Journal of Advances in Science and Technology
Vol. 18, Issue No. 1, March-2021, ISSN 2230-9659

# A Detailed Review on Environmental Solid Waste Management Strategies

**Sangale Jivan Balashaheb[1]* Dr. Amool Bharath Shinde[2]**

[1] PhD Student, University of Technology, Jaipur

[2] PhD Guide, University of Technology, Jaipur

***Abstract – The developed as well as developing nations are facing complications related to Municipal Solid Waste Management (MSWM). Moreover rise in population density across globe has more need of resource consumption edible as well as other used items which produces huge chunk of waste. Severe hazardous health and environmental effects were caused by unsustainable waste management, that are seen in developing countries like India. In this country, range municipal solid waste varies between 0.3-0.6 kg per capita per day and is rising at a rate yearly at 1.33 % per capita every day. There were few loopholes in handling solid waste like improper handling of waste that changes every city, like door to door accumulation is not done efficiently and because of improper management of waste, insufficient collection and unsuitable waste disposal. For inappropriate MSWM municipal solid waste systems are responsible. The pollutant has been generated from the dump sites, Population living with close proximity of dump sites are affected by contaminated water and polluted quality of air. To overcome such issues, concept of recovery, reuse, recycling, and reduction is done. In developing countries, Effective solid management is very financially expensive in developing nations as it requires an overall integrated system which should be sustainable, socially supported and well organized. Recent waste management is lack of approach as per global perspective, recycling, extraction and consumption. In some countries, tremendous amount of garbage mainly received from domestic establishment it observes very high level of service gap, due to which lack of sufficient manpower and technical expertise and capability issues have been generating at site of management. Furthermore, sanitary landfills are suitable methods of final waste disposal. Landfill must be well organized and operated, so as to reduce environmental hazardousness they should be correctly designed, selection of sited to be done very carefully and prior to disposal treatment, recycling and recovery must be established and executed efficiently. For municipal solid waste management this study showcase, a critically reviewed approaches, gap and solution are explained. From this study it was concluded that by efficient planning and execution of effective techniques garbage waste collection, recycling segregation of waste and its reuse and could offer assistance in lowering risk of environmental effects of soil, air and water pollution.***

***Keywords – Waste Management, Environmental Effects, Environmental and Municipal Solid Waste Management.***

----------X----------

## 1. INTRODUCTION

Waste generation was always produced by human activities. When human population was comparatively small and nomadic this was not a main problems, but with urbanization and growth of large conurbations it became a critical issue. Apart from major impact on public health poor management of waste led to contamination of atmosphere, water and soil. As per changes in lifestyle number of characteristics of waste material had developed novel chemical substances that finds its place in many waste streams that has increased dramatically. Health effects on long term due to exposure to substances present in garbage or generated at waste disposal units are more difficult to calculated and analyse, especially in an area when their concentrations are tiny and when there are other exposure pathways (e.g. soil and food) [1]. Urban and industrial areas in developing economies in Asian countries encountered an alarming problem due to Waste management and disposal. Waste production has been observed upward increase trend parallel to rapid growth of population, urbanization, and development of industrialization. Such issues has become main primary urban environmental issues and health hazards. So as to reduce domestic animal attraction of animals and also to retrieve recyclable items. Sometimes it is burnt to reduce its volume thereby creating air pollution as a byproduct. Even though degradation of invaluable land resources and creating of long-

term health and environmental issues, uncontrolled open dumping is still going on in many developing nations that surely requires immediate action plan due to linked harmful impacts (Table1). Above all this more than 90% of entire landfill [2] sarenon-engineered disposal locations in South and Southeast Asia.

**Table 1: The three landfills in Delhi [3]**

| OVER FLOWING DANGERS | | | | |
|---|---|---|---|---|
| Land fill Site | Area (Inacres) | Waste Received In metric tonnes per day | Catering To Delhi Population | Year of Commencement |
| Ghazipur | 70 | 2100 | 30.8% | 1984 |
| Okhla | 32 | 1200 | 18.9% | 1994 |
| Bhalswa | 40 | 2700 | 50.3% | 1993 |
| Total | 142 | 6000 | | |
| Total waste generated by Delhi daily is 8360tonnes per day Status of all 3 landfills | | | | |

Factors that need to be considered in waste management apart from concern on increasing inefficient collection, waste generation, transportation infrastructure system, climatic condition and composition of waste (high organic matter and high moisture content). Improper execution of waste management policy and financial restrictions [2] with lack of cooperation from civil society, private sector, government, educational institutions, and public complicates matter.

Solid waste is the term that describes non-liquid waste material generated from domestic, trade, agricultural and industries and from public entities. Waste is a mixture of various heterogeneous redundant materials which is also known as garbage, rubbish or trash. It is typical information that waste is also a valuable material at wrong place. Every material in the world may be useful if we try to proper utilization of these materials. We consider certain things as waste because of our ignorance as there are several cycles of nature which sustain the world. So it is very important to change the attitude of people about the solid waste. The illustrations of solid wastes are shown in figure1. [4]

The fundamental objective of solid waste management program is to reduce the environmental pollution and as well as utilizing the waste as resource. For fulfillment of the objective is required well financial support and good awareness of people.

The methods of solid waste management vary greatly with types of wastes and locality. So the best systems must be designed by considering the local conditions and factors such as available technology, financial support, awareness of people, prevailing system, traditional wisdom etc [5].

Solid waste management [6] is the significant required function in urban and rural local bodies. Yet, this basic assistance isn't appropriately performed by the nearby bodies, bringing about numerous health and sanitary issues. It is seen that absence of monetary support, organizational shortcomings, incorrectly choice of innovation, transportation frameworks and disposal facilities, public's lack of care towards ecological tidiness and hygiene have made this administration not upto the satisfactory. The objective of solid waste management is to collect waste at the source of generation, recovery of the recyclable materials for recycling, conversion of organic waste to compost and secured disposal of remaining waste. Depending on the physical state of waste, it is categories in to municipal waste, hazardous waste, medical waste and radioactive wastes.


**Figure 1: Photographs of solid waste generation in metros, dumping sites, not proper disposal of solid waste and its effect on environment [4]**

## 2. WASTE MANAGEMENT

According to [7], as long as humans are living in settled communities, solid domestic waste generation will always be an unavoidable and decisive issue both in developed and developing nations. Waste is a pejorative term for unwanted materials. According to [8] "waste" can be defined as any residue from a production, processing or utilization process, any movable or immovable good abandoned or intended to be abandoned. Despite the existence of waste collection companies in developing countries, the issue of waste management in towns most often remains the concern of households in municipalities. As this becomes an individual's problem, people seek individual options, making use of limited, short term and most often inadequate solutions. The most common practices are, the evacuating or dumping of waste in drains before or during rain events [9], open dumping, dumping in valleys, night dumping. Some reasons that lead to such practices are: little or no availability as well as poor distribution of skips, poor road infrastructure and poor settlement configuration.

In metro cities of India, an individual produces a normal of 0.8kg/waste/person every day. The total muicipal strong waste (MSW) produced in urban India has been evaluated at 68.8million tons for every year [10]. However, these bulk values are not very useful in waste management planning, as the specific household production is not known. Neither is the composition of the waste nor the waste management practices of producers. In order to determine the capacity of solid waste management facilities, it is important to determine the per capita production. More accurate assessment of the quantity will be obtained if data is available on the per capita waste generation as a function of settlement types. Knowing the proportion of different settlement types and the per capita waste produced will result in a more accurate assessment of the quantity of waste generated and hence this will facilitate planning [11]. The composition or characterization of waste is important in determining the appropriate waste management alternatives. This study will as such permit to bring forth more information on components necessary for an effective waste management planning.

## 3. REVIEW OF WORKS

A brief review of the literature associated with municipal solid waste and waste management practices is presented below. Hui-Zhen et al., stated [12] in their research that peoples activities are grouped into 3 types: maintenance, subsistence and leisure activities. Also, the author described various aspects related to waste generation such as volume of retail sales of consumer goods, residents groups, time spent on different activities by residents and discussed in detail about waste generation rate during festivals, weekdays and weekends.

### 3.1. Characteristics of Solid Waste

Lorena De Medina et al., studied on physical and chemical properties of municipal solid waste (MSW) [13], stated that based on the characteristics of MSW, a decision can be taken for further processing. Based on their study outcomes of specific heat and ashes, incineration will be a better option for the treatment of MSW. It is costlier than the other techniques, and commonly not recommended for semi-rural and rural bodies. Even though, the presence of humidity, organic matter, pH and sulphur in the solid wastes suggests that it has optimum results for biological treatments such as vermi-composting method, not only because it exploits the weather condition of that particular area but also due to the high level of organic matters observed to favour this practice which is also a good method for waste recovery.

### 3.2. Characterization for MSW Management

Ajayakumar Varma [14] carried out a study in Kerala region for the basic data required for proper planning and effective MSW management such as assessment of quantity of waste generation and different sources of waste generation. This study also gives the details of physical composition of MSW such as paper, plastic, metals, glass, rubber and leather, compostable organics, other textiles, inerts and onsite hazards which is important for deciding the prime management action, namely the reduction, reuse, and recycling of waste. It also described the chemical characteristics of waste such as moisture content, low calorific value and high nutrient content which are the main factors for the conversion of waste into manure.

### 3.3. Municipal Solid Waste Management

Naresh Kumar and Sudha carried out a study on MSW characterization and proposed a management plan for Kharagpur, India [15]. In their study, it was revealed that 45metric tonnes/day of solid waste generated remains not collected which was dumped in public place and natural and engineered drains; as a result it blocks the flow of stormwater and contaminates the groundwater. The author has mentioned the issues such as improper bin location and poor design of it, poor transportation, insufficient labour and shortage of good quality waste treatments and dumping arrangements. The authors suggested an integrated solid waste management plan for Kharagpur city through enhancement of solid waste collection methods to replace the fixed container systems by the hauled container systems, sitting of waste disposal locations and proper methods for disposal.

Kodwo Miezaha, et. al., conducted a study in which generates the regional and national level data of planning and implementation of waste management procedures in Ghana [16]. They have found that organic fractions are more in the waste stream approximately ranges from 48 to 69 percent. Thye also found that the biodegradables are ranges from 58 to 76 percent that can be useful as raw materials in biological conversion process such as composting, biogas and bio-ethanol refinery procedures. Also stated that, the success of any waste segregation method depends on the good involvement of the waste generators of the community and how good they will segregate the wastages.

### 3.4. Environmental Impact

Antti Niskanen et al., carried out environmental assessment of Ammassuo Landfill using LCA modelling (EASEWASTE) [17]. In this study, the authors focused on the impact of waste landfilling on the environment. This assessment has evaluated different types of impacts such as standard impacts, toxicity associated impacts and spoiled ground water resource impacts. In the view point of standard and toxicity associated impacts, the LCA results show that significant effect is projected on

Global Warming, Ozone Depletion, Human and Ecology toxicity. The serious impact was estimated on spoiled ground water resource which is approximately 57.6 person equivalent per tonne of landfilled waste. He stated that LCA method is useful for landfilling systems and it is the best tool that identifies the contribution to the impact potential from various parts of the analyzed model or from the emissions of single substance.

### 3.5. Reduce, Recycle and Reuse

Alice sharp et al. carried out a research in which the objective is to review the different scenarios of solid waste management systems in Monagar, Bhutan [18]. It has analyzed the suitable integrated SWM systems for different type's waste streams that can results into a zero-waste city (http://www.ipcbee.com). The authors recommend two major aspects to minimize the waste generation in the town: one is reduce, raise awareness through campaign, seminar and research and academics as the tool for creating consciousness about solid waste management in the society. The second one is to turn organic waste into fertilizers through composting, which ensures the "reuse" of wastes and converts them into the useful products or energy.

Sesha Sai Ratnamala Bommareddy & Asadi [19] in their study recommend automated plastic separator by which the plastic content in the waste can be segregated and other biodegradable content will be discharged as slurry. The plastic contents may be sent to recycling units and slurry could be utilized as compost for agricultural purpose.

Gerardo Collaguazo et al., carried out a study on household wastes characterization from Bihor County, Romania [20] for the purpose of identifying and quantifying the materials likely to be recovered energetically or economically. The authors stated that, the economic activities and the lifestyle of the population determine the characteristics of the generated waste; therefore they vary depending on the area where the samples were taken as well as on the season. Also, this characterization can be considered as reference for choosing the possible treatment process, so that methods such as composting, agricultural recovery, biodegradation in reactors-energetic recovery, the recycling of metals and glass or other recyclable materials (paper, cardboard, plastic) – economic recovery, etc. could be optimized.

### 3.6. Waste to Energy Conversion

Ankur et al., [21], their study focused on the design and development of anaerobic digester for production of methane gas from kitchen wastage materials. They discussed in detail about design of anaerobic digester, its working principle and process. It's a device thatis useful in the better disposing of solid wastes from kitchen and digester. As the whole decomposing operation of wastes take place then it produces the methane gas as the main product.

Michael Hoffmann et al., conducted a research in four countries: Lithuania, Russia, Georgia, and Ukraine [22] to address the seasonality of waste composition. Their study shows, "although food and yard waste contributed up to 37% of the weight of the energy-rich waste elements, these wastes contributes only 9% of the total energy share. The author stated that the efficient recovery of energy from these elements may only be possible using technologies that can exploit their energy without resorting to energy- intensive drying procedures; hence, they may be better used in composting and the production of biogas. Further they states that the composition of waste depended on several factors, including geography, climate, season, and social context".

Aparna Nayak et. al., stated that [23] "the involvement of industries and government is prerequisite in eliminating waste from the beginning because they are presented with more advantages than individuals. Without their role zero waste will not be possible. Industry has control over product and packaging design, manufacturing processes, and material selection. Governments have the ability to form policy and provide subsidies for better product manufacturing, design and the ability to develop and adopt inclusive waste management strategies which can eliminate waste rather than just manage it. Also discussed in detail about Cradle-to-cradle/Cradle-to-grave, Cradle-to-cradle functioning. The author emphasized about the two categories in the cradle to cradle model, used in industrial or commercial processes that are technical or biological nutrients. Technical nutrients are strictly limited to non-toxic, non-harmful synthetic materials that have no negative effects on the natural environment; they can be used in continuous cycles as the same product without losing their integrity or quality. In this manner these materials can be used over and over again instead of being down cycled into lesser products, ultimately becoming waste. Biological Nutrients are organic materials that, once used, can be disposed of in any natural environment and decompose into the soil, providing food for small life forms without affecting the natural environment".

## 4. CONCLUSION

From study, it was evident that many lacunas were there in solid waste management by municipalities like transportation of waste, and disposal of generated garbage can be reduce to some extent. Waste can be manage easily by observing and implementing of various concept available that is recycling, reduction, recovery and reuse of garbage. Gradual environmental and health effects can be caused due to improper management of solid waste in developed as well as developing countries.

Incineration, pyrolysis, composting and gasification are some of techniques by which solid waste creation can be decreased. In municipal solid waste management each and every individual participation also provides an important role on local and global levels.

## REFERENCES

[1] A review of waste management practices and their impact on human health L. Giusti Faculty of Health and Life Sciences, UWE Bristol, Frenchay Campus, Coldharbour Lane, Bristol BS16 1QY, United Kingdom PG NO-2228-2229.

[2] Chiemchaisri, C., R. Weerasekara, K. Joseph, S. Kumar and C. Visvanathan. (2011). "Application of Bioreactor Landfill Technology to Municipal Solid Waste Management: Asian Perspective." In Impact, Monitoring and Management of Environmental Pollution, 553-570.

[3] Delhi faces fire risk from overflowing landfill sites as tall as a 10-storey building, By Baishall Adak, PUBLISHED: 2 February (2016)

[4] Ajayakumar Varma, R: "Status of Municipal Solid waste Generation in kerala and their characteristics, http://www.seas.columbia.edu/earth/wtert/sofos/Ajaykumar_Status

[5] Alamgir, M, Ahsan, A (2007). "Municipal Solid Waste and Recovery Potential", Bangladesh Perspective Iran. J. Environ. Health. Sci. Eng., vol. 4, no. 2, pp. 67-76

[6] Alamgir, M, Donald, C, Mc Roehi, KE & Ahsan, A (2005). "Integrated management and safe disposal of MSW in least developed Asian countries- A feasibility study, Waste Safe". Khulna University of Engineering and Technology, Asia Pro Eco Programme of the European Commission.

[7] Ali Kamran, Muhammad Nawaz Chaudhry & SyedaAdila Batool (2015). "Effects of socio-economic status and seasonal variation on municipal solid waste composition: a baseline study for future planning and development", Environ SciEur, pp. 16=27

[8] Alice Sharp, Sandhya Babel, Tshering Gyeltshen, Tsheltrim Pelden & Dechen Dorji, Establishment of Integrated Solid Waste Management System in Mongar Town, Bhutan, http://www.ipcbee.com/vol92/rp019_ICFES2016-P1001.pdf.

[9] Amul Late & Mule, MB (2012). "Composition and Characterization Study of Solid Waste from Aurangabad City", Universal Journal of Environmental Research and Technology, vol. 3, issue. 1, pp. 55-60.

[10] Anita Agrawal, Rama Pandey & Agrawal, ML (2013). "Seasonal variation in composition and characteristics of Indian Municipal Solid Waste", A case study, Recent Research in Science and Technology, vol. 5, no. 5, pp. 40-43.

[11] Sudhir V (1996). Integrated solid waste management in Urban India: A critical operational research framework, socio-economic planning sciences, volume 30, issue 3, pp. 163-181.

[12] Arthur Mngoma Omari (2015). "Characterization of Municipal solid waste for energy recovery". A case study of Arusha, Tanzania. Journal of Engineering Science and Technology (JMEST), vol. 2, issue 1.

[13] Arthur Omari Mahir Said Karoli Njau Geoffrey John Peter Mtui (2014). "Energy Recovery routes from Municipal Solid Waste", A case study of Arusha-Tanzania, Journal of Energy Technologies and Policy, vol. 4, no. 5.

[14] Arthur Omari, Mahir Said, KaroliNjau, Geoffrey John & Peter Mtui (2014). "Energy Recovery routes from Municipal Solid Waste, A case study of Arusha-Tanzania", Journal of Energy Technologies and Policy, vol. 4, no. 5.

[15] Arvind K Jha, Sharma, C, Nahar Singh, Ramesh, R, Purvaja, R, Prabhat K Gupta (2007). "Greenhouse gas emissions from municipal solid waste management in Indian mega-cities", A case study of Chennai landfill sites, Chemosphere.

[16] Atiq Uz Zaman & Steffen Lehmann (2011). "Challenges and Opportunities in Transforming a City into a "Zero Waste City" Challenges", vol. 2, pp. 73-93.

[17] Atiq Uz Zaman & Steffen Lehmann (2013). "The zero waste index: a performance measurement tool for waste management systems in a "zero waste city"", Journal of Cleaner Production, vol. 50, no. 123-132.

[18] Atiq Uz Zaman (2015). "A comprehensive review of the development of zero waste management: lessons learned and

guidelines", Journal of Cleaner Production, vol. 91, pp. 12- 25.

[19] AtiqUzZaman & Steffen Lehmann (2011). Challenges and Opportunities in Transforming a City into a "Zero Waste City", Challenges, Vol. 2, pp. 73-93. www.mdpi.com/journal/challenges.

[20] AtiqUzZaman (2012). "Developing a Social Business Model for Zero Waste Management Systems: A Case Study Analysis", Journal of Environmental Protection, vol. 3, pp. 1458-1469,

[21] AvaniChopra, Kapoor, DR (2016). "Study of Public Private Partnership in Urban

[22] Barjinder Bhall, MS, Saini, MK, Jha (2013). "Effect Of Age And Seasonal Variations On Leachate Characteristics of Municipal Solid Waste Landfill IJRET", International Journal of Research in Engineering and Technology, vol. 02, issue. 08.

[23] Benjamin Ternenge Abur (2014). "Emmanuel Enomena Oguche & Gideon Ayuba Duvuna Characterization of Municipal Solid Waste in the Federal Capital Abuja, Nigeria", Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc. (USA), vol. 14, issue.2.

**Corresponding Author**

**Sangale Jivan Balashaheb***

PhD Student, University of Technology, Jaipur