Biomethanation technology for organic wastes

K.V.RAJESHWARI

TERI, New Delhi

Bioresources

- Animal wastes
- Agriculture residues
- Industrial and urban organic wastes
- Wetland vegetation and horticulture

Anaerobic digestion

- Microbiological decomposition of organic fraction of the waste
- Most suitable for wastes with high organic and moisture content
- Successful for segregated waste at decentralized level
- Energy and manure
- Dependency on waste composition and efficiency of biodigester.

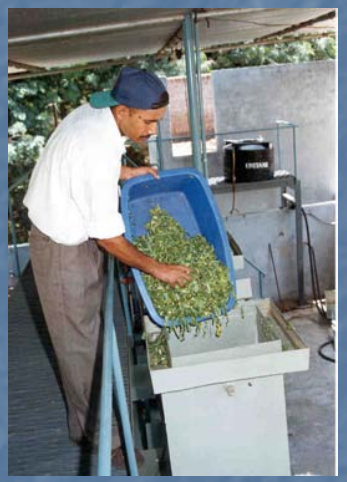
TERI's Enhanced Acidification & Methanation Process

The Process

- Bi-phasic system
  - Acidification
    - The organics from solid waste are extracted in the form of leachate (liquid form) by the action of hydrolytic and acidogenic microbes
    - Digested slurry is rich in available nutrients which is dried and used as manure
  - Methanation
    - The extracted organics (leachate) are treated in a high rate upflow anaerobic sludge blanket reactor to form biogas (composed of methane and carbon dioxide) by the action of acetogens and methanogens

TEAM Process (acidification)

Startup of acidification process

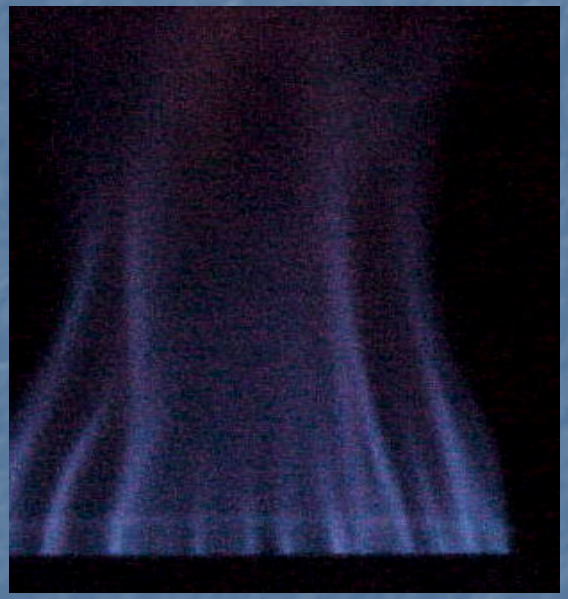


Drying of digested sludge for manure production

TEAM process (methanation)

Granules

Microscopic view



Features of TEAM

- Shorter waste processing period
- Zero waste discharge system
- Elimination of Scum formation- a feature in small size plants.
- Suitability for small and decentralized application
- Low water requirement due to recycling
- Low maintenance cost
- Ease in material handling
- Flexibility of using different construction materials

Product potential

Type of waste	Biogas (m^3/t)	Manure value		
		N	P	K
Apple waste	32.4	0.9	0.04	0.43
Pineapple	13.77	0.33	0.06	0.51
Pressmud	8.9	0.61	0.60	0.37
Vegetable waste	20	2.1	1.6	2.4
Mixed waste	20.25	1.2	0.07	0.63
Coffee pulp	10	1.8	0.1	3
Food waste	54	0.5	0.1	0.3
Tapioca	6.1	2.3	0.02	0.34

Other wastes

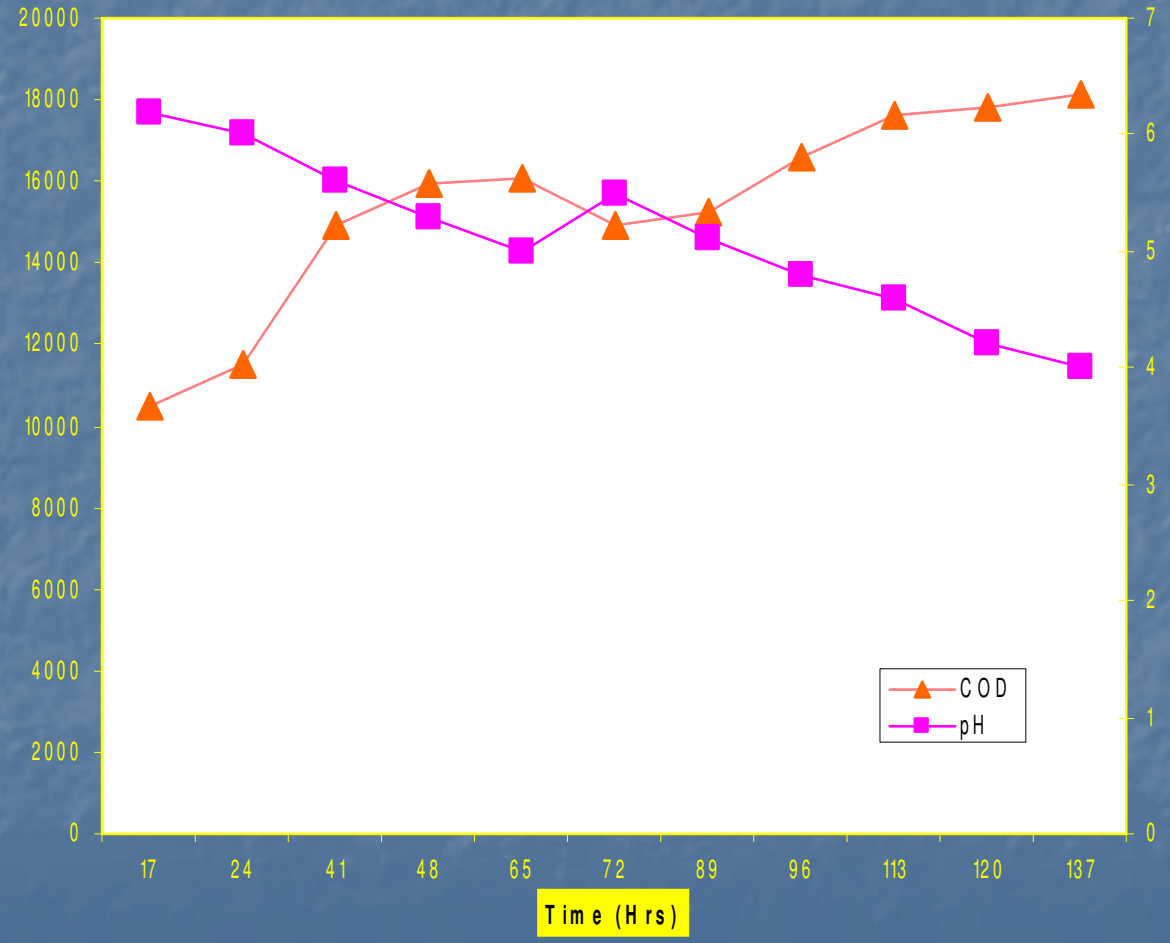
Mixed waste horse stable

Biogas yield – 12 m3/tonne

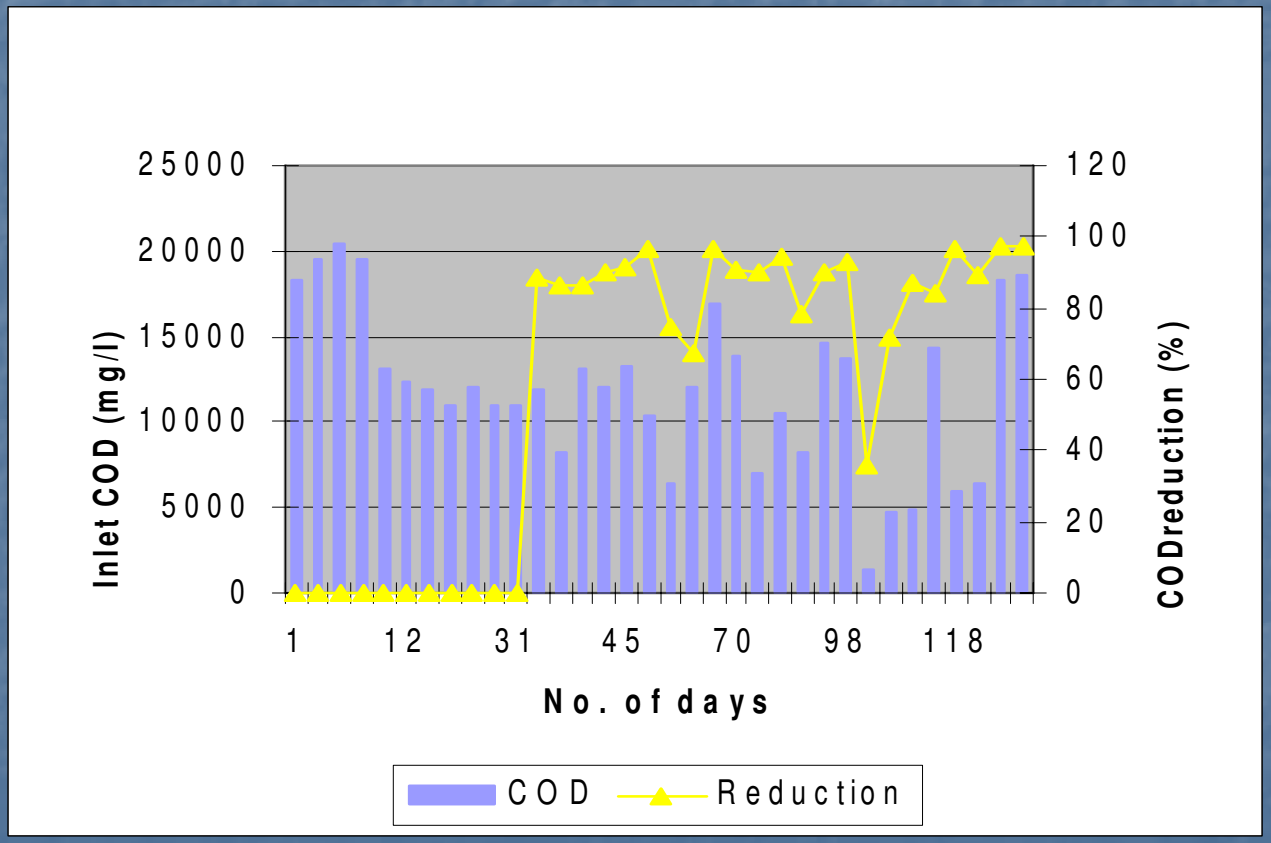
Coir Pith

Biogas yield – 15 – 18 m^3/tonne

Performance of acidification reactor for township waste



Performance of methanation reactor



Resource requirement

Capacity (kg/day)	Cost (Rs. In lakh) (Brick and mortar)	Cost (Rs. In lakh) (Mild steel with epoxy)	Cost (Rs. In lakh) (Stainless steel)	Land requirement (m^2)
50		3.0	4.5	50
100		4.3	7.0	75
250	3.2	4.8		100
500	5.0	6.2	11.3	150
1000	8.0	11		200

Cost-benefit analysis

Capacity (kg/day)	Biogas production (m^3/annum)	Net revenue (Rs. in lakh)	Payback period (yrs) (Brick plant)	Payback period (yrs) (Mild steel with epoxy)	Payback period (yrs) (Stainless Steel)
250	5475	0.7	4.4	6.6	
500	10950	2.1	2.3	2.9	5.2
1000	21900	5.0	1.6	2.2	5.0

Modified digester for rural applications

- Non-suitability of high rate controlled methanation system for rural areas
- Application of the system to mix of biomass residues and cow dung
- Integration of the hydrolysis and acidification reactors with conventional biogas digester (KVIC)
- 20 m^3 plant in two villages

Modified hybrid biodigester

- 4 modules of 5 m^3 capacity
- Feed is high strength liquid extract from acidification phase
- Plastic filter media with high surface area enhances the digestion efficiency

Additional benefits

- GHG abatement due to avoidance of methane from landfill/dumpsites
- Additional emissions reduction by replacement of LPG with biogas
- Nearly 300 tonnes of CO_2 per annum for 1 TPD

Thank you

Contact e mail:

rajikv@teri.res.in