Household Solid Waste Generation and Composition in Pokhara

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Abstract

Population growth and distribution have significant roles to waste generation. Not only the number of people, but also the lifestyle, consumption patterns, and people inhabit and use directly affect the waste generation. More people demand more resources and generate more waste. One of the challenges of a growing population is that the mere presence of so many people sharing a limited number of resources strains the environment. Per capita waste generation has risen day by day. In this context, this study aimed to identify the current status of solid waste generation and composition in the households of Pokhara. For this purpose, 388 households were chosen from all the 33 wards of Pokhara Metropolitan City for collecting the information regarding waste generation and composition. Descriptive statistics was carried out for this study.

The household waste generation rates varied depending on caste and ethnicity, the analysis of waste generation shows that the highest per capita generation making up 0.4 kg produced by Dalit, 0.33 kg produced by Janajati and 0.31 kg produced by Brahmin/Chhetri. The analysis of waste composition showed that organic matter accounted for the highest fraction, making up 64.47% of organic waste, 14.57% of reusable/recycle waste and 20.69 of landfill. The results can be used as part of the waste management planning purpose for the concerned stakeholders.

Keywords: **C***omposition, landfill, organic, population growth, reusable, solid waste generation*

Introduction

Solid-waste management is a major challenge in urban areas throughout the world. Without an effective and efficient solid-waste management program, the waste generated from various human activities, both industrial and domestic, can result in health hazards and have a negative impact on the environment. Understanding the waste generated, the availability of resources, and the environmental conditions of a particular society are important to developing an appropriate waste-management

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ISSN: 2392-4519 (Print)

system. Solid waste problem is a significant concern for national and local authorities in many cities of developing countries (Afroz et al. 2011).

The problem of waste generation and management in most cities especially in developing has become one of the intractable environmental problems facing urban centers. This situation could be attributed to low level of technology that is not sophisticated enough to handle the high rate of waste generation (Baum and Parker, 1973). Human population and rural-urban migration has increase through urbanization, natural increase rate and industrialization, yet the service rendered is not sizeable enough to control the high level of solid waste generated in urban areas and these has contributed to a large extent, the nuisance and the damaging effect of the urban environment (Sule, 2004).

Municipal waste is everything collected and managed further by municipalities. Only part of it is comes from households, the rest is generated by small businesses, commercial and other municipal activities. Therefore, it is produced from both consumption and production processes. Like all wastes, municipal waste is on the rise and it is growing faster than the population, a natural result of our increasing consumption rate and the shortening of product life-spans (SWM Act, 2011).

According to the waste generation survey 2012, the average generates about 230 grams of waste per person per day. Although the per capita waste is low compared to western countries, the volume is huge. The generation of solid waste in Pokhara has been estimated to grow with 1.5 percent annually. The expected generation of waste in 2025 will therefore be around 300 grams per capita per day. The magnitude of the problem is likely to grow even larger unless immediate steps are taken. While the quantity of solid waste generated by society is increasing, the composition of waste is becoming more and more diversified, with increasing use of packaging materials made of both paper and plastic. In 2012, the composition of solid waste generated by the Nepalese people was characterized by more than 65 percent biodegradable waste and less than 35 percent non-biodegradable waste. At present, this ratio is going to be changed i.e. the quantity of biodegradable waste is decreasing and non-biodegradable waste is increasing (PSMC, 2013). The survey shows that the per capita waste generation has risen from 0.23kg per capita per day to 0.34kg per capita per day between 2012(279354 population) and 2017(502960 population) in Pokhara Metropolitan City.

Several research studies have been conducted to investigate the generation and composition of household solid waste in various regions over the world (Pokhrel and Viraraghavan, 2005; Yousuf and Rahman, 2007; Burnley, 2007; Al-Khatib et al. 2010;

Erasua et al. 2018; Vetter-Gindele, 2019; and Lebersorger and Beigl, 2011).

According to the literature, the results of per capita daily waste generation studies for various cities in developing countries were 0.12 kg/per/day in Oyo city, Nigeria (Afon and Okewole, 2007), 0.21 kg/per/day for Cape Haitian city in the Republic of Haiti (Philippe and Culot, 2009), 0.25 kg/per/day for Chittagong in Bangladesh (Sujauddin et al. 2008), 0.28 kg/per/day for Mekong Delta city in Vietnam (Thanh et al. 2010), 0.49 kg/per/day for Kathmandu in Nepal (Dangi et al. 2011), 0.53 kg/per/day for urban areas in Bhutan (Phuntsho et al. 2010). Various values of per capita daily waste generation can be attributed to levels of urbanization, lifestyles, and many other factors specific to particular areas.

Before taking decisions regarding the improvement of the current waste practices or proposing new waste management systems, it is better to have an overall perception of various aspects related to waste issues. The first and fundamental point is to know the amount and characteristics of waste generated in order to determine the most successful and efficient waste management plans and policies. In this context, this study aimed to identify the current status of solid waste generation and composition in the households of Pokhara.

Data and Methods

All the wards of Pokhara Metropolitan City were chosen as the study area because the generation of municipal solid waste is being observed to be increased day by day and with together migration and floating population is very high and rapid. Out of 105825 households in 33 wards of Pokhara Metropolitan City, 388 households from these wards were selected purposively for this study (at 4.9% margin of error, 5% level of significance and excluding 11 institutions).

The following procedure was carried out for this research:

- Total of 388 Sample houses for survey were selected on the basis of pre-determined criteria.
- Sample house owners were trained and oriented about the survey and their role.
- Three different colored waste collecting buckets for three different types of wastes (composting-green, reusing/recycle-blue and landfill-red) were distributed to the entire sample house. Separate poly bags were distributed to the single house comprising of different family.
- Surveyors observed the collected wastes in three different buckets and weighed separately, three days regularly.

- Weight of separate wastes was recorded in predefined data sheet.
- Total weight of three different types of waste was also recorded.
- Analysis of collected data was conducted.

Team of trained surveyors and the researcher visited the sample house for survey and filled the data in field. For the case of composition of waste, team of trained surveyors including selected monitors visited the sample house for survey and filled up the measurement data format in pre -defined data sheet with three broad types of wastes (Composting, Recycle/Reuse and Landfill) in field. Again for collection system, weight of collected waste was taken by the waste collecting vehicles of municipal as well as private sector. Whole process was monitored by monitoring individually and Mayor/Chief Executive officer of the Municipality.

Results and Discussion

Out of the solid waste generation from 388 households, we have the following findings:

Household waste generation

The per capita waste generation of each household was calculated by dividing the total waste produced by the number of people living in that household on that day. Varying from a minimum of 7 households to maximum 23 households gave on average household waste generation as well per capita waste generation with respect to family size each household. The per capita household waste generation rate was found to vary from minimum 0.28 kg in ward no.20 and to a maximum of 0.42 kg in ward no. 6. The average per capita waste generation in the study area was 0.34 kg which is slightly greater than the value obtained from the study of Vetter-Gindele (2019) conducted in Vietnam. This value is less than the value obtained from the study of Noufal et al. (2020) which shows that an average of 0.68 kg per capita solid waste generated was calculated for the entire study area in Homs city.

Table 1: Per capita waste generation in different wards of Pokhara Metropolitan City

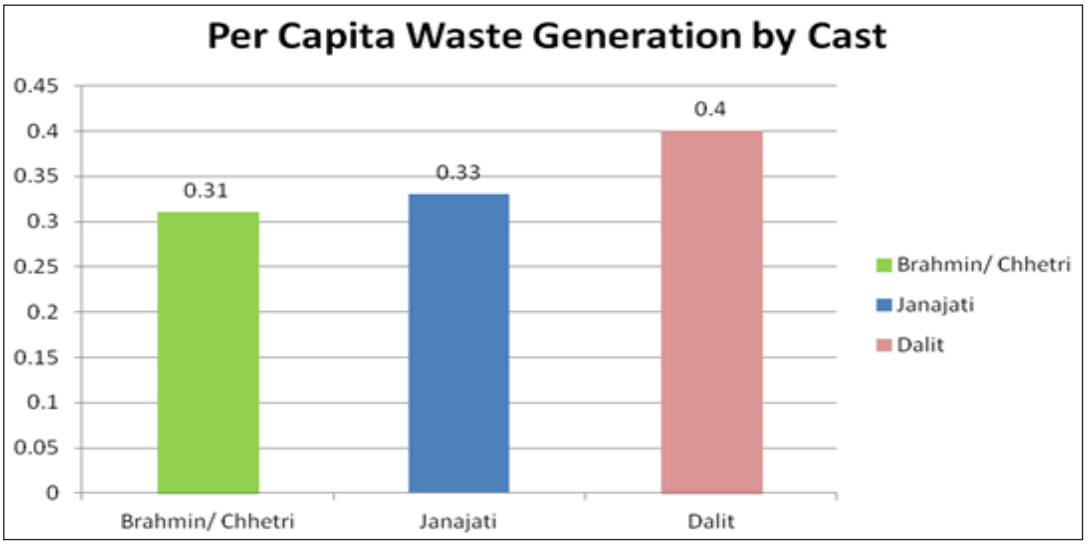
Ward No.	No. of Households	Per capita waste generation	Wards	No. of Households	Per capita waste generation
1	15	0.36	18	10	0.30
2	10	0.37	19	8	0.36

3	11	0.35	20	10	0.28
4	9	0.39	21	11	0.32
5	10	0.35	22	10	0.36
6	10	0.42	23	23	0.31
7	12	0.36	24	14	0.29
8	23	0.41	25	20	0.34
9	13	0.4	26	11	0.34
10	13	0.31	27	20	0.31
11	10	0.36	28	11	0.34
12	15	0.33	29	8	0.36
13	10	0.30	30	7	0.29
14	10	0.35	31	10	0.35
15	9	0.33	32	7	0.31
16	9	0.30	33	8	0.33
17	11	0.34	**Total**		11.25
Total				388(HHs)	
Average per capita waste generation=11.25/33 =0.34 kg					

Source: Field Survey, 2017

Per capita waste generation by caste

The history of human life is associated with the history of waste production, daily human behavior, and other reasons, which are known as history. Studies have shown differentiation in the production of waste due to their daily life of people. Household solid waste is highly heterogeneous and is widely dependent on the socioeconomic status of the households (Miezah et al. 2015; Sankoh et al. 2012).



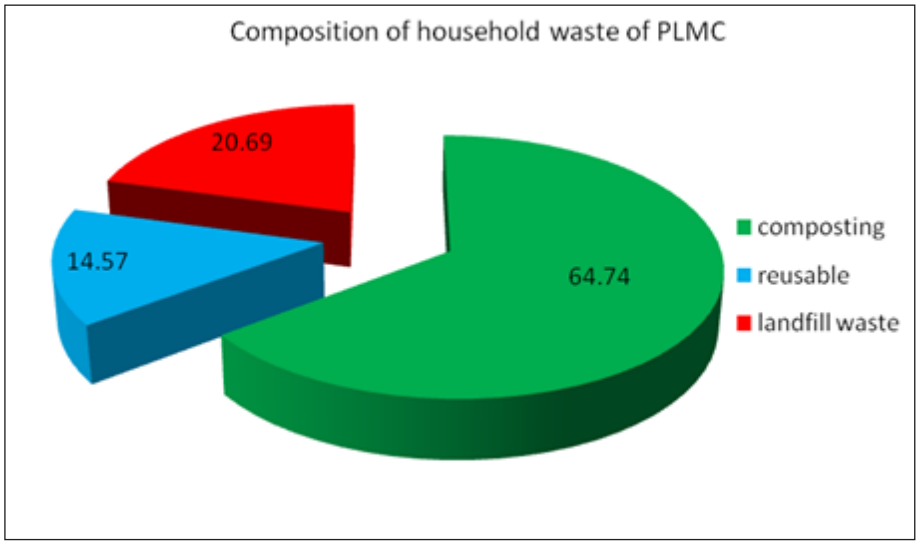
Source: Field Survey, 2017

Figure 1: Per Capita Waste Generation by Caste

Figure 1 revels the caste wise per capita waste generation in Pokhara Metropolitan City. This study shows that the highest per capita generation of waste is 0.4 kg which is generated by Dalit followed by Janajati (0.33 kg) and Brahmin/Chhetri (0.31kg). The reason of caste wise difference in waste generation may be due to the difference in their food habit and other factors.

Waste Composition of Pokhara Metropolitan City

It was observed that composting was the major waste generated by people with the value of 64.74 percent. This result is almost similar to the study of Al-Khatib et al. (2010) and Vetter-Gindele (2019). But the study of Noufal et al. (2020) shows 69.1 percent. Further it is followed by reusable/recyclable with the value of 14.57 percent which is similar to the study of Al-Khatib et al. (2010). For land filled waste, it is generated by the people with the value of 20.69 percent. This result shows that majority of the waste generated in the area are biodegradable waste compared to non-biodegradable waste.



Source: Field Survey, 2017

Figure 2: Composition of household waste of Pokhara Metropolitan City

Conclusion

The household waste generation rates varied depending on caste and ethnicity, the analysis of waste generation shows that the highest per capita generation making up 0.4 kg produce by Dalit, 0.33 kg produce by Janajati and 0.31 kg produce by Brahmin/ Chhetri. The analysis of waste composition showed that organic matter accounted for the highest fraction, making up 64.47% of organic waste, 14.57% of reusable/recycle waste and 20.69 of landfill.

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