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Rural Solid Waste Management

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Abstract: *Solid waste management is become increasing concern universally as the urbanization of rural areas continues to rise and simultaneously consumption pattern changes. Waste management is all the activities and actions required to manage waste from its origin to its final disposal. This includes other things like collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory frame work that relates to waste management encompassing guidance on recycling. The Rural development generally refers to the process of improving the quality of life and economic welfare of people living in relatively isolated and meagerly populated areas. They are often farming or agricultural areas. This paper highlights the study of rural solid waste management. The qualities of solid wastes are increasing and if the wastes are disposed in an uncontrolled manner these may cause adverse impact on public health and environment. Therefore, the solid wastages are still a major problem in these rural areas. To overcome these problems, researchers have proposed to implement windrow and vermicomposting.*
Keywords: *Solid Waste Management, Recycling, Windrow composting, Vermicomposting*.

I. Introduction

India, the world's second highest populated country with population of 133.92 crores (census 2017) already containing 17.5% of the world's population, is a land of physical, climatic, geographic, ecological, social, cultural and linguistic diversity. In India the rural population (% of total population) was last measured about 70% in 2015**[1]**. As per the National statistical offices Rural population refers to people living in rural areas. It is calculated as the difference between total population to the urban population.

Improper solid waste management has become one of the biggest problems all over the world. Rural solid waste contains organic waste and inorganic waste in the form of kitchen, paper, plastic, textile and agricultural refuses. The management of these solid waste materials in rural areas is necessary towards growth of villages. For the proper solid waste management consider the component such as solid waste generation, segregation, collection, transportation and disposal. For effective solid waste management proper coordination is obligatory to avoid health problems and unhygienic environment.

Necessity: Solid waste management is a global issue. It requires a typical solution for proper collection, transportation and disposing. In India, a proper waste management system is urgent necessary for the following reasons:

- To control the different types of pollution i.e. air pollution, soil pollution, and waste pollution.
- To stop the spread of infection diseases.
- To conserve our all environmental resources including forest, water etc.
- To recycling hazardous waste for further production.
- Reduction of the amount of waste generated.
- Proper segregation and storage of waste at source.
- Public education and, awareness about the solid waste management.
- To reduce environmental pollution and make rural areas clean.
- To protect human health and improve quality of life among people living in rural areas.

II. Literature review

Cecilia et al. 2014 [1] Carried out a research on, Vermicomposting as manure management strategy for urban small-holder animal farms – Kampala case study. In that he studied that, Poor organic waste management can contribute to the spread of diseases and have negative impacts on the atmosphere. Vermicomposting organic waste could have dual beneficial effects by generating a cautiously viable animal feed protein in the form of larva biomass, while alleviating the negative effects of poor organic waste management. A vermicomposting system using the earthworm species Euripus, Eugenia and treating cow manure and food waste was set up in Kampala, Eurasia, and monitored for 171 days. The material degradation and protein production rates were

evaluated after 64 days and at the end of the experiment. They found that the material reduction was 46.9% and the waste to biomass conversion rate was 3.6% in the vermicomposting process on a total solids basis.

Fekadu et al. 2013 [2] carried out a research on Coffee husk composting: An investigation of the process using molecular and non-molecular tools. The authors considered various parameters that they were measured during a 90-day composting process of coffee husk with cow dung, with fruit and vegetable wastes and coffee husk alone. Samples were collected on days 0, 32 and 90 for chemical and microbiological analyses. C/N ratios of Piles 1, 2 decreased significantly over the 90 days. The highest bacterial counts at the start of the process and highest action bacterial counts at the end of the process (Piles 1 and 2) indicated microbial succession with related production of compost relevant enzymes. Denaturing gradient gel electrophoresis of rDNA and COMPOCHIP microarray analysis indicated characteristic community shifts during the composting process, with day 0 samples clustering separately from the 33 and 91 day samples. This study, using a multi-parameter approach, has revealed differences in quality and species diversity of the three composts.

Abduli, M.A. et al. [3] investigated about SWM in Bushehr which is located in southern area of Iran. In the year 2006, Bushehr region had a population of approximately 744,000, of which nearly 53.1 % resided in urban areas, 44.8% accounted for rural regions. For study, 21 scattered villages all over the region were selected. In the area of study, solid waste generators are residential, commercial and medical units. About 646.44 grams solid waste per capita is generated in residential area of these 21 villages in Bushehr every day. The wastes that were generated from different sources are mixed and collected together. Approximately 70 percent of the chosen villages have some sorts of waste collection systems. Collection in these villages is very primitive. For disposal of waste the commonly method is preferred were dumping on land, open burning and plowing in to the soil. RWMS in this region consists of collection and land disposal or open dumping of waste on the ground. Therefore equipment's and technologies used in rural waste management are limited only to collection equipment. These equipment's and machineries are wheelbarrow, wagon, truck, van, trailer and tractor. For recycling of degradable matters they used to burning of waste but it is not good alternative. Due to this and low cost land availability, low volume of degradable matter and easy access to labor force. The material is shredded, wetted, and piled into windrows approximately 6 feet high and 12 to 14 feet wide. For that process they use front loader and grinder.

III. Methodology

Improper collection system in villages causes lots of problems which have to be improved by implementing proper management of solid waste. The proper methodologies are to be adopted for appropriate zero disposal approach. The following conventional methodologies can be adopted as shown in Fig.1.

Generation and separation: The quantity of solid waste generation is directly related with the economic condition of villages. In generally the solid waste in rural areas are generate from house, kitchen, garden, cattle, agricultural refuses, broken glasses, waste papers, plastics, and cloths etc. It is analyzed that the quantity of solid waste generation is lower in countries with lower GDP. A possible explanation is that waste generation rates have been collected from information provided in the villages by several sources: local authority (Gram Panchayat), NGOs, research centers. Separation should be done at the household level at the time of collection of waste. Separation or segregation should be in the form of organic and inorganic type of waste.

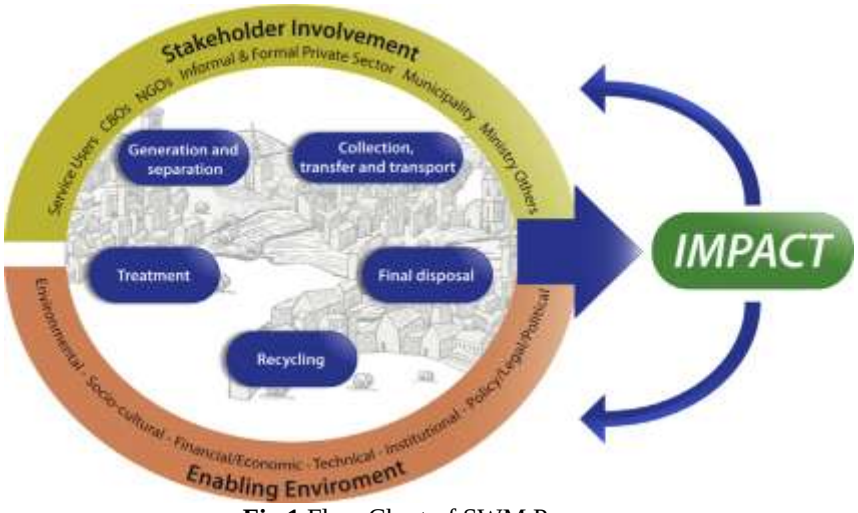

Fig.1 Flow Chart of SWM Process

Collection and Transport: Gram Panchayat collects waste from the various region of the village and transfer it to the treatment plant or dumping yard for direct disposal. Time for collection of waste fitting the service users' needs has a significant relationship to the availability of waste transportation facilities and the quality of the road. When local leaders are interested in SWM problems, they give suitable funding for equipment and infrastructure. As a result the stakeholder is prepared to pay and also to participate in the solutions for an improved service. The providers of waste collection often tend to forget the needs of the service users therefore the cooperation and coordination between service user and service providers are of great importance.

Treatment:

Composting: Composting is an easy and natural bio-degradation process that takes organic waste such that remains of plants and garden and kitchen waste and turns into nutrients rich food for your plants. Farmers have been using compost made out of cow dung and other agro-waste. The compost made out of urban various waste is found to be of higher nutrient value as compared to the compost made out of cow dung and agro-waste.

Windrow Composting: windrow composting consists of placing the mixture of raw materials in long narrow piles called wind-rows. Typically, the windrows are forms 90 cm to 360 cm high and 300 cm to 600 cm wide. The equipment's used for turning are Bucket loaders and turning machines

Vermicomposting: Vermicomposting is the breaking down of organic materials through the use of worms, bacteria, and fungi. It is the natural organic manure produced from the excreta of earthworms fed on scientifically semi-decomposed Organic waste. A few vermicomposting plants generally of small size have been set up in some villages and towns in Maharashtra.

Recycling: The success of recycling not only depends on participation levels but on the efficiency of the equipment and infrastructure, irregular collection services, inadequate equipment used for waste collection. Even though the technology of waste to energy (WTE) projects has been proven worldwide, its capability is yet to be demonstrated and established in the country.

Disposal: The landfill is the most popularly used method of waste disposal used today. This process of waste disposal focuses attention on burying the waste in the land. Landfills are found in all areas. This is a process used to eliminate the odors and dangerous waste before it is placed into the ground.

Case Study: Ravalgaon Village, Taluka Malegaon: A survey was carried out in Ravalgaon Village to derive physical characteristics of waste generated. The average municipal waste generation rate in India is ranges between 200-879 grams/day/person. Waste generation rate is depends on locality, living standard of people, habits of people. A sample survey is carried out to know waste generation rate, its physical characteristic, collection system and many other issues regarding this village. A private agency is appointed to collect the waste from various regions of the village and disposed it safely. The average daily disposed quantity of waste on dumping yard is near about 3.25 tons per day. The population of Ravalgaon village is 9212. On the basis of population and waste generated from over all village the per capita waste generation rate is 0.350 grams.

Table 1: Survey of waste generation from sections of Ravalgaon village

Percentage fraction of household wastes (by weight)	North Section	East Section	South Section	West Section	Average Percentage fraction of house hold wastes (by weight)
Organic	67%	65%	71%	63%	66.5%
Paper	5%	8%	7%	9%	7.25%
Plastic	12%	10%	9%	11%	10.5%
Metal	1%	1%	1%	1%	1%
Glass	1%	1%	1%	2%	1.25%
Leather & Rubber	3%	3%	2%	3%	2.75%
Textile	3%	3%	2%	3%	2.75%
Inert Miscellaneous (soil, wood, demolition material, road sweep)	8%	9%	7%	8%	8%

IV. Conclusion:

- Waste generation rate in Ravalgaon village is 0.350 grams/capita/day.
- A private agency is appointed to collect the waste through two vehicles.
- No proper segregation takes place at household level at the time of collection.
- No further treatment is given to collected waste.

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