Anaerobic Digestion Process

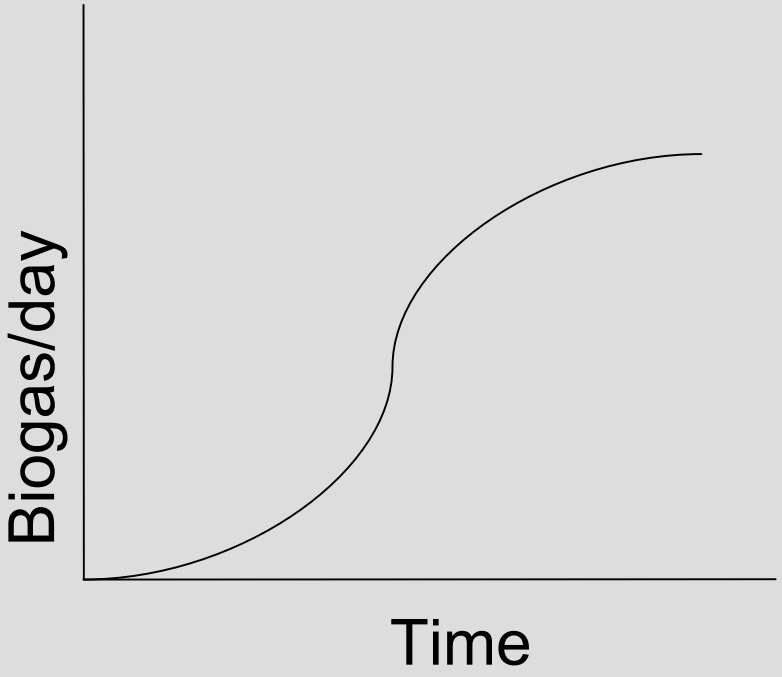
What is an Anaerobic Digester?

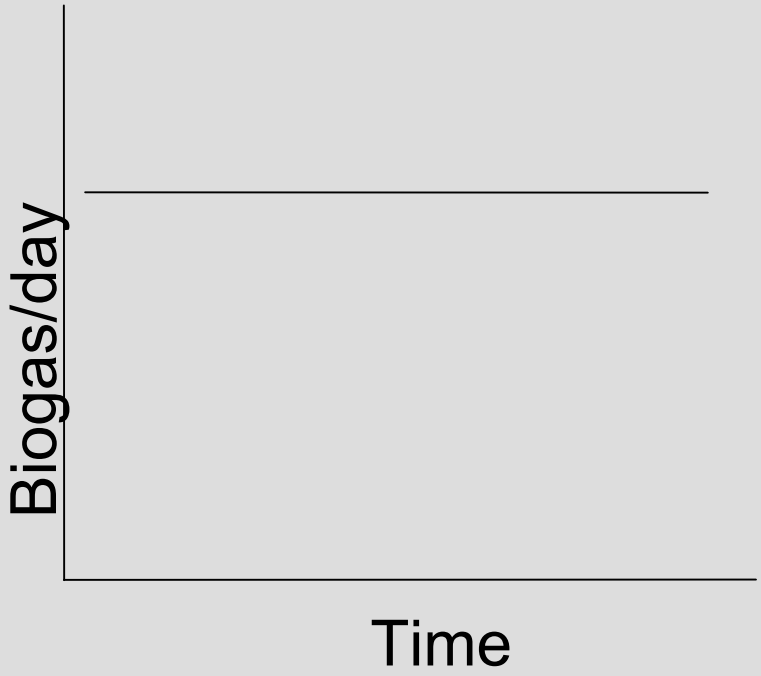
- A vessel that carries out the microbial fermentation of organic matter into methane gas
- A digester is airtight, needs a pressure differential for the movement of gas, and has multiple phases i.e. Liquid and gas
- A anaerobic digester needs to be loaded and unloaded

Batch and Continuous Digestion

- Batch digestion is carried out by loading a fermenter once with inoculated organic matter and allowing the microbial community to acclimatize
- Continuous digestion is carried out by feeding and unloading a digester on a time basis (usually daily) in accordance with certain parameters

Batch vs Continuous Fermentations

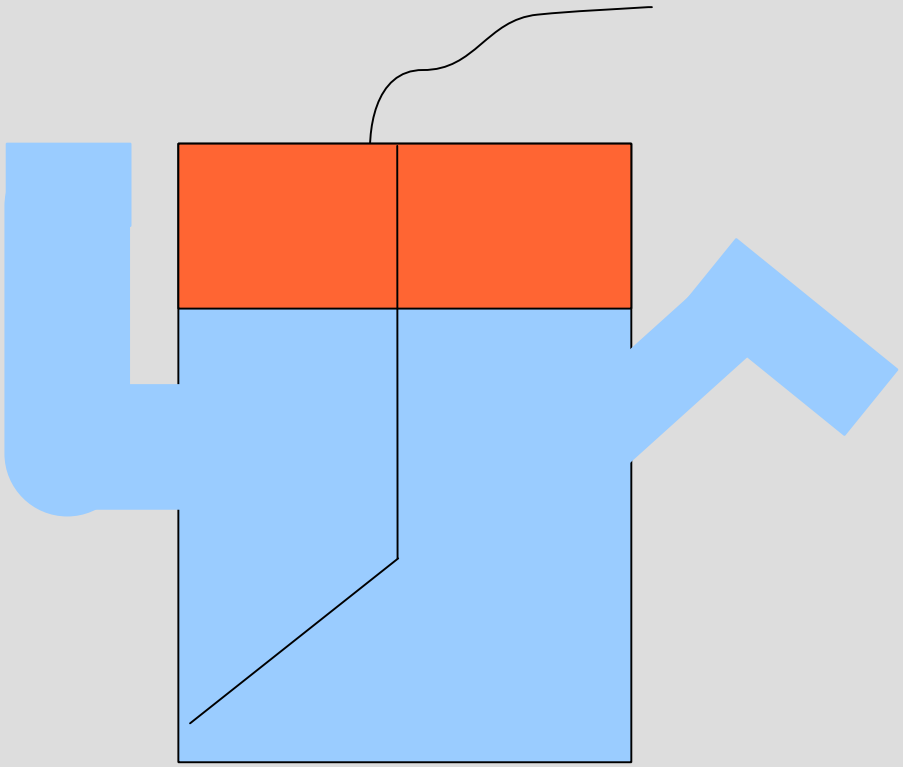




Anaerobic Digestion Terminology

- Reactor Volume
- Head Space
- Active Volume
- Influent/Effluent
- Hydraulic Retention Time
- Organic Loading Rate
- Total Solids
- Volatile Solids

Parts of an Anaerobic Digester



- Influent
- Effluent
- Head Space
- Reactor Volume
- Gas Collection

Hydraulic Retention Time

- Period of time for turnover of active digester volume of a continuous fed digester
- Goal is to produce maximum Biogas/unit time
- Prevents Microbial Washout
- Mediates fermentation

Organic Loading Rate

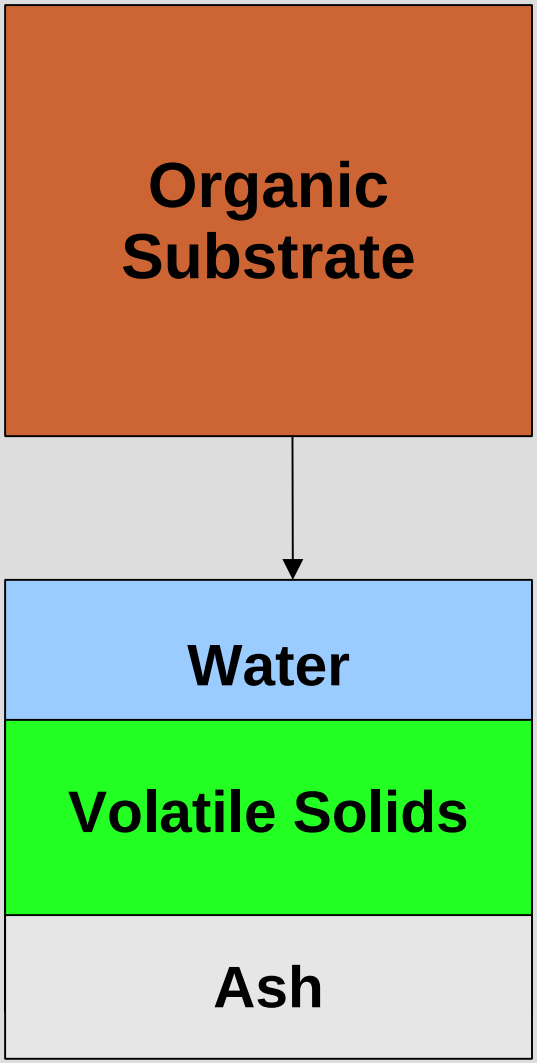
- The amount of “stuff” (organics) added to a digester volume to ferment into Biogas

- Defined in continuous fermentations as loading per day

- Grams/Liter/Day

Total Solids, Volatile Solids

- Measure of the amount organics in a substrate for
- Total Solids is the dry weight in a sample
- Volatile Solids are the portion left over from ash



Temperature

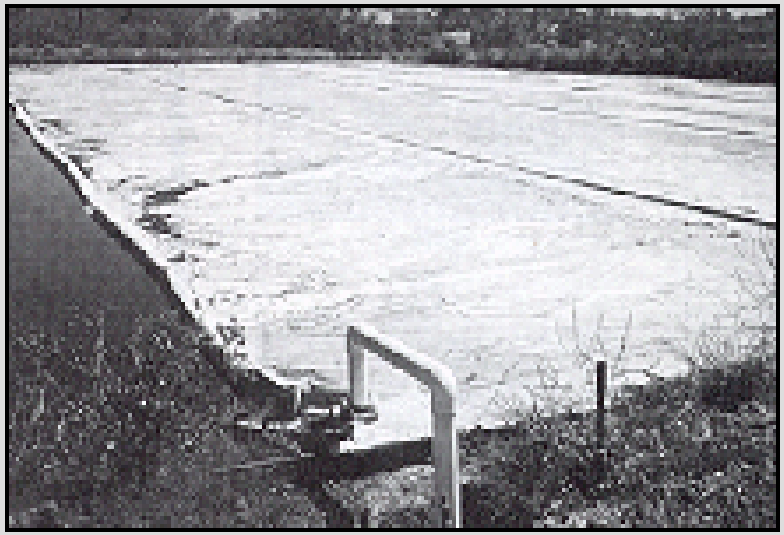
- Temperature affects fermentation kinetics
- Psycrophilic- 0-5 °C
- Mesophilic- 10-40 °C (optimum around 35)
- Thermophilic- 40-60 (optimum around 55°C)
- Ambient Temperature (temperature fluctuations)

Parameters

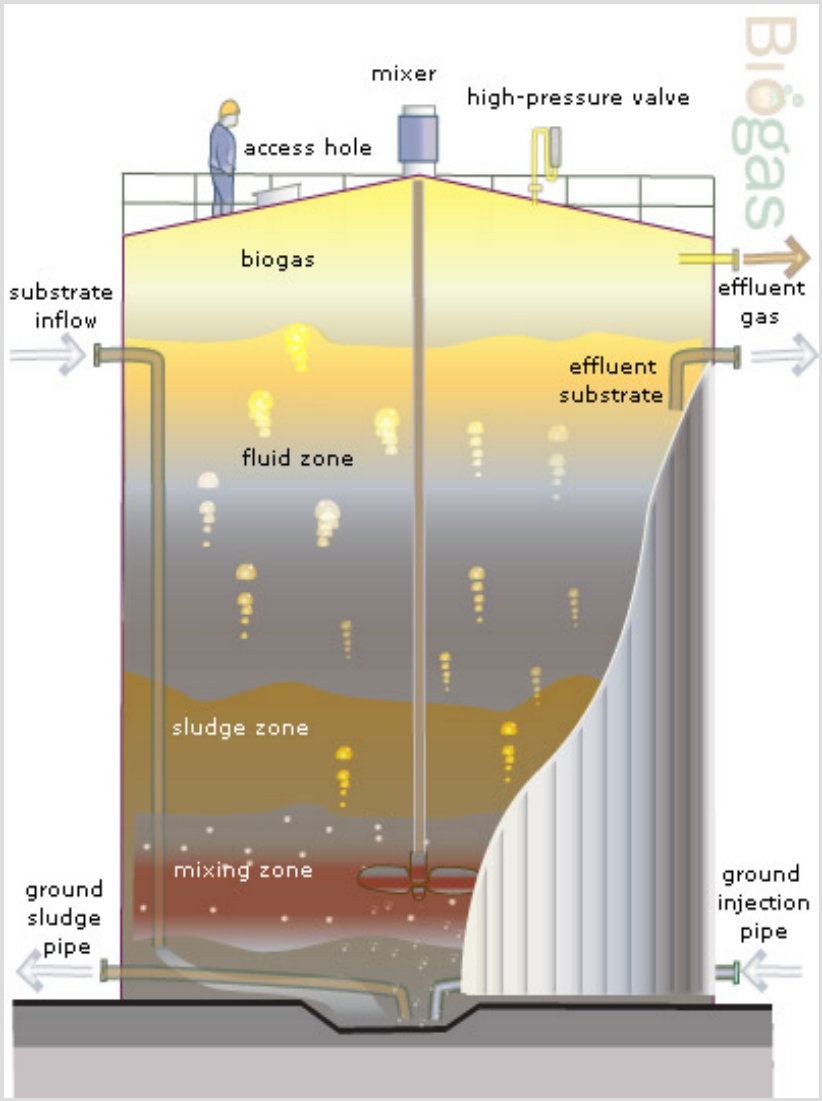
- Temperature- Fermentation Kinetics
- pH- Digester Balance
- Biogas Quality- Digester Balance
- Buffering Capacity- Determines digester disposition to Acidification

Covered Lagoon Digester

- Simply places a cover over a lagoon (usually of manure)
- As gas evolves it is captured by the cover
- 40-60 day HRT



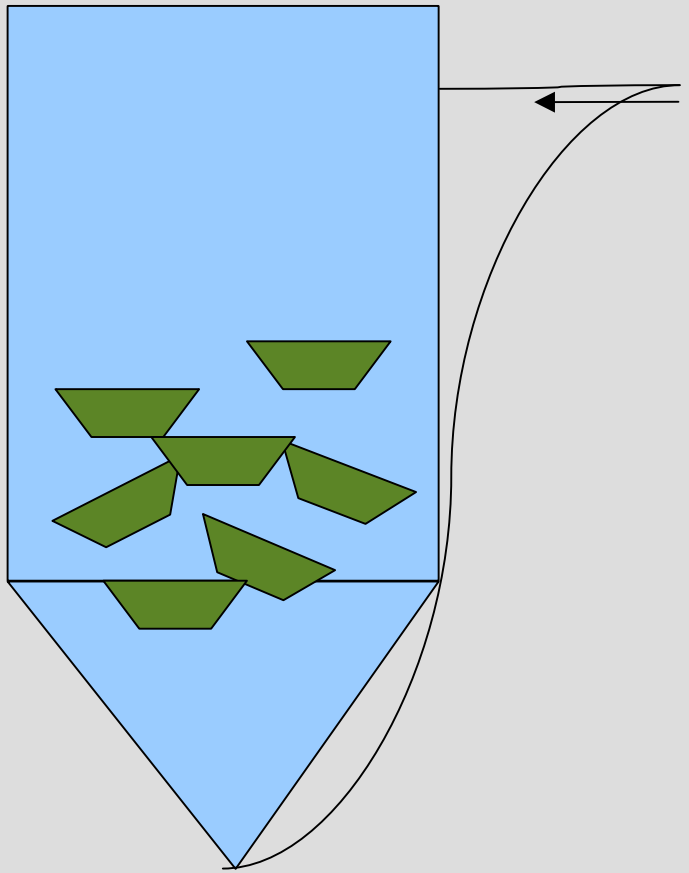
Stirred-Continuous Fed Digester



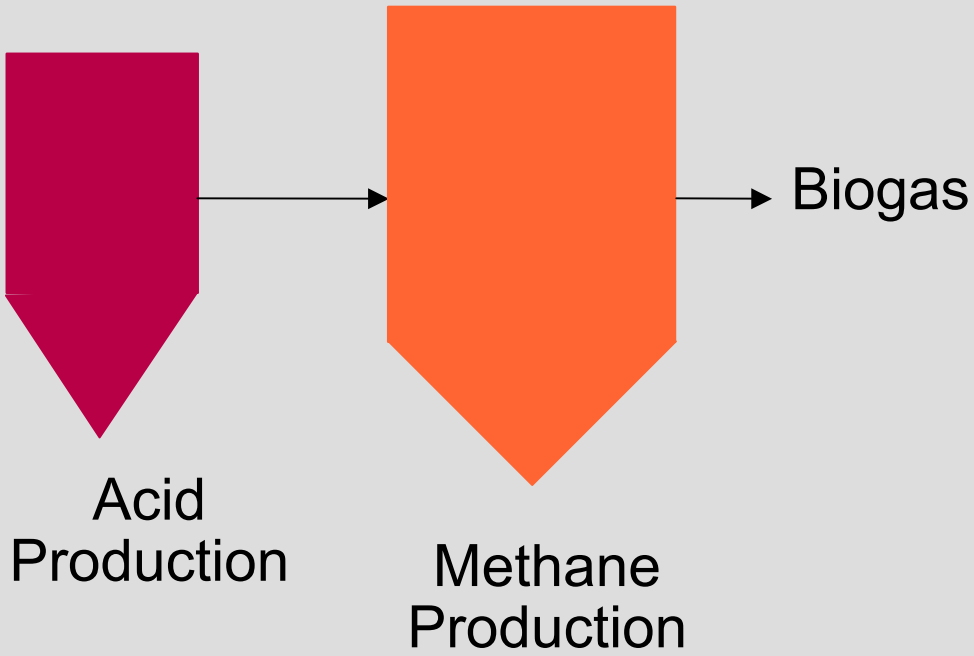
- Bordeaux stirrer digester
- Bioenergy School Digester
- Mixing increases fermentation kinetics through microbial contact
- 20-30 day HRT

Recirculating Batch Digester

- Batch digestion
- Recirculate Liquid phase
- Increases fermentation kinetics



Phase Digestion



- Separates Acid producing and Methane producing phases
- Allows greater control over fermentation
- Increase Biogas quality

UF/IFAS Fixed Film Digester

- Digester at DRU
- Uses Biofilm to increase reaction kinetics
- Continuous flow, Substrate is moved over biofilm
- 2-3 day HRT, Minimal Facility print
- High BTU gas,