

Solid-Waste Management in Bhainsa Municipality

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Abstract—The Solid waste is a material in solid form which is of no use. It is very harmful to the Environment, if left like this. So, proper care should be taken to make this harmful material to harmless. In this paper solid waste management in Bhainsa municipality was studied. In the part of study, collected the data regarding quantity, types of waste generating, equipment status and also gone through field visit where Dump site observations and also status of cleaning on the street is observed. A survey was undergone for some households in the municipality in which questionnaire prepared to know whether public aware of SWM or not, and obtained productive results. Then after having all the information analysis on the data collected, which is forwarded to obtain an effective SWM process. Finally the result came up with different approaches of managing solid waste for different types of materials. Other than this the work done is to obtain a routing system which will result in less cost. This work is done using Arc GIS software to get good results. To have an effective SWM process Solid waste management and handling rules are developed. These rules ensure protective management. So, it is suggested to the municipality to follow the rules. By analyzing the results of survey conducted it is came to know that some are not having proper knowledge on SWM. So, it is the responsibility of municipality to create awareness in the public. And public also need to participate effectively in SWM. Municipality has to use government policies and get out of it. Finally some Productivity results were obtained to make Bhainsa as Zero waste Municipality.

1. INTRODUCTION

Solid waste is one of the growing problems of developing countries. Due to urbanization, industrialization and increase in population there is also a tremendous increase in the pollution of the developing countries. The rate of waste generation is an index of socio-economic development and economic prosperity of the region. This lead to many health and social problems. Therefore need of proper solid waste management came into existence.

SWM refers to the supervised handling of solid waste from its generating to disposal. It is associated with generation, segregation, storage, collection, transfer, transport, processing, and disposal of the solid waste.

In the current scenario in order to cater the need of reduction in solid waste and to meet the energy crisis, technology was adopted. Western style of living and “throw away” nature of

the people has led to increase in the humongous amount of waste.

India’s population is growing at the rate of 1.41% per annum and present population in India was 1.2 Billion (census of India 2011). Due to faster growing population and economy, it's impact could be seen and fairly co-related with production of most of waste categories as well. Generation of municipal solid waste (MSW) in India itself has increased from 6 Million Tons per annum in year 1947 to 48 Million Tons per annum in 1997, with per capita increase of about 1.3% per annum. In year 2004-2005 generation of MSW in country has reached up to 40 million tons (CPCB-NEERI, 2004-2005)). Seriousness of the problem could be well imagined with the fact that in Capital of India, Delhi itself, has 24 Landfill sites, out of that 16 are already filled up, 4 are new and they are receiving about 8000 Tons of MSW on daily basis.

1.1 Types of Solid Wastes

There are different types of solid wastes produced. Some of them are Domestic waste, Commercial waste, Institutional Wastes, Street Sweeping, Industrial/Trade waste, Debris or construction rejects, Bio medical waste, Hazardous waste, Sewage waste.

1.2 Solid waste rules 2000

These rules may be called the Municipal Solid Wastes (Management and Handling) Rules, 2000. Municipal Solid waste rules, 2000 states about collection, segregation, storage, transport, processing and disposal of MSW and also fixes role and responsibilities of concern authorities to manage it. It is the duty of the every municipal authority within the territorial area of the municipality, to ensure the implementation of this rule and to develop infrastructure for the collection, storage, transport, processing and disposal of waste.

Certain rules were specified in schedules which municipalities should follow.

Schedule I: Implementation schedule.

Setting up of waste processing and disposal facilities.

Schedule II: Management of municipal solid Wastes.

This gives the guidelines for collection, segregation, storage, transportation, processing, disposal of MSW.

Schedule III: Specifications for landfill sites.

Rules and regulations for landfill sites are given in this schedule. Guidelines for site selection, facilities at landfill site, specifications for landfilling, guidelines for pollution prevention, water quality monitoring, ambient air quality monitoring, plantation at landfill site, closure of landfill site and post care are given. Special provisions for Hilly areas are given.

Schedule IV: standards for composting, treated leachates and incineration.

Standards for composting, Treated Leachates and Incineration are made in this schedule. The waste processing or disposal facilities shall include composting, incineration, pelletisation, energy recovery or any other facility approved by Central Pollution Control Board. Specifications for compost quality, standards for treated leachates which are not to exceed before discharging into surface waters is given. Operating standards and emitting standards are given for incinerators. The incinerators shall follow these standards.

1.3 Objectives of the paper

Objectives of this paper is to

- To review the existing municipal solid waste practices.
- To recognize gaps in the present system.
- To analyze in house capacities and infrastructure facilities of solid waste management in Bhainsa municipality.
- To study dump sites existing in Bhainsa Municipality.
- To come up with effective solid waste management practice.

2. LITERATURE REVIEW

2.1 Recycling for sustainable polymer in India

One of the important aspect to be consider in the highly commercialized and industry based era that the use of plastic and its deteriorating capabilities on environment. Due to its light weight, inexpensive and durable nature, all are tending to use these materials than jute bags, ecofriendly bags. So there is a need to change the attitudes and practices towards use of plastics and think about the environmental concerns for our future generation and present plastic waste generation. The enormous quantities of waste accumulating in urban areas, was not only taken as a threat to the environment but also as a sign of an individualistic insensitive and hedonistic consumer society. We should think MSW as asset not as waste.

2.2 The need for recycle-literature survey

The increased use of plastics has bought environmental impacts and consequences with the greater volume of

household waste generated. It is known fact that global demand for polymer business is growing rapidly for its extensive use in commercialization and industry chain processes and increasing use of plastic brought environmental impacts. To know the existing condition in the use of recyclable materials and present practices they are using to make recyclable materials more viable. To know observations thermoplastics are the ones which include (polystyrene, polyamides, polyethylene, polypropylene and polyvinyl chloride) being used most abundantly also we can easily recyclable these materials than compared to thermosets which are being used in instruments like computer and as e-waste which mostly are don't know how to recycle.

2.3 Rejuvenating through Recycling

- Provides assistance through job opportunities to the poor by collecting the recyclable material from different areas.
- Thinking MSW as asset rather than waste leads to decreasing in the quantity usage of virgin waste and increases resin waste usage.
- Giving the responsibility of collecting recyclable materials of their own company to the producers of virgin materials, which will intern develop the recycling.
- Banning of 2 cover packaging on "GUTKA AND MASALA" will help us to reduce plastic and instead they can use resin plastic or eco-friendly packets.
- Giving instructions to corporates and the new entrepreneurs about the rules and regulations regarding the usage of plastics and to amend legislations and improving policy frame works gets the good and sustainable results in long term business.
- We should make our governance and legislations in such a way that it will yield the solutions and promote new academic based entrepreneurs to give innovating technologies in the field of recycling.
- A national level monitoring and implementation strategy and an institution should be followed and it does so, then it makes possible for the state and division municipalities to follow the rules of central body.

2.4 Problems faced in recycling

- Non-homogeneity and diverse plastics makes the recycle difficult to get the required material for use.
- Lack of technical guidance about recycling process, if at all there any technical innovation then lack of funds and suitability of technology in particular area creates the situation worse.
- Lack of social awareness about recycling process and its significance in the protection of environment.

- There are no stringent laws against the disposal of waste in and around the residential or their respected living area.
- Lack of policy frame works promulgation in the society and their implementation in the municipalities.
- Lack of boosting/encouraging or not providing opportunities in the field of recycling about industry-academic relationships.

2.5 Technology options

- Collecting exact present data and inserting in the software which will give the model and case studies in various locations across the world to suit for that municipality.
- Use of IT-enabled Services in the recycling and waste management yields good results.
- Getting implementable ideas through open tendering by providing site data and municipality details to enable technology intervention in recycling.
- The use of Spectrometry and Fourier transformation which yields good results about the state of plastic condition.
- Recent civil initiatives like use of plastic in roadways led to good ideas.

3. METHODOLOGY

In Methodology, different steps/techniques are involved. Such as Household survey, Field Test, Data collection, Conventional recycling methods and Transport planning.

Of which we deal with conventional methods and Transport planning.

3.1 SWM in Bhainsa Municipality.

In India SWM is not so well implemented like other developed countries. It is done with mainly of big cities and large municipalities. As Bhainsa municipality 3rd grade municipality which is a lower grade there is a poor management of waste. Solid waste management is supervised by sanitary inspector under which sanitary jawaan and laborers are worked. There is a need of more number of workers for efficient processing but due to financial considerations the municipality can't fulfill the need. These workers are permanent and temporary.

Table 3.1: Status of workers present and vacancy in Bhainsa municipality.

S. No	Name of the Post	Sanctioned	Present	Vacant
1.	Sanitary inspector	1	1	0
2.	Sanitary jawaan	2	2	0
3.	Driver	1	1	0
4.	Public health worker	49	31	18
	Total	53	35	18

3.1.1 Door to door collection

Coming to the collection and transportation of waste, waste collection process is starting early in the morning at 5:00AM daily. It is going to be in two shifts. The collection process undergoing is door to door collection. The waste collected from the individual households is directly transferred to the tractors. There is no bins put up in the streets to collect the waste. Some households are given with two dustbins of red and green in color.

3.1.2 Segregation process

Municipal authorities trying to educate people to commence segregation process at home level. Now it is in initial stage. Wall posters and pamphlets are prepared to distribute to the people. Vehicle requirement needs to be fulfilled here.

3.1.3 Transportation

There is no proper route planning to collect and transport the waste. So, transportation cost is increasing with the diesel requirement. Waste in the transporting vehicle is directly getting exposed to the atmosphere. The vehicle status in the municipality is given here.

Table 3.2: Status of outsourcing vehicles and vacancy in Bhainsa municipality.

S. No	Type of vehicles	No of vehicles present	No of vehicles required
1.	Wheel barrows	0	0
2.	Tricycles	0	0
3.	Tractors	4	4
4.	Autos	8	8
5.	Dumper placers	1	1
6.	Tippers	0	0
7.	Others Bob cot	1	1
	Total	14	14

3.1.4 Processing and disposal

In our study we got to know that there is known adaptation of any waste processing method. Waste is dumped in the dump site directly. Presently municipality is using an empty place near by bus depot as dump site. There is no proper facility for the dump site. They have eleven acres of land which is at a distance of 8km from the Bhainsa town. But it has legal problems. Due to that, it is not being used presently. Municipal authorities are trying to free the land as early as possible.

Total solid waste generation in the Bhainsa town is 27.5MTD. Most part of the waste coming from households of 9.25MTD which is 33% of total waste. Rest coming from the market yard, Drainage and commercial establishments mostly. Increment in waste generation is decreasing annually, except in 2015.

The municipality is facing number of problems from waste collection to the final disposal, like vehicle repairs, lack of

dump sites etc. The proposals are made to the government to rectify the problems.

3.2. Conventional Recycling Methods

As Solid waste is increasing day by day, many conventional recycling methods are proposed to overcome and to utilize the solid waste resources.

Some of them are

3.2.1. Barrel/Drum based composting

- First of all one needs to take a barrel/drum with a capacity of about 150-200litres. And then it should be punched holes all around three sides including bottom about 1/2" dia. and should make of provisions of door opening at the bottom of barrel with open and closed option.
- Place your bin in a rise platform to get good amount of air. Then pour/insert whatever biodegradable material collected for reused purpose.
- Before that cut the waste into smaller pieces. So that it degrades quickly and then maintain moisture content of about 50% to enhance the reaction process.
- Then sprinkle cow dung water over the waste to start degradation process. Stir your compost about once a week to ensure that it is well aerated. If it has too much green waste then add sun brown material like saw dust to balance the carbon to nitrogen ration in the waste.
- Then wait for 2-3 months to get the required compost and it can be useful for increasing soil fertility whether for fields or trees.

3.2.2 Vermi-composting

- It is one of the household technique one can use to convert biodegradable waste to compost within less cost and very effective method.
- Take a plastic crate put a layer of sand(clay) or sand layer and then add cow dung manure above this layer.
- Collect biodegradable waste as much as you can and then place it in plastic crate of capacity 12" square with sides should be punched holes about 0.25-0.5 inches.
- Then insert some earthworms in it. Put some vegetable peels pre composted material in to the pot, and cover it with a layer of dried leaves.
- Then sprinkle little water to maintain the moisture. And then next day remove the wet leaves then add next day collected waste put dry leaves then add water.
- Do the same process until crate filling up and then wait for 5-6 weeks to get compost ready.
- The special type of earthworms here using are Eudriluseugeniae(African night crawler) Eiseniafoetida(Tiger worm), and Perionyxexcavatus(India blues).

3.2.3. Windro composting method

In the form of different municipal corporations or private establishments which produces compost from municipal solid waste through a windro method the compost samples collected were specifically produced from municipal solid waste. The municipal solid waste was either mixed waste partially segregated or Source separated before composting. And techniques or methods involved for composting was collected from the manufacturers of the compost. The physical and chemical parameters of all the large scale composts was tested in the laboratory parameters such as Moisture content, Volatile solids, pH, EC, Total organic carbon, plant nutrients such as N,P&K, C:N ratio, Carbon respiration and heavy metals. All the parameters were compared with Compost guidelines given by FCO 1985. The heavy metals in the compost samples were also compared with MSW 2000(handling) rule, USA bio solids and EEC organic rule.

3.2.4 Transportation Planning

Solid waste management in a municipality for most extent dependent on efficient collection and transportation. 100% water management can be possible only if there is 100% collection. So, it is much needed to have a transportation system through which 100% collection possible. If the system is provided with optimized passengers with less consumption of fuels that leads to less expenditure. About 60%-70% of this amount is spent on collection, 20-30% on transportation and less then 5% on final disposal on waste. Therefore waste collection waste must be regarded as an important issue in order to increase the efficiency of waste management. So, analysis on vehicle routes in Bhainsa municipality is done and optimized routes are found out using Arc GIS.

Shortest Route/Path method by using Arc GIS Software

Finding optimum length of transportation in an urban city is a bit difficult, but after getting through that path/route one will be able to go in an effective way without any great hurdles in managing distance and cost minimization through reducing diesel/petrol cost for transportation. There are various factors influence upon the shortest route method such as accurate input of information will surely give good results but converse will yield bad result that can't be compatible.

So here with the help of Arc GIS software to resolve the problem of shortest path of BHAINSA municipality by which attempted to reduce the money spent by the municipality on diesel/petrol for vehicles used to collect waste. By taking the map from Arc map software with respective longitudinal and latitude noting down, first of all insert into the Arc GIS software and have to do GEO-referencing with latitude and longitude. By creating various features to the map like trees, road network, crop fields with the help of point, polyline, and polygon respectively we can locate various geographical locations.

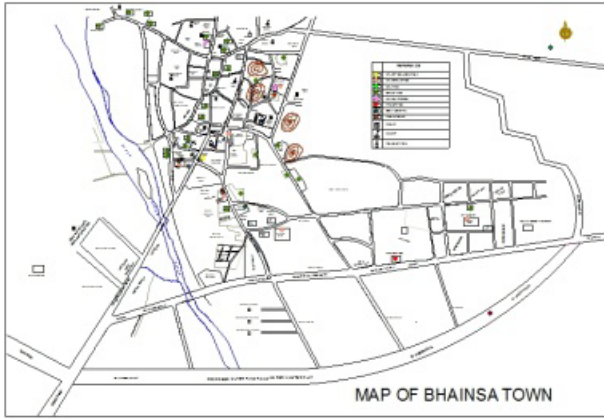


Fig. 1: GIS route map of municipality

4. RESULTS AND DISCUSSION

After getting information about solid waste generation in Bhainsa municipality results found very strange and interesting. Getting information through various sources and taking views of various municipality authorities it is found that Most of the municipalities in Telangana and Andhra Pradesh are like the same. We took this as a challenge to improve and innovate the municipalities facing problems.

4.1 Collection of solid waste

Collection of waste which is an important factor to be considered in municipality and which will give the respective municipality status about hygiene practices and clean and green environment which will intern effect the development processes and healthy living conditions. It is being observed that workers are joining for collection of waste at 05:30AM.especially women workers allotted for different wards for sweeping the roads keeping the collective waste in particular location.

After 2-3 hours men workers will come and dispose into municipality vehicles. It has been observed that 85% of waste which is being collected every day which is quite good quantity to be collected. But the efficiency of collection of waste is poor in some certain cases such as route collection system and allocation of workers to the various locations where more dump is getting.

So we adopted a unique solution to this problem of collection of waste using municipal vehicles through Arc GIS route mapping technology which will enhance the existing condition of collection of waste, and which will save the financial aspects of particular municipality.

One of the primary thing one has to improve in the municipality about collection of solid waste is that providing more of dustbins with high capacity for the storage of waste in temporarily basisto make use of optimum route length process

to reduce cost for municipality in savings of diesel/petrol costs.

4.2 Recycling Practices

From the above collecting and analyzing data we found an interesting fact that If that would have recycling process it would yield good results but unfortunately or due to not having land facility or financial resources this would be remain a problem which has been eagerly waiting for to come. Household, marketing and hotels and restaurant which is totally consisting to 15.25MT per day(As shown in figure). For this there is no proper facility to recycle the same. We should change our aspects about MSW from waste to asset.

Different kinds of recycling techniques with affordable costing are discussed below.

In Bhainsa a total waste 27.5 MTD is being produced.

Table 4.1: Methods to be adapted for making zero waste municipality

Type of waste	Amount of waste generation(MT)	Methods to resolve problem
Household	9.25	Vermi-composting,windrow composting,Barrel/drum method.
Market yard	3.5	Requesting by calling ,leaf mulching,gross cycling.
Drains & silts	6.5	Filling in low lying areas.
Slaughter houses	1	Land filling, feeding to animals.
Hotels & restaurants	1.5	Anaerobic digestion,composting,bi o-gas production.
Commercial establishment	3.5	Electronics,clothing recycling.
Educational establishments	0.75	Paper,toys recycling.
Hospitals	1.5	Burning & incernation,Auto clave waste processing machine,chemical disinfectction.
Total waste	27.5	

In this household wastes of 9.5 MTD which is a huge quantity. Along with this market yard and hotels also produces 5 MTD of waste combinely. This waste can be biodegradable. There are so many process of managing this biodegradable waste. All are not suitable in all conditions.

Apart from biodegradable waste, paper and plastic waste is 6.05 MTD. This waste can be recycled. This waste has to be collected on daily basis and segregated well. Segregated waste can be sold to the paper and plastic producing industries. This

not only reduces quantity of waste but wealth also being created through this.

Metals and glass waste also produced in an amount of 4.12 MTD. This also can be used for other purposes. These can be filled up in the construction processes.

Hazardous waste like medical wastes are very dangerous to living environment. So, one needs to manage it very effectively so that there is no bad affects with these waste. One of the process of managing it is burning it. If it is done according to scientific methods the energy being produced through this process which can be used for other purposes. Incineration and combustion process gives heat as an output which can be used in thermal plants. These are also produces methane gases which can be used for other purposes. These processes are of high cost.

A municipality like Bhainsa which is having less waste material, if it go through these processes it can't get benefit out of it. So, it is suggested to simply burn the waste, without approaching any scientific methods, so that waste can be reduced Debris and silt can be filled up in the low lying areas.

4.3 Public participation

The success of any municipality depends on people in respective municipality. In spite of providing all facilities, institutions framework and policy measures its implementation depends on the people who are involving in that process. Out of total wards population 40-45% are living in slum areas contribution 13 wards out of 23 wards without knowing the basis about waste management so if we try to educate them with social programs related to waste management and their importance (as did in BOBBILI municipality which has achieved 100% cooperation from people) then required results are achieved.

4.4 Dump yard conditions

In a basic structural components of any municipality one of the important to be considered is dump yard for disposal of waste which is being accumulated every day. Through scientific approach one has to select, operate and manage the land fill or dump yard. According schedule 3 of MSW (handling and managing) rules,2000 one has to select the dump yard and land fill site. There they have given specifications for landfill site selection and also what should be the facilities should have in respective site.

It has been observed in the Bhainsa municipality that there is no proper place to dispose solid and liquid waste. Which is being dumped beside which surly effect the population surrounding there in long term.

5. CONCLUSION

Solid waste management is the main consideration to protect our environment and give protective life for our future generation. However we have to achieve clean environment. If we have certain commitment towards it, we can achieve it easily. SWM is not the process done by a single person or an authority. If public who have individual commitment is there, SWM will be more effective. But, public with different levels of knowledge need not have knowledge on solid waste management. It is municipal authority responsibility to let the people know about solid waste management have to conduct awareness camps regarding this. If an individual participated in SWM, municipality will get ultimate benefit in the form of reducing the work. If a work have to be done successfully efficient use of resources is necessary. Municipality must use money and man power resources such that they get maximum benefit out of less resource s.

SWM in Bhainsa municipality can be effectively implemented by proper use of SOLID WASTE (MANAGEMENT AND HANDLING) RULES, 2000 and taking into account the steps followed by Bobbili Municipality to get zero waste.

SWM is done in different manners for different types of wastes. Bhainsa has generating all types of waste. We have come with solutions for each type of wastes. So, we can say, following them will give a better management in Bhainsa. SWM rules are created for protective and effective management. Municipality have to implement this rules and regulation in doing SWM. Presently India and government is coming with new policies on clean environment like SWACHH BHARAT. So, if municipality have to try to get benefit out it. Municipality if under go all these, definitely that will be an advancement in zero waste Bhainsa municipality.

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