

Handbook on Biogas and Its Applications(from Waste & Renewable Resources with Engineering & Design Concepts)(2nd Revised Edition)

Author: NIIR Board of Consultants & Engineers

Format: Paperback

ISBN: 9789381039779

Code: NI114

Pages: 384

Price: Rs. 1,175.00 **US\$** 31.75

Publisher: NIIR PROJECT CONSULTANCY SERVICES

Usually ships within **5** days

Bio Gas typically refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen. Organic waste such as dead plant and animal material, animal dung, and kitchen waste can be converted into a gaseous fuel called Bio Gas. Bio Gas is basically a mixture of methane and carbon dioxide; it originates from biogenic material and is a type of bio fuel. It is a low cost form of energy derived from renewable waste resources: animal manures, agricultural residues, industrial wastewater, human waste and other organic materials. Bio Gas has been used widely as a source of energy and waste treatment, and as liquid fertiliser for soil enhancement, since long time. Digestion the underlying biological process of Bio Gas technology leads to a renewable energy service that ensures a distributed energy production, in which the energy is produced at the point of consumption or demand. A Bio Gas digester, which produces the Bio Gas, also provides an excellent agricultural waste management solution, most notably animal manures. Also, capturing methane generated in a Bio Gas digester has an immensely important role to play with respect to rural energisation, poverty alleviation and development, increased industrial and agricultural efficiency and competitiveness, and improved management of our greenhouse gas emissions. The major applications of Bio Gas are as fertilizer, fuel gas, methane production, mechanical and electrical power production, diesel engine operation, etc. Bio Gas technology is one of the fastest growing renewable energy sectors worldwide, with the annual market growth exceeding 30% each year.

This book majorly deals with Bio Gas plants, raw materials for Bio Gas generation, utilization of Bio Gas and slurry, engineering design of Bio Gas units for developing countries, engineering aspects of small scale Bio Gas plants, a village scale Bio Gas pilot plant study using high rate digester technology, structural behaviour and stress conditions of fixed dome, simplified anaerobic digesters for animal waste, mechanical and electrical power from Bio Gas in developing countries, fuel gas production from organic wastes by low capital cost batch digestion, the toxicity effect of pesticides and herbicides on the anaerobic digestion process, the toxicity effect of pesticides and herbicides on the anaerobic digestion process, Bio Gas manure as a complete fertilizer, feasibility for Egyptian farmers etc.

The book contains technology of Bio Gas generation with its applications. This book will be an invaluable resource for researchers, consultants, entrepreneurs, institutional libraries, students etc.

Contents

1. BIOGAS PLANTS: A BOON FOR RURAL FAMILY

Composition of biogas and slurry

Composition of slurry
Raw materials for biogas generation
Types of biogas plants
KVIC floating drum type
Janata biogas plant
Deenbandhu biogas plant
Shramik Bandhu biogas plant
Selection of size of biogas plant
Selection of type of biogas plant
Factors to be considered
Technical considerations
Consideration of Climatological factors
Consideration of Geographical factors
Economic considerations
Utilization of biogas and slurry
(a)Utilization of biogas
(b)Biogas burners
(c)Chapatti burner
(d)Biogas lamps
(e)Utilization of slurry as manure
Composition of slurry
Wet slurry Dried slurry
Other uses of slurry In Pisciculture
In Mushroom production Advantages
Limitations

2. ENGINEERING DESIGN OF BIOGAS UNITS FOR DEVELOPING COUNTRIES

Design concepts used for floating cover Indian style digesters Design concepts used for a Chinese digester
Design concepts used for a bag digester Items to consider in examining a system Operational factors
Composition of the organic feed-stock Retention times
Concentrations of the feed-stocks Organic loading rate
Degree of mixing
Heating and heat balance Location of a digester system Slurry effluents
Construction materials Sizing of the digester
Size based on health criteria
Size based on production of soil conditioner Size based on energy
Design example
case 1 : fresh manure and urine
case 2 : manure and concrete pad not collected daily case 3 : manure on the ground, partially dried
case 4 : using destruction of volatile solids case 5 : design using ESCAP (Indian) approach case 5 A : fresh
manure and urine
case 5 B : manure from a concrete pad case 5 C : manure on dirt Construction costs
Conclusions

3. ENGINEERING ASPECTS OF SMALL SCALE BIOGAS PLANTS

Structural demands
Relation between the length and height of the bearing structure Size of the Digester
Size of gasholder Gasholder-digester ratio 30 days retention time (RT) 60 days RT
90 days RT
120 days RT
Engineering for extension programs Concluding remarks

4. AN IMPROVED PLUG-FLOW DESIGN FOR THE ANAEROBIC DIGESTION OF DAIRY CATTLE WASTE

Introduction Methodology Description of the plant Mixing and feeding tank Anaerobic digester

Biogas piping and storage

Digester heating station

Capital costs

Results and discussion

Conclusions

5. A VILLAGE SCALE BIOGAS PILOT PLANT STUDY USING HIGH RATE DIGESTER TECHNOLOGY

Digester

Insulation of digester and gas-holder

Slurry heating system

Operation of plant and presentation of data

Discussions of results

Conclusions

6. COMPOST-HEATED SMALL SCALE FARM DIGESTER APPROPRIATE FOR KOREAN CONDITIONS

System design and construction

Biogas generation from pig manure

Results and discussion

Organic material loading conditions

Maintaining high temperature by compost heat

Heat loss comparison

Economic feasibility

7. STRUCTURAL BEHAVIOUR AND STRESS CONDITIONS OF FIXED DOME TYPE OF BIOGAS UNITS

Base of fermentation tank

Wall of fermentation tank

Dome of gas-holder

Construction technique

Analytical considerations

Structural testing of biogas unit

Concluding remarks

8. FERROCEMENT GASHOLDER FOR TWO 60M³ DIGESTER

Procedures for construction of a 20 M³ gasholder

(1) Construction of the mould

(2) Reinforcement

(3) Plastering

(4) Gas-tightness

(5) Inner-steel structure Conclusions

9. SIMPLIFIED ANAEROBIC DIGESTERS FOR ANIMAL WASTE

Batch digester plant

Results

Plug flow digester plant

Results

Covered lagoon biogas system

Results

Continuous expansion digester

Tests on a small electric generator set fuelled by biogas

Results

An economic evaluation of the plants

Conclusions

10. COLD CONDITION BIOGAS

Methodology

Results and discussion

11. MECHANICAL AND ELECTRICAL POWER FROM BIOGAS IN DEVELOPING COUNTRIES

Engines modification for bio-gas use

Performance of biogas fuelled engines

Main factors limiting use of bio-gas fuelled engines and -
prospective solutions

12. PERFORMANCE OF A SMALL DIESELENG IN EOPERATING IN A DUAL FUEL MODE WITHBIOGAS

Objectives of the research

The test unit

Fuels used

Test procedure

Evaluation of the test results

Discussion of the test results

Power out-put

Exhaust gas temperature and combustion

Specific fuel consumption and fuel savings

Efficiency

Comparision of mixing chamber types

Conclusions and recommendations

13. METHANE PRODUCTION FROM FARM WASTES

History of application of farm digesters

Post World War II developments

Post 1970 developments

American farm digesters

Technical problem

Economic feasibility of farm waste digestion

Barriers to application of anaerobic digestion to farm wastes Technical approaches to system improvements

Research needs

14.OPTIMIZATION OF BIO-CONVERSION OF SOLID AND LIQUID RESIDUES

Technological aspects

1.Parallel operation

2.Series (stages) operation

3.Phased operation Advantages of phased operation

Fixed film and suspended growth reactors

1.Fixed bed

2.Expanded bed

3.Fluidized bed

4.Anaerobic rotating discs

5.Recycled bed

A.Contact or recycled flocs

B.Fluidized flocs or sludge blanket

C.The digestor

Choice of process and reactor type Micro-organisms

Bio-chemical study of the process

1. Screening of the Electron Transfer proteins and Enzymes 2.Purification Processes.
Bacterial control of the digester through co-factor analysis.

15. NOVEL PROCESS FOR HIGH-EFFICIENCY BIO-DIGESTION OF PARTICULATE FEEDS

Limitations of conventional anaerobic digestion Novel process concepts

Phase separation High-SRT Digesters

Two-phase digestion of semi solid feeds Studies with CSTR Digesters

Studies with upflow digesters

Dominant reactions in first and second stage digesters Advantages of two-phase fermentation mode and the up flow...

digester

Energetic and economic advantages of two-phase digestion Two-phase digestion of solid feeds

Summary and conclusions

16.BIOGAS FROM ORGANIC WASTE DILUTED WITH SEA WATER

Materials and methods

The organic waste

The synthetic seawater

The Inoculum

The digestion apparatus

Experimental procedure

Analytical procedures

Methane content

Results and discussion

Conclusion

17.FUE LGAS PRODUCTION FROM ORGANIC WASTES BY LOW CAPITAL COST BATCH DIGESTION

Background on "controlled" landfilling

Process description

Conventional landfill gas recovery

Application of enhancement to agricultural residues

Status of landfills as fuel gas sources in the United States

18. BIOGAS PRODUCTION FROM WATER HYACINTH (EICHHORNIA CRASSIPES) : INFLUENCE OF TEMPERATURE

Materials and methods

Fermenter

Substrate

Inoculum

Analytical Methods

Experimental procedure

Results and discussion

19. THE TOXICITY EFFECT OF PESTICIDES AND HERBICIDES ON THE ANAEROBIC DIGESTION PROCESS

Materials and methods Results and discussions

Effects of Lindane and DDT on anaerobic digestion of mixtures of cotton stalks and cow-dung.

Effect of Gesapax and Gesaprime on the anaerobic digestion of mixture of water Hyacinth and fresh cow-dung.

Effect of Gesapax and Gesaprime on the anaerobic digestion of mixture of weeds and fresh cow-dung.

Conclusion

20. BIOGAS PRODUCTION FROM SOME ORGANIC WASTES

Materials and methods

Organic wastes

Geranium flour

Akalona

Watermelon residues Citrullus Vulgaris

Starter

Digestion apparatus

Analytical procedures

Gas volume

Methane content of the biogas

Determinations of total solids

Experimental

Results and discussion

Biogas from geranium flour (gf)

Biogas production from Akalona (Ak)

Biogas production from Watermelon residue (WR)

21. THE ASSESSMENT OF CELLULYTIC ACTIVITIES IN ANAEROBIC DIGESTERS BY THE "TEXTILCOUPON" TECHNIQUE

Experimental

The use of the screw-capped tubes

The crimped-capped-serum tubes

Results and discussion

Discussion

22. BIOGAS PRODUCTION FROM ANTIBIOTIC- CONTAMINATED COW MANURE

Materials and methods

Experimental procedure

Results

Discussion

23. BIOGAS FROM LIQUID AGRO-INDUSTRIAL WASTES DERIVED FROM BANANA AND COFFEE PROCESSING

24. A SIMPLE, RAPID AND ACCURATE METHOD FOR DETERMINATION OF CARBON-DI-OXIDE IN BIOGAS

Background Theory Material Procedure

Estimation of Methane content Validation

25. ASSESSMENT OF ANAEROBICALLY DIGESTED SLURRY AS A FERTILIZER AND SOIL CONDITIONER

Fertilization effect on effluents on field-grown wheat in clay soil Microbiological and chemical analysis

Result

Composition of effluents from bio-gas plants Introduction

Methodology Effluents sources

Detection of phytotoxicity Methods of handling effluents

Fertilization effect of effluents on corn (pot experiment) Fertilization effect of effluents on wheat (pot experiment) Effect of continuous feeding on effluent composition Phytotoxic effect of digester effluent Changes in fertilizer value of digester effluents during handling and storage.

Effluents as soil conditioner

Fertilizer value of the digester effluents Effect on nutrient uptake
Yield response to fertilizer application Discussion

26. REPEATED APPLICATION OF ANAEROBICALLY DIGESTED SLURRY AND ITS EFFECT ON THE YIELD AND NPK UPTAKE OF WHEAT, TURNIPS AND ONION PLANTS

Methodology Materials Experimental Chemical analysis
Results and discussion Effect on the dry matter yield Wheat plant
Turnip plant Onion plant
Effect on Nitrogen, Phosphorus and Potassium uptake

27. BIOGAS MANURE AS A COMPLETE FERTILIZER, FEASIBILITY FOR EGYPTIAN FARMERS

Composition of bio-gas manure and treatments Aim and scope of work
Results and discussion
Short term effect of bio-gas manure
Maize
Wheat
Rice
Broad bean
Cotton
Spinach
Carrots
The residual effect of bio-gas manure
Residual effect of bio-gas manure on Wheat
Residual effect of bio-gas manure on Broad bean

28. HEALTH RISKS ASSOCIATED WITH THE USE OF BIOGAS SLURRY: AN INTRODUCTORY NOTE

29. INCIDENCE, PERSISTENCE AND CONTROL OF PARASITIC EGGS AND CYSTS IN ANAEROBICALLY DIGESTED WASTES

Methodology
1. Incidence of Ascaris eggs and Eimeria Oocysts in different village digester.
2. Laboratory-controlled experiments Aeration of the sludge after 45 days Results and discussion
1. Incidence of Ascaris eggs and Eimeria Oocysts in different village digester
2. Laboratory-controlled experiments
Conclusion
Incidence, persistence and control of some pathogens during anaerobic digestion of organic wastes
Methodology
Isolation and identification of the pathogens Results
Isolation of pathogens in samples obtained from different operating village digester.
Persistence and control of pathogens during anaerobic digestion of sludge under laboratory conditions
Discussion

30. SURVIVAL OF PATHOGENS AND PARASITES DURING THE ANAEROBIC DIGESTION OF ORGANIC WASTES

Methodology
Laboratory digester
Organic wastes
Fermentation experiments
Biogas Analysis
Chemical Analysis
Microbiological determinations
Results and discussion

31.DEVELOPMENT AND APPLICATION OF BIOGAS TECHNOLOGY FOR RURAL AREAS OF EGYPT

Background and objective
The preliminary fact-finding phase
Outline of the R & D activities
The demonstration phase
Future plans
Conclusions

32. BIOGAS PRODUCTION FROM KITCHEN REFUSES OF ARMY CAMPS OF EGYPT USING A TWO STAGE BIOGAS DIGESTER

Materials and methods Materials fed to the digester Plant description
Inlet tank Main digester Gas-holder
Operation of the system Experimental
Methods of analysis
Methane content in the biogas CO₂ content
Results and discussion
1.Heating
2.Mixing

33. AN INTEGRATED RENEWABLE ENERGY SYSTEM PROJECT OVERVIEW

Project objectives
Design considerations
System components
Operation concept
Technical Data

34.PHOTOGRAPHS OF PLANT & MACHINERY WITH SUPPLIERS'S CONTACT DETAILS

About NIIR

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services

bureau, consultants and project consultancy firms as one of the input in their research.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

NIIR PROJECT CONSULTANCY SERVICES , 106-E, Kamla Nagar, New Delhi-110007, India. **Email:** npcs.india@gmail.com **Website:** NIIR.org

Sat, 27 Apr 2024 16:58:11 +0530