

Research Article

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A Study on Solid Waste Composition in Kanchanpur District, Nepal

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<https://orcid.org/0000-0002-1578-9775>**Abstract**

Background: Solid waste is a by-product of human activities. It has become an alarming challenge during recent decades in many cities of Nepal. Quantity and characteristics of solid waste have changed as a result of the modification in people's lifestyle. The purpose of this study is to characterize the composition of solid waste in Bhimdatta Municipality of Kanchanpur district, Nepal.

Methods: In between July to September 2015, a total of 45 households, 15 commercial places, 15 institutions were selected randomly. Solid waste samples were collected in recommended plastic bags. The collected wastes were categorized and weighted. Direct observation of municipal solid waste collection and its disposal practices were also performed. Qualitative information was collected from focus group discussion.

Results: A total of 446.7 kg of solid waste was collected and the highest proportion (66.4%) was organic in composition. In the daily production of overall solid wastes, households were ranked the first (23.3%) and followed to the hotels and lodges (20.4%). The commercial centers produced the highest amount of all types of wastes. The crude waste dumping practice in the open and vacant areas was found a threat to human health, causing ecological imbalances and also bringing land, water, and air pollution.

Conclusions: The rapidly growing population in the urban region of the study area has become an urgent issue in the production of several types of solid wastes. The organic waste was generated in the highest amount and maximum proportions of solid waste were produced from commercial centers.

Keywords: Municipal solid waste, composition, Bhimdatta Municipality, Kanchanpur district, Nepal.

Tweetable Abstract: Information on the composition of municipal solid waste can contribute to SWM and maintain the sustainable environment of a city.

Introduction

Solid waste is a by-product of human activities which tend to increase from the ever growing population, rapid urbanization, improved living standard and changing consumption pattern. In many cities of developing countries, the increasing trend of solid waste management (SWM) has become an alarming challenge for land degradation, biodiversity loss, air pollution, sanitation and transmission of infectious diseases during recent decades globally [1-3]. Nowadays, the production quantity of solid waste has increased. Rapid population growth, activities for economic development and lack of training in modern SWM practices complicate the efforts to improve the solid waste service [4].

Municipal solid waste is produced from the human daily activities. It causes the environmental pollution and endangers the human health, wealth and other living and non-living components of the ecosystem [3,5,6]. In municipalities, SWM involves a huge expenditure and receives scant attention [7]. SWM depends on technology and influenced from legal, socio-cultural, economic and environmental factors and available resources as well. In many developing nations, SWM practice is a subject of concern for public health and environmental protection agencies. The urban residents of developing countries produce less per-capita solid waste in com-

parison to high income countries, but the capacity of the developing countries for collection, processing, disposal or recycling of solid waste in a cost effective way is limited [2].

Central Bureau Statistics survey found that in urban areas of Nepal, majority residents consider SWM as the serious environmental problem where wastes in piles are commonly found in public and open areas [8]. The works of municipalities are often limited to sweep the streets and dump the waste in the nearest river or vacant land. Modern waste management techniques have not yet been introduced in most of the municipalities and resources for waste management are also limited [9].

SWM is also a serious problem in Bhimdatta Municipality of Kanchanpur district. The door to door waste collecting system is limited only in the main market area of the municipality. The waste segregation practice at the source has not yet been strictly adapted by the majority of people. A permanent sanitary landfill site is demanded. Collected wastes are traditionally disposed and dumped haphazardly in the open areas. This study aims to find out the composition of solid waste in selected urban wards of Bhimdatta Municipality.

Methodology

Study areas

Kanchanpur district is located in the plain of Terai of province no 7. It covers an area of 1,610 square kilometers and had a population of 451,248 in 2011 [10]. It is located in the far-west region of Nepal and bordered with Kailali district in east, Dadeldhura district in the north and with India in south and west. The Bhimdatta Municipality is divided into 19 wards.

The climate of the study area ranges from tropical to sub-tropical types with four different seasons: winter, spring, summer, and monsoon. People from the different districts of province no. 7 and other provinces have been making settlements in the fertile land of Kanchanpur district and come to seek future to make their life better. The rate of daily waste generation is increasing with the increase from a number of inhabitants. Therefore, necessary steps for the management of solid waste have to be taken in advance to solve this issue. We purposively selected the three urban municipal wards (ward no. 4, 6 and 8) in this study.

Data collection and analysis

In between July to September 2015, 45 households, 15 commercial places (six shops, six hotels and lodges, and three restaurants), 15 institutions (nine non-government and government offices and five schools and colleges) were selected randomly. The heads from each household/organization were informed on the purpose of the study. Waste samples were collected four times within one month. The household head was requested for keeping the daily collected solid wastes in recommended separate plastic bags and marked with a date. The bags were collected once a week and weighted for the record. The collected wastes were categorized separately. The qualitative information on the solid waste composition and disposal practices were obtained from the focus group discussion (FGD). One FGD in each ward was conducted with the residents of the study area, teachers, politicians, and professionals from government and non-government organizations and participants from commercial centers. The practices of solid waste disposal in municipality were also examined (Figure 1). Information such as municipal solid waste collection practices, available services, disposal facility and field staffs for solid waste collection were also collected from the Bhimdatta Municipality records. Descriptive analysis was performed in Microsoft Excel. Sum and average were used to calculate the total volume and daily amount of waste generated during study period, respectively.

A written permission document for this study was taken from District Administration Office Kanchanpur. Similarly, ward-wise information was collected from the municipal office of Bhimdatta Municipality.



Figure 1. Solid waste management scenario at Bhimdatta Municipality. A: Solid waste thrown haphazardly in street; B: Author collecting (left) and weighing the solid waste (right); C: Municipal staff collecting the waste for disposal, and D: Dustbin in street side and public information for solid waste disposal.

Results

In this study, different combinations of solid wastes were found in the study area. A total of 466.7 kg/day solid wastes was produced and organic waste was the most abundant (66.4%). The daily composition of different waste types produced in the study area is given in table 1.

Table 1 Solid waste composition of Bhimdatta Municipality.

Waste type	Weight (kg/day)	Percentage
Organic	309.8	66.4
Plastics	25.8	5.5
Paper	34.5	7.4
Metal	20.3	4.3
Glass	19.8	4.2
Rubber and leather	14.0	3.0
Textile	18.8	4.0
Miscellaneous	24.0	5.1
Total	466.7	100.0

The collected waste materials were separated and categorized according to their types (Table 2).

Table 2 Description of waste categorization in study area.

Waste type	Description
Organic	Vegetables, fruits, food, leaves
Paper	Newspapers, copy, book, magazine, cardboard
Plastics	PET, PVC, HDPE, LDPE, PS & other plastic toys
Metal	Steel, aluminum, copper, brass & nickel
Glass	Colored glass, white glass, mirror
Rubber and leather	Footwear, rexine etc.
Textile	Wool, silk, rope, cloth etc.
Miscellaneous	Sanitary waste, soiled cloth, construction waste, light

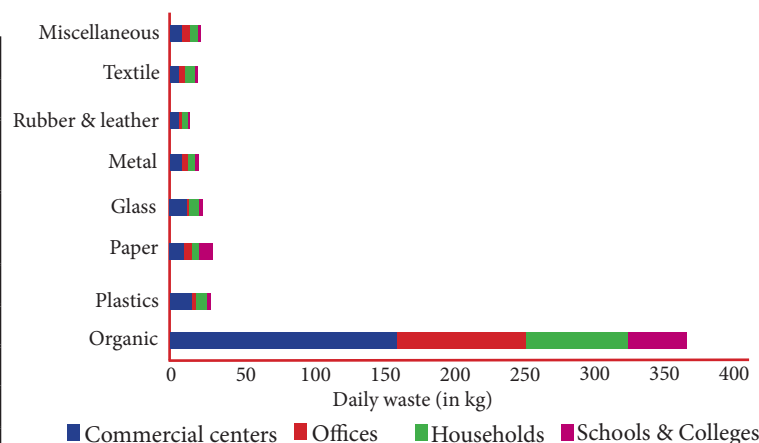


Figure 3. Types of waste produced from different sites in study area (kg/day)

The highest proportion of waste was produced from the households (23.3%) followed to hotel and lodge (20.4%). The amount of solid waste released from different places is given in figure 2.

According to FGD participants of the study area, Majority of the households in rural areas manage the waste in a pit near the house. The organic kitchen wastes are used as food for animals. The collected wastes from town have been disposing near the eco-park (SALGHADI) area. The open-waste dumping practice has degraded the beauty of the town and it may also harmful for public health perspective. A strong enforcement of municipal act is necessary for SWM mostly in the town area of Bhimdatta Municipality.

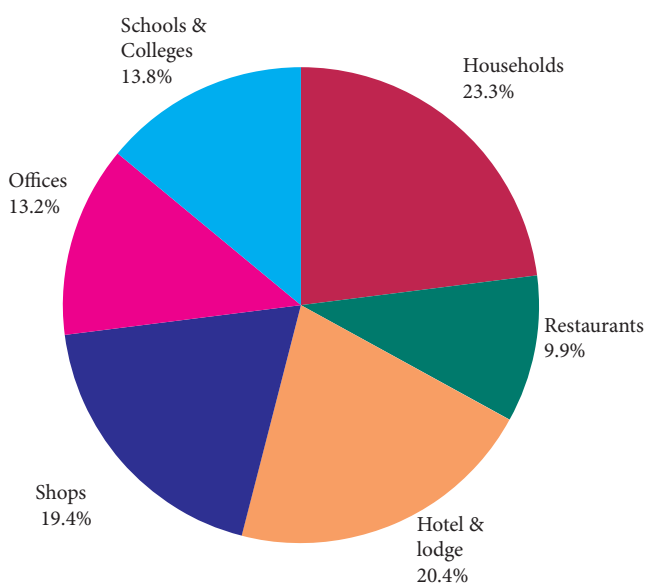


Figure 2. Daily amount of solid waste released from different centers (in kg)

Commercial centers (restaurants, shop and hotel and lodge) produced the highest amount of solid wastes. Organic waste produced in offices (government and non-government organizations) was found higher in comparison to the amount of solid waste released from the household. A detail waste types produced from different sites is given in figure 3.

Discussion

As long as humans have been living in settled communities, solid waste generation has been an unavoidable and critical issue both in developed and developing nations. United Nations conference in Rio de Janeiro has also declared that SWM is a global agenda and great emphasis should be given on reducing wastes generation maximizing environmentally sound waste reuse and recycling at the first step in waste management [11].

Papers and plastics are major inorganic components. They degrade the beauty of municipality, particularly to the public places, streets and eco-park areas. Both of them can be recycled and treatment of waste can clean the environment. Plastics are non-degradable and dumping them uselessly in landfill site can cause the land pollution as they are degraded in hundreds of years.

We also collected the information on the municipality on a number of staffs available for SWM. A total of 29 staffs (Sweepers=25, Supervisor=2, and Drivers=2) were involved in municipal SWM. The wastes were thrown haphazardly in the streets.

Metals and rubbers can be recycled and reused comparatively in much easier way than others. In practice, it is difficult to do proper management. Among the several factors, national and municipal economy, infrastructure, municipality town-planning and literacy of inhabitants particularly play important role in the proper management of solid wastes. It is hard to do systematic waste management and the problem is being alarmed in several countries [2,3,6]. In addition, making clean and green environment is one of the responsibilities of a human being.

In the study area, the majority of people belong to local residents. Traditionally, they stay most of the time at home and cook food in the joint family kitchen. The goods for basic needs and kitchen use are brought from local market. This might the cause of the highest

proportion of waste collected from households. Similarly, the maximum amounts of wastes were collected from commercial centers. The Mahendranagar city of Bhimdatta Municipality is one of the main entry and exit site of terai Nepal for labour workers migration in between Nepal and India. The commercial centers are used for transit stay and foods are supplied to them. The inadequate food quality may refuse them to eat all and this might be the cause of maximum organic waste production in commercial centers. Household organic waste is mostly used as fodder to the animals but in the commercial centers, the organic waste is not managed in such a way and thrown mostly in street and this could become an issue to municipal management. In rural areas of Bhimdatta Municipality, people prefer kitchen waste as food for animals. This practice seems very useful in waste management among the farmers.

The open dumping practices of solid waste without concern of environmental degradation have an impact on public health. The solid waste dumped in haphazardly in the open places can create the problems in the public health, distort the aesthetic beauty of surroundings and causes the loss of sanitary and hygiene environment [5,12]. In the municipalities of Nepal, domestic wastes by most of the houses are disposed of either in street or in public waste containers and municipal sweepers cleaned the streets and collect the waste, usually by handcarts [12]. Not all wastes were collected from all parts of the study area by the municipality. It was found during observation that plenty of solid wastes were deposited in the street, street corners, junction, and sewage drains. The environmental pollution caused by solid waste is rapidly increasing the problem of disposal of ever-increasing quantities of solid substances. Lack of landfill site in the municipality is also a serious concern in the waste management.

SWM has created a new challenge in the municipalities of Nepal. The volumes of solid waste generated in the growing cities are increasing rapidly. With the given size of the urban economy, historically waste management was not considered a problem in most urban areas. Yet with the rise in population, change in consumption pattern and rising awareness of people, solid waste management has become one of the major challenges in Nepal [13,14].

This study has limitations. This study cannot include the hospital and hazardous wastes. This study is limited only in urban and adjacent residential areas of Kanchanpur district.

Conclusion

During the field survey, organic waste was found in the highest proportions. Maximum proportion of solid waste was produced from commercial centers. The disposal practice of waste in street and eco-park areas may harm public health as well as municipal beauty. Therefore, the municipality should give utmost priority to the construction of sanitary landfill site.

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Competing interests

The authors declare that they have no competing interests.

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