

Characterization and Quantification of Municipal Solid Waste in Jeetpur Simara Sub-Metropolitan City, Nepal

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Abstract: Waste management, being one of the most important aspects of urban development, is gaining importance among developing nation like Nepal where rapid population growth, unmanaged urbanization, lack of public awareness and poor management by municipalities have intensified environmental problems in towns in Nepal. In Nepal only six municipalities i.e. Kathmandu, Lalitpur, Pokhara, Dhankuta, Tansen and Ghorahi practice sanitary landfill for waste management and other municipality practices open dumping which has become major cause of environmental and human health hazards (ADB, 2013).

Jeetpur Simara Sub-Metropolitan City (JSSMC) is a recently formed sub-metropolitan city. This city has not performed any study on solid waste management till date and lacks data on quantity and composition of municipal solid waste generation that facilitates effective planning of municipal solid waste management. The household survey revealed an average per capita household waste generation rate of 120 g/capita/day. The total Municipal Solid Waste (MSW) generation is estimated about 15 tons/day and 5475 tons/year. The analysis of household waste composition indicated that the highest waste category was organic waste with 80% followed by plastics with 10%, paper and paper products with 6% and inert with 4%. The composition analysis of institutional wastes revealed 41% paper and paper products, 33% plastics, 13% organic wastes and 13% inert. The study found that commercial waste comprised 59% paper and paper products, 21% plastics, 17% organic and 3% inert. In aggregate, MSW is composed of 56% organic waste, 21% paper and paper products, 19% plastics, and 3% inert.

Keywords: Jeetpur Simara, solid wastemanagement, composition of solid waste, municipal solid waste, Nepal

Introduction

In Asia, municipalities bear the responsibility to collect and treat all kind of waste generated (UNEP/GRID-Arendal, 2006). Currently, developing countries are facing unmanaged trend in urbanisation and industrialisation which has become the main cause of increased generations of solid wastes (AIT, 2004). In Nepal, urbanization is increasing at an alarming rate. This unmanaged urbanization is putting an immense pressure on municipal services to manage the constantly increasing amounts of waste. At present, most of the wastes generated in municipalities are not being properly managed which is creating serious health and environmental hazards (ENPHO & Water Aid Nepal 2008). Due to increased amount of waste generation, environmental sanitation, including solid waste management has also become a critical issue (Devkota, Watanabe & Dangol, 2004).

Jeetpur Simara Sub-Metropolitan City is a recently established city in 2073 BS in Bara District of Narayani Zone in central Nepal by merging 5 new VDC's (Inarwa, Amlekhgunj, Manaharwa, Haraiya and Rampur Tokani) to Gadhimai municipality which was established on 18 May 2014 by merging Pipara Simara, Phattepur, Dumbarwana Jitpur Bhawanipur, Chhata Pipra VDC's. It comprises 24 Wards and a total area of 909.6 Km². The present population of this city is 114785 with a population growth rate of 2.25 per annum. It is surrounded by Nijgadh municipality, Kolvi municipality in the east, Parsa district in the west, Makawanpur District in the north and Kalaiya sub-metropolitan city in the south. It covers major portion of Pathlaiya-Birgunj

industrial corridor. Due to the high immigration rate, the population of this city has increased tremendously which in return has increased the waste generation rate of this city. Because of lack of data on waste generation and composition, this city has not been able to formulate effective plans to properly manage collection, transportation and disposal of MSW. Only the commercial waste generated in Jeetpur market area is being collected but the collected wastes are also not properly disposed. They are collected and simply thrown at the bank of the river. Some of the wastes which can be reused or recycled are collected by waste pickers and sold to the scrap dealers. This haphazard throwing of the waste at the bank of river has caused water pollution, bad odour and nuisance, loss in aesthetic value and serious environmental and health hazards. So, characterization and quantification of solid waste is necessary for formulation of proper plans and policies for sustainable solid waste management in this city.

Aims and Objectives

The objectives of this study was to conduct baseline data collection to generate comprehensive data on composition and quantity of Municipal Solid Waste that is being generated in JSSMC and to determine the per capita waste generation in this city which assists in developing effective plans for sustainable solid waste management.

Study Area

The study area is Jeetpur Simara Sub-Metropolitan City of Bara District in Nepal.

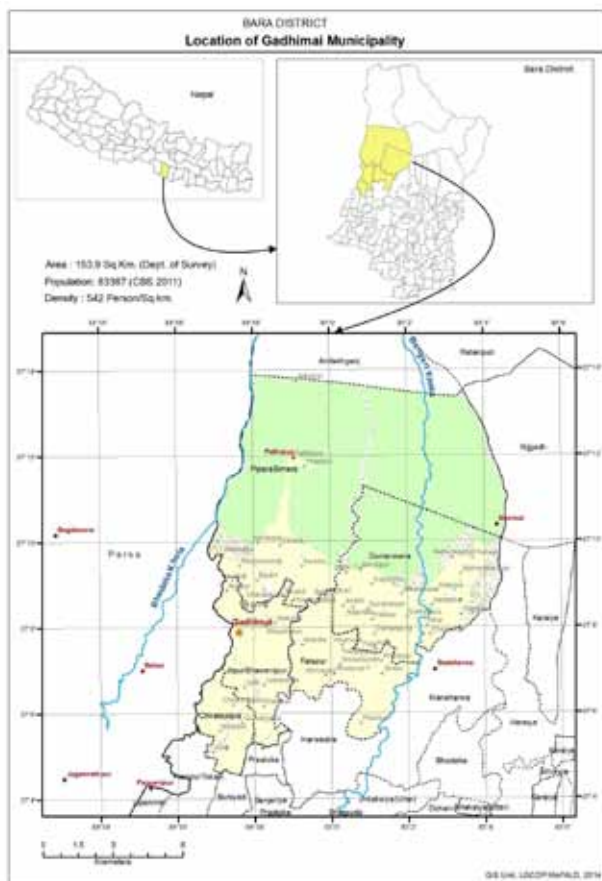


Figure 1: Location map of Jeetpur Simara sub-metropolitan city (New map is not available so map of then Gadhimai municipality is used) (Source: Google map)

Method and Methodology

Eight wards were selected for survey on the basis of urban, remote and village to represent the whole sub-metropolitan city. Firstly, random structured questionnaire survey was carried out in these wards to find out the quantity of waste generated from individual household and to know the composition of the waste generated at household level, per capita waste generation and to understand family size, ethnicity, and economic diversity (Miezah, Obiri-Danso et al 2015). There were altogether 25 questions which include both closed and open ended type questions. For the ease of receiving quick response from the respondents, more than 80% of the questionnaire to be of close-ended structured questions (Butwal Municipality 2009). Households were selected in each selected wards in terms of family size, ethnicity, and economic diversity and geographical spatial to obtain comprehensive data (SWMRMC 2004). Similarly, commercial and institutional houses were selected on the basis of types to make sampling representative. About 15-20 households including 10-15 commercial houses and 2-6 institutional houses were selected in each ward for sampling process. The numbers of sample houses were selected on the basis of density of sample houses (10% of total (Ojeda-Benitez, de Vega & Rami, 2003)) in a selected area of a ward.

Sample was collected directly from the house

(source) where it was generated. This is an established method used in characterizing solid waste (O'leary, Tchobanoglous & Kreith, 2002). Sample collection was done for 9 days on regular basis. Samples were weighted and segregated on site regularly to find the amount and composition of waste in ward level and required calculations were done to find out the composition of household, commercial and institutional wastes, overall composition and per capita waste generation. Study of the waste composition was done using waste reduction method. In this method, the sampled waste was divided into four nearly equal quarters, from which, one diagonal is taken for study and remaining diagonal is removed (Adhikari, Khanal & Manandhar, 2013). The household heads were interviewed possible number of times. In case of the absence of the household heads, knowledgeable family members of the sampled households were interviewed to ensure reliability of information. The questionnaire survey was done for 60 respondents at household level. Similarly, questionnaires survey for commercial and institutional houses was also conducted. Total 15 commercial and 7 institutional houses were interviewed.

Results and Discussion

The per capita waste generation rate of Jeetpur Simara Sub-Metropolitan City is found 120 g/day. The quantity of waste generation is calculated to be 15 tons/day which includes 13.8 tons/day wastes from household, 0.9 tons/day from commercial and 0.3 tons/day from institutional sector. The overall composition of MSW as well as composition of household, commercial and institutional waste in JSSMC is shown below in pie chart.

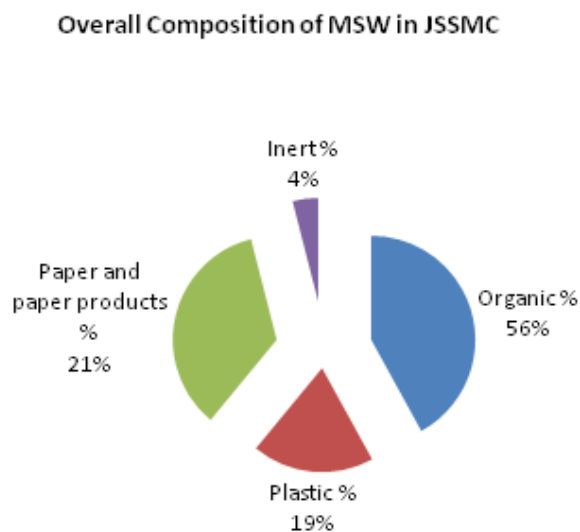


Figure 2: Solid Waste Composition of JSSMC

The fraction of organic, plastic and paper wastes varies in household, commercial and institutional waste. Organic waste (80%) accounted for the highest fraction in household waste whereas paper and paper products waste accounted for the highest fraction in both commercial and institution waste which is found to be 59% and 41% respectively. Highest fraction of organic

waste shows great potential of producing compost manner at household level as well as at commercial level. Similarly, highest fraction of paper waste in both commercial and institutional sector encourages paper and paper products recycling industries in this city.

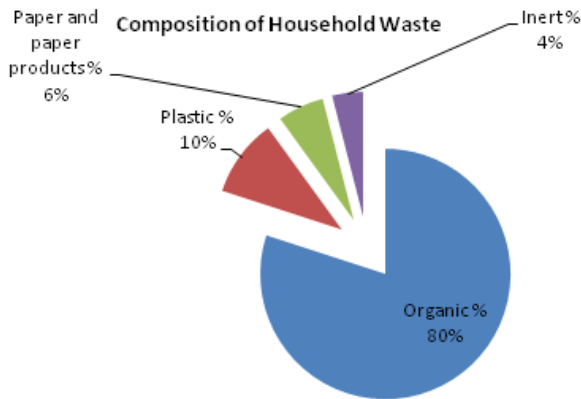


Figure 3: Composition of Household Waste in JSSMC

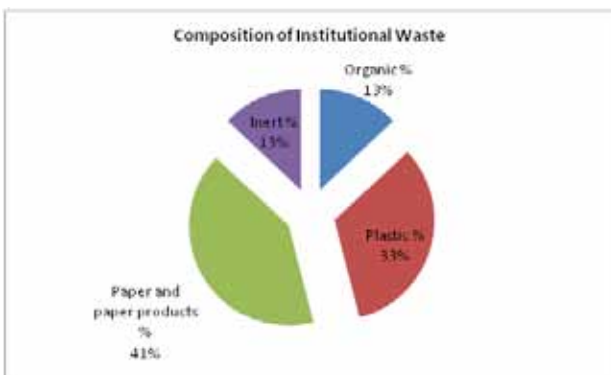


Figure 4: Composition of Institutional Waste in JSSMC

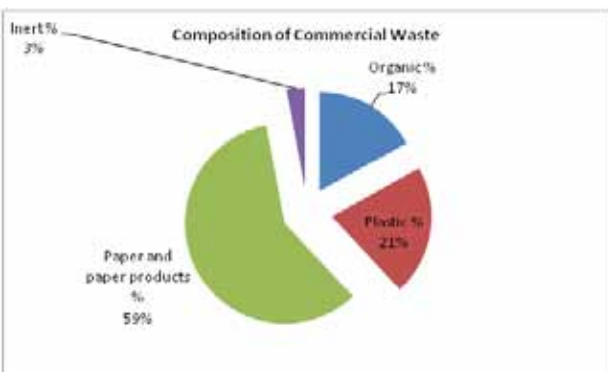


Figure 5: Composition of Commercial Waste in JSSMC

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Bibliography

- ADB. (2013). Solid Waste Management in Nepal, Current Status and Policy Recommendations.
- Adhikari, B., Khanal, S. N., & Manandhar, D. R. (2013). Study of leachate and waste composition at different landfill sites of Nepal. Kathmandu University Journal of Science Engineering and Technology, 9, 15-21.
- Asian Institute of Technology - AIT, 2004. Municipal Solid Waste Management in Asia, Asian Regional Research Program on Environmental Technology (ARRPET), AIT, Thailand. ISBN:974-417-258-1.
- Butwal, Municipality. (2009). A Baseline information on Solid Waste Management of Butwal Municipality of Nepal. Butwal, Nepal: Butwal Municipality.
- Devkota D. C., K. Watanabe, V. Dangol. 2004. Need for Alternative Approaches in Solid Waste Management - A Case Study, in 30th WEDC International Conference: People-Centred Approaches to Water and Environmental Sanitation. Vientiane, Lao PDR.
- Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., & Mensah, M. Y. (2015). Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. *Waste Management*, 46, 15-27.
- Ojeda-Benitez, S., de Vega, C. A., & Ramí, M. E. (2003). Characterization and quantification of household solid wastes in a Mexican city. *Resources, Conservation and Recycling*, 39(3), 211-222.
- O'leary, P. R., Tchobanoglous, G., & Kreith, F. (2002). Handbook of solid waste management. Landfilling. New York: McGraw-Hill.
- SWMRMC. (2004). A Diagnostic Report on State of Solid Waste Management in Municipalities of Nepal. Lalitpur: Solid Waste Management and Resource Mobilization Centre
- UNEP/ GRID-Arendal (March 2006); <http://www.grida.no>
- Water Aid Nepal (Editor) & ENPHO (Editor) (2008). Solid Waste Management in Nepal: Water Aid Nepal, Environment and Public Health Organization (ENPHO), Kathmandu.