

SHORT COMMUNICATION

Status and challenges of waste segregation in residential communities

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ABSTRACT

Degradation of urban environment and health hazard is directly associated with the unscientific handling of Municipal solid waste of India. Urbanization also contribute intensify Municipal solid waste generation. Source segregation of solid waste not only the fact to converge but also possible in maximum resource recovery from the waste. Waste management is a problem due to the ineffective management of waste and lack of knowledge of waste management. The main aim of the evaluation is to understand why and how communities can be approached survey and communicated and convicted towards a more suitable more sustainable and inclusive waste management system in Gurugram of India. All the Housing society of the Gurugram do not sort at all. The government agency responsible for the final management of solid waste does not have any practice to segregation the waste to achieving material recovery. The total waste generation in Gurugram area is 7418 kg per day from 5752 number of house hold. The waste segregation is the main challenges for the Municipal waste management system. The results revealed that average 81 percent of solid waste is just dumping in the land filled site without material recovery.

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INTRODUCTION

Urbanization is a global phenomenon and Gurugram of India is epitomizing this with one of the fastest growth rates in the region. This rapid growth has significantly stressed the existing infrastructure for public amenities. Solid waste management, which is already a mammoth task in India. It is become more complex and changing with lifestyle (Joshi *et al.*, 2016). Financial constraints, infrastructural weakness, improper technology, and public apathy towards municipal solid waste have made the situation difficult. The typical mechanism of dumping waste on the outskirts of cities has created a serious environmental impact. Efficient and sound waste

management in the developing country depends on the waste generation and composition data (Yousif *et al.*, 2007). 80 percent of generated solid waste going to unprocessed due unavailability of this composition data (Naveen *et al.*, 2018). High-income populations produce less organic waste (28%) as reported by (Laohalidanond *et al.*, 2015). Municipal solid waste management is a vital component to achieved sustainable metropolitan development based on source segregation, collection, storage, transportation, processing and safe disposal of solid waste to minimize its adverse effect on the environment. Unmanaged Municipal solid waste (MSW) can create severe health hazards (Kumar *et al.*, 2009). Landfill workers had significantly higher prevalence's of both upper and lower respiratory

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symptoms, and they suffered more often from diarrhea, fungal infection and ulceration of the skin, burning sensation in the extremities, tingling or numbness, transient loss of memory, and depression. (Ray *et al.*, 2005) It is very important to have information on various kinds of contaminants present in landfill emissions particularly leachates (Gupta *et al.*, 2016). Around the world, waste generation rates are rising. In 2016, the world's cities generated 2.01 billion tonnes of solid waste, amounting to a footprint of 0.74 kilograms per person per day. With rapid population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tonnes in 2050 (SWMWB, 2019). Recycling plays a vital role in a sustainable environment. Recyclable material like paper is a fundamental ingredient of urban waste (Minghua *et al.*, 2009). Recyclable waste paper is segregated in various grades to convert high-quality material (Zhuang *et al.*, 2008). Presently information technology is widely integrating with all other industries like the waste management industry also. It is observed that the social status increases the per capita solid waste generation, especially with regard to heavier biodegradable organic waste. (Okalebo, *et al.*, 2014). The study concludes that installation decentralise mechanism for waste management unit in different area and development of marketing strategy of recyclables material. The current study

has been carried out in Gurugram city of India in 2019. The most adopted methods of disposal for plastic waste by all the stakeholders considered are dumping or burning (Olusola, 2019). Composting of the organic waste included both aerobic composting and vermi-composting, and non-biodegradable waste was picked up and recycled for the final disposal of MSW (Pattnaik *et al.*, 2010). The next appropriate steps towards developing a sustainable, integrated waste management system will also vary in each local situation (Wilson *et al.*, 2007).

MATERIALS AND METHODS

Study area

Gurugram is in the state of Haryana. It is most popularly known as the millennium city. It is one of the largest urban centres in the National Capital Region (NCR). The city has experienced phenomenal growth from a population of 0.7 million in 2001 to more than 2.5 million in 2011 (Census report, 2011) and is expected to grow to 4.25 million by the year 2030 as per the Department of town and country planning 2010. The city has the 3rd highest per capita income in India after Chandigarh and Mumbai. The total area of the city is about 232 Sq. km and it is divided into 35 wards. Administratively Gurugram divided into four zones Gurugram south, Gurugram north, and Gurugram west and Gurugram east shown in Fig. 1.



Fig. 1: Geographic location of the study area in Gurugram India

Table 1: Per-capita waste generation rate(CPCB Report, 2013)

SL. No	Population size	Waste generation (Kg/capita/day)
1	>2000000	0.43
2	1000000-2000000	0.39
3	500000-1000000	0.38
4	100000-500000	0.39
5	<100000	0.36



Fig. 2: Collection from house hold

The consequences of a rapidly increasing population in urban areas are more noticeable in developing countries as compared to developed countries. The urban population of India was 377 million which is 31 percent of the total population (Census India, 2011). The population of the urban region increased from 18 to 31.2 % from 1961 to 2011 respectively (Census India, 2011). As per order of Nation Green Tribunal (NGT) 2016 the dumping of mixed waste in Bhandwari land fill site need to be traded to avoid air pollution and ground water contamination. Scientifically waste disposal technique needs to develop for prevent the health hazard in Bhandwari landfill site area.

As per CPHEEO 2000, Composition and characteristics of municipal solid waste (MSW)

Following major categories of waste are found in municipal solid waste.

- Bio-degradable: Food and Kitchen waste, green waste (Vegetables, flowers, leaves, Fruits)
- Non-Bio degradable: Paper, Glass, Bottle, Cans, Metals, Certain plastics

- Inert waste matter: Construction demolition, Dirt, Debris
- Composite waste: Waste clothing, Tetra Packs, Waste plastic toys

Waste generation

It is observed during the field survey conducted by Municipal corporation of Gurugram Per-capita waste generation in Gurugram is 320 gm/day which is including residential commercial and institutional waste. In addition to this the city also produces about 700 Ton per day (TPD) of construction and demolition waste; 1.5 TPD of biomedical waste and 70000 tonnes of e-waste annually. The characterization of municipal solid waste shows that 71 percent is kitchen waste and 12 percent recyclable and 17 percent inert. The city generates more than 1000 tonnes per day of municipal solid waste. It is proposed that solid waste will be increased up to 2900 TPD by the year 2041. As per MCC data the incremental rate of waste generation in Gurugram is 1.33 per annum. The range of solid waste generation with population are shown in the Table 1.

Solid waste management practice

In the present situation the majority of urban local bodies does not have an appropriate action plan for execution Solid Waste Management System (Rawat, et al., 2013). No city in India has 100% segregation of waste dwelling units and on an average of 70 % waste collection is observed, while the remaining 30 % is again mixed up and lost to the urban environment CPCB (2000b). Existing and the future land requirement for disposal of MSW along with growth in the population may create a huge problem in the future. Eco-friendly cost-effective and acceptability to the local community are major attributes to chive an effective solid waste management system.

Segregation

Organized and scientifically planned segregation (Fig. 3) of MSW either at the household level or community level need to be developed by the local authority for effective waste management. In general, there is two types of segregation process are followed for the municipal solid waste management. Segregation at source and segregation at the endpoint.

The effectiveness of segregation is reasonably low due to unsafe and hazardous conditions. Due to improper handling, the segregated waste got mixed up again during the transportation (Xu et al., 2016).

Collection

Waste produced by the houses is usually transferred into community bin, street sweeping also finds its ways to community bin. MCG has contractually engaged various contractor for house hold collection. One contractor has been covered 25 to 35 number of wards and rest wards are managed by employee of MCG. These community bins also used by other commercial sectors like shop, market. Municipal authorities collected the waste from the communities' bin and transport to the disposal site.

Transportation

In general, the mode of transportation is fixed based on the quantity of waste generation as shown in the Fig. 2. Segregated waste are collected and transfer the secondary transportation system. In smaller area truck having 5-9-ton capacity are used

Table 2: Waste generation details of Gurugram

	No of Household	Total residents	The total area of the property (Acres)	Total waste generation (kg per day)	Wet Waste generation (kg/day)	Dry Waste generation (kg/day)	Landfill did of total waste (%)
Tarika Sector 43,	72	280	1.5	84	50	12.6	74%
Heritage city, Sector 25,	850	3400	24	1600	800	420	69%
Orchid Petals, Sector 49,	1532	6128	37	1900	1000	700	95%
The Palms, South city,	499	2000	11	498	250	273	73%
Gardens 1, Sector 47	500	2000	13	733	400	248	72%
Colony in HUDA Sector	1800	7200	25	1933	1200	450	91%
Sector 43	271	1084	2.8	320	NA	NA	74%
Summit Sector 54	228	850	2	350	200	161	96%
Total	5752	22942	116.3	7418	3900	2264.6	81%



Fig. 3: Source segregation from house hold

with an adequate cover system. A sanitary compactor or mobile compactor also used in several places. In considering the breakdown of the vehicle extra vehicle is usually arranged for smoothly running the waste management system.

Disposal

Almost every city of India adopted the unscientific disposal of Municipal solid waste. The existing practice and technology need to be modified as per the requirement of the waste. In the last few decades, the incremental rate of waste generation is directly proportionate with population increase and other factors. Safe disposal is a challenging task for the authority. The generated waste could not be reached to the designated dumping site due to unavailability of land.

RESULT AND DISCUSSION

Social Impact

Segregation at source has a big impact on the waste worker. The waste worker can segregate a higher number of recyclables material from the generated solid waste. The work area is clean from the foul gas. The waste worker gets a better livelihood.

Economic impact

The resource recovery found from dry waste due

to source segregation. 6215 number of the household of 14 apartment complexes have on-site composting facilities. 9.2 tonnes of waste is the recovery of these 14 apartments. By the waste recovery and land fielding process Rupees 2.8 lakh per month from the municipality on account of tipping free saving.

Environmental impact

Necessary of source segregation is not only for recycling waste management it is also very important for the environment. It is observed that 4 percent of Municipal solid waste (MSW) is paper, therefore, the segregated dry waste in the apartment is contributing to saving trees.

As per field survey data of Municipal Corporation of Gurugram 2015, 71 percent of total waste is biodegradable organic waste and other recyclable and inert waste respectively 12 and 17 (Fig. 4).

As per survey report of MCG 79 of solid waste is generated from house hold.110 MT solid waste was collected per day by the MCG in Gurugram area and rest amount collected from Haryana Urban development (HUDA) area (Naveen *et al.*, 2018).

122 number of colonies under the zone I and II. House hold collection and street swiping are managed by contractor of MCG. Zone III and zone IV total managed by MCG without any contractor. Zone wise waste generation of Gurugram are shown in the Fig. 5.

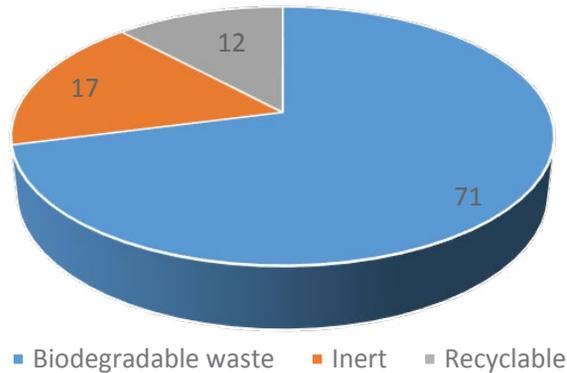


Fig. 4: Physical characterization of solid waste in Gurugram

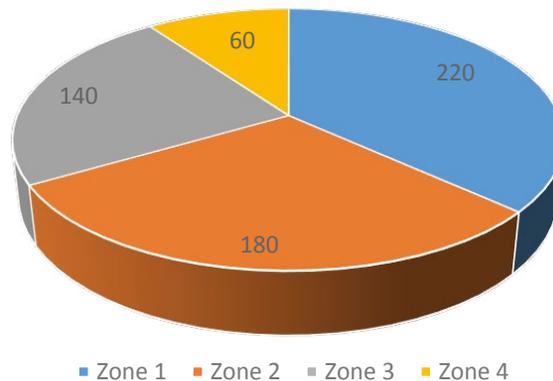


Fig. 5.:Zone wise waste generation

CONCLUSION

Waste management is a subject which should be a censorious issue for every citizen of the country. It is not just up to the municipal authority to take care of the waste generated. The solid waste management rules 2016 by the Ministry of Environmental forest and climate change clearly states that generated waste should be segregated in three separated bin biodegradables non-biodegradable and domestic hazardous waste. Due to inadequate services of waste management like segregation and collection, most of the cities in the developing world face a high level of waste-related issues, Changes in consumption patterns lifestyles economic development urbanization and other issue have responsible in an increase in the quality and complexity of the solid waste generation in our country. However, the human, technical and financial resources needed to address this issue. It is not related to just stakeholders in the

value chain. Participatory approach sharing road and responsibilities among the municipality and citizen are one of the most recommended approaches across the world. The impact of source segregation goes beyond the recovery of recyclables resulting in the saving of virgin resources. It is observed that the creation of worker livelihood opportunities from Source segregation of waste to enable a hygienic environment. It has been also observed that the simple act which does not require any investment, can significantly transform the view of waste and it is a strong driver for spreading the concept to reduce, reuse and recycle.

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CONFLICT OF INTREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. In addition, the ethical issues; including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy have been completely observed by the authors.

ABBREVIATION

NCR	National capital region
SWM	Solid waste Management
MSW	Municipal solid waste
Fig	Figure
TDP	Ton per day
MCG	Municipal Corporation of Gurugram
HUDA	Haryana Urban Development Authority
NGT	Nation Green Tribunal
kg/day	Kilogram /day
Kg/capita/day	Kilogram/capita/day
CPCB	Central Pollution Control Board

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