International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 12 | Dec 2022 www.irjet.net p-ISSN: 2395-0072

A Case Study on Solid Waste Management in Rural Areas: Findings & Suggestions on Waste Treatment

"A Case Study of Village Jajankhedi, District Sehore (M.P.)"

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Abstract - *Cleanliness is an integral part of our life. It is one of the most important practices for a healthy and clean environment. Encouraged by this vision, Swachh Bharat Mission was launched under the guidance of Hon'ble Prime Minister of India, Shri Narendra Modi with an aim to provide basic adequate facilities such as clean and safe water supply, sanitation, hygiene, and proper waste disposal at community level. The present study endeavors to assess practices and knowledge regarding collection and disposal of household solid waste in the rural community of Jajankhedi Village located in Sehore District of Madhya Pradesh. As per census 2011 records, the population of Jajankhedi is around 417 people. At present, there is no proper waste collection and disposal system in the village. Hence, as mentioned earlier, this study is done to discuss the present scenario of solid waste generation in the village along with findings and suggestions for its proper collection and disposal. A community based study was done on randomly selected families living in the Jajankhedi village. Random waste samples were taken from the households and weighed to determine the total waste generation from an average family living in the village. Waste was categorized as per guidelines given in the Swachh Bharat Mission (SBM) manual. It was observed that the percentage of organic waste in the samples is higher as compared to other waste categories. Looking at the factor, vermin composting technology is proposed so that organic waste can be utilized in manure production. This will also help in generating revenue for the Gram Panchayat as the manure formed can be easily sold in the open market. The compliance of this study will be a small contribution towards Swachh Bharat Mission.*

Key Words: Compressive strength, Durability, Service life, Non-destructive testing, rebar's, UPV Test, Nuclear Facilities, pulse velocity, depassivation time

1. INTRODUCTION

The Government of India launched the Swachh Bharat Mission (SBM), also known as the Swachh Bharat Abhiyan or the Clean India Mission, in 2014 to end the practise of open defecation and enhance the country's solid waste management. The first Nirmal Bharat Abhiyan was introduced in 2009, however this new initiative is a revamped version of that programme. Phase-I of the Swachh Bharat Mission lasted till October 2019. Now, phase-II is being implemented between 2020–21 and 2024–25 to help cement the work of Phase 1.

The goal was broken up into two parts: rural and urban. It was the Ministry of Drinking Water and Sanitation (now the Department of Drinking Water and Sanitation under the Ministry of Jal Shakti) that oversaw the funding and management of "SBM - Gramin" in rural areas, while the Ministry of Housing and Urban Affairs, GoI was responsible for "SBM - Urban" in urban settings. The goal of the mission is to improve sanitary infrastructure in both urban and rural areas of India as quickly as possible. The mission is focused on Open Defecation Free (ODF) India and to ensure that solid and liquid waste management facilities are accessible. Keeping in mind that no urban and rural place is left behind, the mission is now moving towards the next phase of SBM. The phase-II will reinforce ODF behaviours and focus on providing interventions for the safe management of solid and liquid waste in villages.

Although, the Government is working hard to develop awareness in public with respect to waste generation and management, there still are some issues that still needs attention. If we talk about rural India, there is a majority of people in every village who do not know anything about waste and its consequences. They still prefer to throw their household waste in the open land. Increasing quantity of waste generation is a key issue in rural India. Due to rising rural populations, rising levels of consumption, and expanding business activity, rural regions are producing more garbage than ever before. Gray water production in rural regions is between 15,000 and 18,000 million litres per day, while solid waste production is between 0.3 and 0.4 million metric tonnes (DDWS-UNICEF, 2008). There is a growing problem with trash in rural regions, but it pales in comparison to the garbage problem in cities.

2. OBJECTIVE OF THE STUDY

The objectives are as follow:

- To find out the main source of waste generation in the study area
- To estimate the volume of waste generated in the study area
- Bring about an improvement in the general quality of life in the area, by promoting cleanliness and hygiene.
- Encourage cost effective and appropriate technologies for ecologically safe and sustainable sanitation
- To find out the issues, if any, in the solid waste management process and suggest suitable and scientific mechanism in dealing with the solid waste.

3. WASTE MATERIAL

Any material that has outlived its usefulness in its existing form and is discarded is considered waste. Its solid or liquid state requires different storage and handling procedures. Materials such as metal, paper, plastic, fabric, and so on are all types of solid trash that may be found in rural regions, along with garbage from kitchens, gardens, cow barns, agriculture, and other sources. Tossed out by households, businesses, and factories, these waste products are made up of biological and inorganic components that have no further monetary worth to their original creators. Overall, waste management in rural areas should aim to promote the outcome of a clean and healthy community where all waste is treated and disposed safely, as this can have health benefits by reducing environmental contamination, economic benefits by reusing and recycling products that would have otherwise been discarded as trash, and aesthetic benefits by eliminating unsightly rotting waste dumped in the open areas.

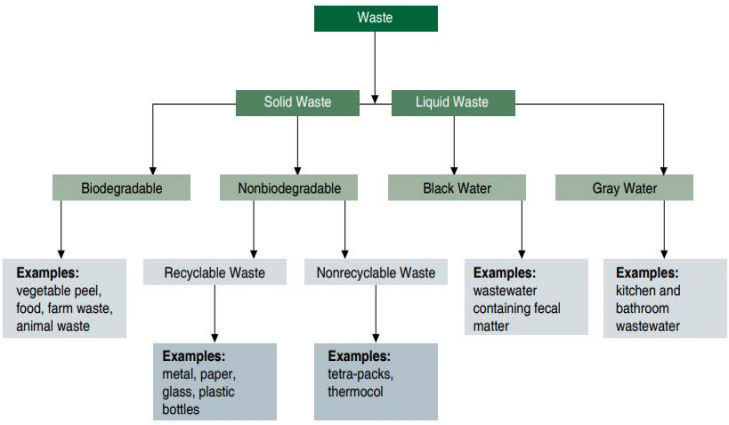

Figure 1 Categories & example of waste

Major Challenges Facing India's Attempts to Manage Its Solid Waste in Rural Area

Issues unique to SWM in rural locations, as well as variations from metropolitan settings, include:

i.Increases in population, consumer spending, and business activity all contribute to a rise in trash production in rural regions. i. It is estimated that 15,000–18,000,000,000 litres of grey water and 0.3–0.4 million metric tonnes of solid garbage are produced daily in rural regions (DDWS-UNICEF, 2008). The amount of garbage produced in rural regions is rising, although it is still far less than in cities.

ii. The rural/urban divide: Because of their smaller size and better community ties, programmes for SBM may be more feasible in rural communities than in metropolitan ones.

iii. As a result, there are more opportunities for waste management in rural regions than in urban ones, where land is scarcer. In addition, the potential for recycling and other waste-reduction strategies is greater in rural communities. Such is biodegradable waste composting for use in vegetable crops, farmland, and other applications.

4. Profile of the Study Area

Jajankhedi village was chosen for the study. Jajankhedi is a small village situated in the Shyampur tehsil of Sehore District in Madhya Pradesh. According to Census 2011 information, the location code or village code of Jajankhedi village is 482856. It is situated around 22 km away from sub-district headquarter Shyampur (tehsildar office) and 22 km away from district headquarter Sehore. As per 2009 stats, Khajuriya Kalan is the gram panchayat of Jajankhedi village.

The whole landmass of the hamlet sums up to 351.63 hectares. There are 417 people living in Jajankhedi, 193 of them are female. Literacy rate of jajankhedi village is 59.71% out of which 76.79% males and 39.90% females are literate. There are about 71 houses in the village. Peoples, out of which male population is 224 while

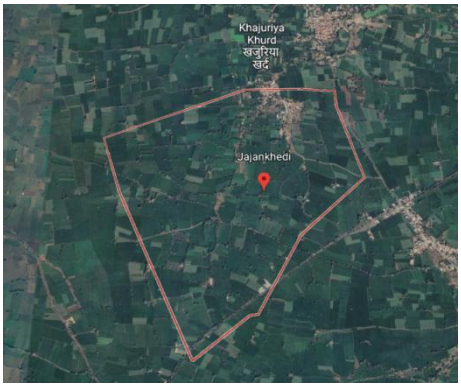

Figure 2 Location of Jajankhedi village

5. METHODOLOGY

The study is based on the data collected from local households. Following approach was adopted for estimation of waste generated Random sampling locations was selected for collection of waste sample.

• A sensitive weighing equipment was used to promptly weigh the garbage bags full of trash that were collected from the garbage generator.

- The amount of trash produced by each kind of garbage producer was recorded..

• The waste collected thereafter was mixed and segregated to differentiate between various categories of waste.

• This representative waste quantity and quality when divided by the population of the village, gives the per capita waste generation rates.

• Almost all organic, with some inert materials, the garbage generated by homes is safe for landfill disposal. Composting is an excellent option for waste management in rural regions since it is environmentally friendly.

• As per 2011 census records the population of Jajankhedi village was 417. Hence, considering the population growth in past years, this system of SWM will be designed for 450 souls.

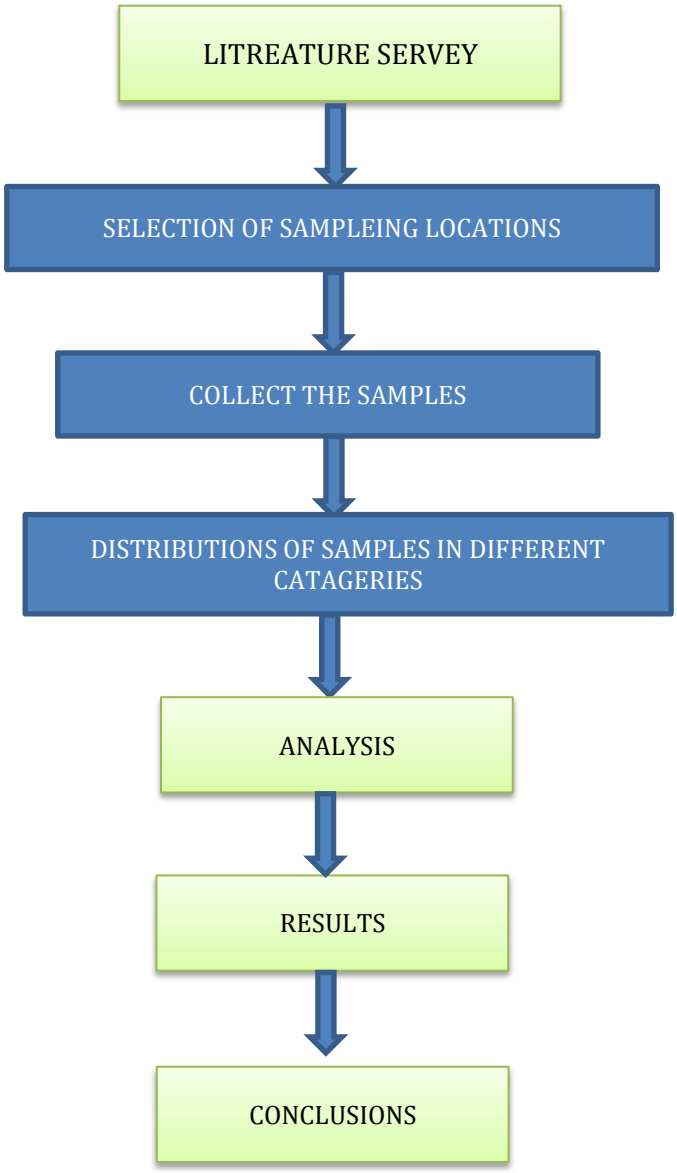

Figure 3 Proposed Methodologies

6. CALCULATION

Table 1 General overview of waste generation in Jajankhedi

Town / Village	District	Design Population	No. of House hold	Total Amount of Waste Generated	Amount of Waste generated per Capita	Density of Waste in (kg/m3)
Jajankhedi	Sehore (M.P.)	450	75	50 kg/day	110 grams	500

Table 2 Waste sampling data and calculation

S No	Name	Family Members	Sample Weight (in gram)
1	Kamal Singh	9	700
2	Bharat Singh	8	650
3	Mahesh	4	200
4	Badri Prasad	3	200
5	Mathura Prasad	9	900
6	Mangi Lal	5	350
7	Phool Singh	6	700
8	Har Laal	6	750
9	Achal Singh	7	900
10	Maya Singh	7	1100
	Total	64	**6450**
	Average	**6.4**	**645**
	Say	**6**	**650**

Table 1 Contents & composition of generated waste in village

Sr. No.	Parameter	Value	Unit
1	Avg. amount of waste generated	110	GPCD
2	Organic content in generated Solid Waste	60.00	%
4	Recyclable Waste	20.00	%
3	Non-Recyclable Waste	20.00	%
5	Average Family Size	6	nos.
6	Designed Population	450	nos.
7	Projected House Holds	75	nos.
8	Total Waste Generation (kg/day)	50	kg
9	Total Organic Content in Waste (in kg/day)	30.00	kg
10	Total Recyclable Waste Generated (in kg/day)	10.00	kg
11	Total Non-Recyclable Waste Generated (in kg/day)	10.00	kg

7. DESIGN OF VERMI-PIT/TANK

Table 2 Design of vermi pit for Jajankhedi village

Sr. No.	Parameter	Quantity	Unit	Remark
1	Total amount of organic waste generated	30.00	kg/day	
	Total organic waste generated in a month	900.00	kg	
	in Tonne	0.90	Tonne	
2	Density of waste	500	Kg/m^3	
3	Volume of waste	1.80	m^3	
4	Provide volume	0.90	m^3	volume of waste will be reduced with each passing day. Organic waste will act as food for worms and waste will be compacted every day.
5	Provide depth	1.2	m	
6	Area required	0.75	m^2	
7	Provide ratio (L:B)	1:1.5		
8	Width of vermi pit	0.71	m	
	Provide	1.2	m	
9	Length of vermi pit	1.8	m	
10	Total no. of vermi pits	2	nos.	
11	Total length required for pits	3.00	m	
12	Total width required for pits	2.2	m	
13	Provide wall thickness	0.2	m	
14	Total area required for vermi pits	6.6	m^2	
15	Provide clear space all around	1	m	

7.1. SIZE OF VERMICOMPOST TANK

The vermin-composting tank with a dividing wall in the middle will be in two parts, each of inner size 1.8m x 1.2m x 1.2m, so that these can be used in rotation or at a time, as per the availability of the vermin-composting material. The wall will be 20 cm thick wall in cement mortar with few openings covered in wire mesh for aeration to earth worms. The floor of the tank will be laid with bricks and plastered with proper drainage in it. The tank will be covered above with a thatched roof open from all sides. This will prevent earthworms from direct sunlight and rain.

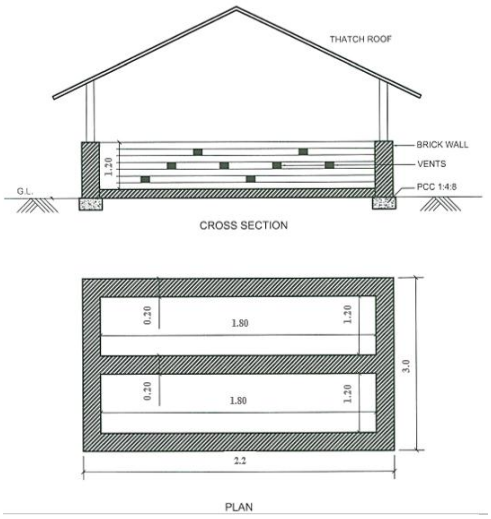

Figure 4 Plan & Cross Section o Vermi Compost Tank

8. CONCLUSION & RESULT

- At present, there is no working solid waste management mechanism in Jajankhedi village.
- The waste from households is thrown in the open grounds.
- The major content of the waste being generated is organic waste.
- Around 30 kg organic waste is generated daily in the village.
- Since organic content is generated in bulk quantity, it can be utilized for making compost which will also contribute in generating revenue for the Gram Panchayat.
- Considering all the important factors, it was concluded that Vermi-composting technology is best suited for generating compost. The quality of compost formed by this process is much superior as compared to compost formed with the help of other technologies.
- As the practice of organic farming is increasing, vermin-compost technology is the best suited among all sustainable practices.
- Vermi-compost is rich in nutrient content and this may be good asset for sustainable agriculture.
- Vermi-composting also improves physical characteristics of soil. Development of this method will also help farmers to prepare itself and low-cost fertilizer from their agricultural waste.
- The proposed technique will take care of all the organic waste generated in households & leftover waste from farming and will also help in generating revenue for the village. The revenue generation calculation sheet is also enclosed.

Table 3 Revenue generation from compost

Calculation of Revenue Generation			
S No.	**Description of Item**	**Quantity**	**Unit**
1	Compost generation*	20%	of organic waste
2	Generated organic waste	30.00	kg/day
3	Monthly generation of organic waste	900.00	kg
4	Monthly generation of compost	180.00	kg
5	Annual generation of compost	2160.00	kg
6	Average market rate of organic compost	20.00	Rs/kg
7	Annual revenue generation from compost	**43,200.00**	**Rs. Annually**

Note:

i. On an average, we can expect a 15-25% finished compost of the total amount of raw material used.

ii. On the basis of above data, it can be concluded that the expenditure in construction of vermin-compost pit can be easily reclaimed in a year by selling off the manure generated.

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