ORIGINAL RESEARCH PAPER

Biotechnology

STUDY OF MUNICIPAL SOLID WASTE MANAGEMENT IN RANCHI, JHARKHAND

KEY WORDS: Solid Waste Management, Ranchi, Waste generation, Disposal, Ranchi Municipal Corporation etc.

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ABSTRACT

Solid waste management (SWM) have becomes a very serious concern globally. The lack of individual responsibilities as well as proper attitude and approach leads to this issue. Rapid industrialization, increase in population and further increase in standard of living and poor waste management have increased the serous health issue. In India we generate about one 1 lakh ton of MSW per day. Almost every ton of MSW is disposed of unscientifically. Though the compostable organic waste ranges between 34-70 percent, improper segregation or no segregation at source has challenged the further treatment and disposal experiments. Ranchi city need to be taken care by various new SWM techniques, proper management skill and adequate care the diseases and improve medical conditions. This paper deals with the proper description of the current MSWM process and the real time scenario where every individual is a source of waste creation. The effect of growing population of last ten years outcome of waste quality and quantity generated throughout these years have been discussed. It is observed that more than 4000 tons of waste per month is being generated. Researches shows that the disposal of solid waste requires 2,700,000 m2 area for the land up to the year 2030. Far sustainable development and effective management it is suggested that implementation of newer technologies, training of common people, and effective implementation of government policies will help to come out of these current issues.

Introduction

Existence of matter in three states results in three types of waste generation; gaseous, liquid, and solid. The gas that is wasted is gas waste, which is generally a resultant of Industrial activities and automobile exhaust. The fluid that is wasted is a liquid waste, which is generally the outcome of Industrial and Domestic activities. Finally, the solid that is wasted, thrown away, refused or not in further use is a solid waste. This solid waste may be categorized as -;

1. Agriculture and forest waste
2. Industrial Solid Waste
3. Municipal Solid Waste (MSW)
4. Bio-medical or Hospital Waste (BMW)
5. e-waste
6. Nuclear and Radioactive Waste

Fig. 1: Municipal Solid Wastes (Biodegradable)

Municipal Solid Waste (MSW) precisely can be defined as "Solid material which is generated or discarded by human beings and which is of no use or wanted by it in its existing form(Sincero-2002) This mainly consist of house hold refuse which Comprises of paper, vegetable and food scrape, clothes, metals, rubber, plastic, etc. as shown in Figure:- 01 The past two decade have witnessed a sea change attitude of waste generation phenomenon. Less people with more money enjoy more leisure and produces more waste. Increase in use of plastic, aluminum has added large amount of bio refractories to the MSW. In India we generate about one 1 lakh ton of MSW (CPCB-2005) per day. Almost every ton of MSW is disposed of unscientifically. Though the compostable organic waste ranges between 34-70 percent (CPCB-2005), improper segregation or no segregation at source has challenged the further treatment and disposal experiments. Every dumping site of the country is overloaded. Due to unscientific landfilling, the problems of groundwater and air pollution are of serious concern. Good municipal solid waste management practices requires collection of critical information which is not just for keeping the records up to date but Used effectively for taking corrective measures as well as proper planning for the future." (T.V. Rama chandra & V.K. Saira., 2003).

Ranchi city is located at 85.30 east and 23.3 0 north to the topic of cancer, its municipal area is around 650.02 km2, and 653 m above sea level. Ranchi considered as the hill station has the composite climate. Ranchi city is located in a Chota Nagpur Plateau, which has forest scenery around it. The growing population, urbanization, improper management of solid waste and lack of environmental training caused this place to its degradation, therefore the reliable waste management technology is required. Municipal solid waste (MSW) considered as trash, garbage and rubbish in United States and Britain. The composition of solid waste can be categorized from its processing properties and different states. Municipality waste also described as a domestic waste released from houses, hospitals, markets, and many service providing sectors.

The waste is categorized as Biodegradable waste, which can undergo degradation by microorganisms or microbes; Recyclable waste such as paper polythene which can withstand the recycling process; Construction waste from the construction site like debris rocks; Electrical and electronic waste such as light bulbs, batteries; Extra composite wastes such as leather clothes, plastic toys; Hazardous waste, which are mostly from the chemical industry converted into spray cans, tires, and fertilizers and; Toxic waste which is basically from fungicide, pesticides and herbicides. SWM from the municipality undergo treatment by recycling, composting, energy recovery and incineration.

The generation of waste in India has increased enormously

since three decades. Extensive researches are needed for the fruitful waste organization in urban India which involve by 1.3 billion individuals, produces about 1.5 lakh metric ton waste daily where only 70 percent are gathered, and rest are still in the environment. Approximately 31 million tons (48 percent) are dumped at land ll destinations. CPCB (Central Pollution Control Board) in India is offering RMC (Ranchi Municipal Corporation) guidelines for gathering, transportation, and disposal of stable waste from the city. Ranchi is evaluated to make more than 400 tons of trash/waste each day. The per capita waste generation are 450–500 gm for every person/day.

MATERIALS & METHODS

In the solid waste management, there are various components such as waste generation at individual level or family level, collection of household solid waste, waste from market and other common public place, waste collection system from residential areas and streets and common Areas, the workers engaged in waste collection (sweepers), the waste collecting peoples, waste transportation system, waste disposal system (dumping site/composting sites) and authority to monitor the waste management system, which comprises administrative officers (sanitary inspectors, ward officers, supervisors). Apart from this, the researcher's and rag pickers are also associated with the solid waste management. The peoples involved in the collection of recyclable material from the waste are also the part of solid waste management.

In the present investigation, the objectives of the proposed research work were worked out by following the widely accepted methods.

Survey of solid waste management (MSWM) system of Ranchi city .Existing status of solid waste management system of RMC to assess the existing status solid waste management system Questionnaire method was used. The questions related to the number of wards present in Ranchi city, area, total population etc. were asked to the authority. The questions are related to working staff of Ranchi Municipal Corporation for solid waste management. The presence of waste collection bins and handcarts used for collection were also enquired along with waste collection and transportation vehicles as shown in Figure:-02

Fig. 02: Dumping Site in Jhiri

The questionnaires were provided to each ward officers of Ranchi Municipal Corporation (RMC).

By considering the local language and language of administrative work carried out in RMC, the questionnaire were draft in local language and provided to the Concerning authority. Along with questionnaire method to collect the information about the existing solid waste management and the allied aspects were collected by using the information published in local and regional Newspapers regarding the solid waste management of Ranchi city Simultaneously for taking the authentic and systemic information regarding the waste management of Ranchi city were collected with referring the published literature in reports of National Solid Waste Association (NSWA), Jharkhand Pollution Control Board (JPCB), Ranchi Municipal Corporation (RMC).The collected information by using the methods applied during the present investigation was used to study the objectives of work. The study was carried out during the December 2020 to August 2021.

Survey to study the severity of waste management problems in Ranchi city. The survey and direct field visit methods were employed to understand the severity of waste management problem in Ranchi city. During the present investigation the waste management problems from Ranchi city were understood by asking questions to concerned peoples and by giving frequent visits to the study area. The severity of problems was confirmed by frequent visits and by collection supportive.

Evidences. The information about the baseline data about the waste generation from Ranchi city was obtained. The problems of waste collection in were observed. The system of waste segregation present in Municipal Corporation of Ranchi city was studied. The problems at waste storage spots and open dumps were observed from study area. The problems during the transportation of waste were recorded along with the solid waste disposal methods. The disposed solid waste leachate problem was identified from waste dumping site. The problem of feeding of stray animals on solid waste was reported from city area and dumping ground. As a direct impact of uncollected solid waste from residential area drainage blocking problems were observed, particularly in rainy season directly related to the handling of solid waste specifically worker handling the solid waste were monitored for the use of safety equipment. Though there is budgetary provision for the certain activities in the solid waste management, sometime these activities fail to give optimum results; hence the economics of waste management system of Ranchi Municipal Corporation and related aspects were critically assessed. The issue of failure of corporation for the waste management raised by common people, non-governmental organizations and media were reported for the assessment of solid waste management carried out in city. The per days solid waste collection rate was calculated by considering the waste carrying capacity of the vehicles (WCCV) used for the transport of the waste from Ranchi city to waste dumping site Jhiri Village and their total number of trips per day, the total amount of waste generated per day was calculated, on the basis of which the monthly waste generation quantity in tons were calculated. MSW Collection / Day = WCCV x No. of Trips / DayMunicipal solid waste collection trends in Ranchi city. The municipal solid waste collection trends were studied during the period December 2020 to August 2021. The collection trends were studied By taking maximum, minimum and average vales of the cumulative solid waste collected every months from Ranchi city by corporation. Study of average per day per capita waste collected from Ranchi city. The average per day per capita waste collection from Ranchi city was studied from December 2020 to August 2021. The per day per capita waste collected from Ranchi city was calculated.

Composting methods

In the present investigation the composting study of collected municipal solid waste from Ranchi city was carried out by aerobic (in metallic container) and biological composting technique with the help of earthworms in wormi-box.

Aerobic composting

About two-hundred liter capacity perforated metal container, covered on top and an open at the bottom was used for composting the degradable portion of the municipal solid waste collected from Jhiri waste dumping ground. The height and diameter of the container was 34 inch and 21 inch respectively. The holes of half inch diameter were made in the surrounding of the container and the plastic pipe of one inch diameter hole was inserted in the container to maintain the aerobic condition. To protect the container from sunlight and

rainfall the cone shaped lid was provided. To pick out the compost from the container the 10 inch by 12 inch opening was provided.

Composting process

The waste collected from Ranchi city by employs appointed by RMC for the solid waste management and transported Jhiri dumping site. From the dumping site the solid waste was collected from the heaps of solid waste and segregated manually for isolating the degradable portion of the waste. The degradable fraction of the solid waste was subjected in perforated metal container for aerobic composting. To minimize the time period required for optimum composting rate the waste was shredded manually. The shredded waste was kept in container for composting by maintaining optimum moisture content and the parameters such as temperature, moisture content and pH were monitored at regular time interval. The temperature of the composting waste was monitored at the interval of 10, 20, 30, 40, and 45 days till the completion of composting process. The monitoring of moisture content of compost in various stages at the interval of 5, 15, 25, 35 and 45 after days was carried out. Monitoring of composting waste was carried out at the interval 5 days during the composting period.

The composting of organic portion of the waste was carried out during different months of the year .The composted organic portion of the waste was collected from the bottom opening of the container. The prepared compost in metallic container was subject to nutrient content analysis viz. Nitrogen, Phosphorus (as P2O5) and Potassium (as K2O) and compared them with international market standards (ICDR, 2005).

Biological composting

The biological composting of degradable solid waste was carried out in laboratory by using vermicomposting.

Vermicomposting

Fig. 03:Vermicompost

The municipal solid waste samples were collected from open storage depots from Jhiri area of Ranchi city. The random sampling method was used for collection of samples. The collected solid waste was segregated for getting the organic fraction, which was subjected to biocomposting (vermicomposting) in laboratory. The degradable fraction of collected municipal solid waste was subjected to vermicomposting box for the composting process by using the earthworm species Eisenia foetida as shown in Figure:-03. The nutrient contents such as nitrogen, phosphorus and potassium were studied at the interval of 15, 30 and 45 days. The average nutrient content of vermicompost was determined at the end. The 63 cm x 45 cm x 30 cm plastic wormi-box was used for the composting of municipal solid waste .The bottom most layer of the vermi unit was covered with coconut coir to maintain the moisture content. The alternated layer of partly digested and powdered cow dung and chopped municipal solid waste were laid. The wormi-box was kept in location free from direct exposure of sunlight and with adequate aeration. Also proper care was taken to protect the box from predators such as insects, ants and rodents. The earth worm species Eisenia foetida was inoculated in wormi-box with sorted organic waste. A moist gunny bags were spread over the surface and moisture content was maintained at regular interval. The composting material was kept for 45 days to convert the organic fraction of municipal solid waste into vermicompost. In addition with waste material the water was sprinkled with pump on waste material for maintaining the moisture level in wormi-box. After completion of 45 days the water sprinkling process was stopped and compost was gently scrapped from the top layers of to a depth at which vermi casting were present. The earthworms were separated from compost manually.

At the interval of 15 (15, 30 and 45) days the compost was analyzed for the nutrients contents such as nitrogen, phosphorus and potassium.

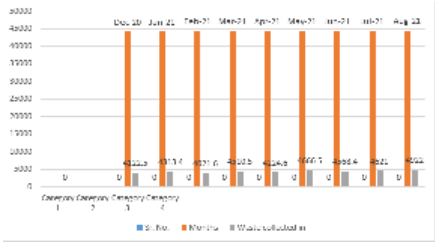
Result & Discussion

The population growth in the city have been increasing since last twenty years. Rapid urbanization and migrating from the villages to the main city for employment and business lead to the increase MSW. The population growth is directly proportional to the generation of MSW. Municipal solid waste is increasing with population growth of 2.2% every year. Present study shows survey, collection, transportation, segregation and disposal of SWM. Some bio techniques such as composting and vermin compost were done. The municipal solid waste collection trends were studied during the period December 2020 to August 2021. The collection trends were studied By taking maximum, minimum and average vales of the cumulative solid waste collected every months from Ranchi city by corporation that can be seen in Below Figure:-04 Showing Table Monthly Collection of SWM and the Figure:-05 Graph showing Monthly Collection of Solid Waste

Figure:-04 Showing Table Monthly Collection of SWM

Sr. No.	Months	Waste collected in tons	Average per day waste collection in tons
1.	December 2020	4122.5	132.9
2.	January 2021	4313.4	139.1
3.	February 2021	4021.6	138.6
4.	March 2021	4510.5	145.5
5.	April 2021	4224.6	140.8
6.	May 2021	4666.5	150.5
7.	June 2021	4568.4	152.28
8.	July 2021	4621	149.06
9.	August 2021	4922	158.77

Fig:-05 Graph showing Monthly Collection of Solid Waste



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