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ISSN: 2096-3246
Volume 54, Issue 02, December, 2022
Special Issue

REVIEW ON SUSTAINABLE WASTE MANAGEMENT

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ABSTRACT
This paper is about the, Sustainable waste management serves as a significant approach and is a promising solution to our current waste problems. Sustainable waste management has now caught a global attention, it would also encourage the society to take up zero waste lifestyles, i.e. reduction in consumption and waste generation at source level. Since waste is a sign of inefficiency, the reduction of waste can minimize the cost through 3'R concept. This project explains the design of, Composting pit for the treatment of organic waste, Energy recovery from food waste using biogas plant and Sewage treatment plant for the sewage are some of the waste management approaches that are to be implemented in the selected project area. The proposed 70 kilo liter per day plant is designed to treat the sewage water generated from the gated community and reuse the treated sewage for gardening purposes. Any material waste would either return as reusable or recycled materials or would be suitable for use as compost. Amount of waste generated and amount of waste converted to energy /manure is been discussed below.
Keywords: Sustainable waste management, composting, biogas, STP, energy recovery.

1. INTRODUCTION
Increase in the globalization and urbanization has led to increase in the lifestyle of the people. The increase in the lifestyle has led to an increase in the waste generation at an alarming rate. 'Sustainable waste management and zero waste' using 3R's concept serves as a significant approach towards the waste management concern.This study focuses on the design of composting pit, bio gas plant and an STP (Sewage Treatment Plant) which are the simple methods for reducing the waste that gets discharged. This study reduces the amount of waste that is sent out which on the whole contributes to the reduces in landfill, reduce the leachate and prevents contamination of groundwater table , avoids the burning of landfill leading to air pollution and improves the NPK value by adding the organic manure. Most of the research focuses on the impacts of the individuals, where as the environmental impacts are not made mandatory. It is time to take and make projects and constructions that are safe and healthy for us as well as our environment. **Julia Carney's immortal lines** (from her poem, Little Things), **"Little drops of water, Make the mighty ocean"**, thus small reduction from individual houses, apartments and gated communities can make a great change.

1.1. WHAT IS WASTE?

Waste (or wastes) are unwanted materials in any substance which is discarded after primary use. Since waste is a sign of inefficiency, the reduction of waste can minimize the cost through 3'R concept.

1.2. WHAT IS SUSTAINABLE WASTE MANAGEMENT?

Sustainable waste management aims to minimize the amount of solid waste that is disposed in landfill by keeping materials in use for as long as possible or through various techniques. It has been discussed since the last decade, however there is no consensus. Sustainability in one nation may not apply to another. There are many drivers affecting sustainability and the impact varies from one country to another, depending on political, socio-economic and environmental factors. The main advantage is to lessen the impact on the environment, by improving the quality of air, water and land which contributes to the reduction of greenhouse gas emissions.

Reducing food waste helps us reduce the heavy environmental cost of producing more food. It also helps people in remote areas to take food at least once in a day, by reducing their cost of living and contributes to the Sustainable Development Goal no 1 and 2 "End poverty in all its forms everywhere" and "End hunger, achieve food security and improved nutrition and promote sustainable agriculture".

Figure 1.0 SDG's

1.4. THE MAIN PRINCIPLES OF SUSTAINABLE WASTE MANAGEMENT USED IN THIS PAPER IS THE "3R'S RULE"

We 'Reduce' the amount of waste that is sent out, 'Recycle' the generated waste, and 'Reuse' them in alternative ways.

2. METHODOLOGY

Treatment of Sewage using cost effective "Sewage Treatment Plant". "Energy recovery" from food waste. Organic waste using "composting techniques". Other municipal solid waste generated are segregated and the method of "trash to cash" is applied.

3. WORK AREA

Aashriya layout, Bommananpalayam, Coimbatore. It has of 30+1apartment (20 houses) and a total of 50. Estimated population inside the community is 200 people.

Figure 2.0 Layout of the site

Waste generated by each individual is taken into account. Length and breath considered for the design of treatment plant is 7 m x 7 m. It is assured that the treatment plant is 20m away from the residents in order to avoid odour and other effects.

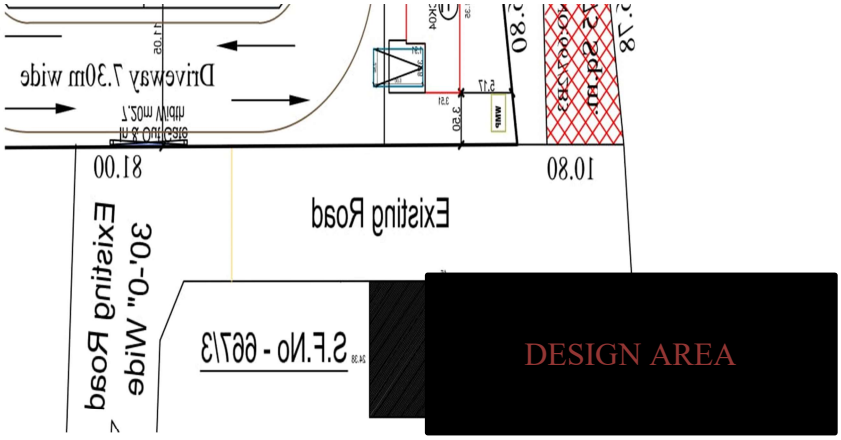

Figure 2.1 Plant layout

4.DESIGN AND CALCULATION OF STP

4.1 SEWAGE TREATMENT PLANT (STP)

The treatment scheme is designed to deliver the treated water quality norms stipulated by Tamil Nadu Pollution Control Board (TNPCB).Amount of waste generated and amount of waste converted to energy /manure is been discussed.The proposed 70 KLD STP plant is designed to treat the sewage water generated from the community and reuse the treated sewage for gardening purposes.

4.2 DATA COLLECTION

POPULATION FORECASTING

The population will have to be estimated with due regard to all the factors governing the future growth and development of the project area in the industrial, commercial, educational, social, and administrative spheres. Special factors causing sudden immigration or influx of population should also be foreseen to the extent possible.

Population as calculated by,

Geometrical increase method: **Formula used: Pn=P (1+ (G/100)) Where, P- Population at present G- Average percentage of growth of 'n**

Pn = 100 (1+(100/100)) = P1 = 200, P2 = 400, P3 = 800…

Or by assuming the data the population in 2022 within the layout is calculated as,

No of houses 50, assuming that each house has minimum of 4 people is 50 x 4 which is 200. The

water supply rate is calculated by Tamil Nadu Water Supply And Drainage based on population. The quantity of water supplied (assume) 135 LPCD in 2022, Rate of water supplied is 200 x135 LPCD equal to 27 KLD. As per norms, 80% quantity of water turns into sewage, 27 x 10^3 x 10^3x 0.8, the quantity of water turns as sewage is 21.6 KLD. The peak flow rate of sewage is, Peak factor is taken as 3, Peak Flow 3 x 21.6 KLD is 64.8 KLD, 70 KLD (approximately)

5. DESIGN

5.1. DESIGN CRITERIA

Length of each pipe connecting the next chamber = 1 m. Slope given to the connecting pipe from one chamber to the other chamber is = 0.2 m. It is completely a gravity flow. Except the wet well all the other super structure's are above the ground level at an height of 10 feet (or) 0.3 m [with the help of concrete column]. The complete structure is a concrete structure and it is been coated with damp proof course. Diameter of the main pipes that carry the water from one chamber to another chamber 150 m. Diameter of the sludge and grit removing pipe 50 mm

5.1 COLLECTION PIPE

Diameter of the collecting sewer line 150 mm. Length of the collection pipe 90 m. Length of the connecting pipe 1 m each. Diameter of the connection pipe 100 mm. Slope provided is 1000mm:3mm. The collection pipe connects to the sewage pipe of all the individual houses to the wet well or collection well.

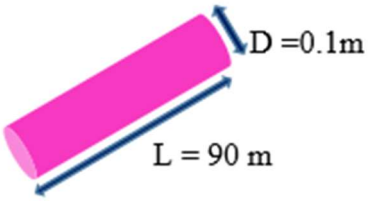

Figure 3.0 Collection pipe

5.2 WET WELL

Average flow per day = 30 MLD. Diameter of the wet well 2.5 m. Depth of the wet well 6 m. No of tank is 2. The raw water is been collected in the wet well or collection well before entering the treatment process. Size of the coarse screen provided 20 mm. Diameter of the collection well 2.5 m. Depth of the well 6 m.

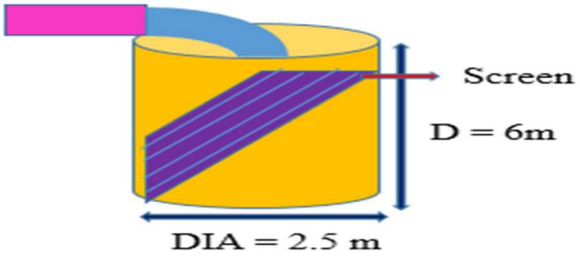

Figure 3.1 Wet well

5.3 PUMP

SL. NO	SELECTION	IMPLIMENTATION
1.	**Brand**	
2.	**Price**	
3.	**Usage/Application**	
4.	**No of pump**	2
5.	**Time taken**	20 mins

Figure 2.2 Flow chem pump

5.4 PRIMARY UNIT

Length of the chamber 4 m. Breath of the chamber 2 m. Depth of the chamber 5.7 m. Size of the screen provided 6 mm. To remove the grit from the bottom provision given 0.3 m, settling time 20 m. The water above the 0.3 m flows to the 2nd primary tank which has a slope 0.3 m.

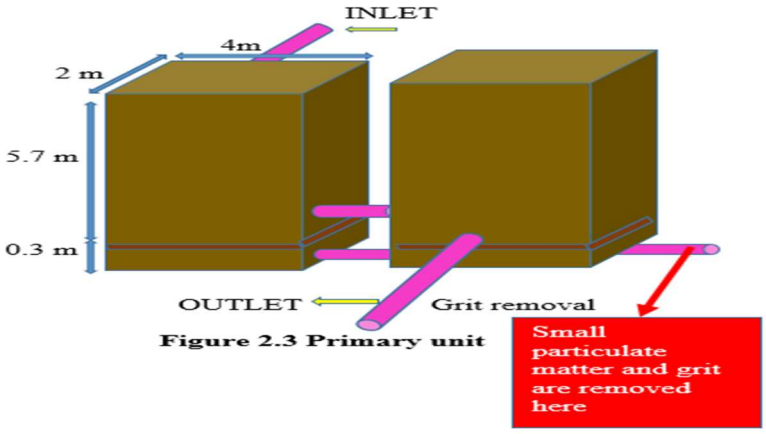

Figure 2.3 Primary unit

5.5 SECONDARY UNIT

Length of the chamber 6 m. Breath of the chamber 4 m. Depth of the chamber 3 m. Slope from the primary tank 0.2 m. Free board provided 0.3 m. Diameter of the inlet 100 mm. Diameter of the outlet 80 mm. Provision to remove the suspended solids present at the bottom 0.3 m Diameter of the pipe that removes the flock 50 mm. Diffused aerator is been used to degrade the bacteria present in the sewage. Sp. Gravity of air @ 30 degree is 1.165. Coagulant Aluminum Sulphate is added and the flocks are removed.

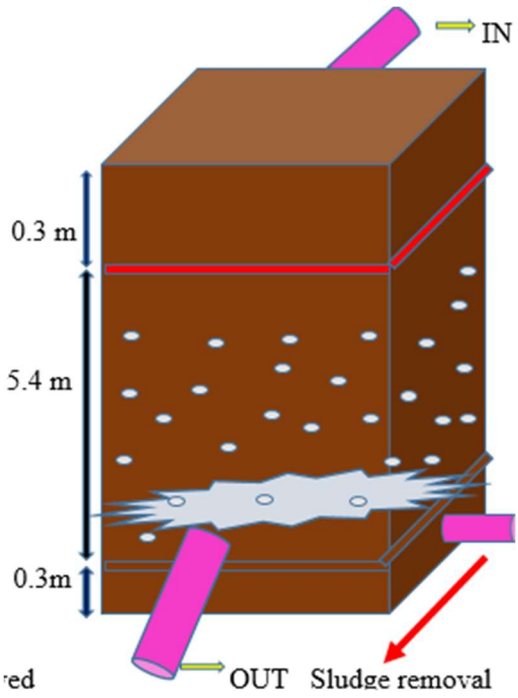

Figure 2.4 Secondary unit

5.6 TIRTIARY UNIT

Tertiary water treatment is the final stage of the multi-stage wastewater cleaning process. This third stage of treatment removes inorganic compounds, bacteria, viruses, and parasites. Removing these harmful substances makes the treated water safe to reuse, recycle, or release into the environment **.**

5.6.1 PRESSURE SAND FILTER (PSF)

These Filters are designed to remove turbidity and suspended particles present in the feed water with minimum pressure drop. These Filters are custom designed to suit the process requirement.

5.6.2 ACTIVATED CARBON FILTER (ACF)

Activated carbon filter is used to remove organic Compounds, Taste, Odour and Free Chlorine from the raw water.Activated carbon works via a process called Adsorption, where pollutant molecules in the fluid (water) are trapped inside the pore structure of the carbon substrate**.**

5.6.3 SUGGESTED BRAND AND COST

SL. NO	SELECTION	IMPLIMENTATION
1.	**Brand**	Shreyans Wastewater Filters, For Industrial
2.	**Price**	₹ 50,000/ -
3.	**Usage/Application**	Industrial
4.	**Filter Type**	Pressure Sand Filter/Multi grade Filter/Activated Carbon Filter.
5.	**Medium Material**	Sand and Activated
6.	**Capacity**	0.5 m3/hr to 150m3/hr

Figure 2.5 PSF and ACF

5.6.4 ULTRAVIOLET WASTEWATER TREATMENT WORK

Ultraviolet (UV) water treatment works by exposing microorganisms (such as cryptosporidium, giardia labia and more) to UV radiation, via a special UV light bulb, which disrupts their DNA and disables their ability to replicate. UV is Ultraviolet radiation, an energy band within the electromagnetic energy spectrum. It is a colourless, tasteless, odourless and chemical free way to ensure your water supply is safe and clear of germs and other microorganisms that can make you sick and UV does not affect sediment, particulates or other mineral contaminants which will require additional water treatment methods.

5.6.5 SUGGESTED BRAND AND COST

SL. NO	SELECTION	IMPLIMENTATION
1.	**Brand**	Aqtra Wastewater UV Water Treatment system
2.	**Price**	₹75 ,000 /-
3.	**Usage/Application**	Wastewater purification
4.	**Water Source**	Household Wastewater
5.	**Capacity Inlet Flow Rate**	100 m3/hour
6.	**Material**	Stainless Steel
7.	**Surface Finishing**	Chrome Coated

Figure 2.6 UV system

5.6.6 CHLORINATION

Wall mounted chlorine cylinder is kept and is connected to the outlet of the UV treatment system. The provision is made in such a way that 5ppm of chlorine is added to every 1 litre of water. Price of chlorine cylinder is Rs.25 / Kg. Baffle walls are been provided to ensure the equal mixing of chlorine

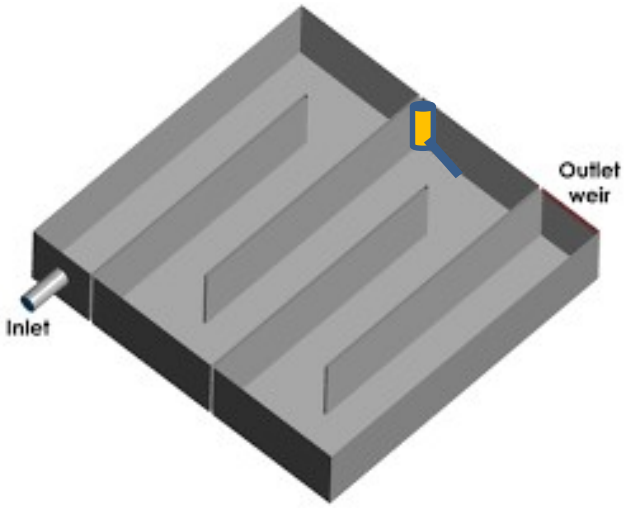

Figure 2.7 Contact tank

5.6.7 SLUDGE DRYING PIT AND GRIT REMOVAL CHAMBER

Length of the pit 6 m. Breath of the pit 4 m. Depth of the pit 0.5 m. No of partitions is 4 (1m each). The sludge removed from the secondary treatment is pumped to the drying pit and kept for drying under open sunlight.

Figure 2.8 Drying pit

5.6.8 STORAGE TANK

Length of the tank is 6 m. Breath of the tank is 4 m. Depth of the tank is 4 m .Total capacity of the storage tank = 95 m^3 . The treated effluent is stored in the storage tank

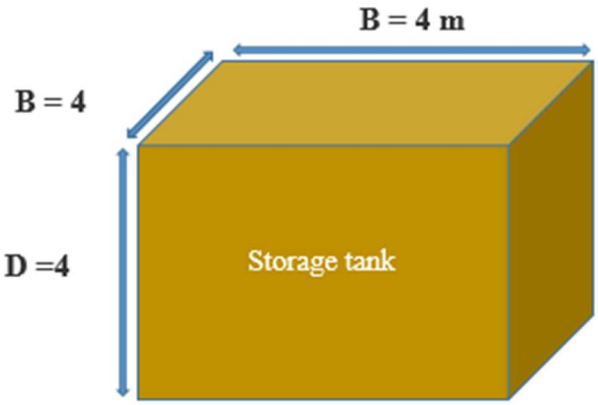

Figure 2.9 Storage tank

6. DAIGRAMATIC REPRESENTATION OF THE TREATMENT PLANT

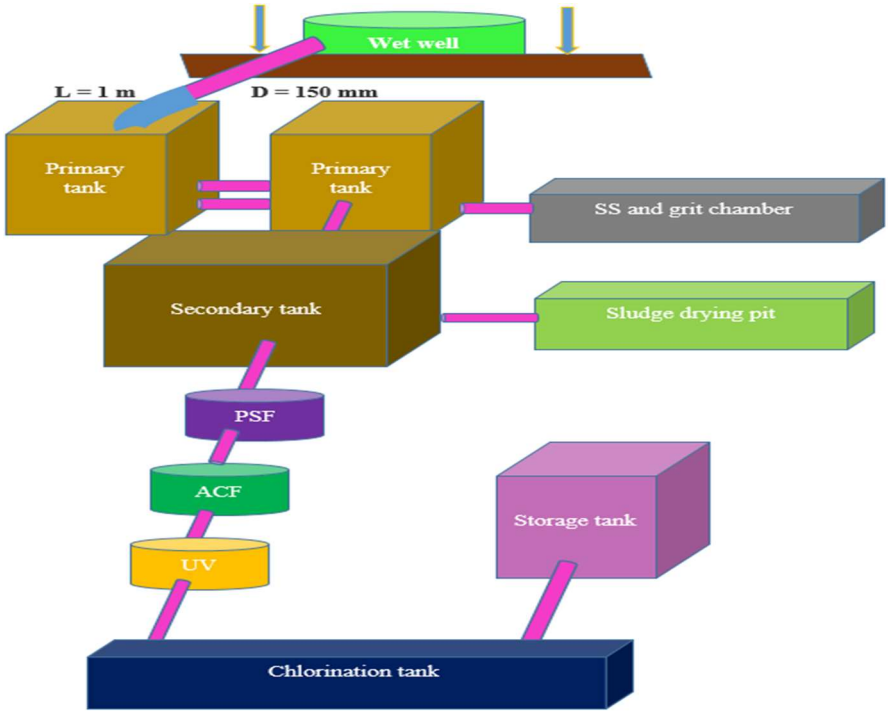

Figure 2.10 Overall outlook of the plant

6. BIOGAS PLANT

6.1 COMPONENTS OF A BIOGAS PLANT

A digester, Inlet tank for mixing the feed and to digest , a gas holder / door. An outlet to remove spent slurry. Distribution pipe line to carry the gas to the kitchen.A manure pit, to store the sludge & slurry and to dry it.

Figure 3.0 Biogas plant

6.2 DATA COLLECTION AND DESIGN

The food waste from each individual houses are collected and given as an input to the plant along with the cow dung. Area allocated is 10 ft x 10 ft. A sintax along with the expansion chamber are kept. Assuming the amount of food waste generated per capita per day is 0.25 kg. Total amount of waste generated is 0.15 x 200 equal to 30 kg/day. Amount of cow dung used per day is 10 kg. Total amount of biogas generated /day is 400 liters/day along with the manure after a duration of 45 days.

6.4 SUGGESTED BRAND AND COST

SL. NO	SELECTION	IMPLIMENTATION
1.	**Brand**	Portable Biogas Plant, For Kitchen Bio-Waste Management
2.	**Price**	₹21 ,000 /-
3.	**Usage/Application**	Kitchen Bio-Waste Management
4.	**Brand**	FERT
5.	**Type**	Floating Dome with FRP Base
6.	**Usage**	To process kitchen waste effectively

7.

COMPOSTING PIT

7.1 DATA COLLECTION AND DESIGN OF COMPOSTING PIT

Assuming the amount of organic waste generated is 0.2 kg per capita/day. Total number of waste generated per day is 0.2 x 200 is equal to 40 kg/day. No of pits is equal to 2. It is made underground. Assuming the length of each pit is 2.5m. Assuming breath is 2 m and depth is 4 m. Therefore, the volume of each pit is equal to 19.625 m^3 is 20 m^3 . Thickness of organic waste is 0.5 m. Thickness of coco peat is 0.2 m. After the first layer is fully filled with the waste along with the dry coco peat, the second layer is been filled. It is been closed and kept for a duration of 45 days under anaerobic condition. Then the second pit gets filled alternatively. The extracted compost material is used as manure for the garden after 45 days.

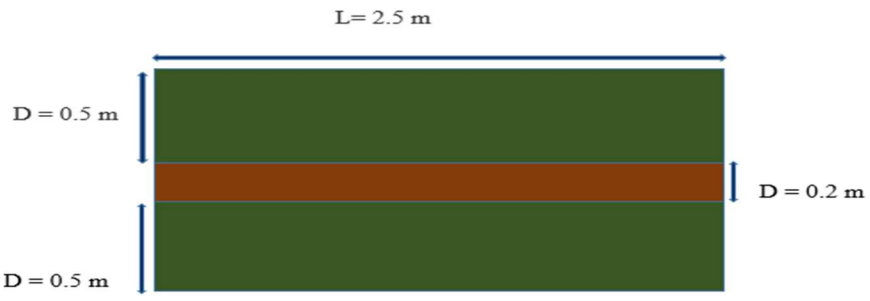

Figure 4.0 Composting pit design

7.2 CONDITIONS OF ANAEROBIC COMPOSTING PROCESS

Particle size : Shredded, minced or pulped particles improves the surface area to act and increases the speed of the digestion.. C/N ratio : 25 – 30. Moisture content : Greater than 50%. Mixing / turning : 38 °C to 66 °C. Nutrient recovery : 4 to 4.5 Kg / ton. Product recovery : Biogas, 30% fibres and 50 % to 65 % fluids

8. RESULT AND DISCUSSION

We treat 30 KLD on an average every day and have designed the STP for about 70 KLD. The treated sewage is been collected in the storage tank and it is sent to the flush of each individual houses and used effectively. The garden area inside the community is watered with the treated effluent. The sludge is dried and used as manure.Converts bio waste into cooking gas & bio-fertilizer Suitable. The total amount of biogas generated /day is 400 liters .The residue from the biogas plant as manure is 1.8 tons in 45 days. Composting pit design converts the organic waste into manure. We generate 1.8 tons of waste in a duration of 45 days.

9.CONCLUSION

We here by conclude that all the waste generated within the layout is been treated and either reused or recycled or converted into manure and energy. We use 3 R's concept in order to attain the sustainable waste management technique. Concept of sustainable waste management can minimize the area of land used for landfills. Composting and energy recovery would use far fewer new raw materials and send no waste materials to landfills. Any waste would either return as reusable or recycled materials or would be used as compost. It provides an opportunity in reducing the consumption and reusing of sewage water and do not affect the ground water table. The treated effluent is used for the flush tanks and in the garden area as well. Since waste is a sign of inefficiency, the reduction of waste can reduce costs. It also supports all three generally accepted goals of sustainability "economic well-being, environmental protection, and social well-being".

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