Toilet Linked Biogas Plant"-As a Means of Total Waste Management at Domestic Level in Pratappura Village

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Abstract--- Untreated waste disposal leads to pollution which has potential threat to harm local community as well as leaving beings. In developing countries such as India, about 54.28% household lacks sanitation facilities hence pracitses open defecation.Open defecation causes odour and health risk to humans. Health risk is increased in monsoon and pollution of water sources .The use of firewood or kerosene filled stoves indoors is everyday practise in most of India.The use of such stoves is not only particularly bad for the environment but it also has detrimental health effects. Health effects due to smoke inhalation cause 1.6 million deaths per year, 28% of deaths due to indoor air pollution occur in india.These effects also account for 20% of fatalities in children under 5 years of age. To alleviate or end some of these unsustainable and dangerous practices the installation of a biogas settler with a latrine facility feed has been proposed.The system will collect waste from both human and animal faeces and convert it to energy and fertiliser. In this paper, pratappura village situated in district gandhinagar,state gujarat,India is take into consideration for toilet linked biogas plant.

Keywords: - toilet linked biogas, biogas, total waste management,sanitary biogas unit

I. INTRODUCTION

Pratappura (balva) is a village in kalol taluka in Gandhinagar District of Gujarat State,India.

It is located 24 KM towards west from District headquarters Gandhinagar.It is surrounded by Kadi taluka towards east, Ahmedabad towards South, Detroj Rampura Taluka towards West.

Fig. 1: location of Pratappura village

The main occupation of villagers is farming and other is working in an industry nearby.The village have disintegrated community.mainly 7 residential parts are considered by the village.other than land used in farming remaining is pasture.

In village inadequate management like uncontrolled dumping bears several adverse consequences: It not only leads to an ugli -f ication of the living area, but also to a high r i s k o f p o l - l u t i ng surface and groundwater through leachate and furthermore promotes the breedi n g o f f l i e s, mosquitoes, rats and other disease vectors. In add i t i on, i t emits unpleasant odours and methane, a major greenhouse gas contributing to global warming.

By surveying the village, it has estimated that out of 377 families of the village only 115 families have toilet facility which means almost 69% practices open defeaction. Untreated human waste can harm community health as well as contaminant the resource water.Firewood is majorly used for half of the energy requirement.Animals like cow, buffaloes have shed to live nearby their owner.

II. CURRENT WASTE MANAGEMENT PRACTICE IN PRATAPPURA VILLAGE

The organic wastes like kitchen food waste is fed to the street animals.The leftover of farm which is grass is fed to pet animals.the dung of pet are used to convert manure and is used as fertilizer.The quantification of waste at domestic level was carried out by observing management prctise for a week at sarpanch's home where plant was going to be installed. Animal dung in the village was openly dumped together to convert it naturally into manure by mixing it with grass as shown in figure .

But the threat to human health is the open defecation as it contain various disease causing viruses and bacterias as well as the pathogen content is very high in human excrement.so it is necessary to provide basic sanitation facility in order to improve the uality of life in such village.Open defecation have many harmful effects in environment.

Fig. 2: Manure from animal dung and farm waste

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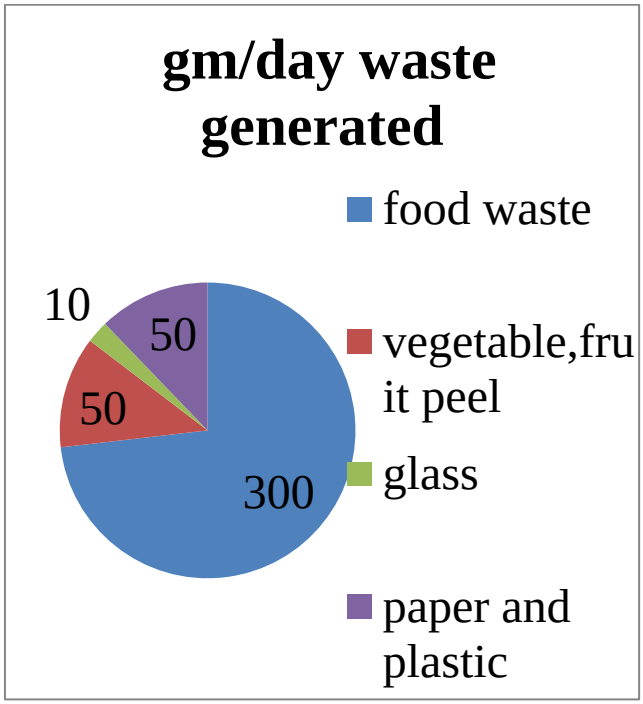

Fig. 3: Composition and Quantity of waste generated

Thus, The different kinds of bio waste including human excreta causing serious threat to human health and cleanliness of the surroundings can be converted to bioenergy and bio manure by treating with the application of biogas technology.

III. Literature Review

A. M. H. Panchani, N. A. Nagar;" Development of Complete Waste Management System at Domestic Level for Rural Areas", International Journal of Earth Sciences and Engineering

In this paper, they designed On-site domestic waste collection and treatment using renewable source of energy as a sustainable solution.By providing mixing and maitaining feed input ratio.

B. S. O. Dahunsi and U. S. Oranusi ," " Co-digestion of Food Waste and Human Excreta for Biogas Production" British Biotechnology Journal

In this paper,an Experimental study of 40L Lab scale digester for 60 days was carried out.They come to conclusion after study that Resulted that treating human waste through anaerobic digestion is a credibly ethical sanitation technology.Food wastes and human excreta, when used in combination are good substrates for biogas generation.

IV. Methodology

Adoption of Total waste management (TWM) based biogas plant to take care of human wastes along with other feed materials to generate biogas is an important way to get rid of hygiene problems.

Based on following the system was designed at sarpanch of pratappura's house:

1. Toilet wastewater and kitchen waste is considered as input to the plant.
2. Family size- 5 members
3. Type of toilet- Pour flush
4. Water usage- 1.5-2 L/capita/day
5. Excreta-0.4 kg/capita/day
6. kitchn waste- 0.250-0.350 Kg/family
7. BOD at 20^0C of the mix- 1000-1200mg/L
8. COD of the mix-2500-3000 mg/L
9. Biogas production from human waste- 0.1 cum. Per person per day
10. Biogas from kitchen waste- 0.07m^3/kg
11. Biogas from cattle dung:0.04 m^3/kg of cattle dung
12. Retention time of the feed in the biogas plant-25 days
13. Black water from the toilet-2L/capita/day
14. Urine-1.5 L/capita/day
15. Kitchen waste water- solid to water ratio 1:1

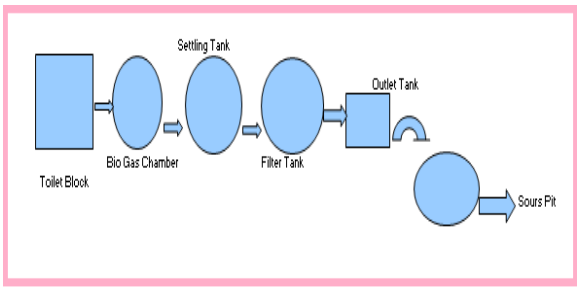

Fig. 4: toilet linked biogas process

On the basis of 5 person of a family and their discharge to toilet which is input for digester, capacity is determined

- Capacity of digester tank-500L
- Capacity of settling tank-100L
- Capacity of Filter tank-100L
- Cost of Full plant installation- approx.20,000 INR
- Material of Construction: LLDPE/HDPE
- Manufacturer of plant components is Sintex industries Ltd.
- Calculated Daily inflow-20L
- HRT=20-25 days

Fig. 5: Installations of toilet linked biogas plant at pratappura at domestic level

A. The biogas chamber:

The sewage from the toilet is brought by gravity to the anaerobic digester.i.e.biogas plant.The food wasrte from the kitchen is h and mixed with water in the ratio of 1:1 to form the slurry,which is also added to the biogas plant.The organic content of the feed undergo anaerobic digestion which results in generation of biogas.Unique product of

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sintax is used as biogas digester here in order to increase the residence time.

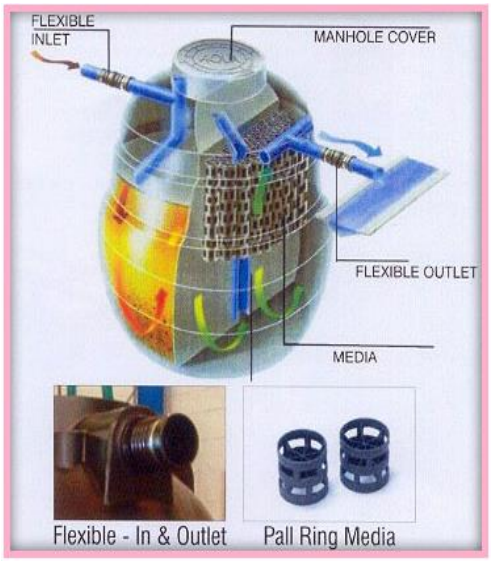

Fig. 6: Septic tank by sintax

B. Settler:

The over flow from the biogs plant enters the settler, where the settleable solids are removed.The discharge:e from bathrooms and wash area can be directly led to the settler for the purpose.

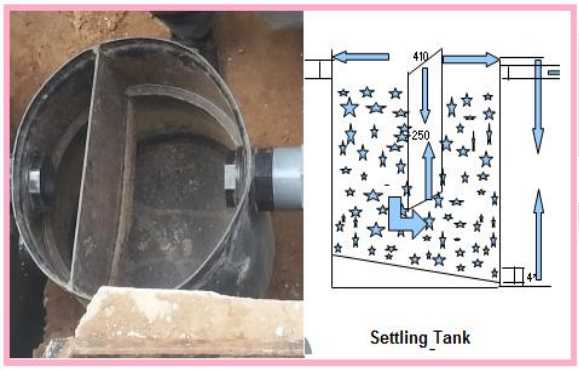

Fig. 7: Settling tank

C. Sand Filter:

The over flow from the settler is loaded to sand filter at the top to remove carry ovr suspended soids.The filtered water is collected at the athroom and taken to treated water storage tank.

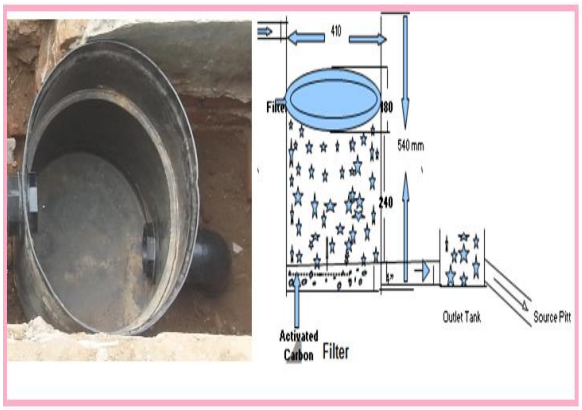

Fig. 8: Filter tank

D. Storage tank:

Depending upon the final utilization of treated water, volume sufficient to hold it for specified time is provided. Biodegradation of organic matter under anaerobic condition to generate biogas with methane as the main component. The settler and sand filter provides the polishing treatment.

V. Conclusion

The installed plant is proposed to solve sanitation problem mainly and it can save fuel by providing biogas.The only problem with such plant is the operation and maintanance as it requires certain

concern.if acid is used for cleaning of toilet it can affect the syste,.soapy water can be tolerated.

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