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Solid Waste Management: Current Scenario and Challenges in Bengaluru

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Abstract: Municipal solid waste management (MSWM) has become one of the significant environmental issues, particularly in developing countries. Bengaluru, the state capital of Karnataka, is one of the fastest growing cities in Asia. The Bruhath Bengaluru Mahanagara Palike (BBMP) with an area of 2190 km2 and a population of about 10.18 million generates around 5000 metric tons per day of solid waste at an average generation rate of 0.5 kg per capita per day (kg/capita/d). Presently, Bengaluru City is facing significant problems due to existing disposal process of generated waste, incurring high cost due to lack of proper infrastructural facilities; also, the open dumping in the expanding zone of the city poses severe problems to the structures constructed on these old dumps. Meanwhile, groundwater quality deteriorated due to improper leachate management. Intending to assess the possible impacts on the water environment and suggest a beer waste management strategy, the present paper discusses the potential for handling the wastes, thereby reducing the amount of waste to be transported to the landfill. If this waste is used for energy and nutrient recovery, decentralization could also become commercially viable and address the technology-wise deficiencies in the existing MSWM system of Bengaluru City.

Keywords: zone, poses, strategy

1. INTRODUCTION

In ancient times, a harmonious and balanced relationship between humans and nature on this earth is necessary for livelihood. As civilization advanced, humans directly or indirectly interfered with the natural environment. This led to an imbalance in the human-nature relationship, finally leading to environmental problems like soil, air, and water pollution and accumulation of municipal solid waste (MSW). In olden days, MSW disposal did not pose significant problems because the population was very less and the availability of land for the dumping of wastes was large. But these days MSWM is a serious problem everywhere. Due to rapid industrialization and increased population levels, the generation rate of MSW in metropolitan cities accelerates. This has led to the migration of people from villages to cities, which generates thousands of tons of MSW daily with rapid change in the quantity and character of the waste in line with the changing lifestyle of the people and also with the changes in the market technology, building technology, and fuel technology.
Moreover, it also addresses the wise technology deficiencies in the existing MSWM system of Bangalore.

1. BANGALORE SCENARIO

The city of Bangalore (12.98°N and 77.58°E) in Karnataka is the state capital, and it has a mild and salubrious climate. It is located at an elevation of 900 m. Since the 1980s, Bengaluru has enjoyed the reputation of being one of the fastest developing cities in Asia. The Bengaluru Metropolitan Area covers an area of 1258 sq. km and is the fifth largest city in India. However, with an increased population level, rapid economic growth, and a rise in community living standard, the generation rate of MSW in metropolitan cities accelerates. The local authorities are struggling to provide the proper solid waste management system to a satisfactory level. Recently the authorities have taken initiatives and measures to organize the MSWM sector. This research would help to identify techniques suitable for the current scenario, the loopholes in the adopted methods, and the possible alternatives.

2. MUNICIPAL ORGANIZATION

The BBMP has a city council that consists of 123 elected members or councilors, each representing a ward. Both the mayor and deputy mayor are chosen from among councilors for a 1-year term. The BBMP has 15,000 employees and is headed by the commissioner. The commissioner is the head of the BBMP, appointed and deputed by the State Government of Karnataka and responsible for performing duties and functions. Presently, the Bruhath Bengaluru Mahanagara Palike is the agency vested with responsibility for effective solid waste management system for the

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Bengaluru City. For a more efficient and effective approach, the Bengaluru City has been divided into different administrative units. There are 294 health wards within the BBMP. Presently, in Bengaluru, there are 198 such administrative or political wards . Within the BBMP, there are two departments, namely, the health department and engineering department. The health department is mainly responsible for the collection, transportation, and disposal of solid waste. The engineering department handles the removal of construction and demolition waste, while they also provide technical and infrastructural support to the health department.

3. WASTE GENERATION

At present, 10% of solid waste is recycled in Bengaluru. Most of the literature reported that the waste generation rate is 0.4–0.6 kg/capita/day. The proposed waste generation rate is about 0.5 kg/capita/day in Bengaluru. Since 1990, the composition of India's urban wastes has changed drastically. At present, the waste generation is about 5000 metric tons, and waste generation is likely to grow over the coming years. Going by the present trend of increase in the quantity of waste, the waste quantity projected for the next 20 years is shown in Waste quantity expected for the next 20 years.

4. WASTE COMPOSITION

The changes in the composition of MSW should form essential criteria for any waste management system. Hence, the data available on the composition of the waste from different sources over the years have been collected and analyzed. This shows variation in MSW composition from 2015 to 2018 in Bengaluru City. With the increase in urbanization and change in food habits and lifestyle, the amount of MSW has been multiplying, and there is variation in waste composition.

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Year	Biodegradable	Paper/Leather/Cardboard	Rubber/deb ries	Glass	Plastic	Others
2015	42	16	10	03	07	20
2016	45	13	09	06	06	18
2017	59	12	05	03	12	08
2018	61	09	04	03	13	16

Table 1:Variations in MSW composition in Bangalore City from 2015 to 2018.

Source: data extracted from Bangalore's Urban Waste Composition
#All components of MSW are expressed in %.

5. COLLECTION AND TRANSPORTATION OF WASTE

The objective of solid waste management is to remove discarded materials from inhabited places promptly to prevent the spread of disease, to reduce esthetic results arising from purifying organic matter and, equally important, to dispose of the discarded materials in a manner that is environmentally acceptable.

6. WASTE DISPOSAL PRACTICES IN BENGALURU

Currently Bengaluru does not have any appropriate scientific treatment techniques for waste generated by municipal and industries around Bengaluru. This has led to the development of various unauthorized dumpsites. The solid waste, generated from hotels, restaurants, Marriage halls, markets, etc., is being directly collected and transported to the treatment/disposal facilities. The treatment facilities have been developed around the city, and their spread over the zone is set out in Table 2.

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Sl. No.	Zone	ExistingDisposal Site /Facility
01	South-Bangalore	Bingpura, Mavallipura, KCDC
02	East-Bangalore	MSGP, Mavallipura, KCDC
03	West-Bangalore	Terrafirma, Mavallipura,KCDC
04	Yelahanka	Mavallipura, Terrafirma
05	Bommanahalli	Bingipura, Laxmipura
06	Mahadevapura	Terrafirma
07	Dasarahalli	MSGP
08	RR Nagara	MSGP /Terrafirma

7. EMERGING TECHNOLOGIES FOR WET WASTE DISPOSAL:

Once the solid waste is collected from the different sectors of the community, the next problem is regarding the safe, economical, and efficient disposal options. Suitable decisions have to be made in this regard to avoid illegal dumping and open dumping of solid wastes that are dangerous and a threat to the environment. Open burning of solid wastes releases smoke containing pollutants harmful to human health and the environment. Therefore, the community has to face severe inconveniences due to illegal dumping practices. Hence, conventional methods employed to safe disposal options of MSW include composting, waste to energy (such as biogas production and incineration), and landfilling. Incineration and composting of MSW are a standard solid waste treatment or processing methods, as they produce secondary waste such as non-biodegradable material rejects from composting and ash from incineration that needs to be disposed of further.

8. BIOGAS PRODUCTION/ANAEROBIC PROCESSING

Bio mechanization plants are being established for wet solid waste at 16 locations, out of which 8 have been made functional. 400 units are generated per day per plant. The biogas produced from the bio-mechanization of plants is being utilized to light the street lights in that locality. Biogas is produced in the absence of oxygen or an anaerobic environment, due to the decomposition of organic material through certain bacteria.

The whole process is referred as anaerobic digestion because biological decomposition takes place in a reactor, where bacteria produce biogas. This biomass can stay in the reactor for about 2–3 weeks. In the end, the by-product produced in this process is a solid residue that is high-grade manure. Generally, in the biogas plant, biomass like vegetable wastes and animal excreta undergo decomposition in the absence of oxygen and form a mixture of gasses. Biogas consists of about 2/3 methane (CH_4), 1/3 carbon dioxide (CO_2), a little hydrogen sulfide (H_2S), and a low hydrogen (H_2). It is created by the decomposition of manure and other form of organic waste from households or industries in anaerobic tanks where it is heated. The biogas is used for cooking and lighting purposes.

9. OPTIONS AVAILABLE FOR WASTE DISPOSAL

In this section are some of the options available for waste disposal. However, it should be noted that the option selected for waste disposal must mesh with the existing sociocultural milieu, infrastructure, etc.

10. PROBLEMS WITH EXISTING MSW DISPOSAL PRACTICES

Transportation is a necessary function for solid waste management activities since municipal solid waste, recyclables, yard waste, and other materials must be collected and transported to be managed. There are various methods for collecting and transporting waste, the choice of which depends on the type of solid waste, the source of solid waste, and

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the proper management method used.

A vital component of a reliable and well-run solid waste management system is to set up an efficient sanitary landfill and customer-responsive collection and disposal of solid waste. Waste collection services are provided to residents in all cities, either private or self-government agencies. In the meantime, the rapid increase in disposal costs across the city, the cost of collection, and the transfer of wastes continue to raise disposal as a percentage of overall service costs for most communities.

10. IMPACT OF SOLID WASTE ON SOIL AND WATER BODIES

MSW landfills are essential in modern-day society because the segregation and disposal of solid waste materials into decentralized locations helps to minimize risks to public health and safety. Currently, in Bengaluru, MSW landfills remain open for decades before undergoing closure and post-closure phases, during which steps are taken to minimize the risk of environmental contamination. Although MSW landfills are an essential part of everyday living, they may present long-term threats to surface water and also hydrologic ally interlinked groundwater bodies. The impact of leachate on groundwater and surface water bodies has attracted much attention because of its enormous environmental significance. In the olden days, landfills were constructed without leachate collection systems and liners. Once leachate enters the groundwater, it will migrate downward through the unsaturated zone until it finally reaches the saturated area. This resulted in creating significant leachate-contaminate groundwater plumes that follow the hydraulic gradient of the groundwater system.

Unscientific management of MSW leachate will lead to contamination of the soil and water bodies. The presence of a contaminant in the soil can change the engineering properties of the soil. The leachate potential to contaminate the soils and groundwater and surface water bodies assumes significance in the context of existing MSW practices, which have many drawbacks.

Considering the importance of the problem discussed, this research mainly focuses on the characteristics of leachate generated from municipal solid waste landfill sites and its effect on surrounding water bodies near the Mavallipural and fill area in Bengaluru.

11. RECLAMATIONOFWASTEDUMPSFORDEVELOPMENT

Bengaluru Many cities, including Bengaluru, are also facing the problems due to old dump yards situated close to the expanding cities. These dump yards need to be reclaimed for the growing needs of the city infrastructure development. This is the case for many cities in India with an alarming rate of the urbanization process. Also, they create a nuisance in the town, and the same needs to be stabilized or reclaimed. The waste sites that were earlier in the periphery of the corporation limits of Bengaluru City are now in the development zone of a more magnificent Bengaluru City, as shown in. It can be seen from a satellite image that the built-up area has come near and around the earlier dump sites. Thus, it is clear that most of the old dumpsite which is existing around Bengaluru has become potential places for development.

These structures built on these dumpsites can undergo distress due to the high se1lement and cause failures due to the low strength of the dumped waste. These dumps can also cause groundwater contamination due to leaching of waste by the percolation of rainwater.

11. RECLAMATION OF MSW LAND FILL

The objective of the reclamation is to return the MSW landfill to a condition as close as possible to leave the site in a state compatible with the surrounding ground. MSW landfill reclamation is a new approach used to expand the MSW landfill capacity and minimize the cost of acquiring additional land. The significant factors influencing the success of reclamation include chemical, hydrologic, and physical conditions of the fill materials, climate, availability of suitable plant species, and proper management of reclaimed sites.

The essential benefits may include a reduction in closure costs and reclamation of land for other purposes and recovered materials such as recyclables, soil, and waste, which can be burned as fuel. Some drawbacks exist in MSW landfill reclamation. This technology may release methane and other gasses from decomposing solid wastes. Also, the excavation work process involved in reclamation may cause adjacent landfill areas to collapse/sink. Hence, it is necessary to conduct a site characterization study. The site characterization should assess facility aspects, such as geotechnical and geological features and the stability of the surrounding area and identified groundwater, and determine the fractions of good soil, recyclable waste materials, and hazardous waste at the site .Based on the available information from the site characterization, it provides project planners with a basis for assessing the potential economic benefits of a landfill reclamation project.

The economic benefits associated with landfill reclamation are indirect; they may include the following: increased disposal capacity; avoided or reduced cost of landfill closure; revenues from recyclable and reusable materials like

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ferrous metals, aluminum, plastic, and glass; combustion waste sold as fuel; reclaimed soil used as cover; and land value of sites reclaimed for other uses.

Geotechnical properties of municipal solid waste presume great importance in their reuse, disposal, as well as reclamation of waste and dump sites. Because of the high demand for land, the abandoned, closed landfills have to reclaim to meet the growing needs of the society. Due to several reasons, the population around the improperly operated landfills is demanding the closure of the landfill. However, just leaving the landfill without proper closure cannot be allowed. Thus any attempt to reclaim land for development should come the characterization of waste for their physical and chemical composition and geotechnical properties. Therefore, these studies constitute the first step to successfully implementing a comprehensive waste management system.

11. CONCLUSION

Based on the above context, the following conclusions can be drawn:

a. For setup, the WTE plants require higher capital investment and are more complicated than the other options of waste disposal.

b. WTE plants are suitable in developed countries mainly because of the tipping fees/gate fees charged by the facility for the service of waste disposal, inaddition to its revenue income from power sales.

c. Due to the high content of biodegradable waste in Bengaluru, a biological process is needed such as anaerobic digestion and composting to treat the waste, gasification, and pyrolysis.

d. Plasma gasification technology can reduce the need for landfills; it can create more renewable energy than the projected energy from solar, wind, landfill gas, and geothermal energies combined.

e. RDF plants are in the initial stage of development in India. It is beneficial in preparing an enriched fuel feed for thermal processes like incineration. TheRDF pellets are used as a coal substitute at a lower price.

f. The pyrolysis process cannot handle the wide variety of wastes, and the end products of pyrolysis are carbon black oil that can be resent to a refiner and hydrocarbon gasses that can be used to make electricity or stream.

g. Sanitary landfill is the cheapest, simplest, and most cost-effective method for disposing of waste.

REFERENCES BOOKS

[1] Environmental Geography Paperback – 1 January 2015 by Savindra Singh (Author).
[2] Geography Of Karnataka (Paperback, Dr. Ranganatha) New Editing book.
[3] Environmental Geography Of Karnataka - Dr Ranganatah
[4] Karnataka population Geography - Dr Ranganath
[5] Urban Geography - Savindra Singhs