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Smart Sanitary Disposal System in Hard Rock Exposures Using Microbes

N.Ramesh[1*], J.Abdul Bari[2], G.Ayyappadasan[2], S.Gunasekar[3]

[1] *Professor, Department of Civil Engg, K.S.Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India.*

[2] *Associate Professor, Dept. of Civil Engineering, K.S.Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India.*
Associate Professor, Dept. of Bio Technology, K.S.Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India.

Assistant Professor, Dept. of Civil Engineering, K.S.Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India.

**Corresponding author E-Mail ID: rameshn@ksrct.ac.in*

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ABSTRACT

Septic system plays a major role in sanitary disposal activities. In developing country it is very essential for proper disposal of wastes for providing clean environment. In our country the government has adopted scheme, "CLEAN INDIA",. For achieving this aim, the septic system is necessary to construct in each and every residential, commercial buildings and public areas. Septic tank systems are a type of simple onsite sewage facility.But groundwater pollution may occur and can create a problem. Usage of mobile septic tank can be helpful to avoid such problem. In this present investigation an idea has been arrived and the septic tank constructed by the way which have been tested for 10 days for decomposition using microbes. The term 'septic' refer to the anaerobic bacteria environment that develops in the tanks which decomposes or mineralizes the water discharged into the tank. The rate of accumulation of sludge is faster than rate of decomposition. So in our project we have used microbes for decomposition.In urban areas, construction of septic tanks are easier. But in rock exposures, the septic tanks cannot be constructed easily. In this paper, the problem is solved by giving an idea as solution by providing a "MOBILE SEPTIC TANK". This will be helpful and eliminate such problems.

Keywords: Septic Tank, Mobile Septic Tank, Decomposition, Groundwater pollution.

1. INTRODUCTION

A major factor influencing the health of individuals happens where public sewers are not available for the proper disposal of human excreta. Many diseases, such as dysentery infectious hepatitis, typhoid and pera-typhoid, and various types of diarrhea or transmitted from one person to another person through the fecal contamination of food and water, largely due to the improper disposal of human wastes. Safe disposal of all human and domestic wastes is necessary to protect the health of the individual and their family and the community from the occurrence of nuisances.

A septic tank is an underground chamber made of concrete, fiber glass or plastic through which domestic wastewater (sewage) flows for basic treatment. This type of mobile septic tank is mainly used in rock exposures areas where the normal septic tanks can't be constructed. The easiest way to dispose most household's daily sewage is to let seep into the soil surrounding the

home. Waste water enters the first chamber of the tank, allowing solids to settle scum to float. The settled solids are an aerobically digested, reducing the volume of solids. The liquid components flows through the dividing wall into the second chamber, where further settlement takes place the excess liquid, now in a relatively clear condition, then drains from the outlet into the septic drain filed, also referred to as a leach field, drain field or seepage field, depending upon locality .

While a properly maintained and located septic tank does not pose any more environmental problems than centralized municipal sewage treatment certain problems can arise with septic tanks in unsuitable location.

As the normal septic tank needs a deep foundation, it cannot be laid in rock exposure areas. The main problem is their soak way or drain fields. It should not be filed with stones or crates. The effluent sewage from septic tank is so dangerous and it is to be properly disposed. When it is laid in rock areas it may be interrupted and therefore the effluent is not properly disposed. To avoid this problem mobile septic tank can be constructed in such areas.

This type of mobile septic tank is more economical. The cost of coarse aggregate is ignored and the cost is less compared to normal septic tank. It is beneficial to all standards of people including poor people. By using this open defecation will be less. It will be helpful to attain 'Clean India'.

SCOPE

This type of mobile septic tank is mainly used in rock exposures areas where the normal septic tanks can't be constructed. The easiest way to dispose most household's daily sewage is to let seep into the soil surrounding the home.

LITERATURE REVIEW:

Samir Alnahhal , (2018) The SLS was designed, developed, and realized for the first time in the Gaza strip for a decentralized separation waste water solids from liquid at household level in order to facilitate a nutrient recovery . One of the key advantages of this SLS over other conventional pre-treatment equipment is the implementation at shallow depths less construction and maintenance requirements and costs. The SLS prototype was designed to allow the infiltrated liquid to be drained to the next treatment equipment before reuse in irrigation. **Sunil Prasad Lohani , et al (2018)** UASB and the combined ST-UASB reactor were simulated at low temperatures . UASB model applied is quite reasonable predicting thebehavior of AD process. ST-UASB model under estimates COD accumulation and COD removal. ST-UASB model over estimates biogas protection by up to 15% . ADM1 based ST-UASB simulation food adequately be used for preliminary design. **Maria del Pilar Durante Ingunza , et al (2018)** Septic tank sludge or septage is a type of sewage sludge defined as a liquid or solid material removed from a septic tank that receives only domestic sewage. The materials (cement , fine aggregate , coarse aggregate) are get mixed and allowed for the testing process . The SA addition improved the overall condition of the mortar, providing better performance in both the fresh and hardened state. The 20% SA addition can be considered, on the limits studied in this work, more suitable, technically and sustainably. The ash from septic tank sludge is a heterogeneous material, predominantly crystalline. It has an intermediate density between cement and sand, angular particles with low sphericity. The SA cannot be classified as pozzolanic, although it has a pozzolanic activity rate very close to that required by the Brazilian Standards. **Spuhler .D , Andreas Scheidegger , Max Maurer (2018)** This paper presents a procedure for generating a set of locally appropriate sanitation system options, which can then be used in a structured decision-making process. Sustainable sanitation systems not only protect and promote human health; they also protect the environment and natural resources and are economically viable,

socially acceptable, and technically and institutionally appropriate (Kvarnström et al. 2004, SuSanA 2008). The procedure is designed to generate a set of decision options as an input into the SDM process.a codified and therefore reproducible procedure to identify an initial set of SanSys decision options as an input into a structured decision making (SDM) process such as CLUES, a strategic sanitation planning guideline developed for urban settings in the global South . **Hongjian Lin, Weiwei Liu, Xin Zhang, Nicholas Williams (2017)** This study attempted to improve the tank effluent by using microbial electrochemical septic tanks (MESTs), an alternative tank configuration to conventional septic tanks (CSTs). Comparison of MESTs with other alternative systems like engineered ecosystems and membrane bioreactor showed its substantial effectiveness in P removal and its readiness to be incorporated in current septic systems. In conclusion, MESTs decreased the phosphorous load that enters the subsequent percolation field, and the adoption of MESTs would enhance the overall role of septic systems in sanitation and environmental protection.

Materials Required For The Septic Tank

1. Cement
2. Fine Aggregate(m-sand)
3. TMT bar -8mm
4. Water
5. Pipe- Dia 2.25cm
6. Wire mesh

DURATION AND COST OF PROJECT

The duration and cost of Mobile septic tank is listed below in Table1

Table 1.Duration and Cost Estimation of mobile septic tank

Si.No	Materials	Duration	Cost(Rs)
1	Reinforcement of steel bars	1\2 Day	1500
2	Cement and M Sand	1\2 Day	500
3	Pipe	1\2 Day	100
4	Welding	1\2 Day	100
5	Plastering	2 Day	250
6	Microbes	1 Day	50
	Total	1 week	2500

Testing of Waste Water in Septic Tank

Microbes Involved in Waste Water

Acetobacteraceti is Gram-negative bacterium that moves using its peritrichous flagella. Louis Pasteur proved it cause of conversion of ethanol to acetic acid in 1864. It is a benign microorganism which is present everywhere in the environment, existing in alcoholic ecological niches which include flowers, fruits, and honey bees, as well as in water and soil. It lives wherever sugar fermentation occurs.

It grows best in temperatures that range of 25 to 30^0C and in pH that ranges from 5.4 to 6.3 for a long time it has been used in the fermentation industry to produce acetic acid from alcohol. ***Acetobateraceti*** is an obligate aerobe, which means requires oxygen to grow. The acetobacteraceti as shown below in Fig .1.

Fig .1Acetobacteracetia

RESULTS AND GRAPHICAL ANALYSIS FOR THE FOLLOWING PARAMETERS.

1. Potential of Hydrogen (Ph)

The results of Potential of hydrogen is shown in Table.2

Table.2 Results of Potential of hydrogen

Contents	0th day	5th day	10th day	15th day
Baffle 1	3.3	4.23	6.3	7.5
Baffle 2	2.6	4.53	6.18	7.7
Baffle 3	3.7	4.86	6.8	7.2

While testing the waste water is taken from the septic tank for the potential hydrogen and Fig 3 shows the graphical analysis for pH

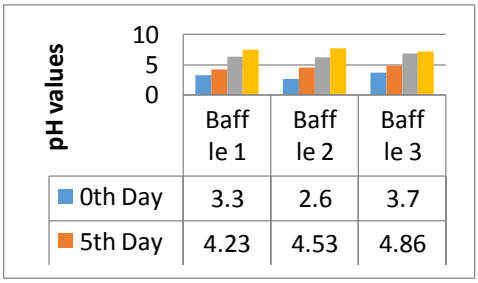

Fig 3. Graphical Analysis for pH

An immobilized enzyme is an enzyme attached to an inert, insoluble materialsuch as calcium alginate (produced by reacting a mixture of sodium alginate solution and enzyme solution with calcium chloride).

Fig .2 Enzymes immobilised in beads formation

This can provide increased resistance to changes in conditions such as pH or temperature. It also lets enzymes be held in place throughout the reaction, following which they are easily separated from the products and may be used again - a far more efficient process and so is widely used in industry for enzyme catalyses reactions. An alternative to enzyme immobilization is whole cell immobilization. Enzymes immobilized in beads of alginate gel as shown in Fig .2

2. Turbidity

The results of turbidity for various days is shown in Table 3

Table 3. Results of Turbidity(NTU)

Contents	5th Day	10th Day	15th Day	Remarks
Baffle 1	70.2	60	60	Not accepted
Baffle 2	85	71	62	Not accepted
Baffle 3	69	65	65	Not accepted

While testing the waste water is taken from the septic tank for the Turbidity and Fig 4 shows the graphical analysis.

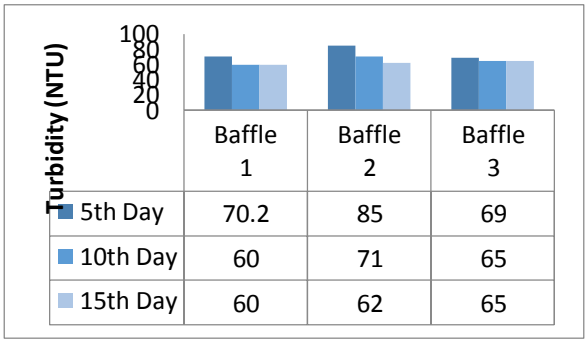

Fig 4. Graphical analysis for Turbidity

i. BOD

The results of BOD for various days is shown in Table 4

Contents	0th Day(Mg/Lit)	5th Day(Mg/Lit)	10th Day(Mg/Lit)
Baffle 1	120	85	60
Baffle 2	132	96	71
Baffle 3	125	69	58

Thus the Fig 5 shows the Graphical analysis for the BOD

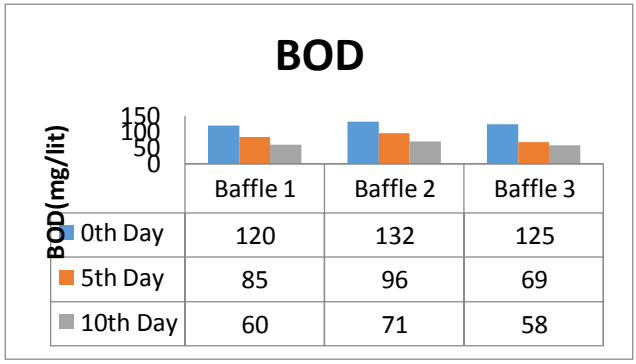

Fig 5. Graphical analysis for the BOD

ii. COD

The results COD for various days is shown in Table 5

CONTENTS	0th DAY(mg/lit)	5TH DAY(mg/lit)	10TH DAY(mg/lit)
Baffle 1	525	416	375
Baffle 2	540	420	360
Baffle 3	530	410	270

Thus the Fig 6 shows the Graphical analysis for the BOD

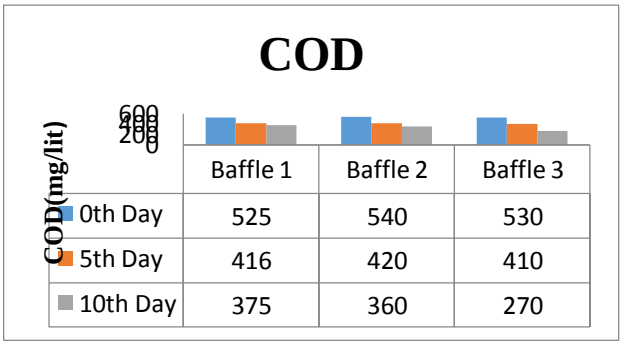

Fig 6. Graphical analysis for the COD

ENUMERATION OF BACTERIA COLONIES IN SEPTIC TANK

Table 6 shows the results of Bacteria colonies for various day

Table 6. Bacteria colonies

Contents	5th day	10th day	15th day
Baffle 1	$32*10^5$	$160*10^7$	$180*10^8$
Baffle 2	$15*10^3$	$53*10^5$	$64*10^7$
Baffle 3	$12*10^4$	$25*10^5$	$54*10^6$

Thus the Fig 7 shows the number of microorganisms per gram of the sample

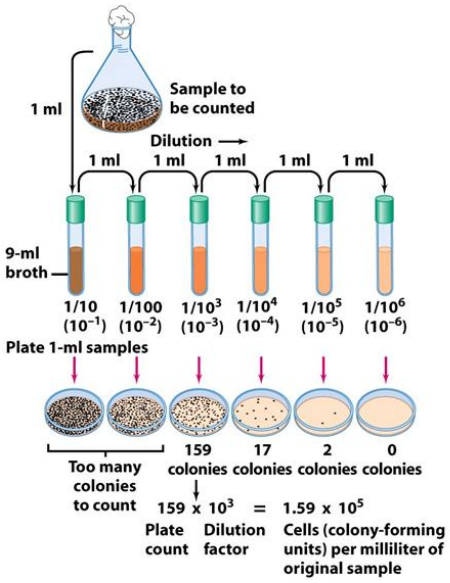

Fig 7. Number of microorganisms per gram of the sample

CONCLUSION

Mobile septic tank system gives solution for problem arise to construct septic in rock exposure areas. It is cost efficient so all standards of people can use this system .the tank is constructed in less weight and so it can be transported, lifted and can be fitted in any place. The microbes used for decomposition is also low cost and it can be utilized by all standards of people.

The septic tank sludge have been tested for pH, Turbidity, Total Dissolved Solids(TDS), Bacterial count, BOD and COD test and have problem it is eco-friendly in nature. By our project the recommend to use mobile septic tank to avoid open defecation and make our country as "CLEAN INDIA" by taking these small steps. Small changes can make things perfect.

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Conflict of Interest

None of the authors have any conflicts of interest to declare.

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