

Pattern and Disposal Approaches of Domestic Solid Waste Generated In Residential Settlements Kano Municipal Council, Kano State, Nigeria

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Abstract

The paper examined the pattern and disposal methods of domestic solid waste generated in Kano Municipal Council. Primary data were obtained through administration of structured questionnaires to a random size of population in the areas that have the highest heaps of solid waste on the major streets and open spaces. Secondary data were obtained from desk review method; information on environmental issues resulting from poor management of municipal solid waste was obtained from relevant literatures. The results of the findings clearly show that, while the communities, industries, individual communities, non-governmental organization, agencies, and pressures groups are responsible the government has the highest concern for the proper handling and evacuation of the domestic solid waste in Kano Municipal Council. The composition of the municipal solid waste in the city is heterogeneous; it contained both biodegradable and non-biodegradable materials which are mostly e-wastes, plastic and polythene materials. The study also reveals that shows that, while the communities, industries, individual communities, non-governmental organization, agencies, and pressures groups are responsible the government has the highest concern for the proper handling and evacuation of the domestic solid waste in Kano Municipal Council. The study further shows that the mean score supporting the statement that lack of knowledge and awareness of improper handling of domestic solid waste may cause prevalence of disease in our community's scores 3.455. There is no organized house to house or street to street collection of the solid waste in some parts of the Kano Municipal Council. The test of association between gender and proper handling of domestic solid waste shows a no significant association between the variables with $\chi^2=(1, N397)=1.558, P=0,212 \geq 0.005$, signifying that there is no significant difference between gender and proper waste handling in Kano municipal council. Generally, the study shows that In Kano Municipal Council the following types of wastes and trash are generated; the biodegradable, which includes things like load and kitchen waste such as meat trimmings or vegetable peelings, yard or green waste and paper. Therefore, the paper recommends that a there is the need to reassess all legislations regarding waste management with a view to stream lining them so that there is a comprehensive and clear role for all the agencies, various tiers of government, as well as the public including Non-Governmental Organizations (NGOs) and community associations.

Keywords: Waste, Domestic, Generation, Municipal, Management

INTRODUCTION

Most human activities naturally result in the generation of waste. As this is an unavoidable event in day to day living, there is need for waste generated to be managed. How this may be efficiently done poses a problem in many societies today. Another natural process, population growth, makes waste management even more challenging; more people in a specific geographic location would imply higher level of waste generation, hence more waste to contend with in that area. As poorly managed wastes are perceived as environmental hazards of high significance, the inabilities of societies to manage waste generation effectively play no small role in increasing extant environmental pressures (Alam, Chowdhury, Hassan, Karanjit, and Shrestha, 2007).

Thus, generation of solid waste in urban areas is an obvious result of human activities. Natural growth of population, reclassifications of habitation and migration trends are common in urban populations. Urbanization is now becoming a global phenomenon, but its ramifications are more pronounced in developing countries. This urbanization, economic growth, and improved living standards in cities led to an increase in quantity and complexity of generated waste. This increase induces unhygienic conditions on the surface and also affects both the surface and underground water quality of water to an alarming extent. The concern about waste is not only because of the rising quantities but also principally because of a derisory management system. It is a convenient but potentially dangerous fiction to treat population projections as exogenous inputs to economic, environmental, cultural, and political scenarios, as if population processes were autonomous. Belief in this fiction is encouraged by conventional population projections, which ignore food, water, housing, education, health, physical infrastructure, religion, values, institutions, laws, family structure, domestic and international order, and the physical and biological environment. (Cointreau, 2006; Nabegu, 2010). A Significant portion of municipal expenses (up to 40%) goes into the provision of SWM services in developing countries, making it one of the singly expensive sectors, paradoxically, the expenses are not commensurate with the services rendered as they remain poor and ineffective. Funds mostly available are in insufficient quantity to enable efficient service provision by local governments saddled with this responsibility. In addition to this is the challenge of inadequate and inappropriately located waste disposal points, as well as introduction of foreign technology (especially waste collection machinery), again SWM methods that are often locally incompatible due to different conditions and requirements under which they have been originally developed (UN-HABITAT, 2010). Dumping of solid waste in highly inappropriate places like middle of roads and unauthorized disposal sites are common practices in many developing countries (Nabegu, 2010; Ali, *et al.* 2011; Igbinomwanhia, 2011). The solid waste management scenario in most developing countries are similar, Nigeria inclusive.

Evidently, from aforementioned issues of urban population and waste generation, the world has experienced unprecedented urban growth in recent decades. In 2008, for the first time, the world's population was evenly split between urban and rural areas. There were more than 400 cities over 1 million and 19 over 10 million. More developed nations were about 74% urban, while 44% of residents of less developed countries lived in urban areas. However, urbanization is occurring rapidly in many less developed countries. It is expected that 706 of the world population will be urban by 2050, and that most urban growth will occur in less developed countries (United Nations, 2007, Idowu, *et al.* 2011).

The multiplier effect of increase in urbanization is a product of population growth and resultant of proliferation of wastes in the nooks and crannies of urban cities. Thus, Butu *et al.* (2013) observes that urbanization affects land-use, when not controlled causes the emergence of illegal structures. This type of illegal and unplanned residential areas endangered waste collection services and eventually enhances indiscriminate dumping of domestic waste generated. Despite the importance of adequate solid waste management to the urban environment, the performance of many city authorities in Africa and Nigeria in this respect leaves much to be desired. Kaduna metropolis fits perfectly into this scenario, the slums, ghettos, sprawls and filthy neighborhood often refers to as Angwar areas that formed more than 70% of residential areas are poorly planned with pitiable sites for human habitation.

MANAGEMENT OF MSW IN NICERIA

Nigeria is a large country with a correspondingly huge population. World Bank Report of 2011 puts Nigeria's population at 162,470,737. The implication of this is the generation of very large volumes of MSW. This is exacerbated by the high rate of unemployment in the country -breeding poverty, illiteracy and a continual increase in population, and urbanization and industrialization. The waste generated in some cities in Nigeria as at 2009 has variously been presented as in the Table 1.

Table 1: Municipal Solid Waste Generation for some cities in Geopolitical Zones in Nigeria

City	Population	Tonnage/month	Density (kg/m ³)	Kg/Capita/Day
SOUTH WEST				
Lagos	8,029,200	255,556	294	0.63
Ibadan	307,840	135,391	330	0.51
SOUTH EAST				
Nsukka	100,700	12,000	370	0.44
Onitsha	509,500	84,137	310	0.53
SOUTH SOUTH				
Port – Harcourt	1,053,900	117,825	300	0.60
Warri	500,000	66,721	-	0.60
NORTH CENTRAL				
Abuja	159,900	14,785	280	0.66
Ilorin	756,400	-	-	0.43
NORTH WEST				
Kano	3,248,700	156,676	290	0.56
Kaduna	1,458,000	114,433	320	0.58
NORTH EAST				
Maiduguri	971,700	850,000	-	0.58

Source: Ogwueleka, (209); Olubori, (2011).

THE STUDY AREA

Kano Municipal Council is one of the most populated local government council in Kano city, located in the Sudan Region of Nigeria between latitude 12° 25' to 12° 40'N and longitude 8° 35'N to 8 45'E. Kano city has for centuries been the most important commercial and industrial nerve centre of Northern Nigeria attracting millions from all parts of the country and beyond. Immigration and natural growth rate of 3% is expected to continue to increase the population and waste stream in the years to come. With a population presently estimated at 3.5 million, Kano Municipal Council is among the fastest growing cities in Nigeria. With a population density of about 1000 inhabitants per km² within the Kano closed-settled zone compared to the national average of 267 inhabitants per km².

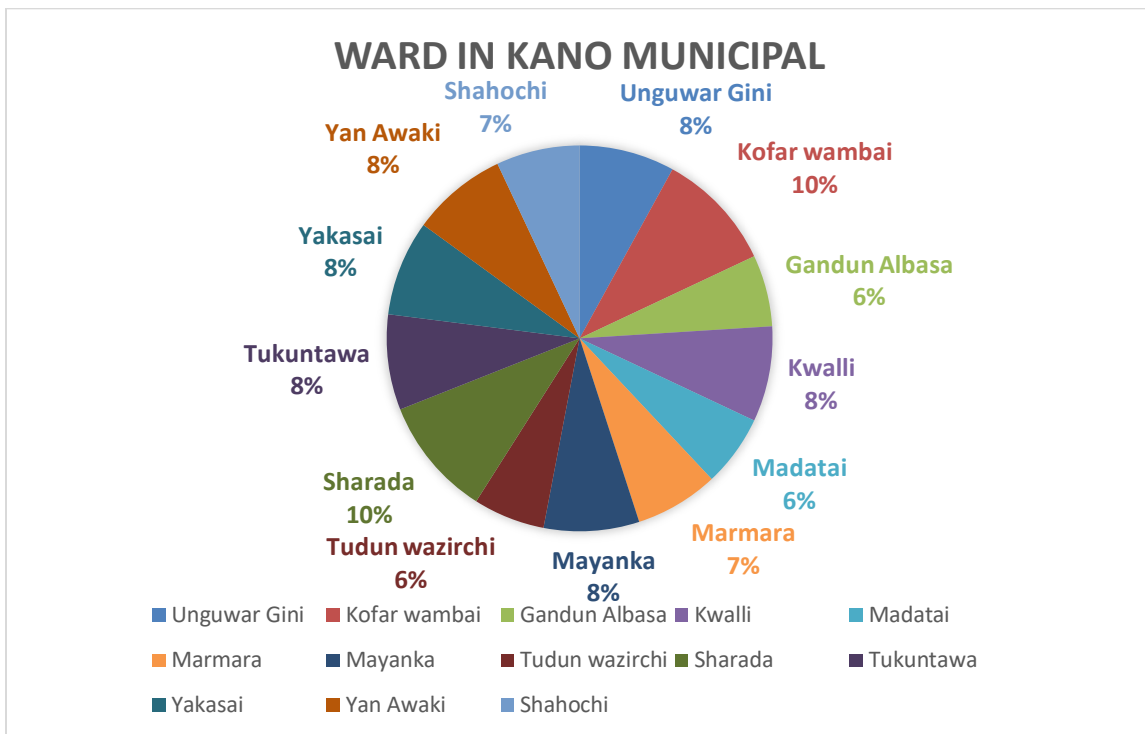


Figure 1: Statistical Representation of Kano Municipal Council’s Population in Percentages

Source: Field Survey, (2019).

RESEARCH METHODOLOGY

Primary data were obtained through administration of structured questionnaires to a random size of population in the areas that have the highest heaps of solid waste on the major streets and open spaces. The total number of the questionnaires distributed were 450 and 397 questionnaires were retrieved back and were used for this analysis. Secondary data were obtained from desk review method; information on environmental issues resulting from poor management of municipal solid waste was obtained from relevant literatures. Thirteen wards in Kano Municipal Council were covered in the survey.

THEORETICAL BACKGROUND AND FRAMEWORK

This section focuses on the description of waste management and the concept of solid waste management hierarchy. It also gives insight to current global approaches, management options, as well as the description of MSWM in Kaduna metropolis based on previous studies.

Municipal Solid Waste

Every unwanted or non-useful solid substance generated in any human population is referred to as solid waste (Kaseva and Mbuligwe, 2003; UNEP, 2005a). Over time, consumption practices and activities of economic nature have resulted in generation of MSW (Cointreau,2006) which is basically waste that is generated from different sectors of a society such as households, educational, health and commercial institutions, public places, etc., and which is taken care of either directly or indirectly by the municipal or local authorities (Williams, 2005). EEA (2009) defines MSW as:

"...Waste from households and other waste which because of its nature or composition is similar to waste from households (cf. the Land Directive). Some of this waste is biodegradable, e.g. paper and cardboard, Food waste and garden waste biodegradable waste means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard (cf. Landfill directive)" (EAA, 2009).

The components of such waste, often an assorted mix, are seldom the same for different areas due to factors ranging from standard of living and habits of residents to resources and climatic conditions found in each geographical location. MSW is often generated in urban areas and has contents that are organic and inorganic nature, the former being often found more in developing countries than the latter. The reverse is mostly the case in the developed part of the world and this is regarded as a significantly distinctive feature from the waste generated in their developing counterpart (Oteng-Ababio, 2011; UNEP, 2005).

RESULTS AND DISCUSSIONS

The literature available revealed similar results all over the developing countries Nigeria inclusive where the municipal governments are responsible for waste collection, transport and disposal (Ali, 2004).

Demographic Profile of the Respondents

The results of the demographic analysis conducted shows that 65% of the respondents are male with 259 frequencies while 35% are females with 138 frequencies. The largest category of age group of the respondents is 48-58 years which constitute 43% of the respondents with recorded frequency of 164, age group between 15 to 25 constitute 15. 1% with frequency of 63, while ages 26 to 36 and 37 to 47 constitute 18% and 17% of the respondents with frequencies of 82 and 66 respectively, the remaining 7% was constituted by the older age group of 59 to 70 years with 22 frequencies (table 2). The next demographic category shows that 60% of the

respondents were Hausas by tribe with 245 frequencies, which is the indigenous language of the people of Kano, 25% of the respondents were Fulani with 97 frequencies and the remaining 15% speak some other minor languages with frequencies of 55. The descriptive statistics also revealed that 61% of the respondents attain tertiary education with 239 frequencies being the highest, at the same time 7% of the respondents attain secondary education with frequency of 36, those that constituted 15% attain primary education with frequencies of 59 and finally 10% of the respondents were not educated with 25 frequencies, while the remaining 7% attend some other form of education. The wards in the Kano Municipal that constituted the study area of this research are arranged in descending order of number of respondents from the wards as follows; Kofar Wambai recorded 10.3% with 41 frequencies, Sharada 9.6% being the second ward with 38 frequencies, Yakasai 8.3% with frequencies of 33, Kwalli also had 8.3%

Table 2: Frequency and Percentage Distribution of the Demographic Variables

Variable	Category	Frequency	Percentage
Gender	Male	259	65.2
	Female	138	34.8
	Total	397	100.0
Age	15 – 25 years	63	15.9
	26 – 38 years	82	20.7
	37 – 47 years	66	16.6
	48 – 58 years	164	41.3
	59 – 70 years	22	5.5
	Total	397	100.0
Tribe	Hausa	245	61.7
	Fulani	97	24.4
	Others	55	13.9
	Total	397	100.0
Educational background	Not educated	38	9.6
	Primary education	59	14.9
	Secondary education	36	9.1
	Tertiary	239	60.2
	Others	25	6.3
	Total	397	100.0
Ward	Unguwar Gini	32	8.1
	Kofar Wambai	41	10.3
	Gandun Albasa	25	6.3
	Kwalli	33	8.3
	Madatai	24	6.0
	Marmara	28	7.1
	Mayanka	32	8.1
	Tudun wazirhici	23	5.8
	Sharada	38	9.6
	Tukuntawa	30	7.6
	Yakasai	33	8.3
	Yan Awaki	31	7.8
	Shahuchi	27	6.8
	Total	397	100.0

Source: Field Survey, (2019)

With frequencies of 33, Unguwar Gini 8.1% with frequencies of 32, Mayanka had 8.3% and frequencies 33, Yan Awaki recorded 31 frequencies and 7.8%, Tukuntawa 7.6% and frequencies of 7.6, Marmara 7.1% and frequencies of 28, Shahochi 6.8% and frequencies of 27, Gandun Albasa and Madatai had 6.3% and 6.0% with frequencies of 25 and 24 respectively.

Governmental Policies on Domestic Solid Waste Handling:

This results is affirm by this research with the results for community are responsible for the enforcement with mean average score of 3.638 in agreement, the mean score for those that agrees that the individual are responsible scores 3.718 higher than that of those who agree that the community is responsible, while those who supported that governments at all level are responsible score mean average of 3.789, which is higher than those who supported the community and individual efforts in Nigeria. Those, that agrees that the agencies and groups are responsible for the enforcement of domestic solid waste laws and regulations in the community scores 3.670 mean averages (table 3). This therefore shows that the general conclusion on the result of this research based on the mean average scores shows that the government at state level scores higher mean signifying that the statement is mostly responsible for the proper handling of the domestic solid waste in Nigeria (Aderogba and Afelumo, 2012).

Table 3: Governmental Policies on Domestic Solid Waste Handling: who is responsible for the enforcement of domestic solid waste laws and regulations in your community?

S/No	Item	Mean	Remark
*	Community	3.6386	Agree
*	Individuals	3.7194	Agree
*	Government	3.7899	Agree
*	Agencies	3.5384	Agree
*	Local Government	3.8788	Agree
*	Groups	3.6709	Agree
	Total	3.7058	Agree

Source: Field Survey (2019)

The study revealed a result on the responsible organ for the transportation, evacuation and disposal of domestic solid waste in the study area with mean score of 3.737 supporting that the community are responsible, while, those who agrees that the industries are responsible Scores 3.595, and in support of individuals being responsible scores 3.495, those in support of the government and non-governmental organizations scores 3.833 and 3.709 respectively.

Ministry/Departments/Agencies/Non-Governmental Organization Responsible for the Proper Handling of Domestic Solid Waste:

The mean score for governmental agencies and pressure groups scores mean average of 3.434 and 3.689 (table 4) respectively as being responsible for the environment. This result is supported by the literature on the study conducted in Sabra Iran and China by (Ali and Snel, 1999 and Christian, 2002). This generally shows that, while the communities, industries, individual communities, non-governmental organization, agencies, and pressures groups are responsible the government has the highest concern for the proper handling and evacuation of the domestic solid waste in Kano Municipal Council.

Table 4: Who among the following ministry/Departments/Agencies/Non-governmental Organization are responsible for the proper handling of domestic solid waste in the environment?

S/No	Item	Mean	Remark
•	Community	3.7372	Agree
•	Individuals	3.5956	Agree

•	Non-Governmental	3.4955	Agree
•	Government	3.7093	Agree
•	Agencies	3.8336	Agree
•	Pressure groups	3.4345	Agree
	Total	3.6421	Agree

Source: Field Survey (2019)

Knowledge Awareness and Health Promotion about Proper Handling of Domestic Solid Waste:

Knowledge awareness and health promotion about proper handling of domestic solid waste by the communities agrees that having knowledge and awareness of the existence of an available municipal solid waste transfer station is a good option with regard to proper handling of solid waste with mean of 3.574, while the statement that knowledge and awareness on the need for proper handling of domestic waste would reduce the communities health effect and their families score mean of 3.496. While those in support of the statement that proper knowledge and awareness of the community and availability of adequate facilities in our community for proper handling of domestic solid waste would reduce the risk of ill-health with mean score of 3.573, and the statement that lack of knowledge, awareness and skills on proper handling of domestic solid waste by the community may be a contributing factor that affects our community's health condition score 3.719.

The mean score supporting the statement that lack of knowledge and awareness of improper handling of domestic solid waste may cause prevalence of disease in our community's scores 3.455. Supporting the statement that lack of adequate health promotion encourages improper handling of domestic solid waste score mean average of 3.547 and the statement that the continues use of seminar, workshops and conference left a lot to cover in terms of knowledge awareness and attitude change for an effective health promotion and proper waste handling ores 3.383 (table 5).

Table 5: Knowledge Awareness and Health Promotion About Proper Handling of Domestic Solid Waste

S/No.	Item	Mean	Remark
•	Knowledge and awareness of a transfer station is a good option with regard to proper handling of solid waste	3.5745	Agree
•	Knowledge and awareness on the need for proper and handling of domestic solid waste would reduce it health effect onto you, our family and the entire community	3.4962	Agree
•	Proper knowledge and awareness of the community and availability of adequate facilities in our community for proper handling of domestic solid waste would be reduced the risk of ill health.	3.5730	Agree
•	Lack of knowledge, awareness and skills on proper handling of domestic solid waste by the community may be contributing factor that affect our community's ill health.	3.7199	Agree
•	Lack of knowledge and awareness of improper handling of domestic solid waste may cause prevalence of disease in our community.	3.4556	Agree
•	Lack of adequate health promotion encourages improper handling of domestic solid waste	3.5474	Agree
•	The continues use of seminar, workshop and conference left a lot to cover in terms of knowledge awareness and attitude change for an effective health promotion and proper waste handling	3.3833	Agree
•	The use of radio and television jingles is meant for only certain group of people	3.0700	Agree
•	The community health promotion campaign will be better in terms of achieving both proper solid waste handling and good health condition of the community	3.8087	Agree
•	Total	3.5142	Agree

Source: Field Survey (2019)

Waste Disposal Pattern and Demographic Characteristics of Respondents:

The results of this study shows that the Chi-Square (χ^2) goodness of fit test comparing some demographic variables with the proper domestic solid waste handling and practices in Kano Municipal council. The test of association between gender and proper handling of domestic solid waste shows a no significant association between the variables with $\chi^2=(1,N397)=1.558$, $P=0.212 \geq 0.005$, signifying that there is no significant difference between gender and proper waste handling in Kano municipal area. This result is at variance with the study conducted by Adu-Tutu, Samuel and Boamah, (2013) which shows that, there is significant difference between gender and magazines/newsletters as sources of information on recycling of waste ($r=11.584$; $p=0.021$). More male respondents (41.2%) than female respondents (36%) are informed by magazines/newsletters.

The research conducted by Adu-1utu, Samuel and Boamah (2013) in Ghana also shows some level of difference between educational level field of study and sources of information on recycling of waste. Some of these sources includes television with ($\chi^2=15.623$; $p=0.048$); radio with ($\chi^2=14.076$; $p=0.080$); magazines/newsletters with (chi-square=13.581; $p=0.09$) and buses/stations with ($\chi^2=28.201$ ” $p=0.002$). Respondents (88.5%) offering London Centre of Marketing programme (LCM) more are informed by television than respondents offering Higher National Diploma (HND) (64.2%). With respondents offering HND (82.26) more are informed by radio than respondents offering LCM (73.1%). With respondents offering LCM (42.3%) more are informed by magazines/newsletters than HND respondents (39.1%). LCM respondents (52%) are more informed in bus or at stations than HND respondents (23.8%) as shown in table 6. This is also supported by the research conducted by Idowu, *et al.* (2011).

Table 6: Chi-Square Test of Goodness of Fit

Variable	Chi – Square	Df	Asymp. Sig.	Decision on H ₀	Remark
Gender	1.558	1	0.212	Accept	No association
Age	6.831	4	0.145	Accept	No association
Tribe	4.145	2	0.126	Accept	No association
Educational background	13.246	4	0.010	Reject	There is association
Ward	0.635	12	1.000	Accept	No association

Source: Field Survey, (2019)

Religion of respondents has significant relation with sources of information in relation to Magazines/newsletters ($\chi^2=14.068$; $=0.080$). Respondents (100%) who indicate that they do not attend any church more are informed by magazines/newsletters than those who are Christians (38.5%) and Muslim (38.5%). The test to establish the level of association between age of the respondents and proper handling of domestic solid waste shows that there is no association with the $\chi^2= (4, N397)=6.831$, $P=0.145 \geq 0.005$, signifying that there is no difference between age and proper handling of domestic solid waste in Kano municipal council of Nigeria. The test of association between tribal affiliation and proper waste handling and disposal shows a no association result with 2, N397)=4,145, $P=0.126 \geq 0.005$, signifying that there is no difference between tribal affiliation and proper waste disposal in Kano municipal Nigeria.

And finally the research test whether there is significant association between educational level and proper handling of domestic solid waste with $\chi^2=(4, N397)=13.246$, $P=0.010 \leq 0.005$, signifying that there significant association between educational background and knowledge of proper handling of domestic solid waste in Kano municipal council Nigeria. In general out of the four hypotheses testing the association between demographic variables and proper handling of domestic solid waste revealed there is no difference between gender, age, and tribal affiliation with proper handling of domestic solid waste, but there is an association between educational level or background and proper handling of domestic solid waste in Kano municipal council of Nigeria.

Categories of Waste Generated in Kano Municipal Council:

In Kano Municipal Council the following types of wastes and trash are generated; the biodegradable, which includes things like food and kitchen waste such as meat trimmings or vegetable peelings, yard or green waste and paper. These particular wastes are common in the residential areas. The recyclable materials include paper and stationeries materials and non- biodegradable items such as glass, plastic bottles, other plastics, chemical, pesticides, dye, refining, rubber goods industries, metals and aluminum cans, these categories are easily accessible and commonly seen along the Sharada where related companies are located. The Inert waste materials are those that are not necessarily toxic to all species but can be harmful or toxic to humans (table 7).

Table 7: Composition of Solid Waste Generated

S/No	Item	Mean	Remark
•	Industrial waste	3.8569	4kg/day
•	Domestic solid waste	3.6099	4kg/day
•	Medical waste	3.1604	3kg/day
•	Hazardous waste	3.4812	3kg/day

Source: Field Survey, (2019)

These involve construction and demolition. Others identified include composite waste includes items that are composed of more than one material, typical examples are clothing and plastics such as children's toys are composite waste, and household hazardous waste comprises medicines, paint, batteries, light bulbs, fertilizer and pesticide containers and the waste like old computers, printers, and cellular phones.

These households hazardous waste cannot be recycled or disposed of with compared with other waste categories so the Central Business District of Kano Municipal Council is where this is highly concentrated. These categorization buttresses the findings of Nabegu (2010) that municipal wastes consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial complexes. With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly particularly in developing countries and its composition changing.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Municipal solid waste generation and disposal pattern in Kano Municipal Council poses a serious issue because of the environmental issues these waste present. The study has shown that increase in population, uncontrolled and unplanned nature of most parts of Kano especially the Kano municipal council (Yakasai; Shahuci; Sharada) and other areas compounded the problems of waste management. The municipal solid waste generation in Kano metropolis is very high, non-biodegradable waste such as polythene bags, the so-called "pure water sachet" and e-waste are scattered all over indiscriminately. These materials are known to contain high level of metals which are toxic when exposed to above certain limits. The biodegradable fractions of municipal solid waste disposed at major open spaces and highways in Kano are mostly food remnants, yard wastes, kitchen consumables and discarded papers for packaging.

Recommendations

To prevent this ancient city and the commercial nerve centre of Northern Nigeria from environmental deterioration the following recommendations are considered necessary:

- There is the need to reassess all legislations regarding waste management with a view to stream lining them so that there is a comprehensive and clear role for all the agencies, various tiers of government, as well as the public including Non- Governmental Organizations (NGOs) and community associations.

- Continuous public enlightenment on the dangers of municipal solid waste to the general public especially the female population.
- Regardless of the type of waste management strategies will translate into reality unless the government takes the required initiatives and makes the necessary inputs available. These inputs do not necessarily have to be financial. For example, waste recycling can be promoted through consumer campaigns encouraging citizens to cooperate in waste separation and promoting to them the purchase of recycled products.
- Citizens should be made to pay a realistic fee for waste services in return for the guarantee that indeed these services will be provided.
- There should be effective and proper monitoring of solid waste disposal activities. Severe Sanction: Re-introduction and enforcement of monthly sanitation. This will assist in cleaning up the city.

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