

# Comparative Analysis for Enhancing Solid Waste Management Technique

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**Abstract** - This paper is analytic review on solid waste management. It is mainly focus on the methods, which are used in present waste management System. It is for enhancing tools & techniques for waste minimization, segregation, treatment and their method of implementation in solid waste management. For this analytical study, we are going to observe Five Metropolitan cities in which Rapid urbanization and industrialization take place these are the major five-mega cities in India, which are festally growing cities situated in Maharashtra or nearby areas. We can study their methodology for solid waste management and new techniques, which they are using for waste treatment. This analysis is mainly to overlook the basic cause of waste generation, where should be the actual waste management have to focus. To obtained comparative results, we are using LCA as tool for analysis. In the content of this, we can review the characteristics of the waste, what are the different causes of the waste generation, how the waste would segregate by different cities, what are the transportation mediums, what are the new techniques and ideas adopting by municipal corporations for waste treatment and minimization of waste generation. LCA tool is useful for comparative analysis and it is used for survey purpose. Generated waste is managed by respective waste management authorities for sorting purpose. The motive of this study is to find the impactful waste management tools and techniques, which used for good percentage of waste recovery from unwanted and discarded materials. The new methods are arises due to constraint of particular area despite of that if the correct implementation done for waste treatment along with constant follow up that will gives environment friendly and healthy results. Due to increase in population and industrialization, waste management is very difficult and challenging thing now days. According to this study, help us to make out the major methods, which used for renewable energy and best practice for solid waste management.

**Key Words:** SWM, solid waste management; TPD, Tons Per day; MCGM, Municipal Corporation of Greater Mumbai; MT, Mega Tons; EEC, European Economic Community; EIA, environmental impact assessment; EPR, extended producer responsibility; ERA, environmental risk assessment; ES, expert system; LCA, Life cycle assessment; SLF, Secured land filled facility.

## 1. INTRODUCTION

This paper mainly reviews waste processes from the stages of its generation to the waste recovery to have it in useful form using recycling capability. This Tools and techniques used by the Mega cities for enhancing waste management techniques. These techniques adopted by local waste Authorities after doing lot of research and trial - error methods. Some of the techniques come up with proper results, with the maximum recovery of solid waste in Tons Per day (TPD) measures. However, few methods are time consuming and not fit for the budget, which are sanction for SWM. Cities, which are having high geographical area, used as landfills for composting or to kept machinery purpose. Some cities are having landfill issues so they are using techniques, which are easy and fit for the low budget and for the shortage of landfill area. Ruler waste survey is virtual in non- exist able because Ruler population rate and the rate of waste generation is goes parallel. Because the rate of waste generation and the percentage of waste recovery is quite similar for household or agricultural waste. Techniques which are using day to day life by ruler peoples are same can be applicable on large scale for Mega City project for waste treatment. For large scale waste management projects we have to set the budget prior the process implementation. Along with the waste reduction the main aim of the waste management is environmental effects, overcome health hazards and financial balance and other effect associated with the solid waste

## 2. ENVIRONMENTAL IMPACT OF MSW

The environmental problems caused by MSW are as follows.

- If waste is not treated as per its rate of generation then it will accumulate at place which result into dirty odour and create environmental pollution
- Unattended waste eventually goes at drains and ducts, which cause blockages in Drains so in rainy season it becomes reason for the result in flooding conditions.
- Uncontrolled waste cases health hazards and bad environmental conditions.
- Thrown out plastic have disposal issue cause it takes year for decomposition.
- Plastic bags which are used on large scale are also cause the death of the graze to animals who eat them.

- Dangerous items like blades, broken glass, needles and other Sharp crate risks of injury or poisoning, to the Waste pickers who sort it for recyclables from.
- Biomedical waste if not dispose properly will result into injury, diseases or poisonous effect on health.
- Industrial waste should be chemically treated properly otherwise turns it into dangerous explosive effect.

### 3. MUMBAI

Mumbai city is one of the largest metropolitan city in the state of Maharashtra. The overall area of Mumbai City is 437.71 sq km. It has 16.37 millions population according the year of 2011 Census . Due to its Rapid population growth it has become third largest fast growing population mega city in the world. Due to such a large growing population best generation ratio also growing in compatible way . For such a major waste generation City quantitative and qualitative analysis of solid waste management needed.

#### Waste generation Rate

The amount of waste generation per day is 7800 MT. According to Municipal Corporation audit 6:30 grams per day waste generation per capita is a rate of waste generation in Mumbai city. Mumbai is a fast growing Population City its speed of waste generation is also growing Fast.

#### Waste recovery methods

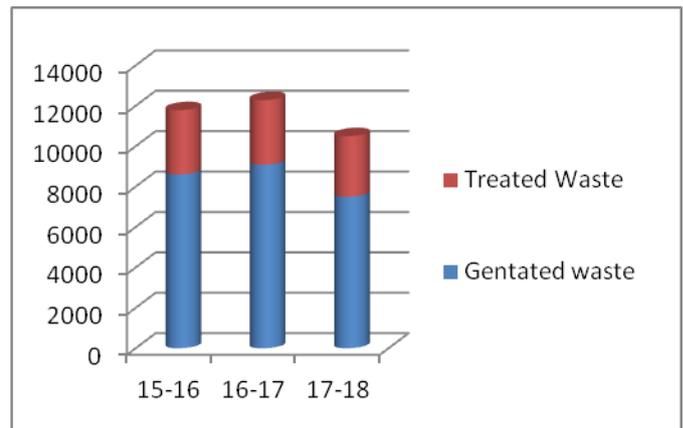
**DUMPING**-To maintain such a huge waste generation MCGM has adopted dumping method. Today MCGM has four open dumping site this sites are at 30 to 40 kilometer South Mumbai region. 1) with 111 Ha area DEONAR landfill has capacity to receive 3140 tons of waste per day. 2)25.20 Ha area Mulund received 275 tons per day West. 3) Gorai has 14.5 Ha area with capacity 424 tons per day waste received. 4) Chincholi with 19.2 Ha area has capacity to receive 1163 tons/day.Due to increase in West generation Re MCGM has won more landfill site proposed at Kanjurmarg with 82 Ha area. To maintain these landfill sites 28% of total budget is allotted for SWM.

**COMPOSTING**-Composting is a natural process of decomposition of organic waste under the microbial activity. Compost is rich in nutrient value and used as soil fertilizer.

**BIO REACTOR LANDFILL**-A bioreactor landfill is a municipal solid waste landfill (MSWLF) in which liquids are added to help bacteria break down the waste. The increase in waste dreadful conditions and stabilization is able through the addition of liquid and air to improve microbial processes. This bioreactor concept is different from “dry tomb” municipal landfill method.

#### Quantitative analysis of waste recovery

Following chart is representation of three years waste management analysis according to MPCB audit report



#### Enhancing techniques

- House to house collection.
- Installation of new bins- every 10 kilometer distance has larger been for waste collection dry and wet waste are segregated as much as possible.
- Biodegradable waste should be dumped at dumping land fields.
- Renewable waste should be straight away transferred to recycling plants

### 4. THANE

Thane District is divided into total area 147 Square kilometer. It is 22.7 kilometer away from Mumbai City. According to 2011 Census the population for Thane District is 18,86,941. It is also called as 'City of lakes 'because thane city is surrounded by 35 lakes.

#### Waste generation Rate

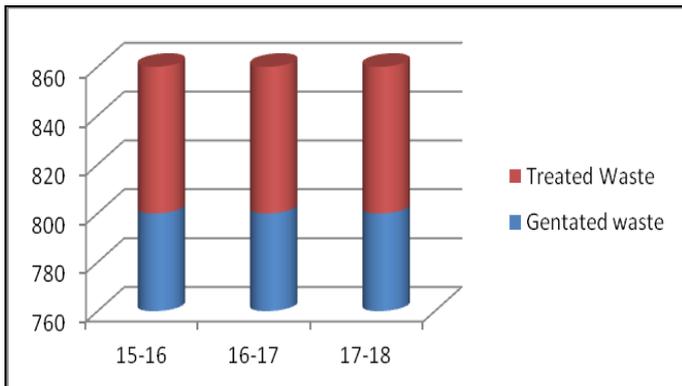
Per day solid waste generation from Thane is 650 MT.

#### Waste recovery methods

**BIO-METHANATION**-It a process of obtaining biogas from organic waste with the help of anaerobic method. It is a process of obtaining methane from microbial activities.

#### Quantitative analysis of waste recovery

Following chart is representation of three years waste management analysis according to MPCB audit report



Vermi composting is a composting process in which certain species of earthworms like red wiggler, white worm are used to increase the process of organic waste transfer into eco-friendly composting material. It is rich in nutrient values and used in agricultural field.

Incineration- Incineration is a process of combustion of wastes to convert them into base components, with the help of generated heat energy. Gases and inert ash are common by-products of this process. Only drawback of this process is it creates pollution, which is dependent on nature of waste combusted and incinerator into the heat. We have to set barometers to check pollution. It is inexpensive process to burn wastes because of this waste volume is reduced up to 90%. The ash derived as outcome of this process is rich in nutrient.

### Methodology for waste disposal

TMC authority has order to residential people to treat the waste within the set of rules for minimization of waste generation due to less land field area . It has order the societies that collection of waste will stop from their local area so people need to handle the weight waste 100 kg per day. They have to treat it the weight waste and the dry waste will be recycled by using different method of recycling. Only hazardous waste should be hand over to the DMC authority. For waste minimization TMC has come up with unique ideas. To lower down the waste generation rate TMC Corporation has announced the following rewards.

1) 5% property tax deduction on the 50% reduction of solid waste. Under these reward Idea the group of societies are the local area group has to minimise the waste generation rate upto 50 %

so they can awarded as 5% property tax deduction

2) For Industrial waste proposed find system from single waste generator to multi domain waste generation

3) Biomedical Waste handle as per the set norms and process. This waste should be treated at CSM hospitals waste disposal plant at Kalwa

4) Biodegradable waste process propose through which 15 Mega 10 waste is process everyday at bio-methanation plant at Kalwa

### PUNE

Pune has total area 156.42 square kilometre . Pune has two Supply Corporation, three Cantonment boards and seven Municipal councils. According to 2011 Census urban area population recorded as 5.05 Millions.

### Waste generation rate

Pune has solid waste generation rate as 1350 MT per day. Waste generation rate per capita is 364 grams per day. Other than residential area Hadapsar and Pimpri Chinchwad are the fast growing industrial areas in Pune. So Waste generation rate is also high in these areas.

### Waste recovery methods

For waste treatment Pune Municipal Corporation adopted various techniques like gasification, pyrolysis, vermin composting. At Hadapsar Vermi composting plant is there which has 300 TPD waste treatment capacity.

**Mechanical Compost** Mechanical composting involve Different techniques other than mechanical it also use chemical and electrical innovations for the composting of waste. Chemical treatments are used for order list waste processing and electrical treatments are used for segregation purpose. Criteria for segregation of waste is by size, decomposing capacity wise, and the methods of its recycling. Using this method PMC which has 50 TPD waste processing capability.

**Gasification** –Gasification is a process of obtaining the carbon dioxide,hydrogen ,carbon monoxide after heating organic substances or fossil fuel .The temperature required for this process is more than 700 and it carried out under controlled amount of stem and oxygen.

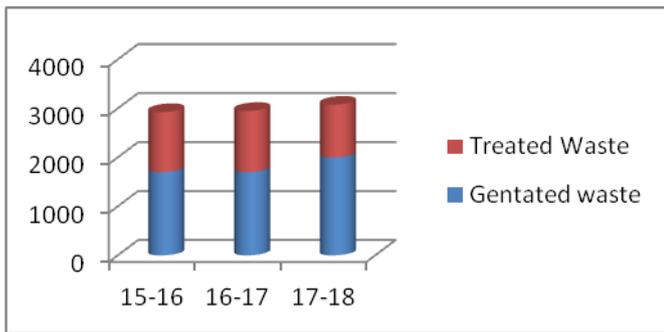
**Pyrolysis** –It is a process of obtaining biomass after heating solid waste on very high temperature in the absence of oxygen.

**Thermo-composting** PMC has adopted thermo-composting plants which has 100 TPD capacity of waste Processing Unit

Thermo-composting is a method for obtaining compost from organic waste the methodology of this method is decomposition of organic waste using aerobic biological control

### Quantitative analysis of waste recovery

Following chart is representation of three years waste management analysis according to MPCB audit report



### Enhancing techniques

Bio-methanation using 25 decentralized plants PMC has increased 120 TPD waste Processing Unit. Due to the restricted land fields PMC has come up 25 decentralized plants are run by the local NGOs and the small scale organisations. These plants give maximum waste recovery.

BMC has proposed one pilot project in 2010 at zero waste project under which they have planned different trash collection methods for minimization of waste generation.

They follow the following activities for the pilot project

1) No landfill required for waste dumping-Maximum amount of waste should be treated at its source of generation so no need to have special landfill for waste management.

### Enhancing techniques

- Use of new technology-Adaptation of new innovations and techniques for waste management so the maximum waste recovery possible.
- Change the attitude to see the waste-Waste like plastic, cardboard, papers should be reuse in maximum way instead of throwing it in first use only.

## 5. NAVI MUMBAI

Navi Mumbai is also known as New Bombay it is a plan constructed City Navi Mumbai has total area and according to 2011 Census it has 111 9477 population. According to environmental status report of Navi Mumbai Corporation 2016-17 the waste generation rate is quite satisfying with the result of maximum waste reduction.

### Waste generation rate

Navi Mumbai is 725 MT per day.

### Waste recovery methods

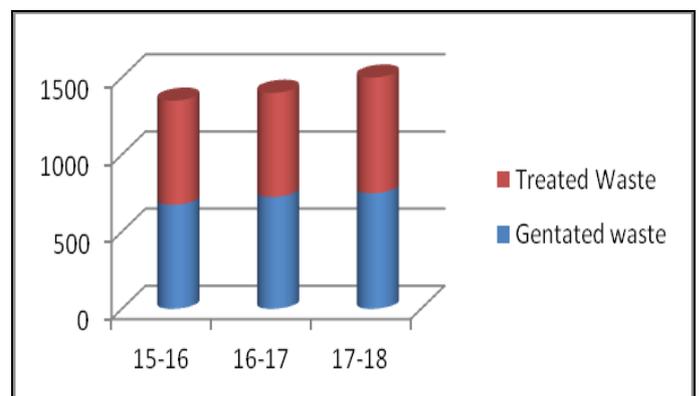
**PLASTIC TREATMENT**-Decomposition of plastic required thousands of years .It also delivers hazardous, toxic substances to the environment. Best way to treat the plastic waste is collection, sorting and reuse of the material

**AEROBIC COMPOSTING**-Process of composting in presence of oxygen is termed as aerobic composting.ATS (aerobic treatment system) is short term process system. In this we get the compost

**RDF PLANT**-Refuse derived fuel is obtaining the useful by products using combustible materials. End product of this is used in many ways to create electricity and many useful energy forms.

### Quantitative analysis of waste recovery

Following chart is representation of three years waste management analysis according to MPCB audit report



### Enhancing techniques

- Navi Mumbai has its own area for the best collection sorting and processing method the 65 acres area at turbhe has very highest waste management plants.
- It also has light vehicle waste reuse plant Le chat treatment plant emitted gases treatment plant to avoid hazardous waste emitted gas effect in environment.
- Most of the waste treatment methods are mainly depend on the method of segregation and collection of waste.
- Navi Mumbai has adopted different segregation and collection methods so 422 MT waste is segregated at generation source only. They have adopted in the colours for the segregation of waste green for wet blue for dry and red for E waste.
- NMMC has also done the anti-plastic drive, it also come up with the smart e toilet and she toilet e toilet is self-cleaning and self-flushing toilets and she toilets are used for the women
- Nmmc also run the anti plastic drive in 2010.After successful completion of this drive 24100 kg of plastic collected from different areas of Navi Mumbai. These all collective plastics are processed to turbhe side and converted into plastic bed. This plastic build are used in

concrete road construction site using modern technology.

- Navi Mumbai has separate waste treatment method for hazardous biomedical, Industrial waste.
- In 2016 17 year total 7216 megatin waste collected from MIDC area. The West was transported through the trucks at the treatment side Taloja for incineration. Incineration is a process

## 6. NASHIK

Nashik municipal corporation is one of the top most metropolitan city situated 180 kilometer away from Mumbai city it is also known as 'Wine capital' of India. Nashik is a Third largest urban area in Maharashtra in terms of population after Mumbai and Pune. It is third most industrialized City in Maharashtra in 2000 Ministry of Environment and Forest notified Nasik solid waste management rules

### Waste generation rate

Per day 300 to 350 tons of solid waste generated in Nashik. According to DPR of solid waste management 2007 average waste generation rate is 218 gram per day per capita waste generation rate Analysis of city West is 37.8 percent easily combustible materials 19. 50% lignite + long-term biodegradable materials

16.20 textile and Rubber 35. 70% Municipal solid waste is a main cause of concern

### Waste recovery methods

**SLF**-Secured land filled facility is used for the disposal of solid waste generated from the industry. It is monitoring unit of plant capacity, waste generation rate, disposal methods and the maximum waste management rate.

**Inert processing unit**-Inert gases are purified argon and nitrogen gases are use in the chemical manufacturing industry. This unit is used for the minimize fire hazardous and helps on comical reactions.

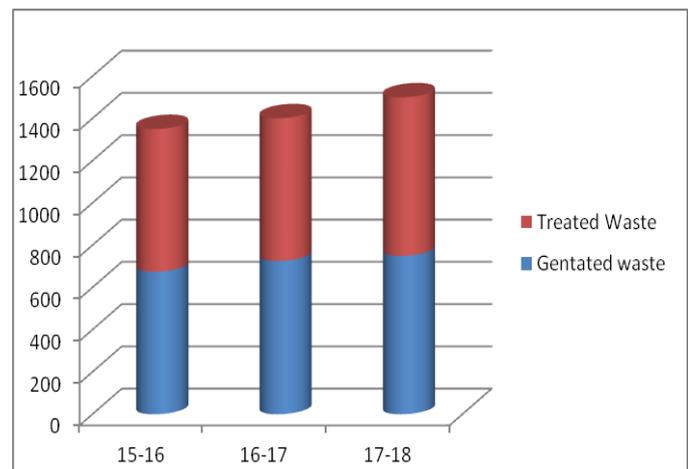
**Windrow composting**-Is also known as Aerated (Turned) Composting

Windrow composting is the production of compost by using biodegradable waste, such as animal waste and agricultural residues, in long rows (windrows). This method is the process is slow and consumes a significant amount of land corresponding to producing large volumes of compost. These rows are generally turned to improve porosity and oxygen content, mix in or remove moisture, and redistribute cooler and hotter portions of the pile. Windrow composting is a commonly used in agricultural composting method. It involves decomposition of organic wastes by microbes by

allowing the waste to stay accumulated in a bottom for a long period of time. The nutrient rich compost can be used as plant manure

### Quantitative analysis of waste recovery

Following chart is representation of three years waste management analysis according to MPCB audit report .



### Enhancing techniques

Nashik has adopted the processing of municipal solid waste methods like

- Free sorting unit electromechanical system which generates 500 turns per day waste recovery.
- Aerobic composting unit out of total Municipal solid waste 3 to 5% converted into composting.
- Inert Processing Unit recovers constant material 50 TPD.
- Leach ate treatment plants 40 kilowatt power is generated through these plant 10 TPD.
- Refuse derived fuel (RDF) 150 TPD.

## 7. LCA ANALYZING TOOL

LCA is being used in a number of countries to calculate different strategies for integrated solid waste management and to evaluate action for waste fractions. According to the characteristics of solid wastes, and availability of disposal options, LCA helps in supporting the identification of opportunities for pollution prevention and reductions in resource consumption while taking the entire solid waste life cycle. It is developed for relative analysis for large data.

The primary elements of solid waste management are generation, collection, transportation, treatment, and disposal. Different scenarios were developed and reported as alternatives to the current waste management systems. The data obtain from this is used for ERA and configuration EIA of

best waste management system. The most prominent is material recovery facility (MRF) and other methods involve source reduction, reuse, recycling, composting, incineration, energy recovery, on-site burial, open burning and bioremediation.

### Methodology

#### a) Functional Input

The first step to have the proper analysis we have to get proper input regarding waste generation, quantity of waste, techniques use for waste reduction, reuse or recovery from waste, level of hazardous waste these inputs need for Analysis

#### b) Parameters

Parameters are nothing but the samplings for data evaluation these parameters are set for the calculation of health effect, environmental effect, social effect by following waste reduction norms, initiatives taken for waste management etc. Rating must be provided along with each parameter so the evolution get simpler and easy

#### c) Data collection

To get a successful study on waste is to have to get accurate and representative waste data this can be achieved by accurate rating of parameters. The steps used for this study were based on the rules of waste management and guidelines set for the waste handling.

#### d) Segregation

On the basis of rating the monitor will be separate the sampling rates using software data handling process. Simply we have to put the data in the software pre set format then automatically it will get decode the data and we get the result.

#### e) Comparison

Data which is available with us is based on present scenario it consist the actual situation which is quite different with the theoretical senario.to compare the actual condition with the desire one ant put the outcome in the proper format.

#### f) Analysis

In the form of chart or graphs we get the total input result along with the proper percentile form.

#### g) Output

Final output will be the conclusion part, which gives the total input of waste and the useful recovery of the waste using different waste management techniques

#### h) Results and discussion

The results from the simulation of the waste are presented based on the monitored impact. These impacts are Discarded waste (in kg) and the energy recovery from that waste The results are presented in the form of tables.

Combination of these finalized LCA models to the framework will allow researchers and SWM decision-makers to discover the various environmental and economic methods suited with SWM policies and technologies using readily available hardware and software.

### IMMEDIATE ACTION PLANS REQUIRED FOR WASTE SEGREGATION

- 1) Segregations is the first and most important step which help the waste management in half of the work done
- 2) Methods need for improvement of wet and dry waste segregation cities
- 3) Segregations should be carried out in the three main ways bio degradable waste, on bio degradable and toxic waste.
- 4) Biomedical waste or the sanitary waste such as diaper's, sanitary pads etc.. Should be wrap in the pouches provided by manufacturer of these products.
- 5) Avoid littering, burying & burning of the waste instead of it handover to the proper waste collector.
- 6) Societies or the residential welfare authorities will have to set the proper rules for the waste treatment and everyone should sticky followed it
- 7) Guidelines should be set for the for the waste generator if he fails to fulfill that he will be eligible for penalty or punishment

### 8. CONCLUSIONS

From the Mega cities waste management analysis we can conclude that waste generation issues arises due to lack of public or employee awareness and less concern about the issues recharge arising from the waste generation.

There is illiteracy regarding the waste management how this process are happens what are the rules what are the consequences of brokage of rules and the appropriate methods for the west recovery best handling and segregation is the for and at most important methods for the waste treatment. It should be follow with the help of solid waste management rules 2016 which are newly upgraded using the new methodology, easy techniques and new innovations happening in the waste management.

Biomedical Waste and industrialize hazardous to waste should be kept all separated from Municipal solid waste it should not mixed up with the regular household waste

It should be separately handle and treated as per the biomedical and industrial waste treatment rules which are set by the government of authority waste management authority (management and transportation boundary movement) rules 2016

There should be no gap between that knowledge and implementation of the rules the process and their implementation

As per this case study we can analyze that Different cities have their own boundaries and limitations for the waste recovery and management techniques. they have different perspectives the geographical limitations of financial limitations and the manpower limitations for their waste recovery treatment although issues are different but they are having the same aim to have the optimum waste generation and the maximum waste recovery. The survey will help to find the easier and most effective methodology for waste management and the treatment for waste generation.

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