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Study of Nashik City Waste Management and Create New Technique for Waste Management

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Abstract: *The Management of municipal solid waste has become an actual problem due to enhance economic activities and rapid urbanisation. Increase attention has been given by the government in a recent year to handle this problem in safe and hygienic manner. So, the total population of Nashik in 2023 is 2,237,000 a 2.61 percent increase from 2022 Nashik has 264.2km2 area. Approximately 10000 industries Are serving in Nashik small medium and large scale No. of establishment a cover by door-to-door service.*

Sr.no.	Establishment Type	Total Number
1	House Hold	2,97,890
2	Hotel and the Restraints	1,806
3	Commercial Establishment	3000

In Nashik city the solid waste generated is greater than 3 lakh metric tonnes per year. This solid waste is collected from 2.9 lakh household of 108 words of city through 168 GhantaGadi's and ownership of the Ganta Gadi is with NMC (National Medical Commission)

Keywords: Solid waste management, municipal solid waste, waste collection, waste disposal, recycling, composting, landfilling, waste-to-energy

I. INTRODUCTION

How to management of solid waste:

1. Segregation method of waste disposal Waste segregation means dividing waste into dry and wet. Dry waste includes wood, construction waste metals,glass,plastic, etc. This waste is used for a construction road and also using like a plastic and other construction waste are melting well mixing. Waste plastic replace Bitumen mixed -+ 36]\
2. 53th recycled asphalt. It uses in repair of service road or a national highway wet solid waste are using biogas etc.
3. Using i.e. reusing plastic metals, solid waste we can made bricks be made from plastic or solid waste it giving more strength and durable its help in construction.

II. OBJECTIVE OF PROJECT

- First of all, awareness should be created among people about waste. People were asked to dispose wet and dry waste separately. And why will people give different compassion? Because we are going to pay them in return.
- First of all, every household will be registered after which they will be given a card. (Garbage Card). In that card, the information of his entire household waste will be stored. Like how much wet waste, dry waste and e-waste they gave.

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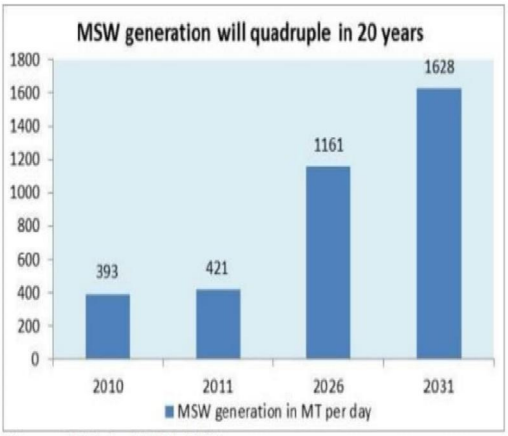
- How is all this possible? So, we are going to install one device to each bell car. The machine will be equipped with a mechanical weighing fork, just plug in the garbage can and insert your Garbage card into the machine, the information about the weight of the garbage will be instantly stored in your card.
- We are going to transform the dumping ground into a recycle industry where all types of waste will be recycled and generate income from that waste.
- Dumping Ground is designed in such a way that all types of waste will be recycled in it and there is no need for signal on any road, any dumping vehicle can reach any recycle plant very easily.
- After all that waste is recycled, whatever products will be produced from it, the profit will be sold in the market, from that profit, all the costs will be separated from the remaining profit, and the waste will be given 14 discounts to the waste giver, such as discount on electricity bill, discount
- which will benefit both the people and the government and will reduce the pile of waste at the dumping ground and create a large number of employment opportunities at the place,
- Most importantly, the ratio of wet waste to dry waste is only 5 to 10%. This project will increase the same amount by 80 to 85%, thus reducing the expenditure incurred by the government on segregation of this west

III. CURRENT STATUS OF SWM IN NASHIK

The Nashik Municipal Corporation is collecting 300-350 Tons MSW per day. According to DPR for SWM, 2007 the average waste generation is only 218 gm/capita per day. This situation is either due to collection inefficiencies or due to high proportion agriculture/horticulture farming, which helps in utilization of green waste for in-situ composting. With better collection and transportation measures, the collection efficiency should increase. Solid Waste Management Plan for Nashik Municipal Corporation 5 The city is registering almost 20% extra growth rate compared to similar other cities in India. This is leading to rapid development of real estates, housing, complexes, shopping malls etc. Consequently the per capita MSW quantity has been estimated to reach 400 gm/day by 2011 as per DPR (2007). The population growth rate of the city during the last decade has been 63.98%. This type of growth rate may be witnessed in the current decade also. Keeping above factors in view the projected quantity of MSW is 750 TPD by the year 2015 and 1628 TPD by the year 2031.



Source: DPR for SWM, 2007

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TABLE I::Generation of municipal solid waste projection

	Year	MSW MT/ day	Quantity MT / year	Remnants @ 15 % MT for Sanitary Land Fill
1	2006	300	109500	16425
5	2011	421	153665	23050
16	2021	827	301855	45278
26	2031	1628	594220	89133
Total			7520095	1128015
Volume in SLF at compaction density of 0.8 = 1410018 M^3				

Analysis of city waste carried out recently, reveals 37.8% easily compostable (short-term biodegradable) materials, 19.50% hard lignite's and long-term biodegradables and 16.20% textiles, plastic, rubber etc. These last two components having 35.70% content in the MSW have become a major cause of concern. These materials are a negative contributor to the processing plant efficiency and rapidly exhaust available land for landfilling. Mounting heaps of high volumes of – low density waste is a common scene around each compost plant. This has necessitated re-thinking of the integrated technological approach to solve MSW disposal problem towards a total solution in a sustainable manner. Looking to the recent trend of changing waste characteristics, increasing quantities of combustible materials and infrastructural bottlenecks, it became essential to upgrade overall MSW collection, storage, transportation and processing through integrated technological facility at Khat Prakalp site. This plant came into operation in 2000. However, this plant was small and could not deal with the entire 350 TPD waste reaching the plant and a backlog of >2.50 lakh MT waste was generated, which was piled put in two heaps close to the plant. Under JNNURM, NMC sought more funds and upgraded the plant to a capacity of 500 to 600 TPD. The plan is that by the time backlog is cleared, fresh arrivals will reach this level of plant capacity. Nashik is an important part of "Mumbai-Pune-Nashik Gold Triangle" development plan. For this business the city has to gear up for growth, expansion, socio-economical and business developments. Keeping the above facts in view overall integrated solid waste management facility was created. Nashik is the only city in Maharashtra which has taken lead towards scientific management of MSW in abidance of MSW rules 2000. With the upgradation of entire SWM system, this facility could act as a lime-light training and development Centre for the State of Maharashtra. NMC has given contract of collection and transportation of solid waste of the 6 divisions of the city to two contractors. Contract of collection and transportation includes door to door collection of solid waste through Ghanta Gadi and transportation to Municipal Solid Waste Treatment Facility. Solid waste is collected from 2.9 lakh households of 108 wards of the city through 124 Ghanta Gadi's and ownership of the Ghanta Gadi's is with NMC

Table 2: No. of establishment covered by door to door service

Sr no	Establishment Type	Total NO.
1	Households	2,97,890
2	Hotel and restaurants	1806
3	Commercial establishment	300

Table 3: Details of Solid Waste Transportation Vehicles

Sr no	Types of vehicles	Total no	Capacity[1]	Tons/month
1	Lorries/trucks	4	3	360
2	Mini lorries/truck	3	1	90
3	Tracer trailers	18	3	1620
4	tipper	124	3	10890

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Processing of MSW

• Pre-sorting Unit:

It is electromechanical segregation system for incoming non segregated MSW with the capacity of 500 TPD and it comprises of two lines with all necessary requirements and materials. After mechanical segregation compostable material will go to windrow composting, material with calorific value goes to RDF plant and inert will be further processed at Inert Processing plant

• Aerobic Composting Unit:

Composting is done through windrow composting method and sheds have been constructed for windrows. Today out of total MSW 3 to 5 % is converted into compost. The compost has already become popular amongst the farmers within 100 km radius of Nashik. By maintaining the price line of Rs2000/MT Ex factory level for loose form and Rs. 2450/- for packed form with necessary backup support, entire quantity of compost will be saleable in this belt. Once segregation at source will be practiced then the quantity of generation of compost will increase up to 10 to 15 % of total MSW

• Inert processing unit ;

22 Inert processing unit, with capacity of 50 TPD, comprises of mechanical sieve and air density separator. Main purpose of inert processing plant is to recover the construction material from the waste and to recycle it by selling or utilizing it for inhouse construction activities. This is mainly to minimize landfill burden on O&M cost and also saving of land.

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• Leachate treatment plant:

Leachate treatment plant with capacity of 0.4mld leachate or 10 TPD organic wastes has been installed for treatment of leachate coming out from the windrows, the solid waste dumps and sanitary landfill site. Proper arrangement for collection and transportation of leachate has been made. As leachate is primarily generated in monsoon season and during other period, same plant is utilized for bio gas generation from organic waste. 40 KW power is generated through the plant and utilized for operation of pumps at MSWM facility

• Refuse Derived Fuel (RDF) Plant:

The high calorific energy containing materials present in MSW are to be handled separately from the stage of receiving at the tipping floor onwards. RDF plant with capacity of 150 TPD is installed for generation of fuel pellets from high calorific value materials. Woody materials, paper products, textiles, jute etc forms the main constituents of RDF which is a valuable source of alternate energy. The technology for RDF primarily focuses on refinement of MSW through material re-combinations, segregation, drying, size reduction, blending and homogenization. This material is further refined for separation of sand, dust, metals, glass etc before grinding or shredding. The shredded material is obtained as fluff

IV. METHODOLOGY

System Planning and Design: Begin by conducting a comprehensive assessment of the city's waste management needs and current infrastructure. Identify key collection points, routes, and waste types to inform the system's design.

Technology Integration: Implement the necessary technology, including sensors and data collection devices on waste collection vehicles, as well as a central server with data storage and analysis capabilities

Data Collection and Transmission: Configure the sensors on waste collection vehicles to record collection times, locations, and quantities of waste. Set up real-time data transmission to the central server via wireless or cellular networks.

Waste Categorization and Sorting: Develop a waste categorization system that classifies waste into different types, such as recyclable and non-recyclable materials. Implement sorting mechanisms, either manual or automated, at collection points.

Routing and Dispatch Optimization: Use collected data to optimize waste collection routes and dispatch. Utilize algorithms and software to determine the most efficient routes based on the quantity and location of wast

Recyclable Waste Handling: Establish processes for the proper handling and transport of recyclable waste to waste management plants equipped for recycling. Ensure that recyclables are further sorted and processed at these facilities.

Non-Recyclable Waste Management: Define the procedures for collecting and disposing of non-recyclable waste, which may include transport to landfill sites or waste-to-energy facilities in compliance with local regulations.

Real-Time Monitoring and Reporting: Implement a real-time monitoring system that continuously tracks waste collection activities. Set up alerts and reporting mechanisms for immediate response to issues like missed collections or bin overflows.

Data Analysis and Utilization: Use the central server's data analysis capabilities to derive insights from the collected data. This information can inform decision-making, route optimization, and long-term planning for waste management.

Public Engagement and Education: Develop public engagement and educational campaigns to inform residents and businesses about responsible waste disposal practices and encourage recycling. These initiatives may include workshops, awareness programs, and educational materials.

Compliance and Regulation: Ensure that the system complies with local, regional, and national waste management regulations and standards. Implement mechanisms for monitoring and reporting on compliance

Methodology Of Collection of solid wastes

1] House to house collection;

Generally, the following methods are used for the collection of solid wastes: Refuse generated and stored in individual household is removed initially by the owner or employee and later by municipal staff. The various house-to-house

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collection methods are given below: Following are the disadvantages of curb service method: Solid Waste from The Society

(a) Curb service: Curb service in garbage collection refers to the method of collecting and disposing of waste or trash from residential or commercial properties at the edge of the curb or the sidewalk in front of the property. In this system, residents or businesses place their trash containers or bags at the designated curb-side 37 location on scheduled collection days. Garbage collection trucks then stop at these points to pick up the waste and transport it to a disposal facility. Curb service is a common approach in many municipalities and urban areas, making garbage collection more convenient for both residents and waste management teams. It allows for efficient and organized waste removal, reducing the need for collection personnel to enter private properties. This system is often part of a municipal waste management program or a contracted service provided by private waste management companies.

(b) Alley service: Alley service in garbage collection refers to the practice of collecting and disposing of trash or waste from alleys or narrow passages in urban or suburban areas. These alleys are typically located behind or between buildings and are not accessible by regular garbage trucks that service the main streets. Alley service is essential in areas where residents or businesses do not have direct access to the main road for waste pickup. In such cases, specialized garbage trucks, often smaller in size, are used to navigate these narrow alleys to collect and remove the waste. This ensures that waste from these less accessible areas is properly managed and disposed of, maintaining a clean and hygienic environment in the community. Alley service is a common practice in densely populated urban areas and can be part of a municipal or private waste management system.

(c) Set out service: - of garbage collection refers to the process where residents are required to place their waste containers or bags at a designated location, such as the curb or a specified collection point, on scheduled collection days. Collection vehicles then pick up the waste from these set out locations. This method ensures organized and systematic waste collection, allowing sanitation workers to efficiently collect the garbage from a centralized point, enhancing the overall cleanliness and sanitation of the community. Residents are typically informed about the specific set out times and guidelines to ensure that their waste is collected promptly and in accordance with local regulations.

V. WASTE SEGREGATION

Importance of Waste Segregation The importance of plastic waste segregation cannot be underestimated, as it leads to a dramatic decline in landfill waste. Separating wet and dry waste facilitates the recycling of dry waste and proper composting of wet waste. Moreover, proper waste segregation and disposal bring a decline in water and air pollutions. Most importantly, it makes composting, recycling and incineration easy, which leads to a further reduction in waste. Furthermore, existing landfills will also decrease, which will reduce the toxicity in our environment, leading to a healthier, greener, healthier, and sustainable environment. Biodegradable plastic bag manufacturers in Malaysia have adopted eco-friendly manufacturing techniques, making it possible to recycle biodegradable plastic bags or use them for quick and easy composting. Your one decision of properly throwing away a plastic bag in a suitable bin can reduce the impact of plastic on our planet. An efficient way of waste segregation at home is using two separate disposal bins – one bin for dry waste and another for wet waste. Remember: kitchen waste, such as vegetables, fruits and decayed food is wet waste, while plastic, paper, glass, etc. are dry waste. Another important tip for waste segregation is that you should throw out wet waste on a daily basis. Dry waste can be disposed thrice a week, depending on your family members and the amount of waste that your household generates. Ensure that every plastic plate, bag or container (or any other dry waste) does not contain any food residue. Now that you know about the importance of waste segregation and the crucial role it plays in promoting an eco-friendly society, spread this knowledge and encourage other people to adopt sustainable activities. Explain the whole process of waste segregation to your friends, family and neighbours to create awareness and facilitate the entire movement of reducing global waste. Segregation at the source is the key in solid waste management, especially when we have limited economical resources. We divide solid waste into three categories 47 Wet, Dry and hazardous waste. According to solid waste management rule, 2016 it is responsibility of generators to segregate waste into these three categories. Lack of awareness, loosely implementation of laws and various other reasons are obstacles in achieving appropriate results. After segregation we can choose Reduce, Reuse and Recycle for appropriate solid wastes. Solid waste management should be sustainable ecologically as well as economically. In a

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developing country like India, it's very important to have a cast effective solid management plan. We have to deal with poverty, population growth and high urbanization rate combines with ineffective and under-funded solid waste management technique. In an order to segregate waste opportunity it is a important to correctly identify the type of waste that is generated. for the purpose of waste segregation at a source, waste is identified and classified into the following category depending on the biological physical and chemical property. • Dry waste Refer to all item that are not consider wet/soil items. This includes both recyclable and non-recyclable materials. Dry waste includes such like a plastic wood, glass, metals and papers. • Wet waste - Refer to all item that are organic like food item, solid food wrapper hygiene products, yardwaste, tissue and paper towels, as well as any other soiled item that would contaminate the recyclable

1) Zone 1 (NashikEast) = waste collection (58866 ton) Plastic Waste - 10 % = 5886.2 T. E-Waste - 7 % = 4120.62 T. Paper Waste - 28 % = 16483 T. Organic Waste - 55 % = 32376 T.

2) Zone 2 (NashikWest) = waste collection (35910 ton) Plastic Waste - 10 % = 3591 T. E-Waste - 2 % = 718 T. Paper Waste - 30 % = 10773 T. Organic Waste - 58 % = 20828 T.

3) Zone 3 (Nashik Road) = waste collection (56296 ton) Plastic Waste - 11 % = 6193 T. E-Waste - 8 % = 4504 T. 53 Paper Waste - 27 % = 15199 T. Organic Waste - 54 % = 30399 T.

4) Zone 4 (Panchavati) = waste collection (52078 ton) Plastic Waste - 8 % = 4166 T. E-Waste - 4 % = 2083 T. Paper Waste - 28 % = 14582 T. Organic Waste - 60 % = 31247 T.

5) Zone 5 (Cidco) = waste collection (54490 ton) Plastic Waste - 17 % = 9263 T. E-Waste - 2 % = 1090 T. Paper Waste - 26 % = 14167 T. Organic Waste - 55 % = 29978 T.

6) Zone 6(Satpur) = waste collection (34256 ton) Plastic Waste - 11 % = 3768 T. E-Waste - 2 % = 685 T. Paper Waste - 25 % = 8564 T.

VI. EQUIPMENT AND MACHINERY

Vehicles: Waste Collection Vehicles: These include traditional garbage trucks equipped with compactors for general waste collection. Some may also have separate compartments for recyclable materials. Recycling Collection Vehicles: Specialized vehicles designed to collect recyclable materials, such as paper, cardboard, plastic, and glass, separately. These often have distinct compartments for various types of recyclables. Transfer Vehicles: Used to transport waste from local collection points to central processing or recycling facilities. They help consolidate waste for more efficient transportation. Compactor Trucks: Compactor trucks are essential for compressing non-recyclable waste, reducing its volume before disposal in landfills or waste-to-energy facilities. 60 Hazardous Waste Transport Vehicles: These specialized vehicles are equipped with safety features to transport hazardous waste, such as chemicals, to designated processing or disposal facilities.

Recycling Machinery :- Shredders: Shredders are used to break down large pieces of recyclable materials, such as cardboard and plastic, into smaller, manageable pieces for processing. Conveyor Belts: Conveyor systems facilitate the movement of waste materials within recycling facilities. They transport materials to various processing stations. Magnetic Separators: Magnetic separators are employed to extract ferrous materials (iron and steel) from the waste stream, preventing them from contaminating recyclables. Optical Sorters: Optical sorting machines use sensors and cameras to identify and sort recyclable materials based on criteria like colour, shape, and material

Specific Recycling Machines: Plastic Recycling Machines: These machines include plastic shredders, extruders, and injection moulding equipment to process and recycle plastic waste into reusable materials. Metal

Recycling Machines: Metal recycling machinery, such as crushers, smelters, and furnaces, is used to recover metals like aluminium, copper, and steel from waste materials. E-Waste Recycling Machines: Electronic waste recycling machinery is specialized for disassembling electronic devices, recovering valuable components, and ensuring responsible disposal of hazardous materials. Wet Waste Recycling Machines: Wet waste recycling machines are primarily used to break down organic waste materials such as food scraps, vegetable peels, and other biodegradable waste into compost

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VII. RECYCLING AND REUSE

Reduce: The most uncontrollable phase in Solid waste management is 'Waste generation'. Generated solid waste particularly from Non-point sources is always a challenge for local administration, so best practice is to reduce the generation of Solid waste.

The reduction of waste can happen only when everybody reduces waste generation in the first place.

Every individual has to contribute in doing so. There is urgent need of public awareness about waste generation. There should be awareness at all levels of Society, which will motivate them to change their casual habits which creates waste.

Public- Private Partnership should be engaged in this awareness activity.

Definite Point Sources of waste generation like Hotels, Restaurant, and Shopping Complexes etc should contribute their space for disposal in their area itself, which ultimately reduces the burden of Collection.

VIII. WASTE TO WEALTH

For Public Gatherings and Events organised in public places for any reason (including for processions, exhibitions, circuses, fairs, political rallies, commercial, religious, sociocultural events, protests and demonstrations, etc.), it will be the responsibility of the Organiser of the event or gathering to ensure the cleanliness of that area.

TOTAL WASTE COLLECTION OF NASHIK CITY (IN TON)

Plastic Waste - 32868 T E-Waste - 13201 T Paper Waste - 79768 T Organic Waste - 166066 T (NOTE :- ALL NUMBERS ARE ESTIMATED, REAL NUMBER OF DATA MAY BE VARIOUS)

CALCULATION OF ESTIMATED REVENUE

Plastic Waste :- (32868 T)

• Reduction assume 40% of plastic waste
• 32868 – 13147 = 19721 T
• Block size = 19 X 9 X 9 cm
• Ratio = plastic sand cement 2 : 1 : 1 225 gm 112.5 gm 112.5 gm • So 1 kg = 4 block are cast
• 1 Ton = 4000 block are cast
• 19721 X 4000 = 7,88,84,000
• 78884000 blocks are cast
• Revenue generated Estimated
• Market rate of 1 block is 10 RS
• 78884000 X 1 78,88,40,000 RS (estimated) 81 E-Waste = (13201 T)
• Reduction assume 60% of E - Waste • 13201 – 7920 = 5280 Ton
• 1 kg e waste market rate = 50 RS
• 1 ton = 50000 RS • 5280 X 50000 = 31,40,00,000 RS (estimated) Paper Waste = (79768 T)
• Reduction assume 60% OF Paper Waste • 1 kg recycle paper cost = 10 RS
• 79768 – 47860 = 31908 Ton
• 1 Ton cost = 10000 RS
• 31908 X 10000 = 3,19,08,000 RS (estimated) Organic Waste = 1,66,066 Tone
• Reduction assume 60 % of Organic Waste
• 166066 – 99640 = 66426 ton
• 1 kg compost market rate = 2 RS (assumed)
• 1 tone compost price = 2000 RS
• 66426 T X 2000 RS =

13,28,52,000 RS (estimated)

TOTAL REVENUE COLLECT IN YEAR = 1,55,47,72,000 RS

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IX. CONCLUSION

The By centralizing the collection, analysis, and distribution of waste-related information, this system offers numerous advantages. It enhances the efficiency of waste collection and routing, reducing operational costs and the environmental impact of waste disposal. Furthermore, the categorization of waste types, with a specific focus on recyclables, contributes to the reduction of landfill waste and the conservation of valuable resources. However, it's essential to recognize that the successful implementation of such a system relies on careful planning, ongoing maintenance, and public engagement. The maintenance of hardware and software components, alongside the training of waste management personnel, ensures the reliability and longevity of the system. Public awareness campaigns play a crucial role in encouraging responsible waste disposal practices and optimizing the system's effectiveness. Looking to the future, there is vast potential for further advancement in waste management. This may involve the integration of advanced technologies like IoT, blockchain, and artificial intelligence, as well as greater cooperation between cities to establish best practices and global standards. As environmental concerns continue to escalate, waste management systems will be at the forefront of sustainable urban development

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