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WELCOME

Waste  Biogas 

Waste Inputs = Useful Outputs !

Anaerobic Digestion Solution

Process Input

Energy Crops

Manure

Industrial waste

Source separated organics (SSO)/
Municipal Solid Waste (MSW)

Restaurant/ Food
Industry Waste

Wastewater Treatment
Plant Sludge

Anaerobic Digestion

Process Output

Electricity

Biogas

Renewable Fuel

Biofertilizer

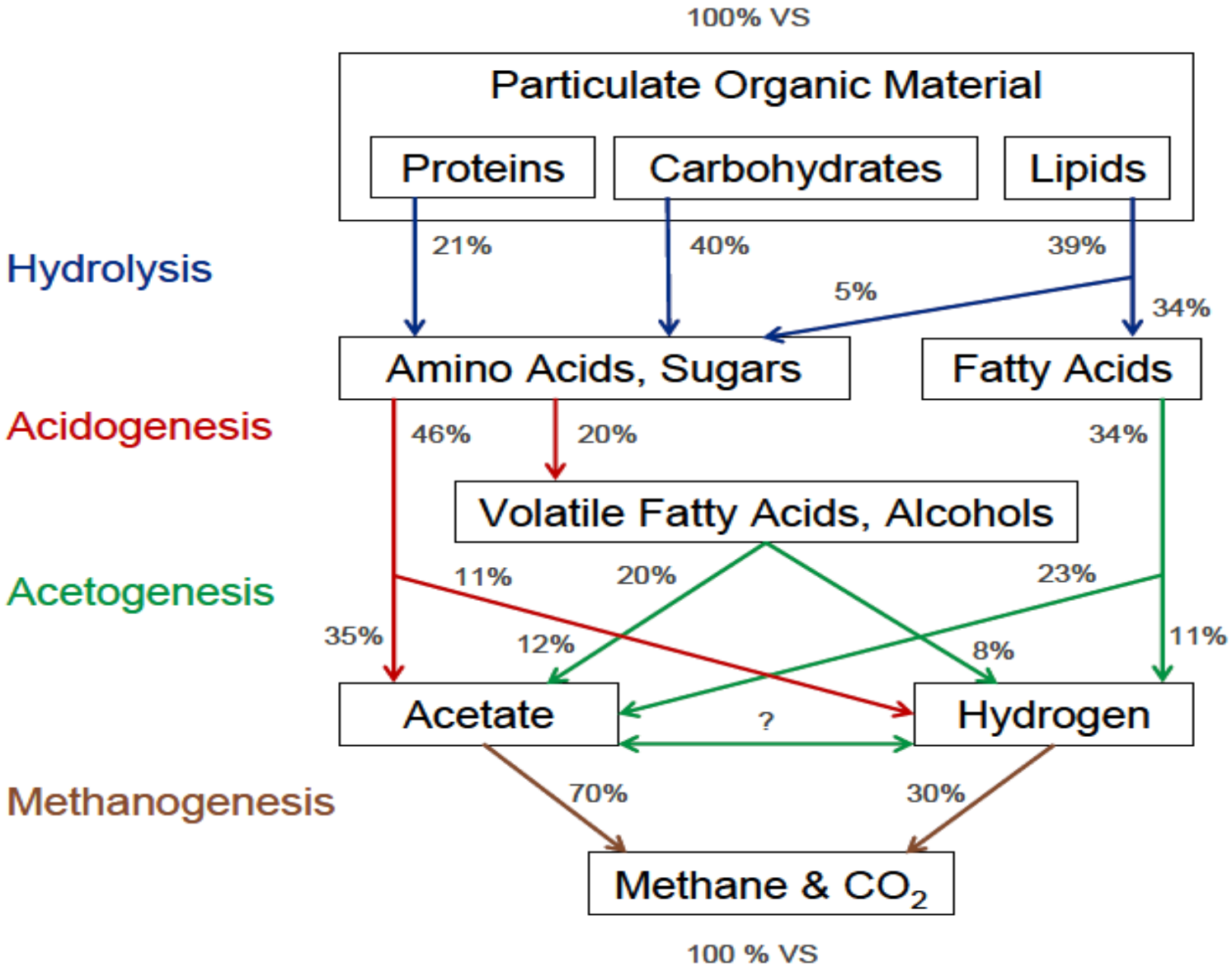
Reusable water

Compost

What is biogas ?

- Biogas : is a mix of gases (CH_4, CO_2, H_2S, H_2O) produced by bacteria during a digestion process.
- How is Biogas produced : it is a complex process, the best way to produce biogas is by anaerobic (environment without oxygen) digestion of organic material.

Anaerobic digestion process



Anaerobic Digestion in a Biodigester

Digester is fed a mixture of water and organic waste.

Daily, fresh waste is added, displacing previous days load that bacteria have started to digest

First, digestible organic matter is broken down by acid-producing bacteria

By-products are then broken down by methane-producing bacteria

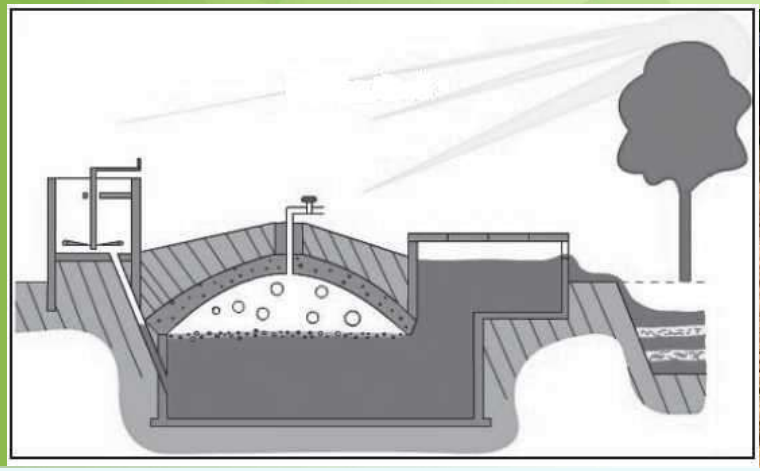
Methane + Digested slurry (compost/bio- fertilizer) is produced

Through the combustion of Methane Energy is produced

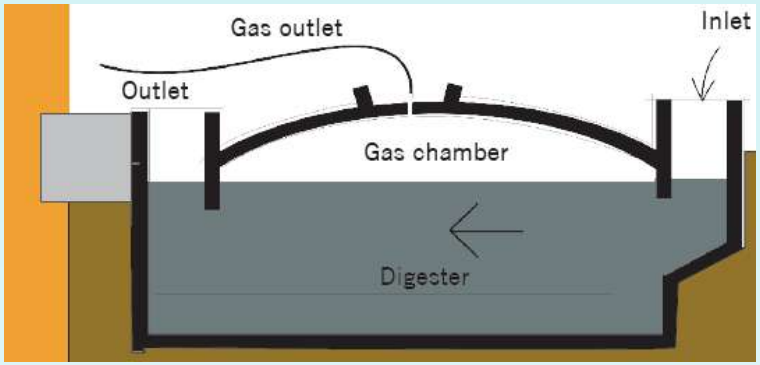
What is a Biodigester?

A device that mimics the natural decay process of organic matter

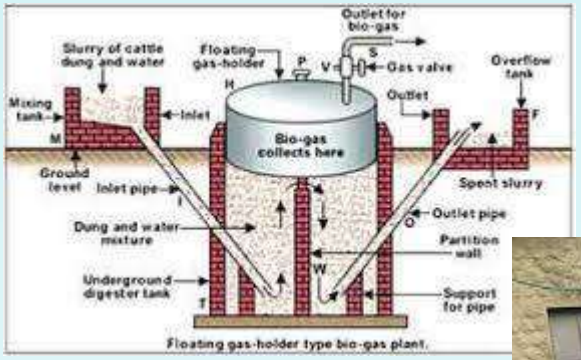
Biogas is produced from anaerobic decay (decay that occurs without oxygen)



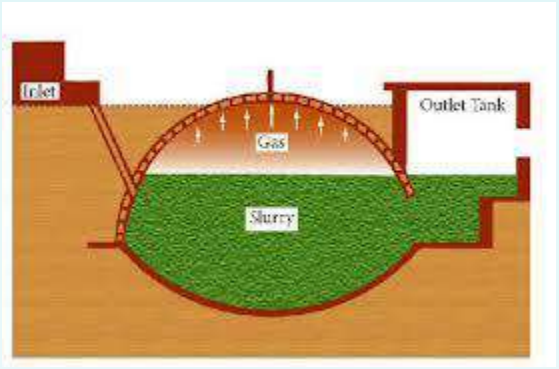
Different Bio Digesters



- Inlet
- Digester
- Gas Holder
- Outlet



Plug Flow (Srilak Umaga)



Compact Model , floating gas

Composition of biogas

- Methane – CH_4 55-70%
- Carbon dioxide – CO_2 30-45%

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Insignificant amounts of hydrogen sulfide (H2S) and water vapor (H2O).

Necessary conditions for optimum biogas production

Anaerobic conditions/Air tightness

- pH (optimum) 6.5-7.5
- Temperature 28^0C-35^0C

  35-37 ^0C (Mesophilic) temperature (below 20 C severe reduction and below 10 C –stop fermentation)
- C/N Ratio 25:1-30:1
- Solid contents 9-11%
- Digestibility of Raw Material

Low Rate Systems

Type of Bacteria / Optimum Temperature

Type of bacteria	Optimum temperature
Psychrophile	$15^{0}C$
Mesophile	$35^{0}C$
Thermophile	$55^{0}C$

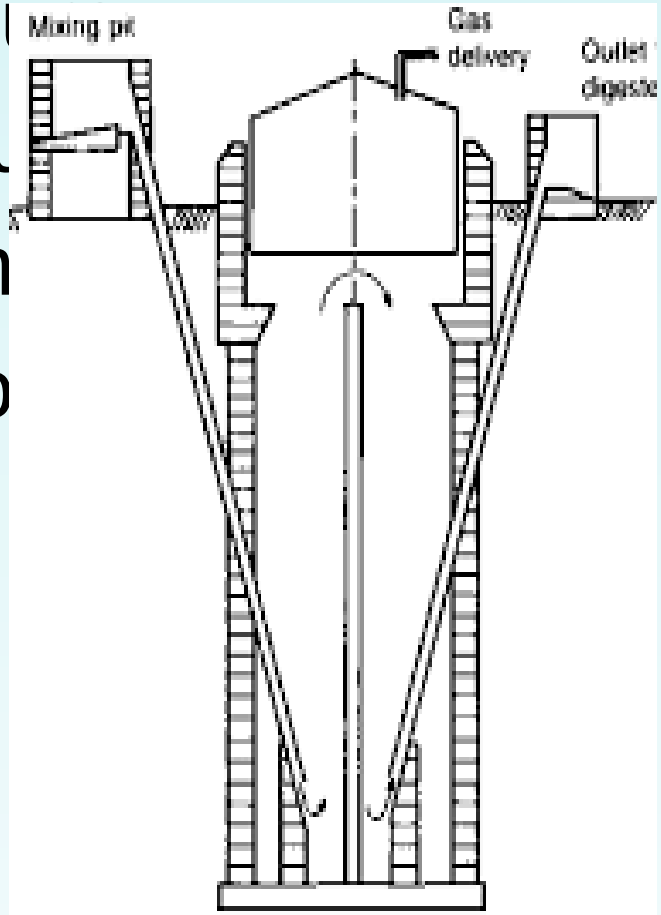
Hydraulic Retention Time (HRT)

- Time taken by bacteria in order to convert the fed-in organic matter into slurry and sludge

Type of bacteria	**Fermentation Period (Days)**
Psychrophile	90 – 120
Mesophile	25 – 30
Thermophile	10 - 15

DIGESTER MIXING

- Prevent settling and maintain contact between bacteria and manu
- Maintain uniform temperatu
- Prevent surface scum form
- Facilitate release of the bio




Semi high rate Systems

Ideal 4 Stage System

* Shredding & Chopping of feed material
Open to air (aerobic) fast digesting Hydrolysis stage

* Acetogenic Stage (aneorobic conditions)

* Acedogenic stage, with
mixing high temperature
(40 - 50 C)

•Mesophilic Bacteria
(methenogenic stage)
PH controlled 7.0,
60 C temperature

Reactor mixer power

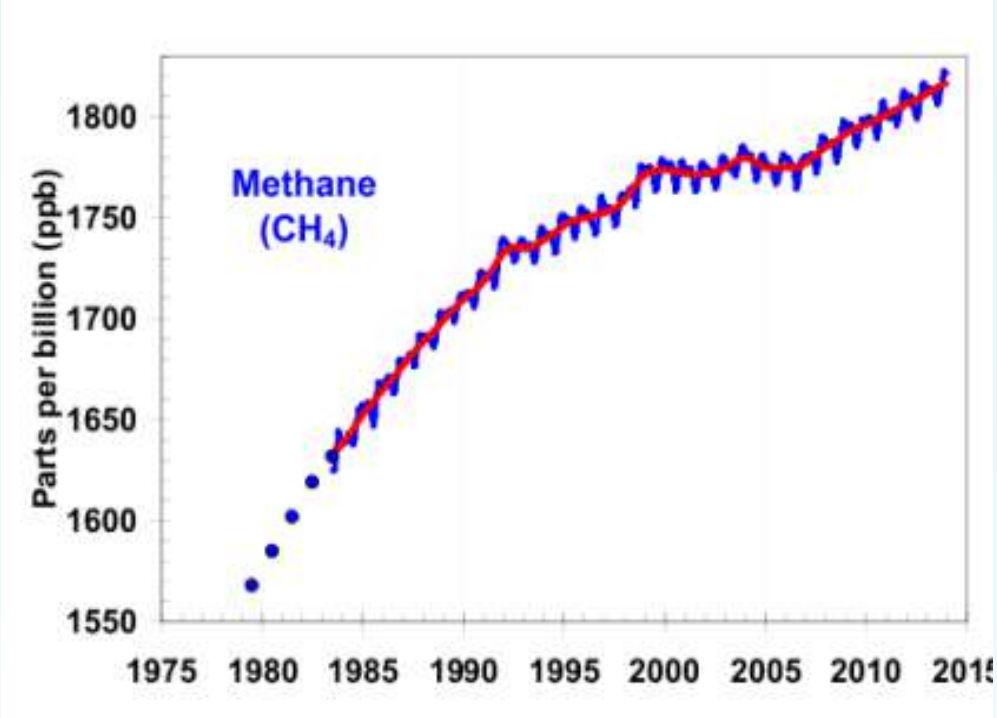
High rate systems

Content of Methane in Biogas Produced from Different Feed stocks

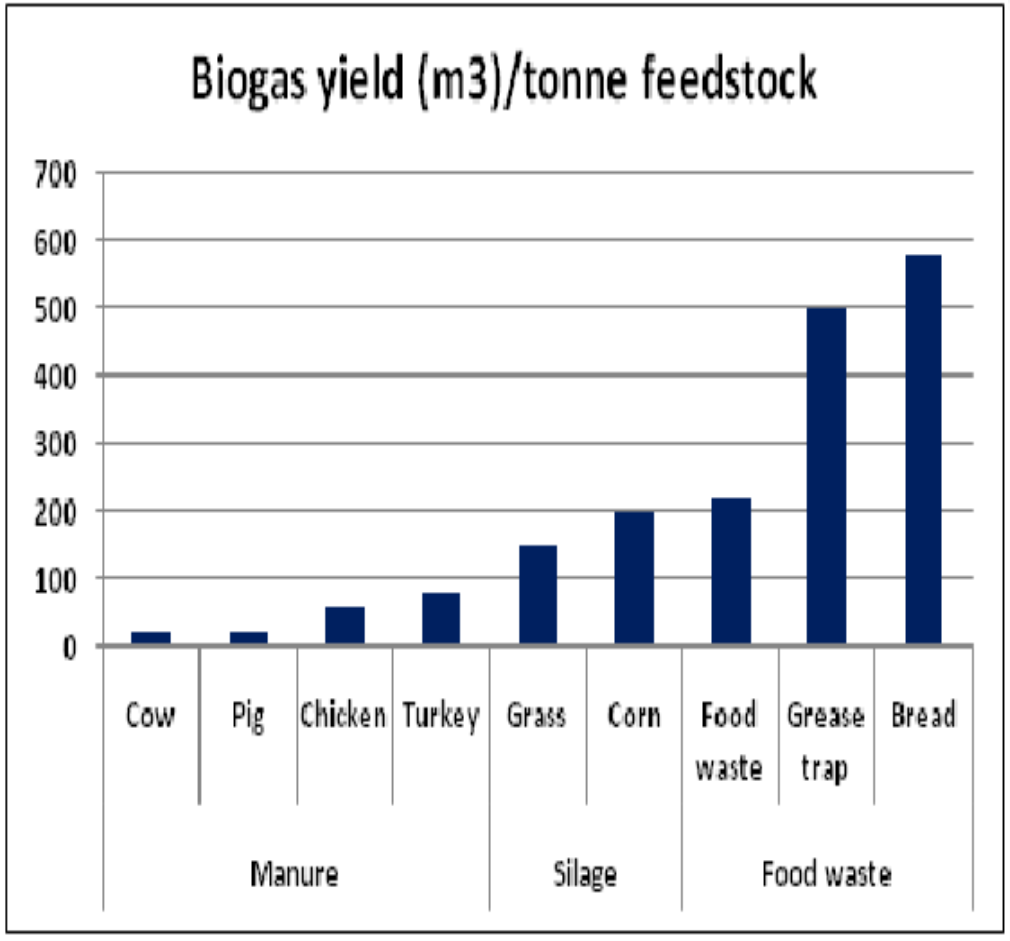
No	Feed stocks	CH_4 Content (%)
1	Cattle manure	54-56
2	Pig manure	57
3	Poultry manure	55
4	Straw	55
5	Grass	60
6	Leaves	58
7	Kitchen waste	50-52
8	Algae	72
9	Distillery effluents	52
10	Human excreta	60

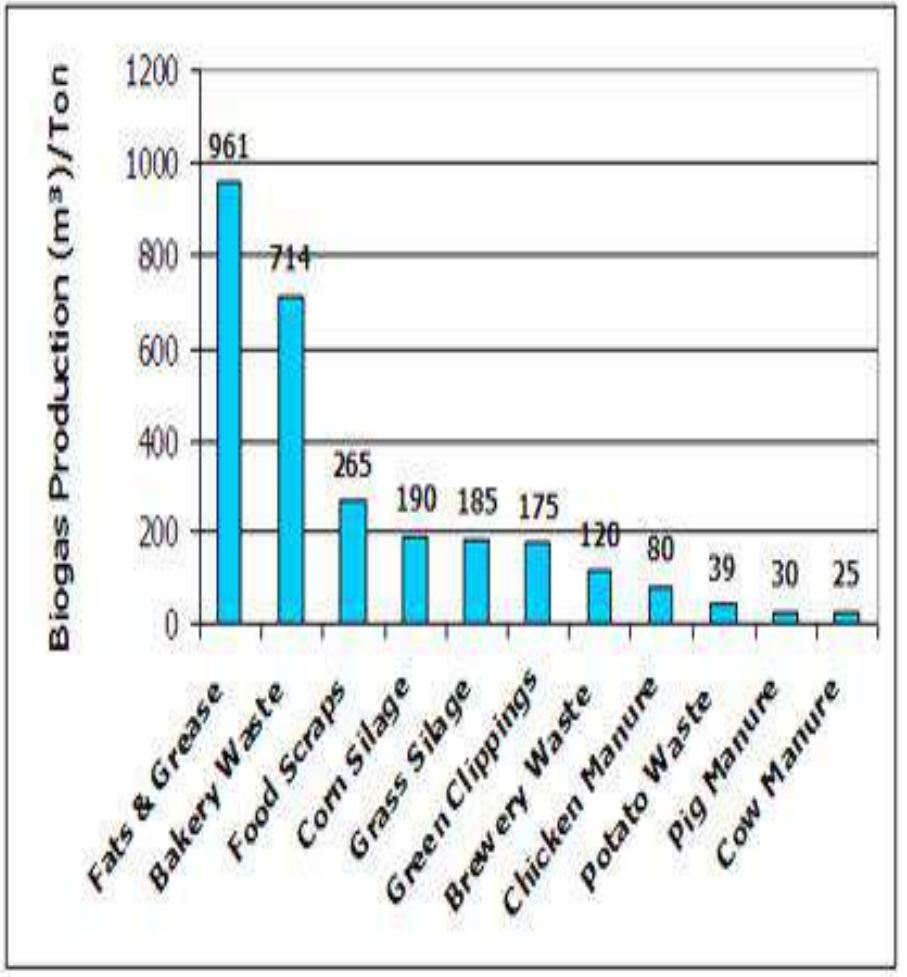
The impact of methane on the climate

- Methane is a potent GHG with a global warming potential 25 times that of CO_2.
- Methane has thus contributed about 20% to the total increase in the greenhouse effect.
- The greenhouse gases increase the temperature rise on our planet.
- Methane in large quantities also destroys ozone



Gas production from different feedstock





Potential gas production from different feed stocks

Type	Gas yield per Kg(M^3)	Manure per animal per day (Kg)	Gas yield per day (M^3)
Cattle dung	0.036	10	0.36
Buffalo dung	0.036	15	0.54
Pig(50Kg)	0.078	2.25	0.18
Poultry (2Kg)	0.062	0.18	0.11
Human excreta	0.070	0.40	0.028

Comparison of Biogas with other Fuels

Name of fuel	Calorific value (Kcal)	Conversion efficiency (%)	Effective heat utilization (Kcal)	Replacement values
Biogas(M^3)	4713	60	2828	1
Kerosene (Lit.)	9122	50	4561	0.6
Fire wood (Kg)	4700	17	814	3.5
Butane (LPG) Kg	10882	60	6529	0.433

Charcoal (Kg)	6930	28	1940	1.5
Furnace oil (Lit.)	9041	75	6781	0.4
Coal gas (M^3)	4004	60	2402	1
Electricity (kwh)	860	70	602	4.5

Thank You!
Questions?