Sustainability and Climate Change aspects of Ecosan Toilet: Nepal prospective

Nam Raj Khatri, Environemntal Engineer, Thecho lalitpur Nepal Email: namrajk@gmail.com

ABSTRACT

In Nepal, Eco-san toilet was constructed in 2002 in Siddhipur. Concept was much accepted by the community people and, for the first time in Nepal that the latrine was linked to sanitation as well as economic benefits of the people and expanded to other parts of the country. Until 2011, about 2000 eco-san toilets have been constructed in 15 different communities. Siddipur emerged as eco-farming center because of self motivated farmer Jeevan Manarjan who is doing research in his own way and in 2010 Darechowk emerged as eco-san village and learning center with self motivated effort of Shreerendra Pokharel. Study carried in 2010 in seven eco-san community revealed that sustainability of eco-san depends on factors like social acceptance, technical comfort, scope for urine use and hygiene behavior of people. People were found to be happy to use eco-san toilet and using urine in most cases but need for improvements in terms of knowledge of people in all aspects was felt. From climate change point of view there are many ways that eco-san can avoid carbon emission indirectly. Considering carbon emission related to equivalent NPK production, anaerobic decomposition of feaces about 107 kg/person/year of carbon emission can be avoided.

.

Key words: Climate Change, **Ecological** sanitation, Ecosan in Nepal, Sustainability

INTRODUCTION

Ecological sanitation (eco-san) works on the principle that human excrement is not a waste product but contains the nutrients required to fertilize land and that it should be used for this purpose. The ecological sanitation cycle begins with containment, where excreta are held in the sanitation installation. The waste is then sanitized through one or several processes which cause pathogen die off, the resultant safe soil conditioner (from faeces).The urine is often collected separately and used as fertilizer to assist crop production. In Nepal mainly two types of toilets are used.

Dehydration Toilets

Dehydration toilets reduce the pathogen content in human excreta through a series of processes. The moisture content is reduced (therefore these types of facility always use urine diversion) and ash and lime are added after each use to increase the pH (above 9.5). The dryness and high pH, combined with the time left in storage, eventually causes the die off of all pathogens. The dryness of these facilities also means there is less of an environment for flies to breed, creating a more pleasant environment for the user.

In Nepal where water is used for anal cleansing there is a risk of the contents of dehydrating toilets becoming too wet and therefore not operating properly. Hence, special pans has been designed which contains a trough over which to wash to prevent the contamination of the drying waste.

Wet Urine Diversion toilet

This is the type of toilet functions similar to offset pit latrines urine diverting facilities in pan. feaces goes to off set pit with wash water and flushed water. This type of toilet is being very common in Nepal recently as it takes care of anal cleansing facilities and does not differ much on operation and feaces management form widely used pit latrine.

Urine Diversion

Main thing in ecological sanitation system separates the urine component of the waste from the faeces. Urine contains more nutrients and less pathogens but if it is mixed with faeces it will require treatment before use as a fertilizer. Urine diversion brings a number of benefits including simple waste management, neutrient recycling form urine, reduce odours, and reduced volume of waste.

In a rural situation the best means of re-using urine is through direct application to land. In urban areas or households who do not own much land, it could be collected and stored (storing for over one month can make the urine even safer to use) or simply evaporated. Since urine is chemically richer than NPK fertilizer farmers feels that vegetables grown with urine use is tastier and giving a higher yield In Nepal it is emerging practice to exchange urine, establish urine bank and collect urine from school building and official building and during exhibition through special arrangement for urine collection.

DEVELOPMENT OF ECOLOGICAL SANITATION IN NEPAL

In Nepal Mr. Roshan Shrestha attended a training in Sweden in 2000 and shared the ideas with colleagues. He practiced the idea in his own homes and office, ENPHO. Then in 2001 Mr. Nawal Kishor Mishra, chief sanitation section DWSS attended a conference in ecological sanitation in Germany. He practiced the concept in a village as a pilot. Though the concept was interesting and beneficial adopting the technology in this culture was challenging. This initiation became the ignition of ecological sanitation in Nepal.

In Nepal, Ecosan concept was introduced in 2002 with an initiation of DWSS/WHO for implementation of pilot Eco-san program in Siddhipur of Lalitpur district. Concept was much accepted by the community people and, for the first time in Nepal, that the latrine was linked to sanitation as well as economic benefits of the people. After the success of this project, the Ecosan technology was extensively expanded to other parts of the country. Until 2011, about 2000 eco-san toilets have been constructed. Village like Sidipur, Tigana, Thecho, Khokana, Darechowk, Sabaithawa, Sunwal are known to be using eco-san toilets in community level. In 2009, Siddipur emerged as eco-farming center because of self motivated farmer Jeevan Manarjan who is doing research in his own way.

During 2010, Darechowk emerged as ecosan village and learning center with self motivated effort of Shreerendra Pokharel who is fully devoted in ecosan, urine application and promoting eco-san in the country. About 800 house holds of Darechowk have used eco-san toilets and known as eco-san village and eco-san resource center. many peoples interested towards eco-san and student doing research have visited Darechowk. Mr Shreerandra being motivated in eco-san left school(Headmaster) and formed local NGO(THE SEWA Nepal) at his village level and devoted himself as full time eco-san promoter. Eco-san has been promoted in many villages after then.

STAINABILITY OF ECOSAN TOILETS

Sustainable use of ecological sanitation toilet depends upon basic factors like social acceptance, users friendly technology, ease to operation and maintenance, use of urine and health and hygiene safety.

A study was carried in 2010 by team of environmentalist, environmental engineer, sociologist and public health expert of department of Water Supply and Sewerage(DWSS) in seven cluster including Siddipur, Khokana, Thechu and Tigani from Kathmandi valley and Darechowk, Sabaithawa and sunwal of outside valley covering 10% (108 houses)of the households having eco-san toilets
Following indicators under five different factors were selected for sustainability

Social factor: Motivated by subsidy or by utility, Traditional practice, shared responsibility for maintenance of toilet, facility to wash, dignity after installation and reaction of neighbor.
Technical factor: outlook and cleanliness of pan comfort to use, easy to manage feaces, smooth diversion of urine, and knowledge of maintenance of eco-san toilet.
Utility factor: use of urine, use of feaces, increased productivity, increased quality of crops, increased quality of soil, facility for urine bank, knowledge of urine use and benefit.
Public health: Digestion of feaces, safe application of feaces, safe application of urine, safe hygiene practices, Types of crops using feaces and urine. Ways of using urine and feaces.

Analysis revealed that people have used dry eco-san toilets in Thecho, Siddipur, Tigani and Khokana. People in Sunwal used mix type. People in Darechowk and Sabaithawa used wet eco-san. Wet eco-san address anal cleaning practices of Nepal and provides urine separation for application in the farm. Eco-san toilets have been used in a small rehabilitated community and urine bank has been established. Their status in terms of various sustainability aspects are summarized in table below.

	Social	Technical	use	PH	Average
Sunwal	47	71	36	56	52.4
Parsa	52.8	61	11	50	43.7
Dare	41.5	73	10	50	43.7
Tigani	50.8	14	66	56	46.9
Siddipur	53.9	81	54	63	62.8
Khokana	54.4	74	58	54	60.2
Thecho	37.4	61	56	62	54.1
Average	48	62	41	56	52

Community like Thecho, Tigani, Siddipur and Sunwal used mixed type and Darechowk and Sabaithowa used wet eco-san toilet. Due to inconveniency in washing and needing un common technology for dehydrating vault people became attracted towards we toilet. Wet eco-san address anal cleaning practice of Nepal and provides urine separation for application in the field. Peoples awareness towards safe application and hygiene behaviors towards excreta and urine was not very satisfactory. Eco-san toilets are found to be suitable in the community where there is scope for urine use in farm, having practice of use of feaces, scarcity of water, isolated houses etc. However, there is potentiality of expanding eco-san in wider community with some modification and awareness for maintenance and use with hygiene knowledge.

NUTRIENT VALUE OF ECOSAN AND CARBON EMISSION POTENTIALITY:

A person excretes about 300gram feaces and 1 liter urine in a day. This makes about 3.5 kg nitrogen, 0.5 kg phosphorus and 1 kg potassium per year. That much nutrients is sufficient to apply fertilizer in 500m^2 land at the level of 70kg/hectare of nitrogen and to produce sufficient food for one person.

Carbon dioxide emission related to production of NPK is about 9kg for Nitrogen, 4 kg for phosphorus and 12 kg for potassium. This is equivalent to 45 kg/person per year which will be avoided by using urine.

A theoretical analysis revealed that One person contributes about 30 gm/day BOD equivalent organic waste. One kg BOD produces 1.4 kg CO2 in aerobic process and 1.68 CO2 in anaerobic process with gas used. One kg of BOD produces 0.68 Kg CO2 and) 0.25 kg CH4. Considering widely used onsite pit system as base line, relative carbon emission of other system is same in anaerobic pond, 69% in septic tank , 29% mechanical aeration system, 32% in anaerobic process, 29% in biogas system and 24`% in natural oxidation system.

One person produces feaces that is about 30 gram of BOD equivalent. Considering that one kg BOD makes emission of about 0.68 kg carbon dioxide and 0.25 kg methane gas per kg and considering climate change factory of methane as 20 times carbon emission of one person in a year becomes 62 kg. If feaces are used as fertilizer/soil conditioner, then emission that would occur in pit can be considered as avoided by using eco-san toilet.

Hence, total carbon dioxide emission that can be saved by use of eco-san system is about 107 kg/person/year.

CONCLUSION

Sustainable use of eco-san toilet needs to take care of social acceptance, comfort to use and hygiene behaviors of users. In Nepal eco-san is expanding being motivated by application of urine, however, it needs attention in increasing awareness of people on maintenance of toilet, use of urine and hygiene. Eco-san contributes to avoiding carbon emission relating use of urine as fertilizer and feaces as soil conditioner up to 107kg/person/year. In addition it saves water in terms of toilet flush and kitchen farm saves energy in terms of fertilizer transport. Vegetables grown from urine application are normally healthy and tasty which does not require use of pesticides. It is very difficult to quantify all but saving is very clear due to its capacity to close the ecological cycle within close premises of household and it is felt environmentally friendly in Nepal.

REFERENCES

Hand book on ecological sanitation, DWSS(2012)
Study on public health aspect of ecological sanitation, DWSS, 2010
Risks and Safe Handling of urine from Urine Diversion Dry Toilets, EcoSanRes, http://www.ecosanres.org/pdf_files/
A Review of Greenhouse Gas Emission Factors for Fertiliser Production, Sam Wood and Annette Cowie Research and Development Division, State Forests of New South Wales, 2004, http://www.ieabioenergy-task38.org/publications/GHG_Emission_Fertilizer%20Production_July2004.pdf