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MUNICIPAL SOLID WASTE MANAGEMENT ANALYSIS IN KANDAHAR CITY

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Abstract: Rapid population growth, inadequate infrastructure, lack of people's cooperation in solid waste management are the main causes of inappropriate solid waste management and it is major environmental problem in developing countries. Currently the population of the city has exponentially increased due to immigration and population growth. Urbanization and industrialization enhanced throughout the city. Vast amount of solid waste are remains for days and nights in public areas and open sources of the city. Solid waste could be find at every hook and corner of the city; which include hazardous and non-hazardous items. The purpose of this study was to review the current condition of MSW management in Kandahar city. This research was conducted in 10 districts of Kandahar city; the data was collected through questionnaire a sample size covered 250 individuals. The results indicated that 26.4% of the people are disposing their waste in open area, likewise almost 2% of the people are burning their waste, and furthermore, 2.8% of the people are discharging their waste in drainage. Moreover, the transportation of the solid waste was being done during the day and 63.3% during the morning which is mostly crowded time of the day in terms of children are going to schools and people moving around.

Keywords: Composting; Landfilling; Segregation; Solid waste management; Waste disposal.

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INTRODUCTION

Disposal of solid waste is an important environmental problem in many developing countries as it is in Afghanistan. Open dumping, which creates environmental hazard is used very commonly in many cities of Afghanistan. Waste is defined as any material that is not useful and does not represent any economic value to its owner (Maria *et al.*, 2011), or any discarded solid materials from industrial, household, commercial, agricultural, constructional and institutional resources (Ziraba, 2016). Depending on the its physical state, wastes are categorized into solid, liquid and gaseous. Solid wastes are categorized into municipal wastes, hazardous wastes, medical wastes and radioactive wastes. Any solid waste generated in the city is often called municipal solid waste. The amount of the MSW generated depends on many factors, such as standard of living, food habits, degree of commercial activities,

populations, social behavior, climate and seasons (Kaushal *et al.*, 2012; Late and Mule, 2013). Today in most parts of the world, solid wastes are disposed either in open dumps, sanitary landfills or by incineration (Sudibyo *et al.*, 2017). Incineration and sanitary land filling are expensive both in initial investment and throughout operation. Their use is mostly related to developed countries, while open dumping is the method used vastly in economically developing countries due to its low cost and simplicity (Das *et al.*, 2013). Open dumping existed in many developing countries 90% in India, 85% in Sri Lanka, 65% in Thailand and 50% in China (Ojha *et al.*, 2012). Solid waste management has become a considerable issue in terms of environmental problems, especially for densely populated cities in developing countries. Kandahar city is second largest city in southeastern area of Afghanistan with

approximately 1005 meters above sea level. Kandahar with subtropical arid climate and no rains at summer and is the regional Hub in southern Afghanistan. Currently the population of this city has exponentially increased than ever because of the immigration of many people from Urozgan, Helmand, Farah, Zabul and as well from many districts of Kandahar province. Due to immigration and population growth, urbanization and industrialization enhanced throughout the Kandahar city. Though the roads are paved, but unfortunately because of improper disposal of solid waste by people and improper management of Kandahar municipality, poor collection and inadequate transportation caused that Solid waste remains for days and nights in public areas and open sources of city. Solid waste could be find at every hook and corner of the city; which include hazardous and non-hazardous items. Burning is being done by local people which has low knowledge and awareness of environmental threats. Burning of solid waste which contains plastics can produce furans and dioxins (Li *et al.*, 2007; Mondal *et al.*, 2015) that are hazardous for public health. Now, what is the current condition of municipal solid waste management in Kandahar city? This study reviews the current condition of municipality of solid waste management in Kandahar city. Second objective to identify the main causes of the improper solid waste management and disposal (storage) in Kandahar city.

Current Scenario of Municipal Solid Waste

Municipal solid waste management is the major problem faced by municipalities, because it involves a huge expenditure and receives scant attention (Bhide and Sundersan, 1983). It is not only a technical problem, but it is also strongly influenced by political, legal, socio-cultural, environmental and economic factors. Moreover, these factors have interrelationships that are usually complex in waste management system (Kum *et al.*, 2005). In Asia, many developing cities face serious problems in managing their solid waste. Annually, the waste generation increases in proportion with growth in population and urbanization and issues related to disposal become challenging (Idris *et al.*, 2004).

Composition of Municipal Solid Waste Management

The composition of MSW depends on a wide range of factors, like food habits, cultural traditions, income level, climate and season (Srivastava *et al.*, 2014; Ogwueleka, 2009). Many types of MSW are found like food waste, commercial waste, agricultural waste, street sweeping waste, institutions waste, industrial waste, construction waste and sanitations waste. Municipal solid waste contains recyclables (paper, glass, metals, plastics, wood and etc.) toxic substances (pesticides, medicines, used batteries, paints), organic matter (fruit, vegetable and food waste), biomedical waste (blood stained cotton, sanitary napkins, disposable syringes) and electronic waste (Herat, 2019; Gupta, 2015; Abdulredha, 2017; Joshi *et al.*, 2016). The composition of municipal solid waste in Kandahar city at generation and collection sources are determined by weight and percentage basis as follows: food/organic 34%, mix paper; 7%, mix plastic, 10%, ferrous 4%, textile 3%, glasses 6% and 36% others (Sahil, 2017). In most situations the main sources of solid waste are: Medical centers, food stores, feeding centers, food distribution points, slaughter areas, warehouses, agency premises, markets and domestic areas (Jha *et al.*, 2011; Mohanty *et al.*, 2014). The per capita waste generation rate is strongly correlated to the Grass Domestic product (GDP) of a country. Per capita waste generation is the amount of waste generated by one person in one day in a country or region. High income countries generate more waste per person compared to low income countries. The average per capita waste generation in India is 370 grams/day as compared to 2,200 grams in Denmark's, 2000 grams in US and 700 grams in China (Annepu, 2012). Solid Waste Management (SWM) system includes; the generation of waste, storage, collection, transportation, processing and final disposal (Mani and Singh, 2015). SWM is a basic public necessity (Annepu, 2012). It was found that solid waste landfilling was the main source of the air pollution by discharging (emission) of harmful substances during unloading, storage, compaction of waste (Copenhagen, 2012). Community participation has an important role on efficient SWM. Yet, the municipal authorities have

failed to mobilize the community and educate citizens on the rudiments of handling waste and proper practices of storing in their own bins at the household, shop, and establishment level. In the absence of a basic facilities for collection of wastes from sources, citizens tend to dump wastes on the streets, open spaces, drains and water bodies in the vicinity creating insanitary conditions. People assume that waste thrown on the streets would be picked by municipality through street sweeping (Asnani, 2007).

Water Pollution

Unsanitary landfills can contaminate ground and surface water resources when leachate produced percolates (penetrate) through the soil strata into ground water underneath or are washed as runoff during rains (Arun, 2010). Studies found moderately high concentrations of heavy metals in ground water surrounding the dumpsite. The heavy generally observed in leachate are lead (Pb) cadmium (Cd), Chromium (Cr), and Nickel (Ni). All these heavy metals are characterized as toxic for drinking water (Annepu, 2012). Malpractices of solid waste management not only causes groundwater and air pollution along with blockage problems in sewer system, but it also causes health risks to population living around the area (Nesli, 2017; Sankoh *et al.*, 2013). Dioxins and furans are known carcinogenic agents; they can cause cancer in case of long term exposure. The risk of exposure to dioxins/furans considerably increased due to the fact that MSW is burnt on the streets and landfills which are at ground level, releasing them directly into ambient surroundings. Increasing human exposure to landfill fire emissions for longer periods was found to have chromosome break incidence in Kolkata of India (Annepu, 2012). Research shows that the main resources of negative impacts on the natural environment are: landfill gas, surface water flow, dray waste fraction (Zhang *et al.*, 2010; Makarenko, 2017). The type and quantity of waste generated varies greatly. The main factors affecting are (i) the geographical region (developed or less-developed country or region); (ii) socio-cultural practices; (iii) material levels among affected population; seasonal variations (affecting types of food available) and packaging of food rations (Njoroge *et al.*, 2014).

EXPERIMENTAL

Field of Research: Solid storages, dump sites, collection and transportation system of Kandahar municipality have been observed in 10 districts of Kandahar city.

Selected Population: Five storage sites were selected in each district. From each storage site, five families were opted for data collection via questionnaires. A total of 250 families were selected.

Sampling Methods: Random sampling has been used for data collection.

Date Collection: A Questionnaire and site observation were used as data collection tools for this study.

Secondary Data Collection: Collected from formal documents, journals, reports, maps, NGOs and government directorate offices related to solid waste management.

Data Analysis: after the primary and secondary data collection, the data was analyzed by SPSS IBM24 version.

Type of Research: A mixed method was used as a research design to address the research questions of the study that employed both quantitative and qualitative dimensions.

RESULTS AND DISCUSSION

Waste management never got priority in Afghan society and particularly in Kandahar city. The solid waste remained for weeks, in bins or outside of the bins which are installed by the municipality of Kandahar City. Furthermore, the problem is not just with remainder of waste for longer in the bins but it is also evident that for most people they have not installed concrete bins or moveable bins which is the biggest challenge for the management of the solid in Kandahar city. Table 1 shows the highest percentage 66.8% for generation of 1-5kg waste per-day, 26% generate waste between 6-10kgs per day and 6%, generate waste from 11-15kg per day and rest are less than zero. Table 2 shows Waste management practice at door step or collection and transportation by the people of districts is at the highest percentages 42%, land filling is the second highest practice which is 23.2%, recycling, burning 11.2%, collection, transportation and disposal are 6.8%, 8% and 4% respectively. The result shows that higher percentage of the people still have the landfilling

practice at their area which must to be considered by municipality authority.

Source of Waste Generation

It is very important to consider the generation resources of solid waste; it helps municipal authorities in better management. Table 3 shows that households generate the highest percentage of MSW 42% and shops and households is at the second stage 37%, houses and road sweeps 6.4%, house, shops and road sweeps, 5.6% and the least percentage is agricultural waste which makes only 0.4%. You can see further details in table 3. The result shows that the households create the highest amount of solid waste.

Discharging Area

Table 4 shows that only 60% of people are discarding their waste in bins and 8% have self-contractor, while 26.4% of the people are discharging their waste in open areas and 2.8% of the people are discharging it in drainage which is very tentative to be considered and as well treats our life. Table 5 shows that only 60% of the collection is being done by municipality while 12% are collected on self-contractor based. 24% participants responded that no one collects their solid wastes and 6% of the people burn their solid

waste in open area which is very harmful for all living beings not only humans.

Bins and Storages Collection

Figure 1 shows that the lowest percentage (4%) of the collection is being done every day and 20% indicate that collection from bins and storages has been done once in a week, while 16% indicate once in a month and 31.2% indicate that collection is done either in more than a month or is never collected by municipality.

Collection Time

The time of collection is crucial for public health and it should be done in most compatible time, in which people are in rest or there is less traffic. Moreover, wind should be less or at least in opposite direction of residential area while the waste collection is in progress. Table 6 shows that 86.9% of the collection is being done in the morning, 6.6% at the noon, 2.7% during the afternoon, 2.7% during the night. The issue/s that people are facing currently from SWM in Kandahar city are ugly street environments, odors, air pollution, disease born and 56% indicates all of the mentioned problems in their environment.

Table 1. Amount of solid waste generated per-day

S.No.	Amount of SW per-day	Frequency	Percent
1.	1 to 5Kg	167	66.8
2.	6 to 10Kg	65	26.0
3.	11 to 15kg	15	6.0
4.	16 to 20Kg	2	0.8
5.	More than 20Kg	1	0.4
Total		250	100.0

Table 2. Waste Management Practice at Door Step

Items	Frequency	Percent
Collection	17	6.8
Transportation	20	8.0
Separation	1	0.4
Disposal	10	4.0
Recycling/Compositing/burning/land filling	28	11.2
Land filling	58	23.2
Collection and transportation	105	42.0
Collection, Transportation and Land filling	5	2.0
Others	4	1.6
All	2	0.8
Total	250	100.0

Table 3. Source of Solid Waste Generation

Source of Waste generation	Frequency	Percent
Household	105	42.0
Agricultural Solids	1	0.4
Street Sweepings	3	1.2
Factories	2	0.8
Shops	2	0.8
Houses and shops	93	37.2
Houses and roads sweeps	16	6.4
Houses, shops and factories	4	1.6
House, shops and road sweeps	14	5.6
All except agriculture	10	4.0
Total	250	100.0

Table 4. Discarding area of solid waste

Discharging Area	Frequency	Percent
Recycle bin	152	60.8
Self-contractor	20	8.0
Open Area	66	26.4
Municipality track	3	1.2
Discharging in Drainage	7	2.8
Other	2	0.8
Total	250	100.0

Table 5. Collection of solid waste

	Frequency	Percent
Municipality	152	60.8
Self-contractor	30	12.0
No one	62	24.8
Burning	6	2.4
Total	250	100.0

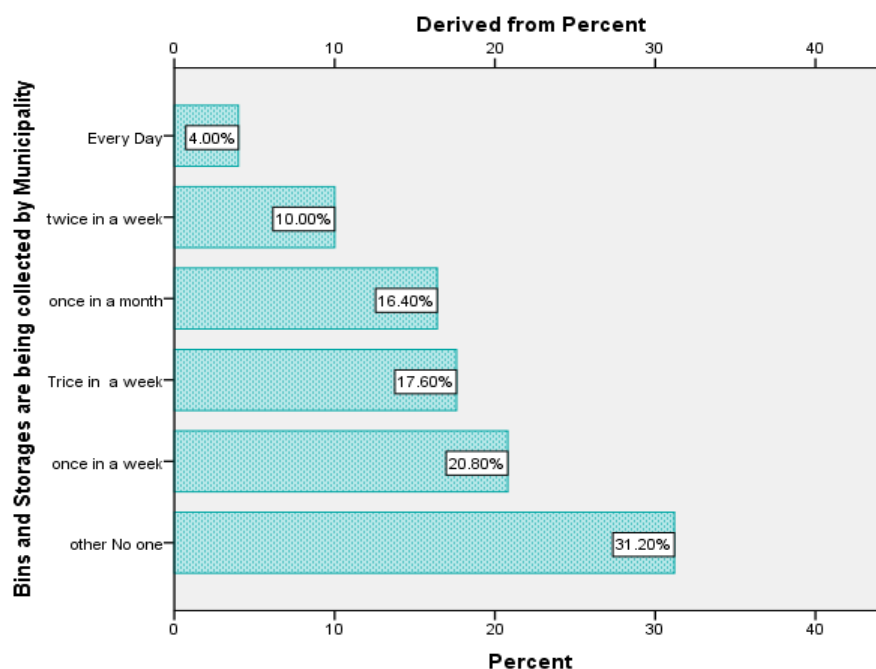


Figure 1. Period of bins and storage collection by municipality

Table 6. Collection time of solid waste by Municipality

Time of the Collection	Frequency	Percent	Valid Percent
Morning	159	63.6	86.9
During noon	12	4.8	6.6
Afternoon	5	2.0	2.7
During night	5	2.0	2.7
Morning and noon	2	.8	1.1
Total	183	73.2	100.0
Missing System	67	26.8	
Total	250	100.0	

Table 7. Issue/s people are facing in Kandahar city

	Frequency	Percent
Disease born	13	5.2
Odor	20	8.0
Mosquito/vectors	9	3.6
Air pollution	17	6.8
Water pollution	4	1.6
Ugly street environment	25	10.0
Vectors and Air Pollution	2	.8
Mosquito and Air Pollution	8	3.2
Odors and water pollution	5	2.0
Water pollution and air pollution	5	2.0
Various	142	56.8
Total	250	100.0

It has been found that uncollected waste often lies outside of the designated bins in most areas of the city due to inappropriate design, capacity location and low public awareness towards using bins. Particularly in some parts of city it has been

found that uncollected waste is generally burnt in open areas, or near to streets. Though in some parts of the city private and contractors are doing segregation still segregation of the waste at the door step is absent although door to door

collection is happening in some regions of Kandahar city. Solid waste remains for days in bins and storage places, mostly it produces awful odors, which have organic materials and makes a suitable living conditions for flies, insects and vectors. Scavengers searching food and children are searching materials which are being affected by infectious agents. The municipal waste received through open vehicles and dropped with secondary handling, 84% carrying solid waste are being done during the day, which makes pollution and emit awful odors. Open dumper spill waste on the road. Proper solid waste management is essential to minimize environmental health risks. People were generating 66.8% solid waste between 1-5kg, and 26% of the people were generating 6-10kg, the authority of municipality should consider and make plan for the carrying the wastes produced each day. The results indicated that almost 27% of the people were discarding their waste in open areas, which is very harmful for the health of the people, that could contaminate potable water, make air pollution, and as well create awful odors, and can leachate in agricultural drainage which finally will affect our health. It is not only the problem in our society but the problem will be escalating while people burn their wastes in open area, especially for those people who are living near to such areas. It could be poisonous and non-poisonous matter, and as well burning plastic by itself is very harmful. Exposure of children to this environment will affect their mental, other organs and system growth. It has been found that in many places of Kandahar City that people are discharging their waste in drainage which consequently could block the drainage systems. Blocked drainage system could make a suitable site and area for flies breeding. Inappropriate disposal of waste, particularly non-biodegradable plastic bags remain for long time in soil.

The results showed that high percentage of people are not satisfied from current management of municipality. Bins and storages are not being collected on daily basis, that is why Solid Waste overflow of bins and storages in most areas of the city. The bins are common for both decomposable and non-decomposable waste at almost all districts, in some parts of the city fixed bins are also existing but movable bins are more compared

to the fixed ones. Even in some parts of city people are using private based transportation and it has also evident that poor families are not giving their solid waste to private transporters. These families are disposing their waste in open areas, which is contributing in making dangerous and odorous environment. The bins by itself have problems, it has not been designed very well, the population of an area is not considered. The number of installed bins are either less or no bins are installed in some areas of the city. Segregation at door step is completely unavailable, recycle bins for plastics, and others are not considered but in some places of the city these have been installed, and people are not sorting their wastes or they are throwing it all together. The problem is just not with municipality authority but lack of help from the people's side which makes it difficult for proper management of solid as well. It has discovered that in some areas of the city the bins are totally empty but still wastes are disposed outside of the bins and storages. Collection and transportation is another challenge which were almost occurring during the day especially during the morning. During this time, children are going to school and people are going around. In some areas they are loading waste with shovel to the truck, which pollutes air and people respire it. The trucks are open and wind can move the dust around.

RECOMMENDATION

Based on the recommendations of the participants and the results, the following issues are recommended for the overall betterment of solid waste management: municipality need to increase the number of bins in dense populated areas of the city and install bins in those areas which has lack both moveable bins and concrete storages. Bins and storage should be located in areas that could be easily accessed by people, it should not compel the people to cross the road for waste discard or throw their wastes in drainages. Collection should be done every day in populated areas, and once in two days in less populated area. Safe transportation is better during the night, and municipality authorities should try their best to manage the carrying and transportation of the wastes during the night with cover dump trucks.

Segregating practices need to be increased both by municipalities and people at door step.

CONCLUSION

Study showed that the segregation at door step is almost absent, and the bins are not installed properly according to the population of the areas. Findings also indicated that in most areas the storage and bins are not installed at all which compels the people to throw their waste in open areas, or due to the lack of transportation, the waste lies outside of the bins for many days. Sometimes people do not discard their waste in bins properly even though bins are installed, yet waste are found outside the bins and it makes difficult for transportation. So it is very important that municipality should consider the population of an area and the resources that generate wastes. However, in some areas the bins are installed on drainage or near to drainage which results that the waste remains in drainage for days that make suitable sites for vectors and flies. It should be transferred to a suitable place. In addition, the people are not helping with municipalities, segregation at door step should be enhanced by increasing awareness of the people, transporting should be happening during the night, and it should be done every day in populated areas and once in two or three days in less populated parts of the city. Improper solid waste management is not only due to irresponsibility of municipality but as well lack of cooperation by citizens of Kandahar City. Public health administration and ministry of education and higher education should run campaigns for proper disposal for having clean city and concerning health of citizens. As a result, millions of grants which are being used both by governmental agencies and international organizations in Afghanistan supporting health sectors and management team to help citizens will be decrease. Finally, it will increase GDP of the country since thousands of the people are going outside of the country for diagnosing purposes and treatment.

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