

Design and Study of Simple Biogas Reactor using Kitchen Waste Within the Habitat of Federal Polytechnic of Oil and Gas Bonny Island, Rivers State, Nigeria

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Abstract:- This research work is about design and study of simple biogas reactor using Kitchen Waste within the habitat of Federal Polytechnic of Oil and Gas Bonny Island, Rivers State, Nigeria to produce gas. The objective of the work is to collect and measure the amount of waste that is been generated within the study area as well as to construct a simple laboratory scale biogas reactor and using the kitchen waste as substrate and measure the amount of gas that is been generated from biogas reactor per day. Based on the objective for this research a biogas digester was designed. Two experiments was carried out to determine the extent of production of biogas and the duration required so as to determine the rate of formation of biogas. In experiment one, dissimilar kinds of biomass like rice, potato, green leaves, sugar in different amounts were mixed with cow dung and rice husk to prepare 4 samples to determine the maximum generation of biogas through fermentation process. The gas is collected in balloons and they were measured to determine the amount of gas produced in each sample. The extent to which the blowing of balloons took place determined the quantity of gas evolved in each of the incumbent samples. In experiment two, we have used two 5lt. bottles in which the amount of cow dung used varies while same amount of kitchen waste mixture was utilized. The process and conditions for trapping and analyzing the gas is the same as in experiment one. From this experiment the rapidness of formation of biogas was observed. The experimental analysis carried out also gives us a clear idea of the indulgence of materials with respect to their combination to deferring extent of concentration to deliver optimum generation of biogas, in particular methane thereby unveiling us to develop an imminent and high performance derivative affordable biogas reactor.

Costs related to collection, transport and treatment still make it difficult for adequate waste management, as its disposal is made in inappropriate areas, such as dumps, ditches, and other places devoid of adequate infra-structure (Carlini, M. *et al.*, 2017. and Apetato, M *et al.*, 1999).

Other than the problems associated with Metropolitan solid waste (MSW), infection of water resources and access to energy resources have typically addressed difficulties for economic improvement, human wellness, and environmental conservation all over world (Lindkvist E. Et al., 2017.; Lansing S. Et al 2018). Hence because of shortage of petroleum and coal it threatens source of fuel all over the world, additionally issue of their ignition induced study in various angles to get right of entry to the new wellsprings of energy, as sustainable energy assets. Sunlight based totally electricity, wind electricity, different heat and hydro wellsprings of power, biogas are environmentally friendly power assets. In any case, biogas is unique from other renewable energies sources in view of its characteristics of using, controlling and collecting organic wastes and simultaneously developing compost and water for use in agricultural irrigation (Hilkiah Igoni, M. et al 2008). Biogas has no geological limits nor does it calls for slicing edge innovation of delivering power, it also includes enormously smooth to utilize and apply. Deforestation is an extremely massive trouble in rising countries like Nigeria, a large portion of the element is based upon charcoal and gas-wooden for gasoline deliver which requires reducing of timberland. Additionally, due to deforestation it prompts decline the ripeness of land by soil disintegration. Utilization of manure, kindling as power is likewise hurtful for the well-being of most of the people because of the smoke emerging from them causing air contamination Karve .A.D. (2007). We need an ecofriendly alternative for electricity. Kitchen squander is herbal cloth having the high calorific really worth and nutritive really worth to microorganisms, that is the motive effectiveness of methane advent may be extended by way of a few large degree as said before. Implies better proficiency and length of reactor and price of biogas creation is dwindled (Shalini sing, et al., 2000). Additionally inside the considerable majority of urban groups and spots, kitchen

I. INTRODUCTION

A. Background of the Study

These days, one of the biggest problems faced by many countries, particularly developing ones like Nigeria is the final disposal of wastes, mainly due to environmental, social, and economic problems caused by its poor management.

squander is organized in landfill or disposed of which causes the general wellbeing dangers and diseases like jungle fever, cholera, typhoid. Insufficient administration of squanders like uncontrolled unloading bears some unfriendly effects: It now not simply prompts contaminating floor and groundwater thru leachate and similarly advances the rearing of flies, mosquitoes, rodents and different illness bearing vectors. Likewise, it transmits disagreeable odor and methane which is a tremendous ozone harming substance including to an Earth-wide temperature raise. Humanity can handle this trouble(chance) successfully with the assistance of methane , besides until now we've got no longer been benefited, because of obliviousness of important sciences - like result of labor is difficulty to strength handy for undertaking that paintings. This fact must be visible in modern acts of using low calorific facts sources like dairy cattle excrement, refinery profluent, metropolitan sturdy waste (MSW) or sewage, in biogas flora, making methane age incredibly wasteful. We can make this framework especially proficient through using kitchen squander/meals squanders. Karve .A.D. (2007).

As nicely as balancing out the natural heap of waste, it creates items, as an example, biogas, wealthy in methane, and digestate, which may be utilized as soil conditioner and is usually used for settling slop started out from sewage treatment, notwithstanding the truth that it's miles a likely software for any herbal count treatment (Cecchi F. Et al., 1991).

Other than the capacity for environmentally pleasant strength age, anaerobic absorption has turn out to be regularly contemplated and greater widely recognized because of many variables, as an instance, lower of waste elimination in sanitary landfills and provision of energy to little communities situated away from metropolitan centers.

One extra appreciably clear advantage is the smaller generation of slug. In anaerobic processing round 10% of natural waste is transformed into slug, and the excess 90% is applied as biogas. Likewise crucial to feature is the usage of anaerobic cycles at both little and large scope, with low execution prices, low demand of region and excellent capacity to endure excessive natural burdens (Chernicaró C. Et al., 1997). Thusly, biogas production and development of technologies for biomethane time have been energized by means of several international locations as an alternative for electricity generation or cogeneration of internal power engines (Budzianowski, W. Et at.,2015., atterson, T. Et al., 2011., Jha, A.K. Et al., 2013., and Venkatesh, G.; et al., 2013). Kitchen squander is natural cloth having the high calorific worth and nutritive really worth to microorganisms, that is the purpose productivity of methane introduction can be increased by a few sizeable diploma as stated earlier than. It implies higher proficiency and length of reactor and value of biogas advent is faded. Additionally in the more part of city regions and spots, kitchen squander is arranged in landfill or disposed of which causes the general wellbeing dangers and ailments like jungle fever, cholera, typhoid. Insufficient management of squanders like uncontrolled unloading bears some unfriendly consequences: It no longer simply prompts dirtying floor and groundwater through leachate and in

addition advances the rearing of flies, mosquitoes, rodents and other contamination bearing vectors. Likewise, it produces undesirable odor and methane which is a sizable ozone depleting substance adding to an Earth-huge temperature boost. Humanity can cope with this hassle(hazard) efficaciously with the assistance of methane , anyway until now we have not been benefited, due to obliviousness of essential sciences - like end result of labor is concern to electricity reachable for engaging in that paintings. This reality have to be seen in present day acts of 9 using low calorific facts resources like dairy livestock manure, refinery emanating, municipal solid waste (MSW) or sewage, in biogas plants, making methane age exceedingly wasteful. We can make this framework exceptionally powerful by using making use of kitchen squander/meals squanders. (Gunaseelan V.N (1997, Leal, M.C.M.R et al., 2006)

B. Statement of the Review Problem

The scarcity of petrol and coal compromises deliver of fuel at some stage in Nigeria and the world at large, additionally difficulty of their ignition caused study in various angles to get admission to the brand new wellsprings of electricity, such as environmentally pleasant power resources, Solar energy, wind energy, distinctive heat and hydro sources of energy, biogas are all renewable energy resources. However, biogas is unique from different renewable energy resources due to its qualities of utilizing, controlling and gathering natural wastes and simultaneously turning it into compost and water to be used in agricultural irrigation. By and huge, in Nigeria there's an important growth the population inside the sizable urban groups due to relocation of people from the rural regions in look for better ordinary environments. Bonny Island is not exceptional and due to this circulation in population has improved essentially in the development of additional biodegradable wastes (in any other case referred to as Municipal Solid wastes). The expansion in the populace will activate essential enlargement inside the extent of waste produce from kitchen. Right now it's far assessed that each own family has at least one kitchen with greater part of wastes held onto of their exclusive living spaces. An extraordinarily large part of the general population do not know approximately the environmental and wellbeing risks supplied by means of the accumulated waste components introduced from kitchen and have to be enlightened.

C. Justification

Kitchen waste is organic material having the excessive calorific worth and nutritive worth to microorganisms, that is the cause capacity of methane production and can be extended by several order of magnitude stated earlier. It implies better productiveness and length of reactor and cost of biogas production is dwindled. Additionally in a massive portion of urban communities and spots, kitchen waste is disposed in landfill or discarded of which causes the public hazards and illnesses like jungle fever, cholera, typhoid. Deficient management of wastes like uncontrolled dumping bears some damaging consequences: It no longer lead to polluting surface and groundwater via leachate and similarly advances the rearing of flies, mosquitoes, rodents and other contamination bearing vectors. Likewise, it emanates

unpleasant scent and methane that's a major ozone depleting substance adding to an unnatural weather change. Humanity can deal with this hassle(hazard) successfully with the assistance of methane, anyway until now we've not been benefited, because of ignorance of basic science – like result of work is dependent on energy available for doing that work.. This truth need to be seen in modern acts of using low calorific inputs like cattle dung distillery effluent, municipal solid waste (MSW) or sewage, in biogas plants, making methane generation highly inefficient. We could make this framework enormously effective by using kitchen waste/food wastes. This study is aim at the construction of simple scale biogas reactor with a view to identify and proposing a better sustainable and more effective management of kitchen wastes in Federal Polytechnic of Oil and Gas Bonny Island.

D. Aim and Objectives of the Study

The aim of this research is to construct a simple scale biogas reactor using kitchen wastes from the Habitat of Federal Polytechnic of Oil and Gas Bonny Island, The specific objectives of this research are;

- To collect and measure the amount of waste that is generated within the study area
- To construct a simple laboratory scale biogas reactor using the kitchen waste as substrate.
- To measure the amount of gas generated from the reactor per day
- To compare the compost effects on vegetation production

E. Scope of the Study

This study focus only on the use of all form of garbage generated from the kitchen as substrate. The research only cover female and male hostels within Federal Polytechnic of Oil and Gas in Bonny Island.

II. RELATED REVIEW OF LITERATURE

Pune (2003) has fostered a minimal biogas plant which utilizations squander meals in preference to any cow waste as feedstock, to fund biogas for cooking. The plant is adequately conservative to be used by metropolitan households, and around 2000 are as of now getting used - both in metropolitan and provincial houses in Maharashtra. The plan and improvement of this simple, but robust innovation for individuals, has gained ARTI the Ashden Grant for maintainable Energy 2006 within the Food Security class. Dr. Anand Karve (ARTI) fostered a conservative biogas framework that utilizes uninteresting or candy feedstock (squander grain flour, spoilt grain, overripe or deformed natural product, nonedible seeds, leafy foods, green leaves, kitchen waste, extra food, and so forth). Only 2 kg of such feedstock produces round 500 g of methane, and the response is completed with 24 hours. The conventional biogas frameworks, utilizing steers excrement, sewerage, and so on use round 40 kg feedstock to supply a similar amount of methane, and anticipate round forty days to complete the response. Accordingly, in step with the attitude of transformation of feedstock into methane, the framework created with the aid of is a couple of times as powerful as the normal framework, and consistent with the angle of response

time, it's far multiple instances as effective. Accordingly, through and huge, the new framework is multiple times as powerful because the everyday biogas framework. Dr. Anand Karve (2003).

A. *The Impact of Absolute Solids Convergence of Civil Strong Waste at the Biogas Created in an Anaerobic Nonstop Digester*

The entire solids (TS) grouping of the waste impacts the pH, temperature and viability of the microorganisms in the decay cycle. They explored one-of-a-kind groupings of the TS of MSW in an anaerobic consistently combined tank reactor (CSTR) and the relating measures of biogas created, to determine situations for best fuel advent. The results display that after the rate entire solids (PTS) of civil sold squander in an anaerobic regular assimilation process expands, there is a evaluating mathematical increment for biogas created. A real examination of the relationship between the quantity of biogas created and the fee all out solids fixation laid out that the preceding is a energy functionality of the remaining alternative, demonstrating that in the end within the increment of the TS, no in addition ascent inside the quantity of the biogas would be gotten. Hilkih Goni (2008).

B. *The Examination of the Reactivity of Methane.*

They presumed that it has in extra of multiple times the Earth-huge temperature raise capability of carbon dioxide and that the grouping of it within the weather is expanding with one to 2 percent every year. The article cross on by means of proposing that round 3 to 19% of anthropogenic wellsprings of methane start from landfills Kumar et al., (2004).

C. *The Increased Biogas Creation Utilising Microbial Energizers:*

They concentrated on the impact of microbial energizer aquasan and teresan on biogas yield from steers' fertilizer and joined buildup of dairy cattle manure and kitchen squander in my view. The final results suggests that double expansion of aquasan to cows manure on day 1 and day 15 expanded the fuel advent via fifty five% over unamended steers fertilizer and enlargement of teresan to cattel compost: kitchen squander mixed buildup 15% extended gas introduction. Shalini Singh et al. (2000).

D. *Biogas Activity:*

Lissens et al. (2004) completed a focus on a biogas hobby to construct the all-out biogas yield from 1/2 available biogas to ninety% making use of a few medicines together with: a mesophilic research middle scale constantly blended tank reactor, an up stream biofilm reactor, a fiber liquefaction reactor turning in the microbes Fibrobacter succinogenes and a framework that adds water for the duration of the interaction. These strategies had been ok in attaining sizeable increments to the all-out yield; be that as it could, the overview became underneath an exceptionally managed approach, which leaves leeway when applied beneath differing situations. Be that as it is able to, Bouallagui et al. (2004) confirmed that minor convergences in temperature don't severely affect the anaerobic assimilation for biogas advent.

E. *The Asset Constraint of Petroleum Derivatives and its Concerns:*

As Taleghani and Kia (2005) noticed, the asset restrict of non-renewable electricity sources and the troubles emerging from their ignition has brought on far and extensive examination on the openness of recent and environmentally pleasant energy property. Sun powered, wind, warm and hydro resources, and biogas are sustainable strength belongings. However, what makes biogas particular from different sustainable power resources is its significance in controlling and gathering herbal burn thru fabric and simultaneously delivering compost and water to be used in farming water device. Biogas has no geological limits or calls for fashion putting innovation for growing electricity, nor is it complicated or monopolistic. Murphy, McKeog, and Kiely (2004) completed a pay attention in Ireland inspecting the makes use of of biogas and biofuels. This look at furnishes an itemized rundown of examinations with different gasoline resources concerning its effect on the climate, finical reliance, and working of the plant. One of the ends the assessment determined turned into a greater prominent monetary benefit with the usage of biofuels for transport in place of power creation; however, strength age become extra lengthy-lasting and has much less renovation requests.

The growing oxygen tension all through moist oxidation on the processed biowaste elevated the aggregate sum of methane yield. In precise, the yield that is frequently 50 to 60% multiplied via 35 to forty% showing the extended capacity to get better methane to create monetary blessings. Thomsen et al. (2004).

F. *The Achievability for Dairy Cow Squander:*

The attainability for dairy cow waste to be applied in anaerobic stomach associated frameworks. Since the creature's squanders are more responsive than other cow squanders, the review recommends dairy cow squanders ought to be picked over other creature squanders. Carrasco et al., (2004).

G. *Anaerobic Processing:*

Jantsch and Mattiasson (2004) observe how anaerobic assimilation is a reasonable method for the treatment of wastewater and herbal squanders, yielding biogas as a valuable facet-effect. In any case, due to dangers in fireplace up and activity it's far often no longer idea of. A ordinary technique to forestalling flimsiness issues and keeping far from fermentation in anaerobic digesters is to keep the herbal heap of the digester a ways under its finest restriction. There are infinite factors which have an impact on biogas creation talent along with: natural instances like pH, temperature, kind and nature of substrate; mixing; excessive herbal stacking; association of excessive unpredictable unsaturated fats; and lacking alkalinity.

H. *The on area Expulsion of H₂S from Biogas Delivered by Food Squander Related to a High-Effect Ooze Biofilter for Steam Transforming Handling:*

They show that A biofilter containing immobilized oxygen consuming muck was successfully adjusted for the expulsion of H₂S and CO₂ from the biogas created utilizing food squander. The biofilter successfully removed the great majority of 1,058 ppmv H₂S from biogas added by way of food burn through treatment framework at a protection season of four hundred sec. The most excessive observed evacuation charge changed into 359 g-H₂S/m³/h with an ordinary mass stacking tempo of 14.7 g-H₂S/m³/h for the massive scope biofilter. The large scope biofilter using a mixed culture framework confirmed most desirable H₂S evacuation capacity over biofilters using explicit microscopic organisms' strains. In the dynamic examination, the maximum excessive H₂S evacuation fee (Vm) and half immersion consistent (Ks) had been determined to be 842.6 g-H₂S/m³/h and 2.2 mg/L, one after the other. Syngas turned into created by using the reactant steam transforming of sanitized biogas, which suggests the threat of excessive productiveness electricity age through SOFCs and methanol fabricating. Jong Won Kang et al (2010) Taleghani and Kia, (2005) illustrated the monetary, and social advantages of biogas creation.

➤ *The Financial Advantages had been as in Line with the Following:*

- Treatment of strong waste without lengthy haul observe-up fees typically because of soil and water infection
- Increased close by appropriation of compost, compound herbicides, and pesticide hobby
- Generation of pay thru manure and electricity deals (biogas/power/heat) to the general public matrix
- Improved soil/agribusiness efficiency through lengthy haul results for soil design and richness through manure use
- Reduction of landfill area and thusly land fees.

➤ *The Social and Wellness Impacts Related with Biogas Include:*

- Creation of labor in biogas vicinity
- Improvement of the overall country of ranchers because of the neighborhood accessibility of soil improving manure
- Decreased odor and scrounger rodents and birds.

III. METHODOLOGY

A. *Description of the Study Area*

Bonny Island is arranged at the southern fringe of Rivers State within the Niger Delta of Nigeria. Bonny Island falls within the Ocean facet edges on-shore geomorphic sub-environment of the Niger Delta and lies among 4°52'N to 5°02'N and longitudes 6°56'E 7°04'E. The overview area is situated in the moist tropical Niger Delta district of Nigeria, portrayed with the aid of unmistakable moist and dry seasons. The dry season appear among November and March at the same time as the moist season is from April to October

(Amadi, 2010 in Nwankwaola et al 2012). Bonny Island has a population of 214,983 as at 2006, yet a population

projection of 302,000 for 2016 by using population census (National Public Commission 2006).

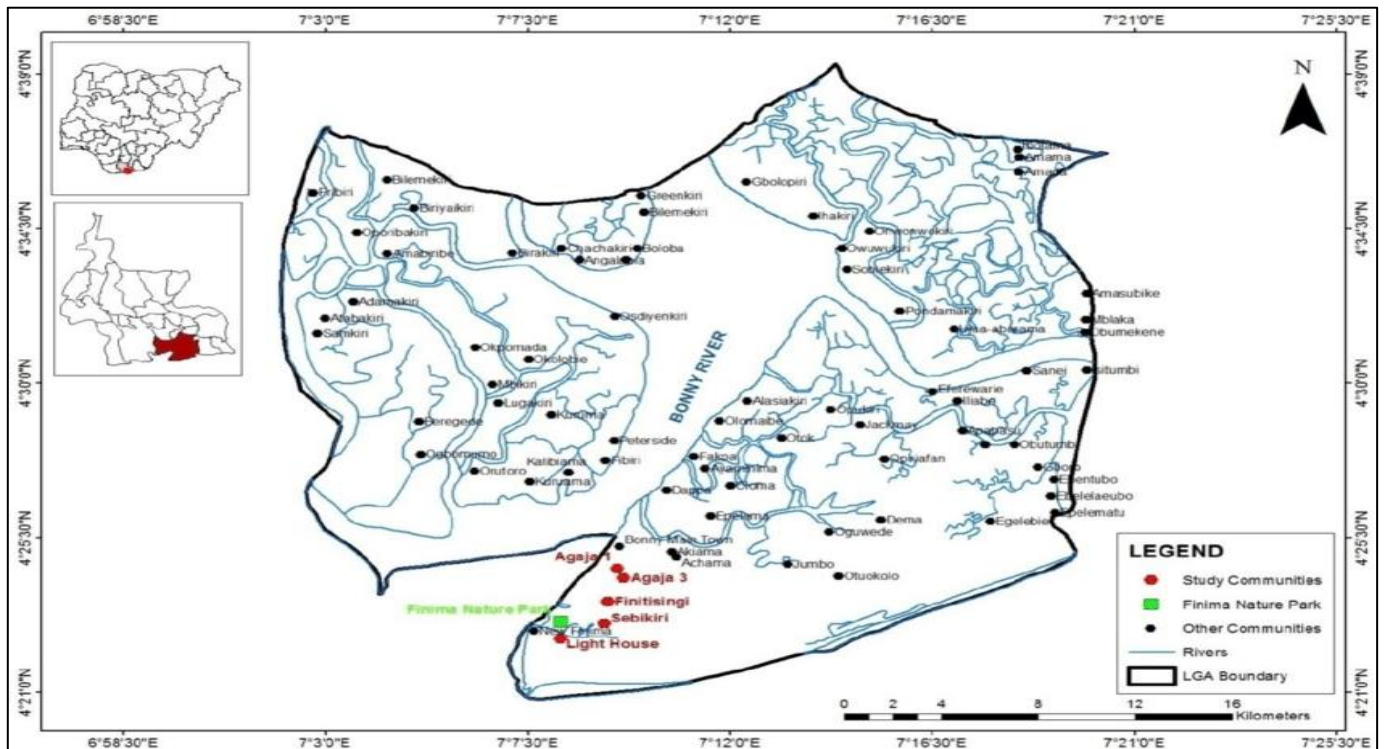


Fig 1: Map Displaying Bonny Island

➤ *Geology*

Geographically, it includes Pleistocene to Ongoing silt stored with the aid of fluvial and shallow mainland shelf hydrodynamic cycles. The place is portrayed by strong wave and tidal action, which in addition compacts the sediments. Plant growth on ocean shore edges at some point of the years has led in the formation of extensive primary tropical freshwater forest. Energy situations decline from shore face to outside facet. The litho facies include the delta tip, essentially uniformly overlaid excellent to medium grained sand.

➤ *Hydrology*

The hydrogeology of the area is profoundly impacted by using the presence of ferruginous sandy formation because of high oxidation condition of the near floor aquifers, and overwhelming saline water interruption. The sand shapes the widespread aquifer nearby while the clay frames the aquitard. The water desk within the space varies with season. The region has a declining water table at some point of the dry season. By and big, water desk inside the area is dynamic and ranges between 0.1-3 m relying upon the season (Amadi, 2010 in Nwankwaola et al 2012).

➤ *Rainfall*

Verifiable facts show that the long stretches of July, August and September have the most noteworthy precipitation while December, January and February record the least rainfall (Ogunorisa and Adejuwon, 2010 in Shell, 2019 pp. Four-7). The imply every year precipitation for Port Harcourt to be 2370.5mm and that of Onne/Bonny to be

24384mm. Warri has the most elevated yearly rainfall of 2907.8mm within the Niger Delta accompanied by way of Calabar (2903.8mm) and Onne (Shell, 2019).

➤ *Vegetation*

Four (4) habitat types had been observed. They are; mangrove swamp (natural habitats), freshwater (natural habitats) and secondary forest (disturbing habitat). In unique, mangrove marsh have to be seen at George Pepple, Alasakiri, Bomu-Bonny Trunk Line, Issille-Ogono and Bonny community, freshwater at Otuokolo and secondary forest at Abalamabie community.

➤ *Land Use, Settlement Pattern and Housing.*

The settlement pattern of the community is largely linear except in Abalamabie which exhibited some clustering in addition to the linear formation/pattern. These communities are rural in nature and aside from Abalamabie which has not many tarred streets, modern health center and educational centers, markets and drainage infrastructure all the othe communities lack the urban amenities like tarred roads for vehicular transportation. Moreover, the communities are profoundly homogeneous concerning accommodations pattern and enterprise pastimes. Land proprietorship is normally vested domestically head, no matter the truth that at times, families or human beings might declare land. Notwithstanding, land component is usually on the privilege of the local vicinity initiative; the course of land procurement starts off evolved with a part making solicitation to the neighborhood place head who then, at that factor, makes suitable distribution. Land use locally is to a super

extent for non-public functions and cultivating as it have been.

The dominant housing structure in the study area comprises sand-crete block wall, cemented floors and corrugated zinc roofing sheets. An exception to this was at Otuokolomabie and Alasiakiri where the houses were mainly constructed of bamboo/thatched walls floors and roofs Compared with national characterization of houses in the rural areas of the country constructed with planks/ disused wood (0.4%), cement (40.1%) and earth/mud (48.6%) (NPC and ICF International, 2014), the study area generally reflected a mixed picture of houses built with sandcrete block and thatch houses. The large household size earlier noted among respondents suggests the possibility of overcrowding.

B. Collection of Kitchen Waste from Source

The squanders accrued from the Hostels at fact of generation (kitchen wastes) remained cucumbers, onions and rice items, cooked vegetables curry leaves and so on. The wastes samples have been amassed from various points within the males and females hostels of the Federal Polytechnic of Oil and Gas. The waste have been segregated such that only decomposable kitchen waste were collected. It was taken to the Department of Science Laboratory Technology where the simple scale constructed biogas reactor /digesters was mounted for the analysis.

➤ Bio-Digester/Bio-reactor: Experiment 1



Fig 2(A)



Fig 2(B)

Fig 2: Experiment 2 Setup of Batch Digester

• Devices Used:

1litres and 5Litres of Soft bottles; thermometers; pH meter; gas flow dimension meter. The bioreactor contains of closed soft bottles with a capacity of 1litre and 5Litre each, in the experiment 1 and 2 which anaerobic conditions was created, were 90% of the capacity was occupied and the outstanding space is kept for gas to be collected. The bioreactor was mixed then had places for measuring temperature and pH. The bioreactor was charged using substrates of different compositions: 1- Cow-dung slurry, 2- food wastes namely; cooked rice, cucumbers, potatoes, Green leave vegetables, tomato, cabbage leaves and curry leaves etc.

• Experimental Procedure

The experimental work was conducted at the Science laboratory Technology (biology Unit) using scale method in plastic tank.

The experiment was done in 1litre and 5litre plastic digesters in two sets of experiments. Here different concentration & combination of wastes were used. It was done to observe the production of gas using kitchen unwanted.

Experiment One, dissimilar kinds of biomass like rice, potato, green leaves, sugar in different amounts were mixed with cow dung and rice husk to prepare multiple samples to determine the maximum generation of biogas through fermentation process. Water is poured into it to prepare fine slurry, thereby increasing the moisture content and augmenting a suitable environment for the microbes. Variable mixtures were allowed to ferment in empty plastic water bottles with a thick pipe secured of to the mouth with duct tape so as to generate an air tight space within the bottle. The other end of the pipe was fixed to a balloon that substantiated as gas holder.

The bottle that used were 1Litre plastic bottles, in total 4 samples were being developed with 850ml of it filled with the slurry mixture. And they were kept for a week before further analysis was done.

Table 1: The Compositions of the Slurries are Mention Below

Sample 1		Sample 2	
Cooked Rice:	100gm	Rice Husk:	50gm
Green Leaves & stem:	100gm	Sugar:	50gm
Cow Dung:	100gm	Raw Potatoes:	50gm
Water:	to an optimum level	Cow Dung:	200gm
		Water:	to an optimum level
Sample 3		Sample 4	
Cooked Rice:	150gm	Cooked Rice:	100gm
Potatoes:	50gm	Potatoes:	15gm
Sugar:	100gm	Sugar:	15gm
Cow Dung:	250gm	Cow Dung:	50gm
Water:	to an optimum level	Water:	to an optimum level

Experiment 2, the amount of cow dung used was varying in both the 5lt bottles and same of kitchen waste mixture is being used. The process and conditions for tapping and analyzing the gas is same as of experiment 1.

The bottle being used were of 5Litre capacity, in total of 2 samples were being developed with 4.5lt of it filled with the slurry mixture. And they were kept for a week before further analysis could be done

Table 2: The Compositions of the Slurries are Mention Below

Sample 1		Sample 2	
Cow dung:	350gm	Cow dung:	1 kg
Sugar:	50gm	Sugar:	50gm
Rice:	400gm	Rice:	400gm
Water:	to an optimum level	Water:	to an optimum level

➤ *Category of Food Wastes and Preparation of Anaerobic Inoculums:*

Food wastes collected from Students Hostels were designed for dewatering. The wastes mostly contain of cucumbers, onions, rice items, cooked vegetables, potatoes and curry leaves etc. The anaerobic inoculums were arranged from slurry of cow-dung which was collected from close cow plot dung.

C. *Data Analysis:*

➤ *Processing of Food Wastes and Introduction of Anaerobic Inoculums:*

The collected food wastes from the hostel were segregated, blended and added to the ‘pre-designed anaerobic reactor and then cow dung was injected into the bioreactor comprising food wastes. The substrate containing of all the branded food wastes was mixed with a mixer to form a uniform phase throughout the whole volume of the Reactor.

➤ *Compost from Biogas slurry*

The remainder of the fermentation arises out as sludge which is known as “digested bio-slurry. Fermentation sludge and biogas was the end products of the process. The fermentation slurry was mixed with the construction mass to

create high-grade compost products. Bio-slurry discharged from the reactor retains all nutrients originally present in the feeding material which makes bio-slurry a potent organic fertilizer. The composition of bio-slurry depends on the nurturing and the volume of water added to the substrate in the digester. After the fermentation process, the biogas slurry was analyzed for nutrients using standard procedure.

IV. RESULTS AND DISCUSSION

The results gotten are showed in the tables below. As the pressure were measured, the temperature was analysis using a thermometer (0-100°C), the analysis were documented. The characterization of food wastes components were analyzed for different preliminary physico-chemical parameters as shown in Table1. From the Table-2, it was clear to observe that the variables gotten were; time, temperature and pH (measured using a manometer). It was presumed that the measured Temperature and pH was like green gas/biogas produced during wastes digestion. All the wastes assessed produced biogas after 24 hours; this was corresponding to temperature increase (Table-2).

Table 3: Characteristics of Food Wastes

S/N	Components in Food Wastes	Value (%)
1.	Total Solids	63.5
2.	Moisture Content	43.4
3.	Volatile solids	16.4
4.	pH	6.6-7.1
5.	Temperature	28-34.2 (°C)

Table 4: Shows Average Temperature Readings in Degrees Centigrade of Individual Food Wastes

Days	1	2	3	4	5
Cucumber	23	22	23	22	24
Onions	22	23	24	23	23
Rice items	24	26	23	26	22
Cooked vegetables	23	22	21	21	24
Curry leaves	21	20	22	21	23

Table 5: Showing NPK Values from Biogas Slurry

SL. No.	Type of Wastes	% of N	% of P	% of K	BOD in mg/Lt
	Wet slurry				
1.	from Biogas Plant	2.02	1.12	3.44	21
2.	Dry Slurry of Biogas Plant	1.08	0.97	1.57	-
3.	Cow dung (alone)	0.61	0.32	0.83	33

In Experiment One, at all 4 sets, gas production occurred but the compositions of gases were not analyzed. The outer diameters of the balloons were measured so as to know which sample got most gas production.

From the result, it has been seen that in sample 4 which contains minimum cow manure and maximum food waste produced more gas than the other three samples. It clearly means that kitchen waste produces more gas than cow dung as kitchen waste contains more nutrient than dung. So use of kitchen waste provides more efficient method of biogas production. Also it is observed that in the sample 1 the gas production is lesser than the other. It may be due to the excessive use of green stem and leaves in the sample along with kitchen waste. These kinds of substances contain lignin and lignin is not digestible by the microbes so excessive use of lignin contained material may choke the digester and gas production will be lesser.

In Experiment Two, sample 1 takes lesser time to produce gas than sample 2. It was observed that the production of gases are rapid in sample one than that of sample 2. There are many factors that could have played their role in the variation of production of gases the samples.

Table 6: Measurement of Balloon Diameter of Experiment 2 in cm

Days	Sample 1	Sample 2
1	10.4	5.8
2	16.2	7.9
3	17.3	12.3
4	21.3	14.5
5	20.3	16.4

In Experiment one, it is clear as seen from table 4.3 that gas manufactured increases in sample 4 and sample 2. And have minimum gas production in sample 1 as it contained green stem of trees. Therefore we can say that lignin content biomass or excessive plant material can greatly affect the biogas production.

In Experiment 2, the observation was done for 5 days. And it can be seen from the table 4.4 that sample 1 have a rapid growth of gas production than that of the sample 2. Sample 2

also have gas produce but its taking some time in the process. There is a decrease in gas production in day 5 in the sample 1. This may be due to some leakage in the experimental setup or gas production was ceased due some other biological factor.

V. CONCLUSIONS

The operational application of soft bottle biogas reactor used for manufacturing of biogas by decaying kitchen waste offers a significant resource growth solution and an inflexible waste management system. Its low cost and its independent working conditions under suitable considered parameters prove that it is economic. In rising countries like Nigeria, more than 80% of the Populace lives in the rural areas where more than 90% of the energy being used up comes from non-commercial resources, the major one being firewood. The cumulative charge of conventional fuel in the city areas requires the exploration of other energy resources. Animal and plant wastes are plentiful especially in local areas.

In the current research, average manufacturing of Green gas (17.1kg/day) was observed at the end of sample 1 (experiment one), whereas average of 11.38kg/day was record in sample 2 (experiment two). Biogas manufactured from food wastes can be as a real supplement for fossil fuels. The manufacturing of biogas from food waste produces a substitute energy resource. The method also generates a tremendous residue that retains the organic fertilizer value of the original waste products. The exploration for different source of energy such as biogas must be strengthened so that environmental catastrophes like deforestation, desertification, and erosion can be arrested (Chanakya et al, 1993). The outcome on NPK study showed that, the possible source in the use of anaerobic digesting system for energy producer could speed dependable NPK values in the slurry gotten from biogas process. Additional, it might be stress-free to convey the farmers to use this biogas slurry as dung/manure for sustainable agricultural processes. The result of this research recommend that, the food wastes produced from the hostels can be used for Green/Bio gas manufacturing and as organic manure/fertilizer.

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