AM0025 -Avoided emissions from organic waste through alternative waste treatment processes

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Technology Details

- This MSW treatment system involves setting up a facility using waste sorting technology to
  - separate inert components for land filling,
  - separating combustible material for use as RDF and
  - to use controlled hybrid biological process to treat the biodegradable fraction of waste so that biogas and compost is obtained from the biodegradable component.
- The inert fraction is separated and dumped into landfill.
- The combustible fraction of MSW is mechanically separated and made into RDF for use as fuel.
- The organic or biodegradable fraction is put into a vessel to generate biogas and compost. This hybrid technology uses a bioconversion process, which is a patented biological process converting organic content of MSW into compost and biogas which uses a Distributive Control System (DCS) to ensure optimum conditions during aerobic and anaerobic phases

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Bioconversion Process

- The 4-stage bioconversion process occurring in the same vessel involves:

a. Aerobic processing – After organic fraction of MSW is mixed and pulverized it is loaded into a treatment vessel where **it undergoes aerobic treatment for 5 days during the loading**. The five days also involve daily loading of biodegradable fraction of MSW.

b. Anaerobic processing – After five days of loading and aerobic process the vessel's phase is changed to anaerobic phase and regulated bacterial inoculum is introduced in the form of water solution. The anaerobic digestion process is carried out for 7 days during which biogas containing approx. 60% methane is generated due to anaerobic digestion of organic waste and this gas is used to generate electricity.

c. Secondary aerobic processing – After anaerobic processing, the water is drained from the vessel, air is reintroduced and **secondary aerobic processing occurs to convert the material into compost for another 7 days.**

d. Removal – Compost is removed over 2 days from the treatment vessel available for retail sale, or use in agriculture. Vessels and system are prepared for the next cycle.

Bioconversion Process

- The Bioconversion cycle occurs over a 21 day period and is managed by a fully-automated control system that constantly monitors and adjusts vessel conditions to deliver an optimal result.

- Aeration system is managed during the aerobic process by DCS that **monitors the oxygen levels inside the vessel via an in-line gas analyzer** that continuously samples the process inside the sealed vessel from 6-ports.

- The DCS activates the addition of air **when oxygen levels fall below a predefined set-point**.

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Issues with current version of methodology

1. Project emissions from composting

2. Emission from leakage from digester

Project emissions from composting

As per current methodology (AM0025 version 12)

- *During the composting process, aerobic conditions are neither completely reached in all areas nor at all times. Pockets of anaerobic conditions - isolated areas in the composting heap where oxygen concentrations are so low that the biodegradation process turns anaerobic - may occur. The emission behaviour of such pockets is comparable to the anaerobic situation in a landfill. This is a potential emission source for methane similar to anaerobic conditions which occur in unmanaged landfills.*

- *If oxygen content is below 5% - 7.5%, aerobic composting processes are replaced by anaerobic processes. To determine the oxygen content during the process, project participants shall measure the oxygen content according to a predetermined sampling scheme and frequency*

- *The percentage of the measurements that show **oxygen content below 10%** is presumed to be **equal to the share of waste that degrades under anaerobic conditions** (i.e. that degrades as if it were landfilled) hence the emissions caused by this share are calculated as project emissions ex-post on an annual basis*

Project emissions from composting

In the proposed bioconversion process

- The monitoring of anaerobic conditions under the aerobic process would be only applicable during the first 5 days and next 7 days of aerobic conditions (after seven days of anaerobic process) in the entire 21 day cycle. The last 2 days of the 21 day cycle are related to controlled extraction of compost and it can be assumed that no methane is generated during this short time.

- The aeration system is managed during the aerobic process by a Distributive Control System (DCS) that monitors the oxygen levels inside the vessel via **an in-line gas analyzer that continuously samples the process** inside the sealed vessel from 6-ports. The DCS activates the **addition of air when oxygen levels fall below a predefined set-point**. The odour control system has a separate gas analyzer that measures the CH4 levels of the air coming from the vessel during aerobic composting. **If CH4 is greater than 1% then the gas is diverted to the flare and the CH4 is combusted to CO_2**

- **To summarize - the share of the waste that degrades under anaerobic conditions from the composting process will be minimal, as oxygen levels will be continuously monitored, and air will be added in case those levels fall below a predefined set-point.**

Project emissions from composting

Suggested revisions

Expand **methodology applicability condition** from

'A composting process in aerobic conditions'

to

*'A composting process in aerobic conditions **which may involve open windrow composting, aerobic composting in closed vessels under controlled conditions or other similar methods**'*

Provide additional option in the section **Emissions from composting (PEc,y)**

In case of composting in vessels under controlled conditions where the DCS activates the addition of air when oxygen levels fall below a predefined set-point **assuring minimal anaerobic conditions during aerobic composting**, **there is no requirement of sampling,** with following conditions.

- For monitoring of the oxygen levels inside the vessel, an in-line gas analyzer with continuous sampling of the process inside the sealed vessel should be used. Aeration system to introduce oxygen when oxygen levels fall below a predefined set-point should be in place.

Project emissions from composting

- A separate gas analyzer that measures the CH_4 levels of the air coming from the vessel during aerobic composting should be in place and if CH_4 level is greater than 1% then the gas should be diverted to the flare and the CH_4 should be combusted to CO_2.
- Equation (10) in the methodology should be used for the project emissions from flaring of the methane generated due to anaerobic conditions during aerobic composting.

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Emission from leakage from digester

As per current methodology (AM0025 version 12)

- A potential source of project emissions is the physical leakage of CH_4 from the anaerobic digester. Three options are provided for quantifying these emissions, in the following **preferential order**:

  - Option 1: Monitoring the actual quantity of the gas leakage;
  - Option 2: Applying an appropriate IPCC physical leakage default factor, justifying the selection
  - Option 3: Applying a physical leakage factor of zero where advanced technology used by the project activity prevents any physical leakage. In such cases, the project proponent must provide the DOE with the details of the technology to prove that the zero leakage factor is justified.

- In the technology discussed the vessels are pressure tested for gas and water leaks prior to commencement of operation. In such cases the preferential order may not be applicable. Hence i**t is suggested to remove 'preferential order'.**

THANK YOU