Municipal Solid Waste Management System For Pune City

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Abstract -

    The growing population create problem of solid waste management (SWM) is a major challenge for Indian cities and villages. We are thinking about to keeping our Pune city clean but have we ever thought about the wastes in the land filling area of the city. Our aim is reduction, recycling and reuse of the waste; to make cities clean. The study is all about the growth of solid waste management (SWM) in different part of the Pune city. Pune city have some policy and program to be adopted by the municipal corporation in managing solid wastes. There are cities which are successfully converting the solid waste into compost, vermicomposting, Biogas, RDF (Refused Derived Fuel), etc.,we need to learn their process to be replicated in each cities of India. Solid waste management includes all the activities and actions which required to manage waste from its collection to it's final disposal. This includes the collection, transport, treatment and disposal of waste. The main and important aim of waste management is to minimize the effect of waste product and hazards to the environment. Effective waste management is quite expensive, usually comprising 20%-50% of municipal budget. With rapid urbanisation, industrialization and an explosion of population in Pune , solid waste management will be a key challenge for governments and local municipal bodies in future. The "SWACHH BHARAT ABHIYAAN" (clean India mission) was created to tackle theses issue's which are mainly related to waste management, cleanliness and sanitation on a national level.

Index Terms – Pune, Solid Waste Management, RDF, Swachh Bharat Abhiyaan.

1. Introduction –

    In Pune city, solid waste management has become a top superiority. Day by day population increases with increasing waste. According to increasing number of population, management face challenge to manage all those things. Management of Solid Waste(MSW) , may be defined as the control of generation, segregation, storage, collection, transfer and transport, processing and disposal of waste based on technical principles. This includes all technological, financial, institutional and legal and policy aspects involved for solving the whole spread of issues related with solid waste. In India ,Pune is 13th cleanest city, according to Swachh Survekshan. Term 'waste' relates to materials which is produced by human activities and the process is generally undertaken to shorten their effect on environment and human health. Poor waste management can create serious health and social problems in a nation. With increasing population , management of Municipal Solid Waste (MSW) in the country has emerged as a severe problems not only because of the environment and artistics troubles but also because of the sheer quantities generated every day. Segregation at source , collection, transportation , treatment and scientific disposal of waste was largely insufficient leading to degradation of the environment and poor quality of life. In Pune city due to growth of population solid waste is increases. Due to improper management of solid waste most common problems associated it includes odour nuisance, diseases, atmospheric and water pollution (Jilani 2002). And also improper disposal on the landfill site's may causes the diseases like asthma, jaundice also reduces the quality of the drinking water (Bean , et al. 1995). In Pune city solid waste comprises , discarded and unwanted materials from commercial, industrial, from houses, hospital, hotels, establishment market changing life style and increase in urban population lead to the generation of

solid waste. If solid waste disposed off in open area on land , then it causes environmental causes, negative impact on health. Large amount of waste poorly disposed and untreated. PMC (Pune municipal corporation) is responsible for collection, storage , segregation , transportation and disposal of MSW. So there is immediate need for designed scientific Integrated SW management system using GIS , Remote sensing to control and minimize negative effects on environments. Covid-19 in India shows that the peak is yet to come and India has a long way to go to control the virus. Because of coronavirus the biomedical waste is generated from the hospitals and laboratories not all the waste is hazardous but even the smaller amount of hazardous waste is enough to spread the virus and hinder our fight against corona. Biomedical waste required handled consciously and it should be treated carefully and properly in way that it does not affects anyone before it gets treated. Solid waste management is crucial and essential job in response to coronavirus after sewing all condition that amount of biomedical waste has been increased to 15 times more than amount of the waste generated from the general patients.

2. Objectives -

The main objective of this research work is to decide the most suitable disposal method of "Municipal Solid Waste Management for Pune city" for future forecast in year 2050

3. Study Area -

Pune is the second largest quick developing urban city in Maharashtra and ranks eight at national level. It is now quickly changing from an education-administrative center to an important industrial centres and the IT Center. Pune is a plateau or upland city which is situated near the western margin of the Deccan Plateau or upland. Pune is situated at an elevation of 560 m above the mean sea level. PMC lies between latitudes 18° 25'N and 18° 37'N and longitudes between 73° 44'E and 73° 57'E and the geographical area is around 243.84 Sq. Km with a population of 3.12 million. The area in the central part of the PMC is slowly populated than the marginal regions.

4. Methodology -

The purpose of the study is find out the total solid waste by population at 2050 year. For the work, first we calculate population projection for 2050 year using geometrical increase method. Population projection is calculated using the equation:

Pb =Pa(1+r)t;

Pb = is population of the for which projection is to be made
Pa = is population of the base year
r = is the rate of growth divided by 100
t = is the number of years between 'a' and 'b'
Ex: If present population (2020) of a Pune city is 6629 with a growth rate of 2.74% , then project the
population for the year 2050.
P (2050) = P (2020) * (1+2.74/100) ^30
        = 6629*2.250
P (2050) = 14915.25 Thousands

4.1 Determination of waste generation rate:-

•Small Town-100g/p/day
•Medium Town-300-400g/p/day
•Large Town-500g/p/day
For Pune city waste generation rate is more than 500g/p/day because Pune is rapid growth city.

Future waste generation = per capita waste generation* projected population

We calculate area required for sanitary landfill:-
- Location - Pune
- Waste generation - 2677 tons per day (current)
- Design life - Active period (30 year)
- Topography - Hilly area
- Water table - Below 3m ground surface
- Average total precipitation - 722mm per year
- Current waste generation per year = 2677 t
- Estimated waste generation after 30 yr =7458t
- Total waste generation in 30 yr =0.5(2677+7458) *365*30

$$= 55,489,125$$
$$= 56 \ MT$$

- Total waste volume (assumed density 0.85 t/cu. m) = $56*10^6/0.85$

$$= 65.88*10^6 \ cu. \ m$$

- Volume of daily cover = $0.1*65.88*10^6$

$$= 6.5*10^6 \ cu. \ m$$

- Volume of linear and cover systems:- $=0.125*65.88*10^6$

$$= 8.23*10^6 \ cu. \ m$$

- First estimate of landfill volume = $(65.880+6.5+8.23-6.5) *10^6$

$$= 74.11*10^6 \ cu. \ m$$

4.2 Area Calculation-

- Area required for infrastructure facility:- = $0.15 * A = 0.15*37.05*10^5$

$$= 55.57*10^5 \ sq. \ m$$

- Area available for landfill Area required for landfill separation

$$= 0.85*Ar$$
$$= 0.85*37.05*10^5$$
$$= 31.49*10^5 \ sq. \ m$$

- Area required for landfill separation Ai = $(74.11*10^6) /20$

$$=37.05*10^5 \ sq. \ m$$

- Total area required for landfill separation = $1.15*Ai$

$$= 1.15*37.05*10^5$$
$$=42.60*10^5 \ sq. \ m$$

4.3 Functional Element-

Various functional elements associated with the management of solid wastes such as generation, storage, collection, transportation, processing and disposal which are given below-

- **Waste generation-**
Waste generated at the start of any process, and at every stage as raw materials are converted into goods for consumption. The source of waste generation determines composition, quantity and waste characteristics.
- **Waste storage-**
Storage of Municipal solid waste (MSW) after collection and prior to transportation to the transform Or disposal site . It is an relevant practical component. Storage time depends on the type of Municipal solid waste.

For example,

the ecological or biodegradable waste cannot be stored for long in a storage holder because of it's decomposable nature. There are so many choices for storage like plastic containers, conventional dustbins (of households), used oil drums, large storage bins (for institutions and commercial area's Or servicing depots), etc.

•**Waste collection-**Collection refers two features: collection from the origin or source of generation to the upcoming collection point and collection from that point to the wide vehicles for transportation or to the transfer stations and then finally go to the processing plant / disposal area. Collections based on the number of containers, frequency of collection, types of collection services and track.

•**Transfer and transport-**
This involves transfer of waste from minor collection vehicle to major ones at transfer stations.
• **Processing**-It is very important functional component of Solid Waste Management system, which leads to many types of resource recovery, recycling, energy generation, production of organic manure, etc.
•**Disposal of final projects**-
Engineering principles are followed to intern the waste to the little possible area, reduce them to lowest particle volume by compaction at area or site and cover them after each day's operation to shorten exposure to ant/vermin.

4.4 Waste Treatment Methods

1) **Windrow Composting**- This method is useful for disposal for the disposal of biodegradable waste. This method is not expensive composting method. It improves the fertility of soil. eg. Yard waste.

2) **Sanitary Landfill**- It involve the dumping of waste into a land fill. A low-laying open area out of the city where solid waste/ Garbage is collected and dumped. e.g. Food Waste

3) **Incineration Method**- It is mainly used to dispose of the medical waste hazardous and toxic wastes. Waste can be easily be rid by using this method. It features combustion of waste to transform them into base component with the generated heat being trapped for Deriving energy. eg. E-waste

4) **Recycling**- It is the process of convert waste material to useful product. This is done to reduce the use of raw materials and minimize the quantity of waste generation.

5) **Integrated System**- Integrated waste management system all inclusive waste prohibition, recycling, composting and disposal program. An efficient integrated system considers how to prohibit, reuse, recycle, manage solid waste in ways that most efficiently. and it protect environment and human health.

6) **Vermiculture**-It is a technique based on utilizing earthworms to convert organic waste into vermicomposting, the product of decomposition by various worms. Harvesting worms that take part in decomposing organic waste and convert it into nutrient rich fertilizer.

7) **RDF**- RDF (Refuse Derived Fuel). This fuel is produced from fundamental which are explosive or combustible that the industry calls Municipal Solid Waste (MSW) for short. This waste, which is from industrial or commercial areas or sites is burned to produce electricity power. Refuse Derived Fuel (RDF) is a renewable energy source. That make sure waste isn't thrown into a landfill area and instead, put to sustainable use.

5. Result and Discussion
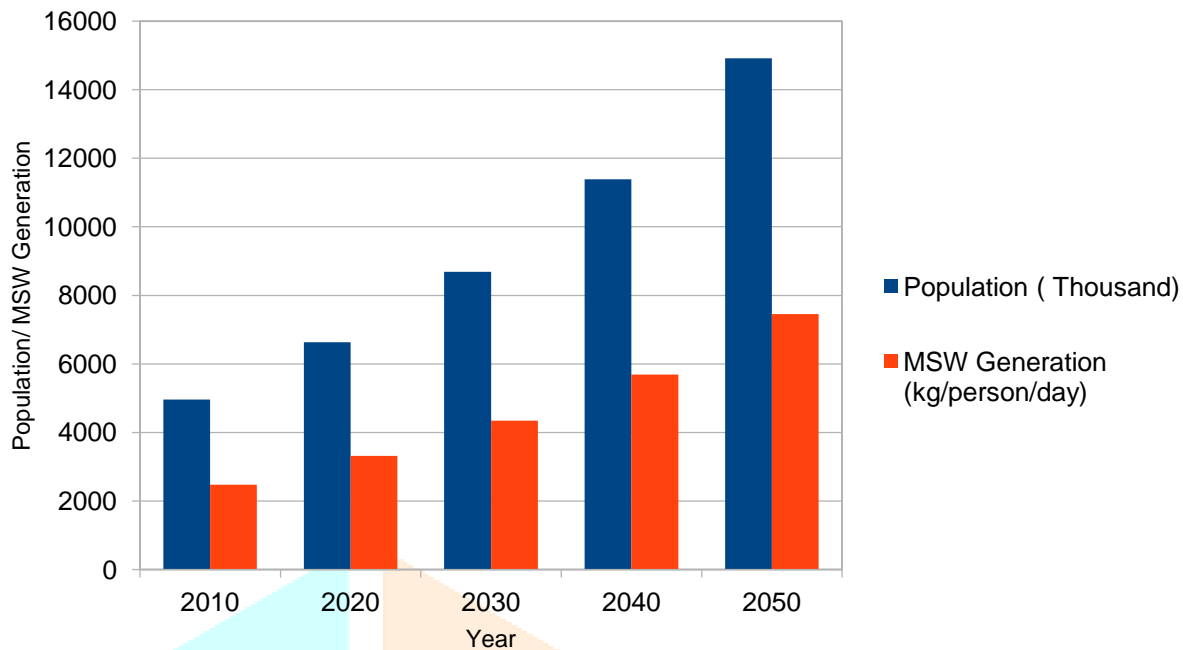
Fig 1. Bar chart OF MSW generation, Population projected form 2010 to 2050.

Total population of Pune city and waste generated from population, Rapidly Increasing from 2010 to 2050.

According to climate change, seasonal variations from wet to dry season, which cause significant changes in the moisture content of solid waste, varying from less than 50% in dry season to greater than 65% in wet season. In wet months, collection and disposal of wastes are often more problematic. High temperature and humidity cause solid wastes decomposes for more rapidly than in colder climates. In India usually a community storage system is practised where individuals deposit their waste in bins located at street corners and at specific intervals. The containers generally are constructed of metal, concrete or a combination of the two.

6. Conclusion

From the study is concluded municipal solid waste disposal at urali devachi depot at Pune, in India. MSW creates many problems to human health as well as to environment. Open Dumping of solid waste affects on the aesthetic view of surroundings area and produce bad smell in nature. At the time of decomposition of waste released many gases like SO2, CO2which affect on human health. From this process land and air also get polluted. It also causes harmful effects on human health. Leach-ate is a corrosive activity, which is very harmful to human beings. From the land pollution the water table get polluted. It is not safe, most important for drinking,commercial and industrial purposes. In Pune city it is observed that there is enough provisions for recycling the waste, but plants are unable to operating at full capacity , as a result waste is getting piled up. Municipal corporation should understand the commercial cost and benefit aspects of creating capacity to recycle is not enough. The main problem is that in most of the cases , for recycling of waste municipal corporation does not have its own plant , so it has to depend on the private companies. These private companies have an edge in case of investment , efficiency , effectiveness and technology. These private companies are driven by the market dynamism or energy of supply and demand, investment and output and cost and profit . The moment they realize that the operation is not profit-making they surrender the operation. Therefore it is Mandatory that the authority understands the existing commercial aspects and market competition. Municipal corporation should understand the pros and can of consensus with the private players. PPP (public private partnership) is good, but needs enough defence measures for sustainable and stable operation. There should be proper section and provision for fine and also against breach of contract. The contact with NGO's and private players should be comprehensible. Corporation or local municipalities are spending immense amount on keeping the city clean.There is vast cost attached with the collection and conversion of waste. The complete process is cumbersome and needs effective handling at each and every step. It Is inappropriate to see litter all around in a promising city such as Pune. Everyone likes cleanliness. Commitment from citizen, government and the corporation is crucial to keep city

garbage free. The study determines the capacity to use GIS , GPS and remote sensing technology for the effective assessment of solid waste management system will reduce the human health problems and environment risk. The study is useful in planning for the city in future. It highlights on the importance of the requirement of solid waste system.

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