Turning Food Waste into Energy at the East Bay Municipal Utility District:

Investigating the Anaerobic Digestion Process to Recycle Post-Consumer Food Waste

Pilot demonstration project shows that 100 tons of food waste anaerobically digested per day produces enough energy to power up to 1,400 homes.

Why Anaerobic Digestion to Recycle Food Waste?

Wastewater treatment facilities have successfully used anaerobic digestion for many years to treat solids in municipal wastewater and produce beneficial end products: methane gas and fertilizer. In California, approximately 137 wastewater treatment plants have anaerobic digesters for sludge, with an estimated excess capacity of 15-30%. This excess capacity could provide a potent recycling opportunity for post-consumer food waste in California. Anaerobic digestion also:

- Reduces volatile organic compounds (VOC's) if used prior to composting
- Produces biogas that can be used for energy
- Reduces solids prior to transporting to a compost facility

Food waste being unloaded at the EBMUD Treatment Plant

Food Waste is:

- The single largest category of municipal solid waste (MSW) going to landfills in California at 5.9 million tons or 16% of total MSW (CIWMB, 1999).
- A waste that consists of food scraps from restaurants, produce markets, fish markets, school cafeterias, homes, and wherever else food is prepared.
- A waste primarily disposed of in landfills, but about 2.5% is also being composted to produce a fertilizer.
- A waste that is high in energy potential that should be recovered, rather than being lost in a landfill.

Increased Food Waste Diversion:

Many local and state waste management agencies throughout the country are requiring increased solid waste diversion from landfills. In order to encourage food waste diversion from landfills, EPA is interested in developing alternatives to landfill disposal. In 2006, EPA provided a grant to the East Bay Municipal Utility District (EBMUD) in Oakland, California to investigate anaerobic digestion of food waste. The purpose of the study was to identify design and operating criteria for anaerobic digestion of food waste, and to compare food waste digestion to that of municipal wastewater solids digestion. Processing involves creating a slurry from the presorted food waste and further reducing contaminants and food waste particle size prior to digester feeding. Food waste processing using other methods may not produce the same results.

Food waste delivery to the East Bay Municipal Utility District's wastewater treatment plant. The food waste is collected by a hauler and pre-processed by screening, grinding, and removing metal pieces. A typical delivery is approximately 20 tons total weight

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How does anaerobic digestion of food waste compare to municipal wastewater solids?

Materials and Methods

East Bay Municipal Utility District (EBMUD) operated two 30-liter bench-scale digesters at mesophilic and thermophilic temperatures and at 15-, 10-, and 5– day solids residence times during the study. The digesters were fed food waste pulp produced by the EBMUD food waste process. The food waste evaluated during this study is representative of food wastes available from restaurants, produce markets, fish markets and wherever else food is prepared throughout California and around the country.

Key Study Findings

- **Methane Generation:**
  - Anaerobic digestion of food waste provides approximately three to three and a half more methane production per volume of digester (2,300 to 3,000 ft³ per 1,000 ft³ of digester volume) than does municipal wastewater solids digestion (750 ft³ per day per 1,000 ft³ of digester volume).
    - The study found that the methane potential of biosolids is around 120 m³ gas/ton and food waste around 367 m³ gas/ton
  - **Anaerobically digesting 100 tons of food waste per day, 5 days a week, provides sufficient power for an estimated 800 to 1,400 homes for one year.**

- **Solids Reduction:**
  - Food waste digestion results in half the residual produced after digestion, compared to residual biosolids from municipal wastewater treatment sludge digestion. This residual can then be composted for further use.
  - Food waste contains more biodegradable solids, based on a higher volatile solids percentage (86% to 90%), than does municipal wastewater treatment solids (70% to 80%).
  - Because food waste is more readily biodegradable than municipal wastewater solids, a shorter anaerobic digestion solids residence time is needed.
  - The shorter residence time means that food waste can be recycled in smaller digesters than municipal solids, resulting in lower capital costs for new digesters.
  - An anaerobic digester can accept much more food waste at one time than municipal wastewater solids without adverse process impacts.
  - To illustrate: volatile solids (VS) loading rates of 0.53 lb/ft³-day and chemical oxygen demand (COD) loading rates of 1.1 lb/ft³-day rates for food waste are easily handled, but recommended maximum loading rates for municipal solids are only 0.1-0.2 lb VS/ft³-day and 0.06-0.3 lb COD/ft³-day, respectively.

Food Waste vs. Wastewater Solids Comparison

Parameter	Food Waste Pulp	Wastewater Solids
Volatile Solids in Feed (%)	85-90	70-80
Volatile Solids Loading (lbs/ft3-day)	0.60 +	0.20 max
COD Loading (lbs/ft3-day)	1.25 +	0.06-0.30
Total Solid Fed (%)	10+	4
Volatile Solids Reduction (%)	80	56
Hydraulic Detention Time (days)	10	15
Methane Gas Produced (meter³/ton)	367	120
Gas Produced (liters/liter of feed)	58	17
Biosolids Produced (lbs/lbs fed)	0.28	0.55

For More Information:

If you have questions or concerns, please contact any of the people listed below.

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