4} = dC_{CH4}/dt * V_{total,}$

Where V_{total} is the volume of the flux chamber plus the volume of the head space in the composting unit, which decreases over time as the unit is filled with waste.

3. The data should finally be converted to yield total methane emissions (mass basis) for the total composting cycle by integrating under the concentration vs. time curve for the entire project period (6 weeks)

Other Notes:

1. The concentrations of gases inside the composting unit are expected to be elevated because of the build-up under the lid. Before measuring the emission of gases, the air in the composting units should therefore, exchanged to start the measurement as close to ambient concentrations as possible.
2. The flux chamber, when placed on top of the composting unit, is expected to witness the emission of gases from the compost material resulting in a linear increase of the gas concentration over time period of measurement.
3. It is assumed that the entire volume of air over the waste is totally mixed during emission measurements and this should be ensured by mixing the air manually with a propeller.
4. The head space volume must be estimated for every emission measurement by measuring the height of the waste in the composting units.
5. The inlet to the gas measurement equipment (analyser) should be equipped with a water filter (such as a membrane separator) to ensure that no moisture is transferred to the measuring chamber.
6. The CH4 emissions are expected to be mostly affected by mixing the material. The emission of CH4 is anticipated to increase significantly after mixing the material but also decrease drastically to the original level within the first hour. This must be borne in mind when mixing the material and then replacing the static flux chamber swiftly to ensure measurement of gas concentration immediately after mixing.

Laboratories interested in executing the entire project with OHW material, Composting Cycle Maintenance support supplied by Client (us), and equipment purchase (on actuals by Client) should respond accordingly with a firm quotation for:

1. Testing and Measurement Services
2. Data Analysis Services

Sincerely,

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