Solid and liquid Waste Management in Rural Areas

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Abstract

In this paper we have studied solid and liquid waste management in of seven villages. The qualities of both solid & liquid wastes are increasing and if the wastes are disposed in an uncontrolled manner these may cause adverse impact on public health & environment. Therefore, the solid wastages are still a major problem in these rural areas. To overcome these problems, we have proposed to implement vermicomposting. Key words: Solid waste, vermicomposting, liquid wastes. Introduction to Solid and Liquid Waste Management
Keywords: Biodegradable, Recyclable, diarrhoeal

I. INTRODUCTION

Solid waste has become one of the biggest problems and its management is one of the major issues now days for our environment. The problem is not restricted to a single place rather it covers all parts of the environment which leads to toxic pollutants. Developing countries face major problem i.e. solid waste management in urban as well as in rural areas. The most obvious environmental damage caused by solid waste is aesthetic. A more serious risk is the transfer of pollution to ground water and land as well as the pollution of air from improper burning of waste.

II. WASTE PROBLEM IN RURAL AREAS IN INDIA

In India especially in rural areas, waste is a severe threat to the public health concern and cleanliness. Though, the form of waste (both solid and liquid) generated in rural areas is predominantly organic and biodegradable yet becoming a major problem to the overall sustainability of the ecological balance. Close to 88% of the total disease load is due to lack of clean water and sanitation and the improper solid and liquid waste management-which intensify their occurrence, e.g.

1) 5 of the 10 top killer diseases of children aged 1-14 in rural areas are related to water and sanitation
2) Almost 1500 children die every day from diarrhoeal diseases

III. TYPES OF WASTE

Waste is any material/liquid that is thrown away as unwanted. As per physical properties, waste can be categorized as:

A. Solid Waste:

Any waste other than human excreta, urine & waste water, is called solid waste. Solid waste in rural areas generally includes- house sweeping, kitchen waste, garden waste, cattle dung & waste from cattle sheds, agro waste, broken glass, metal, waste paper, plastic, cloths, rubber, waste from markets & shopping areas, hotels, etc. Solid waste can also be defined as the organic and inorganic waste materials produced by households, commercial & industrial establishments that have no economic value to the owner.

As per biodegradability, solid waste can be classified as:

1) *Biodegradable:*

Waste that are completely decomposed by biological processes either in presence or in absence of air are called biodegradable. e.g. kitchen waste, animal dung, agricultural waste etc

2) *Non-Biodegradable:*

Waste which cannot be decomposed by biological processes is called non-biodegradable waste. These are of two types:

3) *Recyclable:*

waste having economic values but destined for disposal can be recovered and reused along with their energy value. e.g. plastic, paper, old cloth etc

4) *Non-Recyclable:*

Waste which do not have economic value of recovery e.g. tetra packs, carbon paper, thermo coal etc.

B. Liquid Waste:

Used & unwanted water is called waste water

1) *Black Water:*

Waste water generated in the toilet is called "Black water". It contains harmful pathogens

2) *Grey water:*

Waster water generated in the kitchen, bathroom and laundry is called "Greywater". It may also contain pathogens.

IV. OBJECTIVES OF WASTE MANAGEMENT IN RURAL AREAS

1) To protect human health and improve quality of life among people living in rural areas
2) To reduce environment pollution and make rural areas clean
3) To promote recycling and reuse of both solid and liquid waste
4) To convert bio waste into energy for ensuring greater energy security at village level.

A. Selected Villages:

Table – 1
Selected Village

Villages	*District*
Dashela	*GANDHINAGAR*
Chandrala	*GANDHINAGAR*
Alampur	*GANDHINAGAR*
Dolarana vasna	*GANDHINAGAR*
Vajapur	*GANDHINAGAR*
Piplaj	*GANDHINAGAR*
Mahundra	*GANDHINAGAR*

V. METHODOLOGY

The following steps may be followed for introducing community based Waste Management System: Information Collection, Participatory Planning and Preparation of GP/Block level action plan.

A. Step 1: Information Collection:

In order to draw up a plan of action for community based SLWM in an area, it is essential to know the exact number of houses, institutions and commercial establishments to determine the types and amounts of waste generated in the area. The Survey findings through data collection will also serve as documents for introducing the system. For developing the SLWM plan of the GP/Block, the following information may be collected following rapid rural survey of the community.

1) No. of Households
2) Total Population
3) Details about shops, marriage halls, market, commercial establishments, etc
4) Community map of the area
5) Existing system and practice of waste management
6) Quantum of solid and liquid waste generated per day
7) Local body's approach and future plans for SLWM
8) Details of vacant spaces available in the local body
9) Details and activities of NGOs & CBOs, e.g. Women Self help Groups etc available in the village.

B. Participatory Planning:

1) The data collected is to be analyzed along with the representatives of the community
2) The community should be informed about various technology options for SLWM both at household as well as community level and accordingly technology options should be decided
3) Based on the discussions with the community, SLWM action plan should be prepared.

C. Preparation of GP/Block Level Action Plan:

GP/Block action plan should broadly contain the following:

1) *Social Mobilization and Awareness Generation:*

It should focus on inter personal communication, focused group discussion, technology demonstration and exposure visits to successful sites

2) *Technology Options:*

Household and community level technological options with approximate cost estimates should be worked out.

3) *Operation and Maintenance:*

Success of a technology depends upon proper O&M at the household and community level. This aspect should be discussed in detail during planning process and incorporated in the action plan.

VI. DESIGN

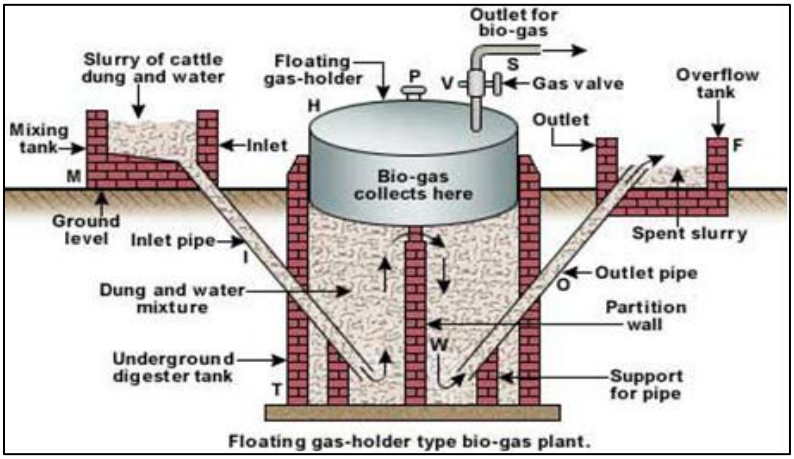

Fig. 1: Floating Gas- Holder Type Bio-Gas Plant

1) *Solid Waste Management:*

We have designed a biogas plant for the village Mahundra .
Population of village= 1885
No. of houses in village = 363

2) *Design:*

Design criteria is taken from (https://energypedia.info/wiki/Sizing_of_the_Biogas_Plant)
Let's assume the solid waste needed for producing biogas is generated by all the villagers themselves.
Total discharge of waste from village = Population × Waste generated per day per person
According to (Renewable energy practices. Pdf) Total solid value of fresh discharge for human waste is 0.2
Total solid value of fresh discharge = 942.5 × 0.2
8% concentration of total solid is required for making biogas influent.

- For 188.5kg, it is = 188.5/0.08 = 2356.25 kg

Water content in influent = 2356.25 – 942.5 = 1413.75 kg
So 1413.75 kg of water has to be added in the solid waste.
Volume of digester = Total influent × Hydraulic retention time
Hydraulic retention time for Indian condition is 40-80 days.
Take 60 days
Volume = 2356.25 × 60 = 141375 kg
Now, as we know, 1000 kg = 1 m^3
So, 141375 kg = 141.37 m^3
Take 145 m^3.
Now, Volume of cylinder = $(\pi d^2 h)/4$
$145 = \pi d^2 h/4$
So, $d^2 h = 184.72\ m^3$. ……. (1)
Gas storage = Total discharge × Gas yield
Gas yield for human waste is taken between 0.025-0.035.
Gas storage = 942.5 × 0.03
= 28.275 m^3 …….. (2)
Total volume to be designed = (1) + (2)
184.72 + 28.275

= 212.995 m^3
Take 215 m^3.
Total ($\pi d^2h/4$) = 215
d^2h = 273.885
Assume h = 6m
So, we get d = 6.76m
Take 6.8 m
Where, d = Diameter of cylinder
h = Height of cylinder

VII. CONCLUSION

Two decades of economic growth since 1990 has changed the composition of Indian wastes. The quantity of MSW generated in India is increasing rapidly due to increasing population and change in lifestyles. Land is scarce and public health and environmental resources are precious. The current SWM crisis in India should be approached holistically; while planning for long term solutions, focus on the solving the present problems should be maintained. In India especially in rural areas, waste is a severe threat to the public health concern and cleanliness. Though, the form of waste (both solid and liquid) generated in rural areas is predominantly organic and biodegradable yet becoming a major problem to the overall sustainability of the ecological balance.

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REFERENCE

[1] DOSIWAM- An Innovative Technology for Integrated Waste Management Leading to Resource Recovery and Reuse, developed by Dr. S.V. Mapuskar Adviser Sanitation Bioenergy, Maharashtra Gandhi Samark Nidhi, Pune and Director, Appa Patwardhan Safai W. Paryawarn Tantraniketan Dehgaon village, Tal. Haveli, Dist. Pune, Maharashtra.
[2] Innovative strategy for viability of family owned night soil based biogas plant by Dr. S.V. Mapuskar.