

Biogas Generation from Human Excreta

A multi-dimensional Sanitation Approach- Experience of Lem Ethiopia

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Background

High population pressure and unplanned urbanization complementing with poverty is worsening the sanitation situation of communities in developing countries. The attitude and tradition with regard to sanitation and lack of access to proper sanitation means accelerate soil and water pollution that again resulted in poor health situation. Live alone in rural areas even in cities/towns where slum areas dominate; people use open spaces including river banks as public toilets at night. More than 90% of the rural communities do not have toilets; thus, defecate around homestead and farmlands which exposes the communities for excreta borne diseases.

Disease incidences caused by unhygienic situation are serious problems in my county, Ethiopia and it takes the third place in some places that is next to malaria and tuberculosis. As we all know, unhygienic situation is favorable for pathogenic microorganisms such as bacteria, viruses and parasites or fungi. These days, the Ethiopian government has given due attention to issues of sanitation in its health policy and one of the components of health package is construction, usage and maintenance of sanitary latrine extension package.

Based on the above facts, Lem, the Environment and Development Society of Ethiopia has given due attention to environmental sanitation. Among which construction of biogas digesters from human excreta is one. The biogas, which originates from bacteria in the process of bio-degradation of organic materials under anaerobic (without air) conditions is becoming popular than ever since the issue of environment become a hot socio-economic, political and ecological issues in the 1980. Biogas was introduced in Ethiopia in Ambo Agricultural College to generate energy required for the purpose of welding in 1957/58. During the period 1980 – 2000 more than 1000 biogas plants have been constructed to government institutions, private sector and communities, where most of them were established for demonstration purposes. But the awareness and practices didn't go beyond such places.

Regardless of its construction cost, we found it multi-purpose approach to sanitation, environmentally friendly that addresses socio-economic and environmental problems of the communities who suffer due to lack of proper sanitation system. Thus, by bringing together the innovations made by different countries and searching new ways to reduce the cost of the construction of biogas digester, it is possible to address the problems of sanitation (reduce human excreta borne diseases), use the slurry/effluent as organic soil reconditioning, reduce the use of fuelwood, reduce indoor and outdoor air pollution that help to improve the health of women and children.

Scope of the Paper

The paper is limited to knowledge gained from practical experiences and review of secondary data including web sites.

Results

Lem Ethiopia started to intervene on issues of sanitation as soon as it was launched, in 1992. It has been involved in urban waste management to reduce sources of human health problems related to hygiene in such a way that through target community partnership. Beyond solid waste collection by training and organizing unemployed youth in composting household waste and promotion of urban agriculture, 7 biogas digesters in 7 high schools were established during 2000-2002 with the support of Embassy of Finland in Ethiopia. The volume of the digesters varies from 20 m³ to 30 m³ and the main input/raw material was/is human excreta driven from the school toilets. All the digesters have been dome shaped and under ground in design, constructed with cement and stone/clay bricks by being water tight and air tight to the foundation and gas collecting chamber respectively. Of course if affordable, concretized structure is safer. The methane gas produced from the human excreta within 4-6 weeks time depending on the temperature, serves for cooking. The average population of each school (regular and extensions students and staff) was closer to 5,500.

Before the introduction of the biogas digesters, each school was expending more than €50 per month to empty the toilets which is too much for the school. On the other side due to the bad smell around the toilets, students were not encouraged to use the toilets, if forced use outside the toilet to defecate. In addition to this the school's canteen required closer to 10 liter of kerosene to cook food and tea to serve students and teachers. The total monthly expenditure for kerosene was closer to €90. Most of the time, the schools' laboratories were not functional due shortage of gas.

The introduction of the biogas digester to those schools improved the sanitation situation and students have been encouraged to use the toilets as there is no more bad smell. The effluent is not also attractive to flies and other vectors of diseases. According to the report from the Addis Ababa University, patho-biology center, and Chinese research reports (web site), most of the pathogens died in the anaerobic process that makes the use of the effluent as organic fertilizer safe and healthy. Thus, the schools used it as organic fertilizer to grown vegetables and different species of tree seedlings.

Biogas energy making kitchen life easy



In one of the schools farm field trial was made using three different plots; one without any type of fertilizer, one with chemical fertilizer and the third with the effluent of the biogas digester and saw barely on both fields other factors kept constant.. As observed for three consecutive years, the one that used the effluent was found more in productivity than the one with without any type of fertilizer and 5% less than with chemical fertilizer for the first year and during the 3rd year its productivity increased by 4% than with chemical fertilizer. But the density of the one grown with effluent was more than the others through all the trial period.

Energy expenditure required for the schools' canteen and laboratories is reduced by more than 80%. We have planned to construct biogas digesters in Bahir Dar town under our project called "Bahir Dar Participatory Waste Management Project" funded by Tampere, Sustainable Future –NGO.

Limitations

Though sanitation/health, energy, etc., are specifically serious problems of poor people, the promotion of biogas has limitation factors beyond its unaffordable construction costs by ordinary people. Among the factors are temperature ranges, and water. The attitude and culture of rural communities to generate biogas energy from human excreta is not without challenge. The technical and management of the system requires at least basic education. The components required for the system such as pressure gauge, biogas light lamp and gas detector device, are not available in local markets as required.

Conclusion and Recommendation

It has been observed that biogas generation from animal dung and human excreta benefits are not limited to energy required for cooking, lighting and welding. But the use of methane as a source of energy contributes to the reduction of green house gases where methane is one of them with more impact than other green house gases.

Improved sanitation programs and projects should be part and parcel of the efforts we people in developing countries and partners made to improve livelihood security of our communities. In line with this, 'the 'Dry Toilet' program is also an essential component of the MDGs to improve the health of women and children who are the most exposed for health hazards caused by poor sanitation. Thus, our cumulative effort will bring change in human livelihood security and specifically human health.

Thus, promotion of biogas specifically using human excreta and organic household wastes has the capacity to address energy, health, economic and ecological problems and can be considered as multi-dimensional development approach in the southern hemisphere.

Recommendations

- Awareness and skill development training is very essential to own the technology/practice by local communities,
- Be it the construction of dry toilets or biogas digesters, the question is its affordability, replicability, social acceptability and sustainability that needs due attention,
- Along with the construction of toilets for poor people, it is essential to consider installing water system to wash hands after using toilets.
- Strong global partnership is essential to improve/develop standardized designs in such a manner that with low/minimal cost, information and other resources sharing

References

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