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AN OVERVIEW OF MUNICIPAL SOLID WASTE MANAGEMENT

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AUTHOR'S CONTRIBUTIONS

This work was carried out in collaboration among all authors. Author GM designed the study. Author AG collected the data and wrote the first draft of the manuscript. Author TI edited the manuscript and analyzed the data. All authors read and approved the final manuscript.

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Review Article

ABSTRACT

The waste management from the previous few decades has become imperative environmental issue. The increasing population, industrialization & urbanization are the key factors associated with enormous waste production throughout the world. This review paper touches the functional elements of the Waste Management System. It is analyzed that the Solid Waste Management System (SWMS) should choose proper steps like collection, storage, processing, transport & disposal of waste so that severe impacts of waste can be minimized & the quality of life can be improved.

Keywords: Waste management system; population; disposal; vermicomposting; land filling.

1. INTRODUCTION

Human beings are facing the threat of solid waste pollution. So, solid waste is an overall world wide threat. To reduce the effect of solid waste, there occurs a series of processes such as generation, collection, storage, transport, processing and proper disposal. Solid Waste Management includes proper planning viz., managerial, fiscal, engineering and legal functions. It is a crucial fact of environmental safeguard and it ultimately to be integrated with environmental planning [1]. Solid waste generation makes the world's largest urban areas vulnerable, as the population in the cities depicts bust and boom and this has caused to at all time amplifying quantity of domestic solid waste rather than space for disposal diminishes. Non judicial disposal of municipal solid waste can alter the environmental balance. Lack of infrastructure facilities like door-to-door collection of waste has been the major problem in SWM. Waste treatment and disposal in urban centers needs much attention regards devising suitable and operative mechanisms. SWM provides opportunity to uplifts the benefits by sustainable use resources and enhancing environmental efficiencies [2]. Multiple disciplines are necessary such as involvement of private sectors, environmental awareness in the general public and implement of strict environmental laws for proper management of solid wastes [3].

On the basis of source, the solid wastes can be grouped into different categories like municipal, hazardous, industrial, medical, mining, institutional, agricultural, radioactive, construction and demolition as shown in (Table 1).

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Table 1. Types and sources of solid waste

*Source	Waste Generators	Solid Waste
Residential areas	Single or multifamily dwellings	Food, paper chits , cardboard remains, plastics, textiles, leather, yard wastes etc.
Industrial	Light/heavy manufacturing units etc.	Housekeeping wastes, packaging materials, food wastes, construction and demolition materials etc.
Commercial	Stores, hotels, restaurants, main markets units, offices etc.	Crockery, bottles, paper, plastic bottles/cans etc.
Institutional	Schools, hospitals, government and nongovernmental centers	Paper, cardboard pieces, plastics, wood, food wastes etc.
Municipal work	Street cleaning, landscaping, parks, beaches, other recreational areas etc.	Street washing, landscape and branch trimmings etc.
Processing units	Heavy/light manufacturing units, refineries etc.	wastes, scrap materials, etc.
Agriculture	Crops/orchards	Spoiled food and chemical/fertilizers

**Source: Manual on Municipal Solid waste Management, 2000*

Operational Components of the Waste Management System: The waste management system has six operational components as shown in (Fig. 1) which is given below.

Waste generation and characteristics: The identification of unusable wastes and are either collected for disposal or thrown away. The generation of solid wastes is dynamic and so varies from place to place and type to type. Various factors like income, the sources, the population, climate, impact of quantity and composition. The differences in the municipal solid waste are keen indicator of urbanization and development. In urban areas, the major proportion of municipal solid waste is biodegradable materials (40%-60%) and inert (30%-50%) as shown in Fig. 2. Routine generation of solid wastes in metropolitan city is extremely high as compared to other areas [4]. Uneducated people and lack of public awareness also responsible for the generation of MSW [5]. Investigated the situation of municipal and industrial solid waste in China, revealed increase in the total quantity of municipal solid waste and dynamics composition is connected to population bulge and enhanced living style and standard [6].

Onsite handling, storage and collection: The second most needful step is the handling, storage and collection. These are the activities taken place at the point source of waste generation which promote safe and fast collection of both degradable and non-degradable waste material (no segregation of waste is performed) and the waste is judicially dumped off at disposal center. For example, dust bins are usually placed at the sites (public green spaces) which produce ample waste. Storage bins are classified as movable bins and fixed bins. Color difference is also put to segregate the solid waste according to degradability. The fixed bins are more long-lasting and large in size but immovable, while the movable bins are versatile in transportation but showing lack of durability [7]. The waste collection is unorganized, for the recyclable waste which consists of $1/4^{th}$ of the total municipal solid waste [8]. Municipal authorities should maintain the dumping facilities in such a way that they do not play unhygienic and unsanitary conditions [9].

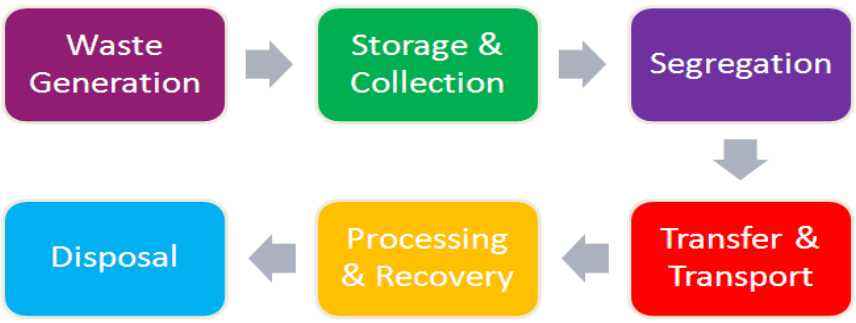

Fig. 1. Operational components of WMS

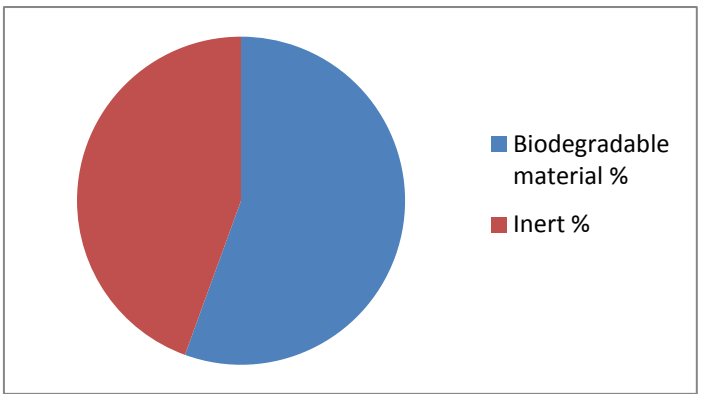

Fig. 2. Proportion of Biodegradable material and inert

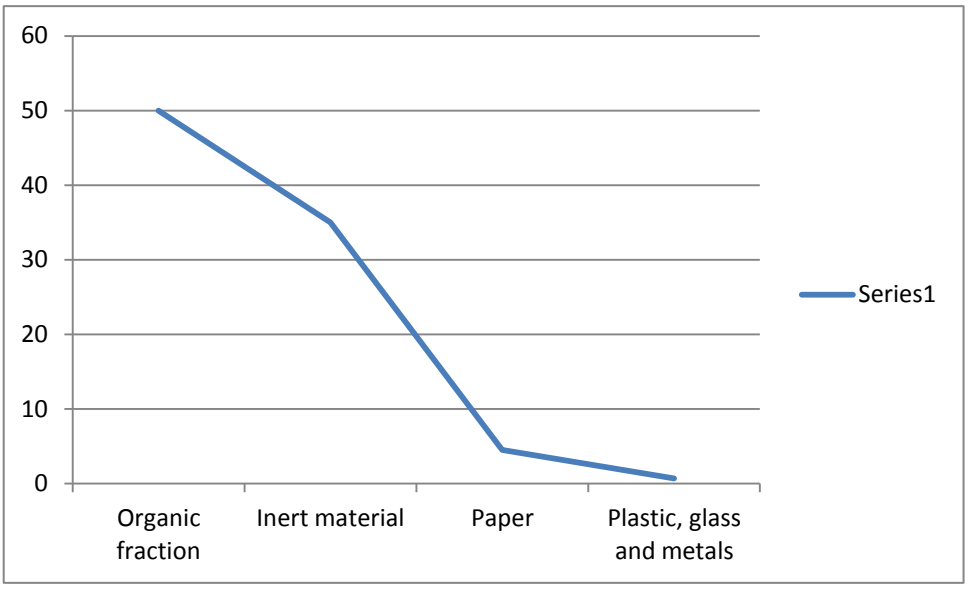

Fig. 3. Solid waste at point source was determined on the wet weight

Composition of municipal solid waste: Solid wastes are the amalgam of various constituents. Food habits, cultural traditions, climate and income are some factors that contributes in the generation of more solid waste [10]. Different types of municipal solid waste are food waste, street sweeping waste, industrial waste, construction and demolition waste, and sanitation waste [11]. The percentage/proportion of solid waste at point source was determined on the wet weight, organic fraction, inert material, paper, plastic, glass and metals [7] as shown in Fig. 3. The varying pattern of waste composition emphasizes the significance of segregation for resulting function of waste management facilities. There is difference in the solid waste of urban cities of developing countries from that of developed nations [12]. The composition of wastes also varies both from country to country and within a country depending on the sources like residential, commercial, industrial and institutional [12]. Municipal solid wastes contain high percentage of organic matter [13]. In developed countries the waste is mostly inorganic in nature, where as organic contents form a great portion of waste in developing countries [14]. Biodegradable and compostable wastes are the primary constituent of municipal solid waste, followed by inert and recyclable material [15].

Waste processing and recovery: It refer to the binning process which includes the facilities, equipments and techniques exploit to recover, reusable or recyclable materials from the waste stream by scientific methods and processing such as sorting, shredding, compacting, baling, or composting. Overall systems for processing and recovery of solid waste may include three major component subsystems: size reduction, separation and recovery [16]. Recycling of the municipal solid waste is a prominent way to render the large amounts of solid waste out of landfills, also save resources and energy, particularly in developing countries [17]. Recycling

and reutilization of solid waste is important for environmental safety, sustainable development and resource degradation. Recycling and source separation of municipal waste helps further to put to use the solid wastes for energy generation. Hazardous waste should not be dumped off or stored for longer time without proper processing and screening [18].

Disposal: It is the final and maximum significant step of waste management. Measures for disposing the solid waste in phases to ensure the safety of inhabitants [19]. Proper disposal eliminates the threat of tragic incidents that sometimes happen by the dumping of toxic waste.

Treatment and disposal of municipal solid waste management: The two most important methods of waste disposal include composting (aerobic composting and vermicomposting) and waste-to-energy (incineration, bio-methanation etc). These are limited but realistic opportunities for energy production from waste [20].

(i) Composting

The organic content of MSW usually decomposes over a short period of time leading to various odor problems. To guarantee a better disposal of the waste, it is desirable to reduce its pollution potential. Microorganisms aided in the decomposition of organic matter in diverse conditions such as warm moist, aerobic and anaerobic environment. Composting of waste is the most easy and economic technology for the organic part of MSW [21]. It has been supported in many parts of the world for efficient disposal of biodegradable waste and the end product is being used as manure [22, 23]. Presence of high percentage of moisture content makes organic wastes undesirable for incineration but most suitable for the process of composting [16].

(ii) Vermicomposting

The process of turning the organic waste into a mineral rich soil by the means specific worms. These worms convert organic waste via excreting them as nutrient rich material, look like fine textured soil. Nutrient composition and quality of Vermicomposting are often much better than traditional compost [24].

(iii) Landfilling

Landfill is a site for the disposal of waste via burial. It is a process in which a disposal of waste done with different liners and finally covered with soil. The most critical components are bottom liners and a top cover. Aerobic microbes are the promisable approach of land filling and could be implemented ad novo as well as existing landfills. It advantageous method of land fill compared to conventional one [25]. It is the most economic, especially in developing countries [26] significantly reduces various parameters like costs and rate of green house gas production, would rapidly stabilize the waste.

(iv) Bio-methanation

Bio-methanation is the conversion of organic matter into combustible gas (CH_4) and manure by anaerobic bacteria. Agro-based industries are source of solid wastes which are rich in organic content and therefore management by the means of bio-methanation process in which an economic outcome like manure and biogas is expectable. The acidification and methanation are two stages in bio-methanation (CPCB, 2007).

(v) Incineration

Incineration is a thermal waste treatment process that involves the high temperature combustion of organic substances present in waste materials, where raw or untreated waste can be used as fly ash (in cement) and feed stock [27]. Incineration takes place at the temperature of 850°C and in the presence of air so that waste are transformed into carbon dioxide, water and non-combustible materials with solid residue i.e., bottom ash [28]. Generally incineration is operated to hospital and other biomedical wastes. Incineration of MSW is experienced to decrease waste volume and recover energy [29].

(vi) Pyrolysis

Pyrolysis is a thermo chemical transfer process where a fuel is treated in the presence of heat but in the absence of an oxidizing agent (in an inert atmosphere). There are two technologies for the transfer of heat: one is fast pyrolysis, for making bio-oil and another is slow pyrolysis for making of charcoal [30]. Pyrolysis of solid waste generates enormous energy. Pyrolysis of biomass is a source of non-conventional energy and chemicals. Bio-oil is an emerging alternative to the depleting fossil fuels which are prominent source of greenhouse gases, and are conventional source of energy. Accumulated deposits of agricultural wastes like rice husks, maize cobs and other solid wastes of organic origin which litter backyards, street corners and threshing floors in our residential areas can support biofuel production facilities (through pyrolysis) thus opening up other frontiers for the beneficial management of these solid wastes.

2. CONCLUSION

In this paper, authors compiled a general review on the unreliable approaches of quantity and features of MSW. The different form of waste profile stresses the significance of separation of wastes into different categories at the source of waste management facilities. Municipal authorities ought to carry on the solid waste processing facilities in such a way that they do not cause unhealthy and contaminated conditions. Since the MSW is dynamic in nature, a ample samples to be collected and analyzed to get statistically solid outcomes as waste production is accelerating and municipal authorities are unable to uplift the facilities demand for proper disposal of wastes. So in this regard, there is an emergent need to improve the medium term planning at the municipal and state level so that judicial investment projections can be advanced and implemented.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. WHO. Health and environment in developing world. World Health Organization, Geneva; 1998.
2. Hui Y, Li'ao W, Fenwei S, Gang H. Urban solid waste management in Chongqins: Challenges and opportunities. Waste Management; 2005.
   DOI: 10.1016/j. Wasman.
3. Thapa GB. Lessons learned from solid waste management in Kathmandu, Nepal. Habitat International. 1998;22(2):97-114.
4. Mukherjee AB, Roy P. Calcutta metropolitan waste, its characteristics, pollution load and disposal problem. Environment Ecology. 1989;7(4):1019-1022.
5. Hockett D, Lober D, Pilgrim K. Determinants of per capita municipal solid waste generation in the Southeastern U.S. Duke University, Durham; 1994.
6. Wei JB, Herball JD, Zhang S. Solid waste disposal including-Situation, problems and suggestions. Waste Management and Researches. 1997;15(6):573-583.
7. Sharholy M, Ahmad K, Mahmood G, Trivedi RC. Municipal solid waste management in Indian cities A review. Waste Management. 208;28:459-467.
8. Gupta N, Yadav KY, Kumar V. A review on current status of municipal solid waste management in India. Journal of Environmental Sciences. 2015;37:206–217.
9. Kaushal RJ, Varghese GK, Chabukdhara M. Municipal solid waste management in India-Current State and Future Challenges: A Review. International Journal of Engineering and Technology. 2012;4(4):1473-1489.
10. Naveen BP, Sivapullaiah PV, Sitharam TG. Disposal options for solid waste of Bangalore city base on its characteristics. International Journal Environ. Waste Management. 2013;12(1):77-88.
11. Upadhyay V, Jethoo AS, Poonia MP. Waste collection and segregation: A case study of MNIT Campus, Jaipur. International Journal of Engineering and innovative technology (IJEIT). 2012;1(3):144-148.
12. Cointreau SJ. Recycling from municipal refuses-A state-of-art**.** World Bank technical paper No. 30. The World Bank, Washington DC; 1984.
13. Patil AD, Alone BZ, Bhide AD. Characteristics of MSW and its variation in Pune cit**y**. Current Pollution Researches in India. 1985;2:185-187.
14. Medina M. Globalization, development and municipal solid waste management in third world cities. Institute of Advance Studies Mexico. 2002;3:1-23.
15. Ahmad P, Bhat GA. Solid waste generation in different income groups of Srinagar city. Journal of Research and Development. 2007;5:45-50.
16. Testin RF, Neil L. Processing and Recovery of Municipal Solid Waste. Journal of Sanitary Engineering Division. 1970;96(3):699-714.
17. Jain PK. Waste management in Delhi. Civil affairs. 1994;31(2):51-57.
18. Shah SP. Packaging taxes and recycling incentives: the German green dot program. National Tax Journal. 1994;47:689-701.
19. Dayal G. Solid wastes: sources, implications and management. Indian Journal of Environmental Protection. 1994;14(9):669–677.

20. Stassen HEM. Biogas and biomass technology: Energy generation from biomass and waste in Netherlands. Renewable Energy. 1994;5(11):819-823.
21. Asnani PU. Solid Waste Management. India Infrastructure Report. 2006;160–189.
22. Gautam SP, Bundela PS, Pandey AK, Awasthi MK, Sarsaiya S. Composting of municipal solid waste of Jabalpur City. Global Journal of Environment and Research. 2010;4(1):43–46.
23. Porkhrel D, Viraraghavan T. Municipal solid waste management in Nepal: practices and challenges. Waste Management. 2005;25(5):555–562.
24. Datar MT, More AB. Vermicomposting- A technological option for solid waste management. 2007;3.
25. Read AD, Hudgins M, Harper S, Philips. The successful demonstration of aerobic land filling and the potential of more sustainable solid waste management approach. Resource, Conservation and Recycling. 2001;32:115-146.
26. Daskalopoulos E, Badr O, Probert SD. An integrated approach to municipal solid waste management. Resources, Conservation and Recycling. 1998;24(1):33-50.
27. Zaman AU. Comparative study of municipal solid waste treatment technologies using life cycle assessment method. International Journal of Environmental Science & Technology. 2010;7(2):225–234.
28. Zaman AU. Life cycle environmental assessment of municipal solid waste to energy technologies. Global Journal of Environmental Research. 2009;3(3):155–163.
29. Rajput R, Prasad G, Chopra AK. Scenario of solid waste management in present Indian context. Casp. Journal of Environmental Science. 2009;7(1):45–53.
30. Becidan M. Experimental studies on municipal solid waste and biomass pyrolysis Ph.D. Thesis Norwegian University of Science and Technology, Norway; 2007.