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Portable Low Cost Toilet Construction using Aluminum Alloy Coated High Tensile Steel for Rural India

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ABSTRACT

Innovation in toilet challenge is the need of the hour for safe and sustainable sanitation worldwide. Emerging technology in the field of toilet construction have been widely increased day by day though rural India need a specific model which is to be adaptable to behavior change. The aim of this paper is to provide solution to the global sanitation issues by constructing a system which is friendly to the local thoughts and have an outsized potential in acceptance which will change people's lives for the better. Aluminum alloy coated high tensile steel cooling sheet has been identified as an alternative cost effective construction material and used as wall and roof top. Anaerobic digestion technology is employed using movable biodegradable plastic tank. Estimation of the project is predicted as per need of the rural civilization in India.

Keywords: Rural, Sanitation, Toilet design, Bio-septic tank.

1. INTRODUCTION

Bio originated waste have large potential in creating environmental nuisance, it is the responsibility of nation's technocrats to suggest innovative method in preserving the environment by pollution free [1]. Modernization in the field of constructing toilets and application of anaerobic digestion technology as per need of the society may considerably impetus to developing strategies in sanitation universally [2]. Indian household toilet usage in urban areas 81% and rural areas 43% the rest are using community toilets or open-defecation. It is not easy to shatter the acceptance of defecating and urinating in the open fields of farmers and communities' daily life [3]. Construction of household toilet nationwide has been triggered up from November 2015 for achieving open-defecation free country by 2019. 24 millions toilets were constructed in rural areas and 87 millions toilets are yet to be constructed in the next two years. As per CPCB, NSSO 2016, Tamil Nadu (62.6%) placed third position for safe disposal of liquid waste from household and community toilets in spite of having higher no of wards. The rest of the states are still lacking in building powerful sanitation. Optimizing a technology should be adaptable only it provides logical approach, availability of options concern to technical and economical analysis [4].

In view of giving solution to the problem there arises an idea of constructing low cost easily portable toilets. The structure designed is a socio-economic, zero emission with removable septic tank. The government allocates amount of 12,000 per toilet. For a large number of manufacturing it needs more time and budget. But by introducing aluminum alloy coated high tensile steel for wall and roof along with degradable plastic septic tank the target could be achieved at the earliest. Initial investment is a burden for people below poverty line though affordable for construction in a larger perspective or for communities. As the construction is simple less material content and labour expenditure are minimal. The objective of this work is to promote low cost and hygienic sanitation system. To build a sustainable toilet affordable for the rural. To reduce the environmental impact of disposal sites as the biodegradable waste fraction largely is to blame for the polluting leachate and the methane problems. It can be easily dispatched and fixed in another places. Low operation and maintenance cost. As the globe is facing water scarcity issues, this is the need of the hour in giving solution to build a most cost effective and environmentally friendly system which would prevent pollution abatement [5].

2. MATERIALS AND METHODS

Conventional concrete have various advantages in spite of having less tensile strength, the aluminum alloy coated high tensile steel has been identified [6]. Rural India specific material and easy method of construction is being adopted in this model which is displayed in Figure 1. The material identified for the design is aluminum alloy coated high tensile

steel which has a specific quality that are easy to keep clean and easy maintenance. The tensile strength of aluminum is 572 Mpa, percentile of ductility is 11 and have a very high yield strength of 505 Mpa. It is observed to be an effective replacement for existing brick and concrete work.

The Bio-septic tank is designed of biodegradable plastic which comprises of dual partition for both solid and liquid. Solid is to kept settled and the liquid to be periodically expelled out. Solar water disinfection method is adopted as preliminary treatment for the liquid collection and is expelled out to the sewer. The solid wastes are evacuated through a vacuum pressured vehicle which is then subjected to composting by earthworms. The volume of the biodegradable plastic tank is framed in such a way that it takes six month to fill with odourless solid waste, where a pipe vent for air flow is provided it leads to evaporation, dehydration and deodorizing process.

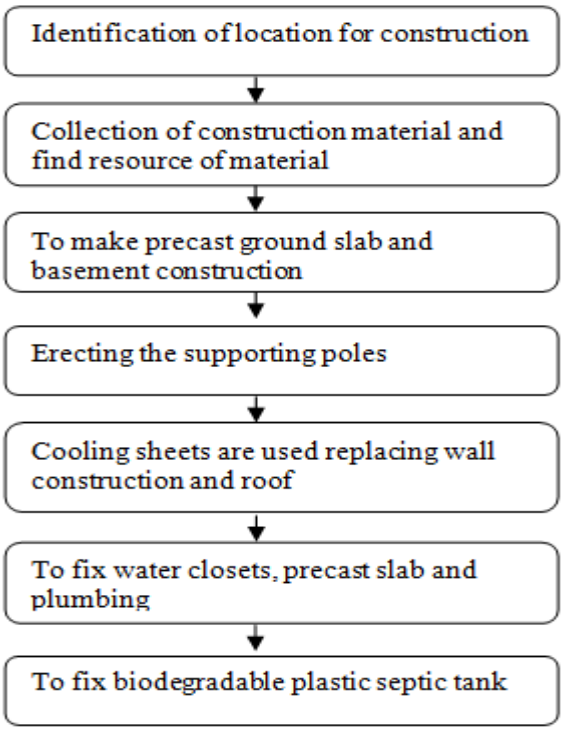

Figure 1: Schematic diagram of the methodology of the present diagram

3. RESULT AND DISCUSSION

3.1 Structure Details

In fulfilling the objective of this study, the design of toilet is carried out in three segments. The first segment is to identify suitable site and to start basement construction. The second segment acts as a superstructure, which is provided with erection of supporting poles, loading of wall and roof coverings. The door is fabricated with the same material and proper ventilation is to be provided. The predominant structure at this phase is fixing of water closet and pan. The ground level segment acts as a substructure, comprises of biodegradable septic tank.

The structural design features are proposed for rural Indian individual home, which can be constructed 10 m away from drinking water pipeline. This model is adaptable in lab scale and necessary modifications are to be carried during implementation on the site. The details of design features are shown in table 1 and the budget particulars are provided in table 2. The components of the portable toilet are shown in figure 2 and figure 3.

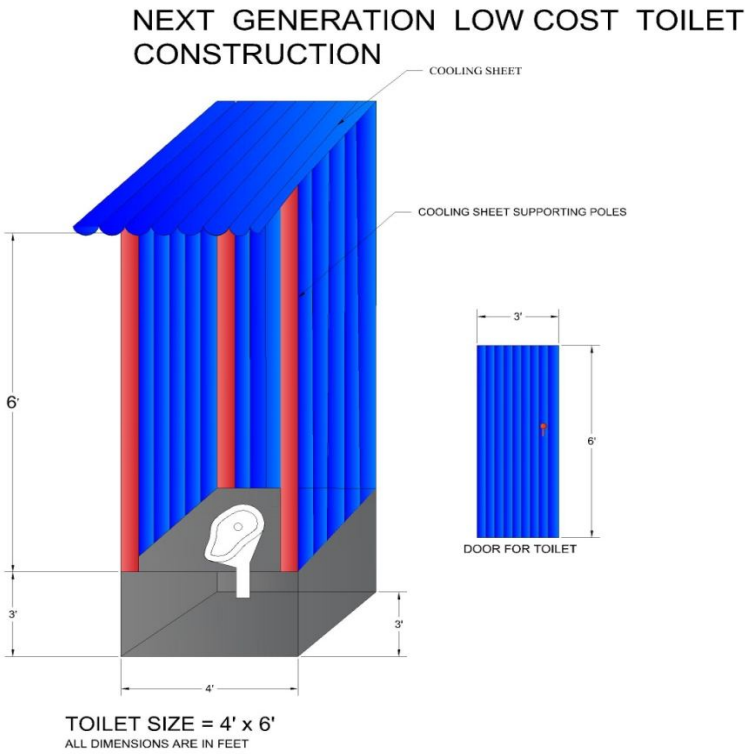

Figure 2: Schematic view of the portable toilet

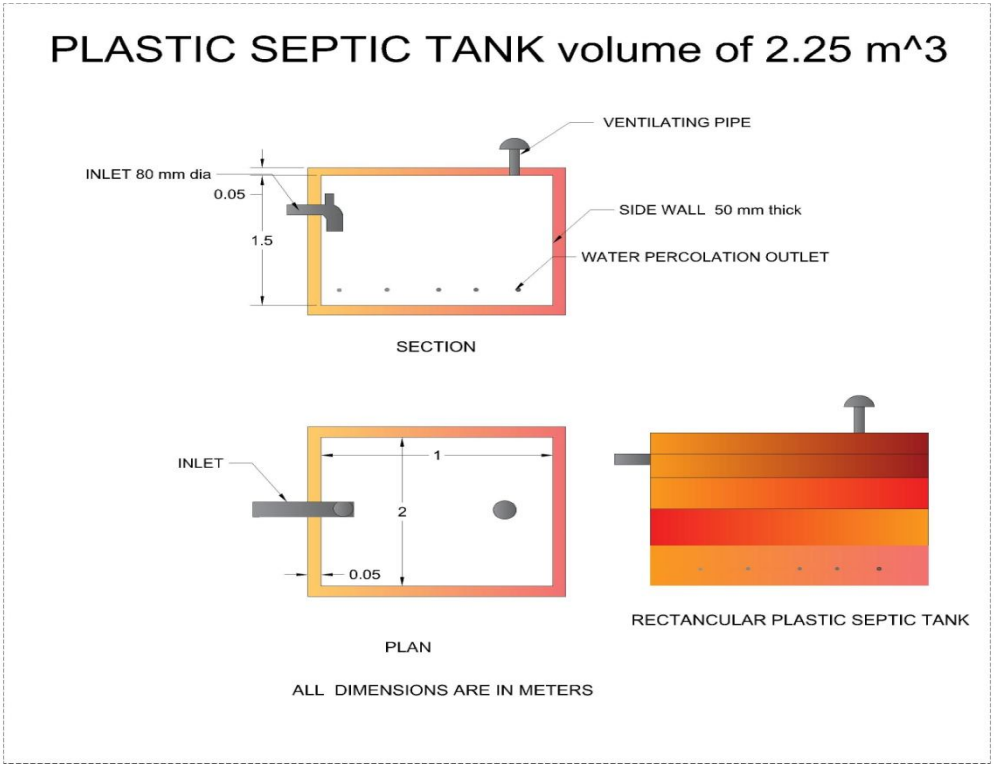

Figure 3: Schematic view of the biodegradable plastic septic tank

Table 1: Low cost Portable toilet specifications (All dimensions are in feet)

S.No	Parameter	Quantity
1	Type, Structure and Model	Precast, Aluminum alloy coated high tensile steel toilet with movable septic tank
2	Structure plan size	4'x 3'
3	Structure height	9'
4	Type of closet used and No.	Indian closet, 01
5	Precast base floor slab size	4'x6'x2"
6	No. of precast slab	1 nos
7	Septic tank type	Movable plastic septic tank (capacity = 2.25 m^3)

Table 2: Budget Particulars

S. No	Material	Quantity Required	Rate Per Quantity	Amount (Rs)
1	Cooling sheet	6 sheet	750 / sheet	4500
2	Iron pipe poles	6 poles	175/ pole	1050
3	Iron fittings	Lump sum	Lump sum	200
	Brick II class	150	5/brick	750
3	Cement	1 bag	350/bag	350
4	M-Sand	0.06 m^3	1060/m^3	125
5	Aggregate(40 mm)	0.097 m^3	920/m^3	75
6	Bio septic tank	1 nos (2.25 m^3)	3450	3450
7	Closet	1 nos	500	500
			Total amount:	11,000/-

4. CONCLUSION

The designed toilet may be installed in a place or can be shifted to another location as when required, the module can be assembled and disassembled easily. Major parameters to be monitored during the installation are proper fixing of door, aldrop and stopper. The lavatory pan should be placed as per design. Comparing with conventional toilet construction this model would be competitive in the market.

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