BIO-MASS BRIQUETTE

Introduction

Biomass briquetting is the densification of loose biomass material to produce compact solid composites of different sizes with the application of pressure. Briquetting of residues takes place with the application of pressure, heat and binding agent on the loose materials to produce the briquettes.

Following are the advantages of briquette

- This is one of the alternative methods to save the consumption and dependency on fuel wood.
- Densities fuels are easy to handle, transport and store.
- They are uniform in size and quality.
- The process helps to solve the residual disposal problem.
- The process assists the reduction of fuel wood and deforestation.
- Indoor air pollution is minimized.

Two different types of densification technologies are currently in use. The first, called pyrolizing technology relies on partial pyrolysis of biomass, which is mixed with binder and then made into briquettes by casting and pressing. The second technology is direct extrusion type, where the biomass is dried and directly compacted with high heat and pressure. Setting up the briquette production unit raw material should be locally available. The raw materials for biomass briquetting can be:

- Agricultural residues (husks, cob, stalks, leaves, stems, shells, sticks)
- Invasive plants (Banmara, Lantana camera, Euphorbia royalena, Congress grass)
- Waste from bio-product industries like sawmills, plywood industries, furniture factories.

Briquettes a promising fuel

Briquettes produced from briquetting of biomass are fairly good substitute for coal, lignite, firewood and offer numerous advantages:

- Briquettes are cheaper than COAL, OIL or LIGNITE once used cannot be replaced.
- There is no sulfur in briquettes.
- There is no fly ash when burning briquettes.
- Briquettes have a consistent quality, have high burning efficiency, and are ideally sized for complete combustion.

- Combustion is more uniform compared to coal.
- Unlike coal, lignite or oil, briquettes are produced from renewable source of energy, biomass.
- Loading/unloading and transportation costs are much less and storage requirement is drastically reduced.
- Briquettes are clean to handle & can be packed in bags for ease of handling & storage.
- Briquettes are usually produced near the consumption centers and supplies do not depend on erratic transport from long distances.
- The technology is pollution free and Eco-friendly.
- The briquette is easy to ignite.
- Continuous burning and Long burning duration.

Functions / Application

The briquettes can be used for domestic purposes (cooking, heating, barbequing) and industrial purposes (agro-industries, food processing) in both rural and urban areas.

The briquetting technology available at MGIRI

1. Manual operated (Bee Hive form)
2. Machine Operated (extruder machine)

1. Manual operated (Bee Hive Briquette) - Beehive briquetting is produced from pyrolizing technology. The briquette produced is around 5.5 inch in diameter and height is around 3.5 inch. The briquette has around 19 holes of diameter 0.5 inches which facilitates the proper combustion. Since the briquette has the shape of bee-hive hence the name beehive briquette.

2. Machine operated –The developed machine is screw press type. The diameter of the briquette is closely related to the output of the machine. In this process pallets of briquette produce around 0.5 to 2,0 inch diameter and length 1.0 to 4.0 inch. In the screw-presses, material is fed continuously into a screw which forces the material into a cylindrical die

Specification

Calorific value: 16 to 20 MJ/Kg

Binder Material: tamarind seed powder

Binder composition: 10-15%

Equipments Required

- Charring Drum
- Briquetting die
- Extruding machine

Cost: The charring drum along with die and extruder is available and its cost is Rs. 15,000.00

Development of Bio-gas Enrichment and Compression System for Rural Energy Supply

Introduction:

Biogas is an environment friendly, clean, cheap and versatile fuel. Biogas is produced by anaerobic digestion of degradable wastes such as cattle dung, vegetable wastes, sheep and poultry droppings, municipal solid waste, sewage water, land fill etc. Presently the biogas is mainly used for cooking and lighting purposes in the rural areas. The use of biogas in stationary engines used for different agricultural operations is going on. Its utilization is also feasible in automobiles, used for transportation purposes by enriching and compressing it in cylinders. Biogas can be converted in bio CNG after enrichment and bottling. It becomes just like CNG.

Potential of the Technology:

So far, biogas has mostly been used as fuel for cooking and running stationary engines. However, it's potential has not fully utilized, yet. There is a great enhancement in its utilization potential particularly where bigger plants are in operation e.g. institutional biogas plants in Goshalas, dairy farms or community biogas plants in villages. Goshalas are running generally on charity basis and most of Goshalas are not in sound financial position. Enrichment and bottling of biogas will help to improve it.

India has a vast potential of 6.38 X 10^{10} cubic meter of biogas per annum from 980 million tonnes of cattle dung produced. A National Project on Biogas Development (NPBD) was launched by Government of India in 1981. A total of about 36.5 lakh family biogas plants have been installed under this programme all over the country till Dec. 2004. This is about 30 % of the total 120 lakh family type biogas plants potential. More than 3380 Community Biogas Plants (CBP), Institutional Biogas Plants (IBP) and Night-soil based Biogas Plants (NBP) have been installed all over the country with most reporting satisfactory performance levels. The family biogas plants in the country are estimated to be saving 39.6 lakh tonnes of fuel-wood per year. Besides, about 9.2 lakh tonnes of enriched organic manure are being produced every year from these plants. There are number of *Goshalas,* dairies, village communities having large number of cattle which have potential of installing biogas enrichment and bottling system.

BIOGAS COMPOSITION, PROPERTIES AND UTILIZATION AS CNG:

Biogas comprises of 60-65% methane, 35-40 % carbon dioxide, 0.5-1.0 % hydrogen sulfide and rests of water vapour. It is almost 20% lighter than air. Biogas, like Liquefied Petroleum Gas (LPG) cannot be converted to liquid state under normal temperature. Removing carbon dioxide and compressing it into cylinders makes it easily usable for transport applications, say three wheelers, cars, pick up vans etc and also for stationary applications at various long distances. Already, CNG technology has become easily available and therefore, bio-methane (enriched biogas) which is nearly same as CNG, can be used for all applications for which CNG are used.

BIOGAS ENRICHMENT PROCESS:

A variety of processes are available for enrichment i.e. removing CO_2, H_2S and water vapour. Commonly CO_2 removal processes also remove H_2S. One of the easiest and cheapest methods involves is the use of pressurized water as an absorbent liquid. In this method, the biogas is pressurized and fed to the bottom of a scrubber column where water is sprayed from the top. In counter-currently operated absorption process, the carbon dioxide and hydrogen sulfide present in the biogas is absorbed in down going water and methane goes up and collected in vessel. However, water requirement in this process is high but it is the simplest method of removing impurities from biogas

Different Methods of Biogas Enrichment

Sl. No.	Method	Advantage	Disadvantage
1	Absorption in Water	One of the simple and cheap method for CO2 removal. Recommended for rural application	Water pumping load is high. CO2 can not be recovered
2	Absorption by Chemicals	The chemical absorbents are more efficient in low pressure and can remove CO2 to low partial pressures in treated gas.	Regeneration of the solvent requires a relatively high energy input. Disposal of by-product formed due to chemical reactions is a problem.
3	Pressure Swing Adsorption	By proper choice of the adsorbent, this process can remove CO2, H2S, moisture and other impurities	Adsorption is accomplished at high temperature and pressure. Regeneration is carried out by vacuum. It is a costly process.
4	Membrane Separation	Modular in nature and separate CO2 and CH4 effectively.	High pressure requirement. The processing cost is also high.
5	Cryogenic Separation	Allows recovery of pure component in the form of liquid, which can be transported conveniently	High cost involved also energy intensive
6	Chemical Conversion	Extremely high purity in the product gas.	Process is extremely expensive and is not warranted in most biogas applications.
7	Vortex tube	Physically separate CO2 and CH4 Very simple technique Low cost involved Both the gases can be used.	Still in conceptual stage. No perfect design is available which can separate the desired amount.

CONCEPT OF ALTERNATIVE BIO-CNG:

Biogas contains a large proportion (about 40 % by volume) of carbon dioxide, a heavier and non combustible gas and some fraction of hydrogen sulphide. Hence it is needed to enrich biogas by removing these undesirable gases to save compression energy and space in bottle and corroding effect, which can be done by scrubbing. The scrubbing system is found to enrich methane about 95 % or more depending upon biogas inlet and water injection pressure. Biogas can be used for all applications designed for natural gas, assuming sufficient purification.

SCOPE OF THE TECHNIQUE:

Enriched biogas is made moisture free by passing it through filters after that it is compressed up to 200 bar pressure using a three stage gas compressor. Compressed gas is stored in high pressure steel cylinders as used for CNG. There is large potential of this technology in buses, tractors, cars, auto rickshaws, irrigation pump sets and in rural industries. This will help to meet our energy demand for rural masses thus reduces burden of petroleum demand, moves towards energy security and will improve economic status by creating employment generation in rural area.

Animal Driven Prime Mover

Introduction:

Draught animal are in use in India for cultivation operation, transport and rural agro processing. The basic user of draught animal power are generally small and marginal farmers. The draught animals are a holistic source of energy and other useful survival needs. These animal cultivate 60-65% land. There are about 68 million draught animal and they provide energy to agriculture related activity. To develop technologies and create a mechanism to provide best possible draught animal power inputs in a comprehensive manner to production and processing agriculture in the country.

This eco-friendly technology enables a very effective utilization of draught animal power by providing a rugged design of Animal Driven Prime Mover and an appropriate pump a mechanical devices system. It is expected to be of immense utility to the small farmers and Rural Entrepreneurs.

Main Motivation for Animal Driven Prime Mover

- Need for effective utilization of draught cattle power which is a historic resources for sustainable rural economy
- Need for reduction in agriculture cost and making farming eco-friendly and viable for small farmers
- Need for reducing dependence on diesel and fossil fuel based electricity for essential agro – industrial operation in rural area and thus augment self sufficiency.
- Transition towards organic farming will also demand larger animal population farming will also demand larger animal population for bio manure etc., their effective utilization will facilitate this transition.

Increasing Utilization of Draught Animal Power

- Normal working hours 300 to 1500 annually.
- Idle hours 2500 giving 8 hours of work for 6 days each weeks.
- Main use of draught animals are tillage, sowing, transport, inter-culture, water lifting, cane crushing and oil extraction.

Annual utilization can be increased in the following ways:

1) By developing equipment for operations for which animals are not presently being used.
2) By increasing use of animal power in agro-processing.
3) This type of activity can increase the annual use of animal power by 1000 to 1500 hours.

Salient Features of Power Transmission System

- Crown and pinion are mounted in a covered frame, and not emerged in oil.
- Two thrust bearings are used to support the vertical input shaft.
- A pin joint provides movement to hitch beam
- Two Pneumatic wheels
- Ratchet - energy is transmitted only when bullocks exert pull
- The whole PTS does not move while the bullocks slow down or stop.
- Energy losses are reduced
- Avoids hammering on the legs of bullocks
- Flywheel, absorbs and supplies energy
- Motion and energy at uniform rate.

Existing Animal Driven Prime Mover

CIAE, Bhopal developed a prototype for prime mover application for farm operation**.** In this design spur and bevel gear pairs are used. It gives 100-150 rpm mechanical application. This can be used for chaff cutting, flour mill etc.

College of Agril. Engg. Raichur: developed a prototype for prime mover application. This design can be effectively used for opration of agro processing machine.

Panchal Pumps: developed new design of prime mover for water lifting. In this design there is a gear box and screw pump

Kanpur Go-shala: developed a design for also effectively used for operation of agro processing machine.

Technology for conversion of existing rural application diesel engine in to bio-fuels (i.e. bio-gas, producer gas and bio diesel) engines

Introduction:

Biogas is an important renewable energy resource for rural areas in India. It is produced by anaerobic digestion of biological wastes. It is an environment friendly, clean, cheap and versatile fuel. Biogas like Liquefied Petroleum Gas (LPG) cannot be liquefied under normal temperature and pressure. Biogas generally comprise of 55-65 % methane, 35-45 % carbon dioxide, 0.5-1.0 % hydrogen sulfide and traces of water vapour. Average calorific value of biogas is 20 MJ/m3 (4713 kcal/ m3). Biogas like Liquefied Petroleum Gas (LPG) cannot be liquefied under normal temperature and pressure. Critical temperature required for liquefaction of methane is -82.1 C at 4.71 MPa pressure. Therefore use of biogas is limited nearby the biogas plant.

Contribution of Bio Gas Technology

* Better and cheaper fuel for cooking, lighting and power generation.
* Produces good quality enriched manure to improve spoil fertility.
* Effective and convenient way for sanitary disposal of human excreta, improving the hygienic conditions.
* As a smokeless domestic fuel.

Special Feature of Bio Gas Engine

Saving in diesel**:** can replace 80% diesel in dual fuel mode or 100% in Single fuel mode.

(2) The engine conversion cost can be recovered.

(3) Exhaust smoke density - is less when run on bio-gas.

(4) Exhaust gas temperature - remains almost the same.

Gas Consumption

25-30 kg of dung is required to generate 1 meter cube of the gas. The consumption of the gas is 0.8-1.0 cubic meter per kilo watt hour. A 5 h.p. (3.7 kW) Biogas Engine will require approximately 2.5-3 meter cube of the Biogas per hour.

Power of the Engine

Diesel engines converted to Biogas engine will be derated and will generate approximately 60%-55% power that of diesel. i.e. 10 hp (6.5 kW) diesel engine converted to 100% Biogas engine will generate 5 –5.5 hp (3-4 kW).

GASIFIER SYSTEM

Types of Gasifier – There are three types of gasifier these are as follows

● **Updraught Gasifier:**

– Biomass flows downwards, and gas/air flow upwards

– Simple construction

– Tar content in gas high

- Most suited for thermal applications

● **Downdraught Gasifier:**

– Biomass moves downwards, so do air/gas

– Gas passes over high temperature zones: low tar

- Most suited for engine/gas turbine applications

● **Cross-draught Gasifier:**

–Biomass moves downwards, air/gas flow horizontally

–Suitable for high capacity systems

–Tar content is high

Application

● Shaft / Electric Power Applications - Small, medium power installations using eciprocating engines

-Large Power Installations using gas turbines, reciprocating engines

● Engine types: – Dual Fuel: Producer Gas with pilot Diesel for ignition

– Single Fuel: 100% producer gas, spark ignition engine

INDICATIVE LIST OF BIOMASS GASIFIER MANUFACTUERS

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Models / Cost / Prices / List of Manufacturers

Present cost of the Gasifer system (model wise) given by approved firms from MNES Govt.of India, list of manufacturers of the system.

M/s Rishi Pooja Energy and Engg. Co., Gorakhpur Model Elec. Ther. (Rs. in lakh)			M/s Ankur Scientific Energy Technical Pvt. Ltd., Baroda Model Ele. Ther. (Rs. in lakh)			M/s NSY Energy & Consultancy Services Pvt. Ltd. New Delhi. Model Ther (lakh)	
Urja 40	4.35	3.60	WBG/FBG40	4.05	3.65	200 kw downdraft	3.25
Urja 60	5.05	4.35	WBG/FBG60	5.45	4.95	360kw updraft	4.50
Urja 80	6.85	5.85	WBG/FBG80	6.90	6.20	360 kw downdraft	6.50
Urja 100	8.20	6.90	WBG/FBG100	8.25	7.45	600 kw downdraft	9.50
Urja 150	10.80	8.20	WBG/FBG150	10.70	9.65		
Urja 200	12.90	9.00	WBG/FBG200	12.95	11.75		
Urja 250	14.40	10.80	WBG/FBG250	15.15	13.65		
Uraj 300	18.10	12.90	WBG/FBG300	17.40	15.70		
Urja 500	24.40	15.30	WBG/FBG500	25.75	23.20		

GENERAL INFORMATION:-

- For single fuel operation (i.e. using biomass only as fuel) Amount of fuel needed (Biomass) – 1.2 to 1.5 kg/kW-hr of Electric output
- For Dual fuel operation (i.e. using biomass and Diesel as fuel) Amount of fuel needed (Biomass) – 1.2 to 1.5 kg/kW-hr of Electric output
- Proportion of fuel for duel fuel operation:- 0.3 kg diesel and 0.7 kg biomass per kg of producer gas
- Calorific value of producer gas = 15 to 20 MJ/kg
- Lower cost of gasifier for thermal operation
- M/s Ankur Scientific Energy Technical Pvt. Ltd., Baroda and M/s. Cosmo Powertech Pvt. Ltd; Raipur provide low cost gasifiers

Bio Diesel

Introduction

Bio-diesel is fatty acid alkyl esters obtained from transesterification of glycerides from vegetable oil or animal fats with suitable alcohol. It has very similar composition and properties as that of petroleum diesel. Diesel forms 40% of energy consumed in the form of oil. Annual import bill of crude oil 60400 crores (in terms of foreign exchange). Per capita consumption of fuel oil will be three times more need from the existing level of consumption.

Need of Bio-Diesel

- Current energy perspective- depletion of fossil fuels and hikes in oil prices.
- Bio diesel is renewable source of energy.
- It is less polluting than conventional energy fuels.
- Bio diesel is produced domestically, which would help in reducing India's dependency on imported petroleum.
- It is considered biodegradable and non-toxic
- The development of the bio diesel industry would strengthen the domestic, rural and agricultural economy
- Bio-diesel has positive energy balance ratio
- Bio diesel and bio diesel blends can be used in all types of engines without or with minimal modification.

ADVANTAGES OF BIO DIESEL IN INDIAN CONTEXT

- Utilization of local resources for local uses
- Reduce import of petroleum products
- Saving foreign exchange
- Create employment in rural sector
- By-product(Seed cake) can be a good fertilizer, pesticide and raw material for alcohol production
- Reduce environmental pollution
- utilization of wastelands for production of non-edible oil seeds

Benefits of Rural Biodiesel system

- Effective use of Wasteland
- Decentralized power generation for rural areas
- Meet out local demand of petroleum products
- Enormous job opportunities in rural area from petro-crop plantation to biodiesel as a diesel replacement

Availability of Non-edible oilseeds: India

Oil	Potential (MT)	Utilized (MT)	% Utilization
Rice Bran	474000	101000	21
Sal	720000	23000	3
Neem	400000	20000	6
Karanja	134000	8000	6
Jatropha	Potential to grow in waste lands		

Jatropha Carcus – Indian perspective

- It grows readily from cuttings and seeds
- Cuttings strike root so easily that the plant can used as an energy living fence post
- The active medicinal compounds can be extracted before oil extraction
- The remaining oil cake can be used as fertilizer

Poangamia Pinnata (Karanaja]

- Planting in road side for shading because it is evergreen plant and gives cool shade
- It starts fruits after 6-7 years
- Harvest season extend from November-December to May-June
- The yield of the seed 9-90 kg/tree
- 24-27.5% from the expellers and 18-22% from the village

POTENTIAL OF THE TECHNOLOGY:

- Biodiesel production has been identified as an important sector to revive the economy of the country
- Efforts have been started to develop large-scale biodiesel production.
- As biodiesel is obtained from non-edible oil seeds, its cultivation, oil expelling and trans-esterification are the important steps involved in biodiesel production.
- A village level enterprise has been envisaged
- A complete package of practices and technology for biodiesel production for village level industries is under development, which could be disseminated in the country