Society & Change
Vol. XIII, No.3, July-September 2019
ISSN: 1997-1052 (Print), 2227-202X (Online)

Human Excreta of Refugee Camps: The Source of Biogas

Md Sayed Ali*

Abstract

Non-renewable natural gas is going to be exhausted very soon and the renewable sources of energy are required in order to fulfil the requirement. It is evident that human excreta can support a part of fuel. The aim of the study is to assess how human feces can be utilized as a source of fuel gas. Biogas is a mixture of Methane, Hydrogen and Carbon Monoxide which can be oxidized or combusted in the presence of Oxygen. Biogas can be used as fuel in cooking and heating purposes. In addition, electricity and heat can be produced if biogas is used in gas engine. Study with biogas production from human excreta is a social research in nature, so both the qualitative and quantitative research method was taken into consideration.500 refugees were considered as one unit for collection of their excreta in septic tank. Studied from journals, articles, research reports from other national and international organization for secondary data. One person passes 250-300 grams of fecal matter per day [Andriani, D., et al 2015].. 500 - 520 living members in a camp can give rise to 150 Kilogram of carbon per day. At least 24% carbon in 150 Kilogram dry matter in one day. Methane containing biogas provides heat energy approximately 6-8 kWh/m^3 equivalent to 0.5liter of diesel or 5.5 kg of firewood. Therefore, some 200 liters of biogas equivalent to 1.0 kg of firewood, 100 liters biogas equivalent to 1.0 kg dried animal dung, 500 liters of biogas equivalent to 1.0 kg charcoal, and 50 liters of biogas equivalent to 1.0 kg human excreta. Literature evident that each cubic meter (m^3) of biogas contains equivalent of 6.0 kWh of calorific energy [Balat, M. and Balat, H., 2009]. Ten million refugees in the world can produce 388.8 billion K.cal energy or 0.0927 billion kilo watt hour electricity. This bio-energy can be beneficial to economy, social and environmental condition and agriculture field as well.

Keywords: Biogas, Energy, Septic tank, Human excreta, Refugee

* Brigadier General, PhD Candidate, Bangladesh University of Professional (BUP), Email: sayedali1044@gmail.com

Introduction

The use of biogas had been reported about 3000 BC. It is used for cooking and as a source of energy for lighting. It was used in Assyrian bath for heating and for lighting the Victorian lamp in the mid nineteenth century [Sibya, 2016]. Presently many busses are being run by biogas in Sweden, UK, Germany and so on. About 50 million household uses biogas for cooking purposes in China [Gosen and Lu, 2013]. .Biogas is produced due to digestion of organic waste by bacteria in absence of Oxygen. Biogas is a mixture of different gases and agriculture waste, municipal waste, sewerage, can give rise to biogas. It can be considered as a renewable energy source with scanty carbon foot print.

Biogas is a mixture of methane, hydrogen and carbon monoxide which can be oxidized or combusted in the presence of oxygen. Electricity and heat can be produced if biogas is used in gas engine. Compressed Biogas (CBG) can be made by compressing biogas [Hakawati et al. 017] is used for cooking and as a source of energy for lighting. About 17% of vehicle use biogas as fuel in UK. In some countries, biogas is being used in lieu of natural gas (Hakawati et al., 2017).

Energy usually comes from electricity, natural gas, coal and different types of solid biomass fuel. New sources of renewable energy are required for meeting the demand of electricity. In this regard, domestic septic tank from rural, urban, commercial areas and high-rise apartment complex and the refugee camps may be considered as the sources of energy. At present, there are about a million Rohingya refugee in Bangladesh. Refugees are living in a compact area and their feces can be utilized for energy with technological process.

The excreta of the refugee people can be stored in an air-tight container which are portable and can accommodate the excreta of 150-500 people. These septic tanks can help to produce inflammable gases that can be added as a source of renewable energy. It can be stored in cylinder, can be transported to other areas and can be used in small industries. In this aspect septic tank of community area and refugee camp may be a good source of fuel gas for use in the camp area or domestic use or can be used as (CBG) concentrated biogas.

Methods

As the production of fecal matter per head is varying from 250-300grams (Andriani et al. 2015, it was needed to identify the measure by which the fecal matter of bulk refugee areas can be consumed for the production of biogas and manure from the sludge. Some 6 to 10 persons may remain in a house or in a tent and they were usually responsible for the construction and maintenance of their residence and their toilets. The fecal matter has

to be collected from different small tent to central area nearby. Different capacities of tanks: (i) The tanks which can hold the 5 days fecal matter of 150 person fecal matter and round about 225 kg -250 kg capacity or (ii) 5 day fecal matter of 500 persons with the capacity of 750- 800 kg and or (iii) Underground septic tanks: As the refugee camps are temporary, underground septic tank may not be feasible. If possible , two tanks to be made side by side with the provision of gas out let. one tank to be in use and one to be kept reserved for alternate use. It is better for production of gas . In all cases fecal matter to kept for two months. Gas to be taken out through out let key and to be reserved in the cylinders as compressed bio gas (CBG) and to transport to the users end. The sludge abandoned in the tank after taking out the gas , to be used as manure in the agriculture field. The tanks to be recycled time and again. Thus the fecal matters in temporary camps and in build up can also be utilized for production of biogas and manure for agriculture lands. In camp area refugees usually use pit latrine and causes environmental pollution.

Results

In the light of study in built up area, if 520 refugee passes 300 gm feces every day, then approximately 150 kg/day (300gm x 520 persons) fecal matter will be collected. So 24% carbon present then 150 kg dry matter could be made available in one day. In five days, it becomes 750 kg and gives some 108 kg of carbon. Each cubic meter (m^3) of biogas contains equivalent of 6.0 kWh of calorific energy (Balatand Balat, 2009) that can be utilized in:

i. One person gives rise of 500 ml kerosene (approx.) or equivalent per month. In Bangladesh, there are 160 million people those who can save 80 million liter of Kerosene per month or 960 million liters kerosene or equivalent energy per year.

ii. 1000 people can give rise 1296 kg carbon per month.

iii. Energy from biogas:

iv. 1.0 kg of carbon can exert 500 liters of biogas, 160 million people can produce 103,680,000 m^3(648,000 x160m) biogas in a month. Or, one million refugees can produce 648,000 m3 (648000 x 1m) of biogas in a month.

v. 1.0 m^3 biogas can generate 1.25kWh electricity. Some 129.6 million kWh electricity in one month or 1.555.2 billion kWwh in a year in Bangladesh. Or, 8,100,000 kWh (64,80,000 x 1.25 kWh)

vi. 1.0 m^3 biogas has Caloric value about 5000 kcal, can give rise to 518.4 billion kcal of energy per month.

It is expected that in a year Bangladesh can save about 960 million Liters kerosene or equivalent energy or can produce about 6220 billion kcal of

energy or about 1.55billion kWh of electricity from human excreta per year. This amount of energy can be used in household, small industries and even can be shifted to national grid of electricity.

Discussion

A simple pit latrine is less expensive those who are poor people they maintain this as primary and basic forms of household sanitation. Sometimes it becomes difficult to maintain the basic standard of sanitation. Community sanitary latrine may be the ideal, as these fecal matters can be treated by the help of local and government body. This system will improve the maintenance activity [Montgomery and Elimelech, 2007].

Cow dung, human night soil and agriculture waste can be used in anaerobic bioreactors in many parts of the world specially in Nepal. They produce methane gas, which is used in kitchen and for lighting [Gautam et al., 2009]

Bangladesh is a middle-income generating country which is shouldering more than a million refugees those who came from neighboring country Myanmar. They are the victim of ethnicity, linguistic and religious minority in Rakhine state of Myanmar. Presently, they are staying at Kutupalong and Nayapara in the southeastern side of Bangladesh [Sultana et al., 2011].

When refugee crisis comes on any country, many countries and agencies try to help the affected country. Many people live in a crowded area and disposal of night soil becomes a practical problem. Many gastrointestinal diseases breakup. In some camps of Uganda more than 200 people use one latrine in refugee camp area. Which should not be more than 50 people per latrine [Bonner P C et al 2007]

For using latrne- maintenance and treatment should be maintained. To find specific locations for sanitation and to restrict access to a certain number of refugees. They have to be guided by earmark towards sanitation/latrine [De Vries et al 2017]

The latrine in Uganda specially in Bududa district are relatively dirty which causes unhygienic condition leading to breakout of many diseases. This may lead to increase the presence rodent leading to breakout of special type’s disease like Lassa Viral fever.

Cattle manure, human excreta and agriculture residues are used in anaerobic bioreactors in many parts of the world to produce methane gas, which is used for the purpose of cooking and lighting [Gautom R et al 2009].

Complex emergencies remain major threats to human well-being in the 21st century. More than 1000000 Rohingya people entered from Myanmar to Bangladesh, Myanmar count them as a minority people. They fled to neighboring countries for more than last 20 years over. Recent crisis are the sudden flow started about one year back. It identified that water supply and sanitation is moderate. Their nutrition and health status are better now. Average level of water and sanitary status are acceptable.

Conclusion

Many international helping body like WHO, URCS, UN Health sector trying to overcome the situation It is believed that the many international agencies spending money in many sector in the camp area around the world. If latrines are made for biogas production then the environment will be friendly, 'Methane gas produced from the plant to be used as a source power, which will reduce the green house effect and manure from the sludge of the plant contributing I in production agriculture product.

Looking to the source of renewable energy: Community residence like latrine to be made for refugee camps which can accommodate 150 to 500 persons fecal matter and to switch over the fecal matter to another tank. After consuming the gas the sludge to be taken out and the tank can be used again. So, the cycle will be continued.

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