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Municipal Solid Waste Management in India- Revisited

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Abstract

Municipal Solid Waste (MSW) is a socioeconomic activity that entails with solid waste generation. Management of municipal solid waste is a national problem and is faced in all the cities of India. Urbanization contributes enhanced municipal solid waste (MSW) generation and unscientific handling and final disposal of MSW degrades the urban environment and causes health hazards. Various collection systems engaged by the municipalities collect less than half of the total waste generated. As a result, wastes are either scattered in urban centres or disposed of in an unplanned manner in low lying areas or open dumps, or fired by the residents in their backyards. Insufficient collection and inadequate have made the situation exasperating due to which various environmental and health related issues are increasing. Keeping in mind of the present situation, the current paper reviews about municipal solid waste management system in the country and initiative to be taken by education institutions.

Keywords: *MSW, SWM, ULB, solid waste*

INTRODUCTION

Cities in the developing world have undergone a rapid urbanization during the past 50 years [1]. India, being the world's second most populous country, the level of urbanization in India has increased from 29.24 % in 2005 to 32.75% in 2015 [Source:https://www.statista.com/statistics/271312/urbanization-in-india/].
Urbanization in developing countries like India implies the growth of existing slum areas and the introduction of latest ones. destiny want for waste series in slums, therefore, is possibly to place extra strain on municipalities already unable to offer the provider to their contemporary citizens. The ever rising populace is placing colossal strain on call for food, shelter and different herbal resources [2].

MSWM is one of the maximum unnoticed basic services furnished by using the authorities of India. feature of MS may additionally range at the extent of u . s ., state, metropolis in addition to numerous areas in of the equal town. MSW generation quotes range among zero.3 and 0.6 kg/ capita/day in Indian cities and annual increase in MSW generation (quantity) is estimated as 1.33 % in keeping with capita.

Half of the waste is collected of the total waste. Worldwide; over two thirds of human wastes are released into the environment with little or no treatment, which results into the various deterioration of the surroundings in the form of air, water that causes diverse health hazards. attention of intense financial processes and high degree of intake in urban regions growth general waste generation and greater area is needed for waste disposal.

The town's only embody two percentage of the world's land floor, yet they're responsible for consuming over 75percentof the planet's sources and bring seventy five% of the arena's waste (supply: Siemens, "Sustainable city"). The most urgent problem faced via any city centre in India these days is Municipal

strong Waste management (MSW).over the past few years, the managing this MSWM has become a prime organizational, monetary and environmental project [3].

The population of urban India was 377 million (Census of India,2011a), which accounts for 31% of the total population. India produces47.3 MT of MSW annually at present. In the developed countries, solid waste management (SWM) belongs to prominent thrust areas for pursuing research (Dijkgraaf & Gradus, 2004; Ferrara & Missios, 2005) and economic and technological advancements have initiated responsiveness of stakeholders towards it (Shekdar, 2009). High population growth rates, rapidly varying waste characterization and generation patterns, growing urbanization and industrialization in developing countries (Troschinetz & Mihelcic, 2009) are the important reasons for paying attention towards MSWM as more area is required to accommodate waste (Idris, Inane, & Hassan, 2004).

Several studies suggest that reutilizing of stable waste isn't only a feasible choice to MSWM (Kasseva & Mbuligwe, 2000; Sudhir, Muraleedharan, & Srinivasan, 1996) however also applicable—socially, economically, and environmentally (Kaseva& Gupta, 1996; Misra & Pandey, 2005; Schoot Uiterkamp, Azadi, & Ho, 2011). one of the huge troubles in urban India is sort of no segregation of MSW and disposal of production and demolition debris (C&D), plastic wastes, industrial and business refuses, and e-waste (Buenrostro & Bocco, 2003).

MSW CHARACTERIZATION

Municipal solid waste (MSW) is a kind of waste this is generated from academic sectors, organizations and household activities. It does not include constructiona l, industrial or sewage waste.

MSW category:-
By means of fabric – This category consists of the waste that's obtained from plastic, paper, steel, rubber, meals waste, oryard waste. As an instance a plastic toy or a plastic yogurt carton which is obtains from the equal substances. By Product – This category includes the waste which is used for originally. For example, the waste may be an old potato chip bag, a worn-out shoe a broken toy, a plastic beverage container or an aluminum beverage container.

Table I: *Sources and types of MSW [4]*

Source	**Typical waste**	**Types of solid wastes generators**
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardouswastes
Industrial	Light and heavy manufacturing, fabrication, construction sites,power and chemical plants	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes
Commercial	Stores, hotels, restaurants, markets, Office buildings, etc.	Paper, cardboard, plastics, wood, foodwastes, glass, metals
	Schools, hospitals,	Paper, cardboard, plastics, wood,

	Institutional prisons, government centers	foodwastes, glass, metals,special wastes, hazardous wastes
Municipal services	Street cleaning, landscaping, parks,beaches, other; recreational areas,water and wastewater treatment plants	Street sweepings, landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas; sludge
Process	Heavy & light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing	Industrial process wastes, scrap materials, off-specification products,slag, tailings
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc.

Recent Trends in MSWM in India

MSW quantities are inextricably linked to economic pastime and useful resource consumption. If the lagging non-OECD (agency for monetary Co-operation and development) international locations are able to transition to a sustainable better growth direction, the worldwide poverty ratio will fall from approximately 21 percentage in 2005 to less than 2.five percent in 2050 [4]. as the financial system flourishes, the general MSW era fees will dramatically boom [8].Per capita waste generation increasing by 1.3% per annum.

- With urban population increasing between 3 – 3.5% per annum
- Yearly increase in waste generation is around 5% annually municipal solid waste annually.
- Per capita generation of waste varies from 200 gm to 600 gm per capita / day. Average generation rate at 0.7 kg per capita per day in 0.1 million plus towns.
- The change in waste composition of Indian garbage between 2000 and 2025 are as follow:-
- Organic Waste will go up from 40% to 60%
- Plastic will rise from 4% to 6%
- Metal will escalate from 1% to 4%
- Glass will increase from 2% to 3%
- Paper will climb from 5% to 15%
- Others (ash, sand, grit) will decrease from 47% to 12%
- 7.2 million tons of hazardous waste
- One Sq.km of additional landfill area every-year
- Rs 1600 crore for treatment & disposal of these wastes
- In addition to this industries discharge about 150 million tons of high volume low hazard waste every year, which is mostly dumped on open low lying land.

ENVIRONMENTAL AND HEALTH IMPACTSOF IMPROPER MSWM

Improper management of SMW causes various types of pollution i.e. air, soil, and water. It also impacts on economy, environment and society which are mentioned below-

Table II: *Impacts of MSW [5]*

Economic impacts	Environment impacts	Social impacts
Function of the internal market Investment costs Operating costs Administrative burdens	Climate Energy Air quality Biodiversity, flora, fauna, and landscapes Quality of water and	Social inclusion and protection of particular groups Non-discrimination Individuals, privateand family life, personal data

Public authorities Property rights innovation and research Economic effects on consumers and households Economic effects on industry and business	resources Soil quality or resources Land use Renewable or nonrenewable resources Environmental consequences of firmsand consumers Likelihood or scale of environmental risksAnimal welfare	Governance, participation, good administration, access to justice, media, and ethics Public health andsafety Security Access to and effectson social protection, health, and educational systems Culture

MSW DISPOSAL AND TREATMENT PROCESS

Waste treatment is a technique which transforms the waste into a form that is more manageable Waste remedy strategies are decided on the basis of composition amount form of the waste fabrica few waste treatment methods being used nowadays encompass subjecting the waste to extremely excessive temperatures, dumping on land or land filling and use of organic methods to deal with the waste [10]. The waste management sector follows a normally universal hierarchy. The hierarchy began as the reduce, reuse, recycle, healing

Re-Use and Recycle of MSW

Re-use is basically the recovery of items to be used again, perhaps after some cleaning and refurbishing. Re-using materials and products saves energy and water, reduces pollution, and lessens society's consumption of natural resources compared with the use of single-application products and materials [12]. After the re-use of materials and products, recycling comes next in the integrated waste management hierarchy [6]. Recycling is the reprocessing of discarded materials into new useful product. The process of reusing of cans can save money. Recycling of paper will reduce of cutting of trees.

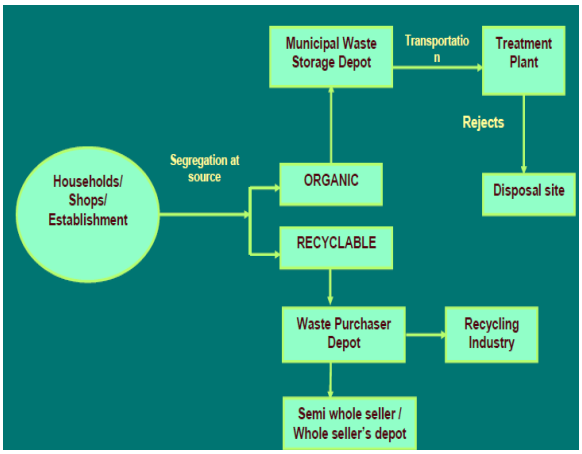

Fig. 1: *Steps in the recycling chain*

Reuse of metals will reduce the mining activities. In India about 40-80% of plastic waste is recycled compared to 10-15% in the developed nations of the world. However the recovery rate of paper was 14% of the total paper consumption in 1991, while the global recovery rate was higher at 37% [06].

FUNCTIONAL ELEMENTS OF MSWM

To built a proper MSWM system various aspects have to be considered such as waste generation, storage and collection, processing, transfer and transport, and disposal and disposal options [14].

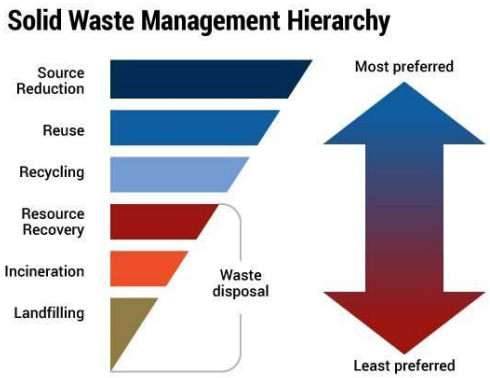

Fig. 2: *Waste Management Hierarchy*

BARRIERS TO IMPROVED WASTE MANAGEMENT IN INDIA

The current status of SWM in India is poor because the best and most appropriate methods from waste collection to disposal are not being used. There is a lack of training in SWM and the availability of qualified waste management professionals is limited. There is also a lack of accountability in current SWM systems throughout India. The lack of strategic MSW plans, waste collection/segregation and a government finance regulatory framework are major barriers to achieving effective SWM in India Municipal authorities are responsible for managing MSW in India but have budgets that are insufficient to cover the costs associated with developing proper waste collection, storage, treatment and disposal. [4].

Public attitudes to waste are a major barrier to improving SWM in India. Limited environmental awareness combined with low motivation also has inhibited innovation and the adoption of new technologies that could transform waste management in India.

CHANGES REQUIRED TO IMPROVE WASTE MANAGEMENT IN INDIA

A strong and independent authority is needed to regulate waste management if SWM is to enhance in India. Without clean regulation and enforcement, improvements will now not appear. The waste management region thru strong waste regulations desires to include appealing and worthwhile businesses with clean performance requirements imposed through the city local bodies (ULB) with monetary penalties applied when waste management services aren't operating correctly. Finance for waste management corporations and funding for infrastructure need to be raised from waste producers through a waste tax. An average charge of 1 rupee per individual in line with day might generate near 50 000 crores yearly, and this degree of investment would probably be enough to offer effective waste management at some point of India[17].

state-degree procurement of equipment and vehicles is important for number one and secondary collection with powerful systems for tracking collection, transport and disposal. records on future portions and characterization of wastes is vital as this determines the appropriateness of different waste control and remedy options. Waste management need to involve waste segregation at source to permit a whole lot extra green cost extraction and recycling. setting apart dry (inorganic) and wet (biodegradable) waste would have sizeable advantages and must be the responsibility of the waste manufacturer.

Long-time period waste management planning calls for visionary challenge development with the aid of ULBs, the personal area and NGOs. The jobs and obligations to supply sustainable structures need to be described, with tracking and assessment to display progress. Studies need to be shared among extraordinary areas of India and unique social companies. There are a number of research institutes, businesses, NGOs and private quarter agencies running on a holistic

method to SWM, and destiny waste management in India should involve large involvement of the casual zone in the course of the gadget.

There is a need to develop training and capacity building at every level. In this direction, AICTE had taken initiative along with International Institute of waste management, Bangluru by giving Green campus awards to normalize sustainable and eco-friendly practices in Indian technical campuses from 2017. The main objective is to initiate and maintain environment management systems in educational institutions in order to achieve zero net carbon and resource efficiency/All Indian school children should understand the importance of waste management, the effects of poor waste management on the environment and public health, and the role and responsibilities of each individual in the waste management system. This will develop responsible citizens who regard waste as a resource opportunity [15].

CONCLUSION

It can be conclude that MSWM system in India is not proper. Although the economic condition of our country is satisfactory, we have to manage the problem more wisely for the benefits of the whole country. To manage the problems with maximum possible effectiveness, the country should develop specific solutions regarding different area's problem. This analysis may include a number of actions to move towards an increasingly integrated and sustainable MSWM system in India.

REFERENCES

1. Kumar S., Smith S. R. and Velis C., "Challenges and opportunities associated with waste management inIndia", Royal society open science, Royal society Publishing, 2017.
2. Agarwal A., Agarwal M., Mehta A., and Bajpai M., "A Review on Present Status of Municipal Solid Waste Management", SSRG International Journal of Civil Engineering (SSRG-IJCE), Vol.3(5), pp. 45-53, 2016.
3. Jeswani H.K. and AzapagicA. ,"Assessing the environmental sustainability of energy recovery from municipal solid waste in the UK", Waste Management Vol.50, pp.346–363, 2016.
4. Agarwal A., Agarwal M., Mehta A., and Bajpai M., "A Review on Present Status of Municipal Solid Waste Management", SSRG International Journal of Civil Engineering (SSRG-IJCE), Vol.3(5), pp. 45-53, 2016
5. Burge N. and Gangurde S., "Waste Management in PCMC (3R"s Principle)", International Journal of Science and Research (IJSR), Vol.4 (5), pp.476-481, 2015
6. ShashikantaKeisham and DrBiswajit Paul, "A Review on the Recent Scenario of Municipal Solid Waste Management in India", International Journal of Engineering Research and General Science, Vol. 3 (3), pp. 528-542, 2015.
7. Adamu Isa Harir, Rozilah K. and IshiyakuB.,"Exploring the Resource Recovery Potentials of Municipal Solid Waste: A Review of Solid Wastes Composting in Developing Countries", International Journal of Scientific and Research Publications, Vol. 5 (4), pp. 1-8, 2015.
8. Mundhe N., Jaybhaye R. and Bhalachandra D., "Assessment of Municipal Solid Waste Management of Pune City using Geospatial Tools", International Journal of Computer Applications, Vol.100(10), pp. 24-32, 2014.
9. Singh, G., "Urbanization Trend and Pattern in India: Census 2011 and Beyond", 2014.
10. Njoroge, B. N. K., Kimani, M. and Ndunge, D., "Review of MunicipalSolid Waste Management: A Case Study of Nairobi,

Kenya,Research Inventy", International Journal of Engineering and Science, Vol.4 (2), pp. 16-20, 2014.
11. Kumar V. and Dr. PanditR.K.,"Problems of Solid Waste Management in Indian Cities", International Journal of Scientific and Research Publications, Vol.3(3), pp.01-09, 2013
12. Chavan B.L. and Zambare N.S., "A Case Study on Municipal Solid Waste Management in Solapur City, Maharashtra, India"International Journal of Research in Civil Engineering, Architecture& Design Vol. 1(2), pp. 46-53, 2013
13. Sridevi, V., Modi, M., Chandana L. M.V.V. and Kesavarao, L., "A Review on Integrated Solid Waste Management", International Journal of Engineering Science & Advanced Technology, Vol. 2 (5), pp. 1491 – 1499, 2012.
14. Ana Pires, GraçaMartinho and Ni-Bin Chang, "Solid Waste Management in European Countries: A Review of Systems Analysis Techniques", Journal of Environmental Management, Vol. 92, pp.1033-1050, 2011.
15. Medina, M., "Solid Wastes, Poverty and the Environment inDeveloping Country Cities: Challenges and Opportunities",Working Paper No. 23, 2010.
16. Rajput, R., Prasad, G. and Chopra, A.K., "Scenario ofSolid Waste Management in Present Indian Context",Caspian Journal of Environment Science, Vol. 7 (1), 2009.