BIO-TOILET

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Introduction

Problem statement:

Downstream sanitation the human excreta and urine have been causing problem of disposal. Open defecation free causes diseases and even climate has direct influence on faecal sludge due to temperature and moisture. The urine when separately disposed causes bad smell and creates other related environmental issues. Appropriate urban sanitation planning that includes design approach for adequate faecal matter and urine treatment infrastructure is the key element to protect public and environmental health through Swachh Bharath initiative is a challenge. The recent experience has shown that policies that combine incremental implementation of standards with innovative management projects can be successful and lead to cost-effective solutions.

Objective:

To provide a comprehensive and integrated sanitation technology as bio-toilet by on site collection, treatment, disposal / reuse.

Materials and methods:

Bio-toilet technology prototype model consists of biogas tank, wash water tank and final waste water treatment tank. All the three tanks are provided with engineering devices of baffles and are attached with poly mats impregnated with bacterial inoculum. Reinventing the Toilet (Bill Gates).

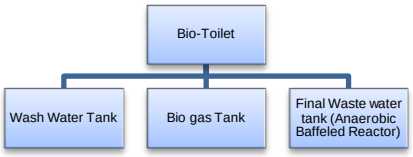

Figure 1: A Schematic diagram of Bio-Toilet

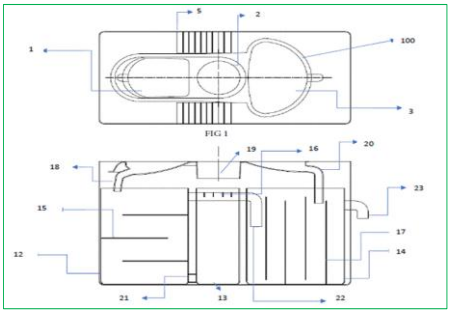

Figure 2: Diagrammatic Representation of Bio-Toilet

Figure 3: Bio-Toilet

Process:

Treatment process:

The faecal, urine and anal washings are collected individually in the respective tanks.

The toilet pan is non-sticky and an easy mechanical devise is provided to cover or open the top of pan.

The faecal matter a functional modified bio gas tank with **Bio gas tank** is provided with baffles arranged horizontally facilitating to break solid into smaller particles which biologically treated into semi solid. Just above the bottom, a bend pipe is provided and joined in the wash water tank.

Wash water tank this facilitates in treating the toilet wastes in combination with the anal washing which gets liquefied in the presence of bacteria. The organic waste materials are converted into the mixture of gases that constitute sour methane which is a mixture of methane and hydrogen sulfide may be used as an alternate fuel.

In the wash water tank the baffles with poly mat are arranged coating of bacteria. The process in the wash water tank is the collection of

liquefied material from the bio gas tank which flows by gravity into this tank. The anal washing from the origin of the toilet pan comes into this tank and mixes. The liquid material when passed into this tank the internal pressure increases raising water level which pass into Final Treatment tank known as Anaerobic Baffled reactor (ABR).

Final waste water treatment tank (Anaerobic Baffled reactor)(ABR):

The urine from the toilet pan drains along with pre treated waste water and finally treated and reused. The majority of these chemicals are absorbed by bacteria in the present system. The bacteria such as nitrosomonas and nitrobacter are most biologicaly successful in treating urine.

The acidic part of toilet when combines with urine gets neutralized and the bacteria which are coated in the baffles enhance the quality of water for reuse. When wash water enters into the ABR and urine from the toilet pan directly joins in the ABR thus increasing the volume and efficiency of treatment by hydraulic retention of time of the wastes. By baffles are vertically arranged increases the pressure inside tank. The treated waste water is disinfected using chlorine and reused for flushing the toilet and hand washing.

Result:

Excreta contains nutrients originate from food consumption constituting as follows.

Table 1: Nutrients Composition

S.No	Nutrient	Faecal matter	urine
1	N	10-20%	80-90%
2	P	20-50%	50-65%
3	K	10-20%	50-80%

Ammonia(NH3) is produced by deamination of organic nitrogen. Ammonia in faecal matter comes from urine. The nitrogen content in faecesis about 20% as ammonia, 17% as organic nitrogen in the cells of bacteria and the remainderas organic nitrogen (proteins and nuclic acids)

Table 2: Indicating Composition between Public Toilet and Septic Tank *

S.No	Parameters	Public Toilet	Septic Tank
1	Ph	1.2 – 12.6 6.5 – 9.34	NIL
2	Total solids	52,000	12,000 – 35,000
3	Total volatile solids	68	50 -73
4	COD(mg/L)	49,000	1,200 – 7,800
5	BOD (mg/L)	7,600	840 – 2,600
6	Total Nitrogen (mg/L)	NIL	190 – 300
7	Total Kjeldahl TKN (mg/L)	3,400	1,000
8	NH_4-N (mg/L)	2,000	400
9	Nitrates No3(mg/L)	NIL	0.2 – 21
10	Total Phosphorus,TP (mg/L)	450	150
11	Faecal coliforms (cfu/100mL)	1×10^5	1×10^5
12	Helminth eggs (Numbers/L)	2,500	4,000 – 5,700

*Note Operational factors varies

Sustainability:

The sustainability of this system is on the basic foundation of utilizing the resource as product. The system further contributes on the effective sanitation by anaerobic digestion by developing composite bacteria and impregnating into poly grass mats. The maintenance and affordability of this system besides environmental hygiene will have impact on the society.

Scalability:

The present toilet technology is developed to scale up to the site requirement of any terrain any volume and climate. Using durable materials, coupled with our technical knowledge leadership and local socio-economic development. The three wastes will be collected in separate conduits and treated and reused.

Conclusion:

The prototype model of Bio-Toilet technology provides complete better sanitation, and cost effective, affordable and maintenance free. There is no need to have separate septic tank, and safety to all who use it. The system developed will replace the conventional toilet and particularly open defecation free(ODF). The system could be tried as it is published in the news that 'Astronauts' urine may be recycled as nutrients. (Times Of India dt 24-08-2017). A right political momentum exists in our Country and a will and confident in implementing innovative sanitation would bring sanitation performance goal coverage to all. This would greatly benefit being a specific local context of India's rural population. The prototype model is based on the experiences gained in the construction of toilet linked bio gas plants, waste water treatment plant and human urine powder development system in the recent past.

Reference

1. "WASTE TO WEALTH" by Dr.A.Abdul Rahman

https://www.researchgate.net/publication/261760909

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