



IJMIRD 2015; 2(3): 590-593
www.allsubjectjournal.com
Impact factor: 3.672
Received: 08-03-2015
Accepted: 23-03-2015
E-ISSN: 2349-4182
P-ISSN: 2349-5979

Kowsar Hussain Bhat
Department of Environmental
Science, GDC Boys Pulwama,
192301 Jammu and Kashmir,
India

Fayaz Ahmad Dar
Department of Environmental
Science, GDC Boys Pulwama,
192301 Jammu and Kashmir,
India

Niyaz Ahmad Khan
Department of Environmental
Science, GDC Boys Pulwama,
192301 Jammu and Kashmir,
India

Ab. Qayoom Mir
Department of Environmental
Science, GDC for Women
Pulwama, 192301 Jammu and
Kashmir, India

Correspondence:
Niyaz Ahmad Khan
Department of Environmental
Science, GDC Boys Pulwama,
192301 Jammu and Kashmir,
India

Approaches for the Analysis of Generation Rate and Density of Municipal Solid Waste of Allahabad City

Kowsar Hussain Bhat, Fayaz Ahmad Dar, Niyaz Ahmad Khan, Ab. Qayoom Mir

Abstract

Increasing population levels, rapid economic growth and rise in community living standard accelerates the generation rate of municipal solid waste (MSW) in Indian cities and same is the case with Allahabad city. Improper management of MSW causes hazards to inhabitants. The objectives of the study are to determine the waste generation rate and density of MSW of Allahabad city. Allahabad is among the largest cities of Uttar Pradesh in terms of population and area. The geographical area of Allahabad is about 70.5 sq km (under municipal corporation). Three sampling sites were selected in Allahabad city Naini, Phaphamau, Allapur. A random sampling was carried out in all the three sampling sites and a survey work was conducted to analyze waste generation rate and density of solid waste. Samples were collected at 10 days of intervals from 03 February 2011 to 04 May 2011. The total waste generation rate in Allapur and Naini is 0.4 kg/ capita/day and in Phaphamau 0.39kg/capita/day. The density of MSW decreases with increase in temperature from February to May because of decrease in mass of MSW due to loss of moisture content. In order to solve the solid waste management problems in Allahabad, this study recommends clear goals and timeframes need to be established, duties and responsibilities of local government, NGOs and Allahabad Municipal Authority and funding needs to be allocated in order to produce an effective waste management framework in the City.

Keywords: Municipal solid waste, Sangam, Phaphamau, Allahabad city, Naini

1. Introduction

Solid waste can be defined as any solid or semi-solid substance or object resulting from human or animal activities, discarded as useless or unwanted. It is an extremely mixed mass of wastes, which may originate from household, commercial, industrial or agricultural activities. Solid waste is a broad term, which encompasses all kinds of waste such as Municipal Solid Waste (MSW), Industrial Waste (IW), Hazardous Waste (HW), Bio-Medical Waste (BMW) and Electronic waste (E-waste) depending on their source & composition.

Solid wastes are those organic and inorganic waste materials produced by various activities of the society, which have lost their value to the first user. Improper disposal of solid wastes pollutes all the vital components of the environment (i.e., air, land and water) at local and global levels. The problem is more acute in developing nations than in developed nations, as their economic growth as well as urbanization is more rapid. There has been a significant increase in MSW (municipal solid waste) generation in India in the last few decades. This is largely because of rapid population growth and economic development in the country. Due to rapid growth of urban population, as well as constraint in resources, the management of solid waste poses a difficult and complex problem for the society and its improper management gravely affects the public health and degrades environment.

The inhabitants of the Allahabad city generate more than 500 tons of MSW daily. Municipal waste arises from Residential, Commercial, institutional and Industrial sources. It is composed of paper, plastic, glass, cloth, metals, organic wastes etc. Wastes are almost always produced whenever we convert a natural resource into a product, though its nature and quantity can vary. Various studies reveal that about 90% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment. In Allahabad city MSW produced from individual households is taken to the collection point or just deposited on the adjacent roadside from where it is collected by the sweepers. This type of collection is called primary collection.

AMC has provided 49 Depots for the temporary storage of MSW which are scattered throughout the city. The MSW is collected again from the collection point for transportation to the disposal site. It is termed as secondary collection.

Study Area:

Allahabad is among the largest cities of Uttar Pradesh in terms of population and area. The geographical area of Allahabad is about 70.05 sq km (under municipal corporation). Its spatial extension falls at 25° 28' N latitude and 81°54' E longitude. The district of Allahabad is surrounded by the Pratapgarh districts in the North, district Jaunpur in the Northeast, Sant Ravidas Nagar and Mirzapur in the east, Kaushambi and Chitrakoot in the west and the state of Madhya Pradesh in the South. The city has a population of 5954391 inhabitants (AMC, 2011). Allahabad Municipal Corporation (AMC) is responsible for the management of the MSW generated in the city. The city is divided into 20 sanitary wards and the entire operation of solid waste management (SWM) system is performed under four heads, namely, cleaning, collection, transportation and disposal. In the city, the cleaning and collection operations are performed by the public health wing of AMC, while as transportation and disposal of MSW are being performed by the transportation wing of AMC.

In Allahabad city the cleaning and collection process involves collection of MSW from the street in wheelbarrows and thereafter, it is dumped into depots (49 depots). MSW is then loaded into the transportation vehicles, which transport the waste to different disposal sites. There are six open disposal sites where the MSW of the city is disposed. The disposal sites of Allahabad are Kareli, Chandpur Salori, Phaphamau, Sulemsarai, Alopibagh, and Naini.

Three sampling sites were selected in Allahabad city

1. Naini
2. Phaphamau
3. Allapur

Methodology:

It describes materials and methods used for analyzing to estimate the density of Municipal Solid Waste and to analyze the waste generation rate in Allapur, Naini and Phaphamau. Methodology presents the various steps that are adopted for collecting data with regard to generation, collection, and density analysis of municipal solid waste. It also deals with processing and analyzing of data.

Three sampling sites were selected in Allahabad city

1. Naini
2. Phaphamau
3. Allapur

A random sampling was carried out in all the three sampling sites and a survey work is also conducted to analyze waste generation rate. Samples were collected at 10 days of intervals from 03 February 2011 to 04 May 2011. The apparatus used is Single Pan, Physical balance. The Parameters studied are generation rate and Density of municipal solid waste. The Formula used for analysis of

Density (Kg/m³ = mass of solid waste / volume occupied by solid waste and for

Waste generation rate = quantity of solid waste (Kg/day)/ population

Density of Municipal solid waste:

In Naini: - As reported in the table 1.1 and figure 1.1 the maximum density of MSW in Naini was found as 120.71kg/m³ at first sample on 03 February. The density was begin to decrease with increase in temperature from March to May and volume of solid waste increases. The minimum density of MSW in Naini was found at 10th sample on 4 May which is 53.08kg/m³. The variation in density in MSW in 1st, 2nd, 3rd, and 4th sample is due to variation in composition of MSW.

In Phaphamau:- as reported in the table 1.1 and figure 1.1 the maximum density of MSW in Phaphamau was found as 148.58kg/m³ at 4th sample on 3 March due to very high contribution of miscellaneous biodegradable waste and minimum was found as 63.83kg/m³ at 9th sample on 24 April. The density decreased from 13 March to 24 April due increase in atmospheric temperature, but on 4 May at 10th sample the density again increased to 103.5kg/m³ due to rain fall on sampling day.

In Alapur:- as reported in the table 1.1 and figure 1.1 the maximum density of MSW in Alapur was found as 288.33kg/m³ at 2nd sample on 13 February and it was begin to decrease from March to May with increase in temperature the minimum density was found as 30.64kg/m³ at 10th sampling on 04 may. A slight variation of density has represented in figure due to variation of composition. Where the amount of miscellaneous waste increases in sample, density also increases.

Table 1.1: density of waste in Kg/m³

Sampling date	Naini	Phaphamau	Allapur
03-02-2011	120.71	108.77	123.81
13-02-2011	103.94	100.55	288.33
24-02-2011	112.69	112.51	134.07
03-03-2011	118.00	148.58	95.00
13-03-2011	96.61	138.42	76.72
24-03-2011	94.38	77.68	75.91
04-04-2011	76.51	74.15	74.90
14-04-2011	66.39	68.24	70.96
24-04-2011	62.45	63.83	31.13
04-05-2011	53.08	103.53	30.64

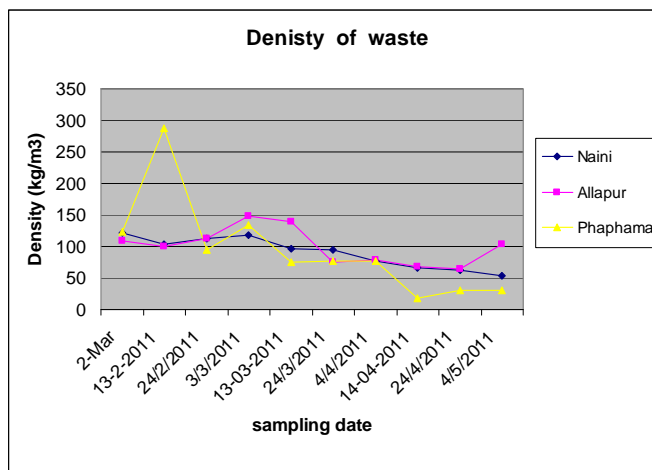


Fig 1.1: variation of density (Biodegradable and nonBiodegradable) waste at different sites

Waste generation rate:

In Naini:-

As represented in table 1.2.1 total waste generation rate in Naini was found as 0.40Kg/capita/day and as in table 1.2.2 house hold waste generation rate was found as 0.25Kg/Capita/day.

In Phaphamau:-

As represented in table 1.2.1 total waste generation rate was found as 0.39 Kg/capita/day and as in table 1.2.2 house hold waste generation rate was found as 0.29Kg/Capita/day.

In Allapur:-

As represented in table 1.2.1 total waste generation rate was found as 0.40Kg/capita/day and as in table 1.2.2 house hold waste generation rate was found as 0.30Kg/Capita/day.

Table 1.2.1: total waste generation rate

Area	Population	Total waste quantity (Kg/day)	Waste generation rate (Kg/capita/day)
Naini	81140	32670	0.40
Phaphamau	15784	6280	0.39
Allapur	91996	37040	0.40

Table 1.2.2: House hold waste generation rate

Area	Total No. of houses Surveyed	Total No. of individual in surveyed houses	Total quantity of waste(kg/day)	Waste generation rate (kg/capita/day)
Naini	30	108	27.900	0.25
Phaphamau	30	138	39.950	0.29
Allapur	30	112	33.900	0.30

Allahabad city does not have a sanitary land fill for proper disposal of MSW. There are six open disposal sites where the MSW of the city is disposed. The disposal sites of Allahabad are Kareli, Chandpur Salori, Phaphamau, Sulemsarai, Alopibagh, and Naini.

Conclusions and Recommendations:

Allahabad city the largest cities of Uttar Pradesh in terms of population and area, covers an area of 70.5 square kilometers and has a population of 5954391 inhabitants (AMC, 2011). The inhabitants of the Allahabad city generate more than 534 tons of MSW daily. Municipal waste arises from Residential, Commercial, institutional and Industrial sources. It is composed of paper, plastic, glass, cloth, metals, organic wastes etc. Based on the field studies on various aspects of waste generation and density of solid waste in Allahabad city, following conditions/findings and recommendations are drawn.

- ❖ The total waste generation rate in Allapur and Naini is 0.4 kg/ capita/day and in Phaphamau 0.39kg/capita/day while as the house hold waste generation rate is 0.3 kg/capita/day, 0.25 kg/capita/day and 0.29 kg/capita/day respectively. The physical analysis of municipal solid waste at Naina shows Paper/cardboard/cloth comprise of 28.49%, followed by food waste 23.83%, plastic and polythene 20.29% and glass/metals 2.68%. While all other wastes (miscellaneous wastes) including stones, bricks, rubber, leather, wood etc. accounted for 30.57% at Phaphamau Paper/cardboard/cloth comprise of 25.64%, followed by food waste 20.25%, plastic and polythene 15.7% and glass/metals 2.26%, while all other wastes accounted for 25.23% and at Allapur Paper/cardboard/ cloth comprise of 38.98%, followed by food waste 20.32%, plastic and polythene 16.76% and glass/metals 1.72%. While miscellaneous wastes 22.19%.
- ❖ Solid waste had been taken from entire study area not from a particular dumping site. Six dumping sites are present in Allahabad. Characteristics of solid waste from dumping site should also be studied. For analysis of total waste generation rate, supporting data had been taken from AMC. The quantity of total waste can be estimated by load

count analysis on dump site and population of study area can be determined by survey work.

- ❖ Density of MSW decreases with increase in temperature from February to May because of decrease in mass of MSW due to loss of moisture content. But the graph shows deviation from this concept at some point due to presence of miscellaneous waste. It can be concluded that same quantity of waste occupy much space in summer than in winter.
- ❖ MSW shall be collected, stored, segregated, transported and disposed separately without mixing with biomedical, slaughter and hazards wastes. Separate land fill of sites should be made for disposal of hazardous wastes. AMC shall also launch an awareness campaign and lay stress on source reduction of the waste.
- ❖ The workers should be given awareness about the ill effects of wastes on health. The dumping site should be fenced and should be away from residential area and sanitary land filling of waste should be done. The Govt. should also come forward and should provide every facility regarding the waste management.

References:

1. Ashokan Pappu, Saxena Mohini andAsolekar Shyam R. (2007): "Solid wastes generation in India & their recycling potential in building materials" *Building and Environment* 42, 2311-2320.
2. Berkun, M., Aras, E. and Nemlioglu, S., (2005). Disposal of solid waste in Istanbul and along the Black Sea coast of Turkey *Waste Management*, (25), PP: 847–855.
3. Bhide, A.D. and Sundaesan B.B. (2001), "Solid waste management – Collection, Processing and Disposal", Mudrashilpa Offset Printers, Nagpur.
4. Bisoyi L.K. (2006): "Solid Waste Management in Rourkha Municipality" Orrisa Review.
5. CPCB (1999), "Status of solid waste generation, collection, treatment and disposal in metro cities "Central Pollution Control Board", Delhi.
6. Dhameja, S.K. (2002), Environmental Engineering and Management, S.K Kataria and sons, New Delhi, PP: 177-180.

7. Dhere Amar M., Pawar Chandrashekhar, Pardeshi K. Pratap Singh and Patil Dhanraj (2008): "Municipal solid waste disposal in Pune city- An analysis of air and ground water pollution" *Current Science*, Vol. 95, No.6.
8. Esakku S., Swaminathan A., Karhitikeya O. Pratibha, Kurian J. and Palanivelu K. (2007): "Municipal Solid Waste in Chennai City, India." Proceedings Sardinia, Eleventh International Waste Management and Symposium, Cagliari, Italy.
9. Gawaikar V. and Deshpande V.P. (2006): "Source Specific Quantification and characterization of Municipal Solid Waste" *IE (I) Journal-EN*, Vol. 86.
10. Hongtao, W. and Yongfeng, Nie (2001), Municipal Solid Waste Characteristics and Management in China *J. Air & Waste Manage. Assoc.*, (51), PP: 250-263.
11. Kansal, A. (2002), Solid Waste Management Strategies for India, *JJEP*, 22(4), PP: 444-448.
12. Kumar Rakesh (2008): "Urban Municipal Waste Management Newsletter" ENVIS NSWAI Issue 11.
13. Kumar, S. and Gaikwad, S. A. (2004), Municipal solid waste management in Indian urban centres: An approach for betterment. In *Urban Development Debates in the New Millennium* (Gupta, K. R. Ed.), Atlantic Publishers & Distributors, New Delhi, PP: 101-111.
14. Negi Anjula, Rajan Ankur, Tripathi Artiman, Sharma Shilpi and Chandra Vikas (2008): "Integrated approach to Municipal Solid Waste Management" *IL&FS IDC interface*, issue 2.
15. Mamdouh, A., El-Messery, Gaber, A.Z. Ismail and Anwaar, K. Arafa (2009), 'Evaluation of Municipal Solid Waste Management in Egyptian Rural Areas' *Journal Egypt Public Health Assoc* (84) 1 & 2.
16. Mufeed Sharholy, Kafeel Ahmad, Gauhar Mahmood, and R.C. Trivedi (2008), Municipal solid waste management in Indian cities – A review *Waste Management*, (28) 2, PP: 459-467.
17. Pandey Sandeep K, Tyagi P. and Gupta Anil K (2007): "Municipal Solid Waste Management in Ghazipur city-A case study" *ARPJN Journal of Agriculture and Biological Science* Vol.2,No.6.
18. Patil, D. A., Pawar, C. B. and Dhere, A. M. (2006), *Environment Education*, Phadke Publication, Kolhapur.
19. Sahu Amiya (2007): "Present scenario of Municipal Solid Waste Dumping Ground in India" Proceeding of the International Conference on Sustainable Solid Waste Management, Chennai, India, pp 327-333.
20. Sharholy Mufeed, Ahmad Kafeel, Vaishya R.C. and Gupta R.D. (2007): "Municipal solid waste characteristics and management in Allahabad, India" *Science Direct, Waste Management* 27, 490-496.
21. Shivayogimath C.B., Lokeshappa and Doddamani S.S. (2007): "Municipal Solid Waste Management in Raichur City" Proceedings of the International Conference on Sustainable Solid Waste Management, Chennai, India, pp 50-53.
22. Sudhir, V., Muraleedharan, V. R., Srinivasan, G. (1996), Integrated solid waste management in Urban India: A critical operational research framework *Socio-Economic Planning Sciences*, (30) 3, PP: 163-181.
23. Vijay Ritesh, Bantam Ajay, Kalamdhad Ajay, Gupta Apurba and Devotta Sukumar (2008): "GIS-based location analysis of collection bins in municipal solid waste management system" *J. Environ. Eng. Sci.* 7:39-43.