Nature and Management of Solid Waste in Karu Nasarawa State, Nigeria

Anyanwu, N. C.
Department of Geography
Ahmadu Bello University Zaria
Nigeria

Dr. Adefila, J. O.
Senior Lecturer
Department of Geography
Ahmadu Bello University Zaria
Nigeria

Abstract

Solid waste management is a major problem that has reached alarming proportions requiring drastic measures. The increasing difficultyin managing wastes in Nigeria has become one of the most intractable environmental issues. There is unprecedented increase in the volume of waste generated by urban residents; changes in the quality of waste composition and the disposal methods are not improved upon. The cardinal objective of the study is to examine the nature and management of solid waste in Karu, Nasarawa State, Nigeria. Both primary and secondary sources of data collectionwere adopted. A field survey was undertaken to determine the types, volume, composition and methods of managing solid waste in Karu urban areas. The volume of waste was measured from three selected households in the four residential areas namely Mararaba, Masaka, Ado and New Karu. Two hundred and thirty (230) sampleswere selected using combined systematic, randomization and stratified sampling techniques among the households as well as the staff of the municipal waste management agency. The study employed descriptive statistics to analyse the data. The analysis indicates that solid wastes are generated from households in Mararba (28.8%),Masaka (22.9%), New Karu (25.7%), and Ado (22.6%)in that order. The methods of solid waste disposal range from direct dumping (43.6%), open burning (23.0%), dust bins (32.4%), composting and dumping in drains accounted for (1.0%) in the study area.On the basis of the results, it was recommended among other things that government should provide basic facilities;equipment, adequate funds,and qualified personnel to manage the various wastes generated and increase public awareness through enlightenment campaign against the danger of indiscriminate dumping of wastes as they affect human health. Moreover, appropriate policy should be put in place to encourage partnership with private individual corporations with a bid to ensuring quality of the environment.

Keywords: Solid Wastes Generation Composition EnvironmentManagement

1. Introduction

Solid wastesareabandoned materials and could be garbage, refuse, sludge from a waste treatment plant, discarded materials resulting from industrial, commercial, mining, agricultural operations, and those resulting from community activities such as waste tyres, scrap metal, latex paints, furniture toys, garbage, appliances and vehicles, oil and anti-freeze, empty aerosol cans, paint cans and compressed gas cylinders, construction and demolition debris, and asbestos (Bamgbose, *et al*2000). In addition, solid waste can be household, industrial and biomedical wastes. However, most of the commonly known garbagewastes which consists of everyday items being discarded by the public is generally regarded as municipal solid wastes.It covers all materials throw awayas products of packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries (Afon, 2006; Bassey, *et al* (2006)).

The quantity and rate of solid waste generation in a city is largely a function of population, level of industrialization, socio-economic status and the kinds of commercial activities (Dauda and Osita, 2003). It has been observed that high density, large amount of organic content, small sized particles and large amount of dust and dirt often characterized wastes generated in developing countries.

Waste management is simply the generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes (Blight and Mbande (1996).The management of wastesrelates to reduction of their toxic effects on health, the environment and aesthetics by means ofstoring, collecting, transporting, and re-cycling. Also, it relates to policy regulations, education, training, planning and implementation strategies. This is the most important aspect of environmental problem ranking after water quality control in the developing countries (Awomeso *et al.,* 2010).

The major causative factors are population explosion, poverty and high urbanization rates combined with ineffective and under-funding by government to proffer efficient management of waste (UNEP, 2002; Doan, 1998).The importance of efficient waste management cannot be overemphasized. Almost all substances that are designated as waste possess potential resource utilization in that within the waste stream, there exists some degree of residual value for alternative uses. Waste represents valuable resources as ground cover to reduce erosion, fertilizer to nourish the crops, the source of energy (Adekunle, 2011). The management of waste should focus on how to find the value and redirect it back to the community. Unfortunately, the collection and dumping processes often make separation an expensive and sometimes impossible task to manage properly solid wastes (Sharama, 2005).It has been observed that between one-third and one-half of the solid wastes generated within most cities in low and middle-income countries are not collected but end up as illegal dumps on streets, open spaces and wasteland (Ajani, 2007).

However, in Nigeria waste disposal is essentially the statutory function of municipal councils. The rapid increase in volume and types of solid and hazardous waste, due to continuous economic development, urbanization and industrialization is becoming a burgeoning problem for most governments in ensuring effective and sustainable management of wastes (Igoni, *et al* 2007). It is estimated that in 2006, the total amount of municipal solid waste generated in Africa reached 2.02 billion tones representing 7% annual increase since 2003 (UNEP, 2002). It is further estimated that between 2007 and 2011, generation of municipal waste must have raised to 37.3%, equivalent to roughly 8% increase per year most especially those wastes categorized as hazardous.UNEP (2002) estimated the total health-care waste per person per year in most low income countriesrangefrom 0.5 Kg to 3 Kg while the European Union estimated that its 25 member states produces 700 million tons of agricultural wastes annually. Although there has been no estimate about global industrial wastes generation, American industrial facilities generated and disposed some 7.6 billion tons of non-hazardous industrial solid waste each year. If the solid wastes could be diverted for material and resource recovery then a substantial reduction in final volumes of waste could be achieved and could be utilized to generate revenue to fund waste management. This formed the premise for Integrated Solid Waste Management system based on reduce, re-use and recycle principle. (Seadon, 2006).

Given that waste management in developing countries and cities is an on-going challenge due to weak institutions such as environmental laws, chronic under-funding, rapid urbanization and industrialization, the situation in Karu, Nasarawa State, Nigeria, may not be different from other cities in the developing world. These challenges along with the lack of understanding of different factors that contribute to the hierarchy of waste management may affect the treatment of wastes in the region. It is imperative therefore, to examine the nature of solid waste generated and the efficiency of waste management agency in the region.

2. Recent Studies in Solid Wastes Management

The unprecedented increase in worldpopulation growth rate particularly in the developing countries coupled with technological advancements, waste disposal and management constitute serious problem in the societies. In rapidly urbanizing cities, the problems and issues of solid waste management are of immediate importance (Momoh and Oladebeye, 2010). Nigerian cities and towns are currently facing serious environmental problem arising from poor solid waste management. Solid waste is generated at a rate beyond the capacity of the city authorities to handle in order to maintain a sustainable urban environment. This has resulted in poor solid-waste management system that portends serious environmental crisis in most Nigeria towns and cities (Abel and Afolabi, 2007).

Babayemi and Dauda (2009) reported high waste generation rate in Abeokuta without a corresponding efficient technology to manage the wastes. Of some 201 sampled respondents in Abeokuta Ogun State, (35.8%) used waste collection services, (64.2%) used other waste disposal options, (16.4%) used both, (68.7%) and (58.7%) were aware of waste collection service and waste management regulations respectively.

Okeniyi and Anwan (2012) reported that the average wastes generated per day in Covenant University Ota, food waste exhibited the highest percentage of(26.2%), followed by polythene bag (19.3%); and plastic bottles (13.6%), metal cans (11.5%), paper (10.5%), plastic food pack (7.2%), other combustible wastes (5.6%) and polystyrene food pack (5.6%). Similarly, Ogu (2000) interviewed 591 households in Benin-City, Nigeria and found out that three-fifth of the respondents had no solid waste collection service. This is attributed to inadequate resources, and the privatization scheme set up in 1995 to address the environmental issues. The study stressed the need for private partnership with government in providing adequate delivery services to the public. Similarly, Nkwocha *et al.* (2011) assessed the efficiency of the solid wastes collection services in Owerri municipality and observed that the level of efficiency in waste collection was only about 61%, a situation they attributed to a wide range of socio-economic and technical factors. Ogwueleka (2009) investigated solid waste management involving nine cities in Nigeria and discovered that a great majority of the total solid wastes generated in the cities are organic in nature. The study revealed that there is gross inefficiency in the solid waste management in practically all the cities. The poor performance was attributed to inadequate funding, personnel, equipment, and technological constraints.

Onwughara *et al*. (2010) examined the disposal habit, environmental impact of solid waste management in Umuahia, Abia State, Nigeria. It gavean overview about the various management practicing and necessary rules to achieve sound management. With a population of about 1.2 million people who produced 250 metric tons of waste in 2005 and 350 metric tons of waste in 2007 daily. The study revealed that (80.0%) of the solid wastes was generated from market traders consisting of mixed wastes containing hazardous and non-hazardous components which are separated, treated or recycled before disposal by the municipality.

Solid waste generation scenario in Nigeria has been of great concern to the government and waste generations have been known to pose hydra-headed problem beyond the scope of the local and city councils (Awomuti, 2008)).The reason is centred on the fact that major streets experience continual presence of solid waste from varying sources. Although studies have been conducted on various aspects of the phenomena in Nigeria, however, most of the studies are confined to the much larger and older cities, and thus seemed that the awareness about the situation in the smaller but new cities, which may even be experiencing faster urbanization, are being neglected. Karu is one of such relatively new but rapidly expanding urban areas yet to be fully explored for adequate data on solid waste generation, collection, disposal and management practices.

3. Methodology

3.1 Reconnaissance Survey

A reconnaissance survey was undertaken in February 2012 in the study area. The objectives were to obtain available relevant information on the environment of the study area; intimate and seek for cooperation of key stakeholders in particular, the agency Karu zone, and the community leaders andto obtain a general overview of the study area. The outcome of the preliminary survey was the identification of key informants to the project and verbal assurance from the Waste Management Agency, Nasarawa, Karu Zone in the study area.

3.2Data Selection

In order to achieve the aim and objectives of this study, data were obtained the following:-

  i. Household characteristics, waste generation and management – through questionnaire survey.
 ii. Waste composition and volume – through on-site sorting and measurement of wastes.
iii. Capacity of Karu waste management agency and activities – through in-depth study added by structured questionnaire and check-list.
 iv. Bio-physical and socio-economic environment of Karu – through field observation and desktop review.

3.3 Detail Field Survey

The field method employed incorporated questionnaire and interview survey, field observation and measurement. The questionnaire and interview survey made use of both structured questionnaire and checklist. The observational checklist was applied to the characterization of the dump sites while measurement of waste generated was carried outat different points of solid wastes being generated.

3.4 Questionnaire Administration

The questionnaire was in two categories namely the household and the waste management agency. The household questionnaire was used to establish household solid waste management practices, quantity of waste generated, and challenges faced with solid waste disposal. The second part was on waste management as regards cleanliness of the environment, method of disposal of household refuse, distance to disposal point, and frequency of collection by the board charged with this duty. In all, two hundred and thirty (230) samples were selected from the households, using combined stratified, random and systematic sampling methods. Firstly, the whole ofKaru Urban Area is stratified according to major settlement that coalesced to form the town namely, New Karu, Maraba, Masaka and Ado. Secondly, numbers of streets within each sub-town were selected using simple random sampling method. Finally, systematic sampling method was used along each selected street to pick household to be interviewed. Giving marked variation in the size and population of the sub-towns, the number of streets and therefore the respondent households vary amongst the different locations. The interviewees were the household heads or spouses. Also, before the commencement of the data collection, the structured household questionnaire instrument was pre-tested and some amendment was made after the pre-test. The second category of questionnaire was used in an in-depth study of the Waste Management Agency Karu Zone, which centred on the activities of the agency with respect to capacity in terms of human and capital resources, the staff strength, available and functional facilities for waste collection, frequency of waste evacuation, allocation of designed dumped sites and major problem faced.

3.5 Field Measurement of Wastes

On-site waste separation and measurements were done at individual households across the town which involved sorting and weighing all wastes from selected households on daily basis for eight consecutive days. Each household selected amongst those who responded to the household interview survey in a street was used in the waste generation monitoring exercise. The households were grouped into 3 categories namely high, middle and small. The households were provided with ten (10) litter plastic bins with which they collected their daily waste. The next day the bags were collected, sorted into categories and the weight of various wastes were determined by using a 10 Kg weighing scale. Gloves and refuse bags were used in sorting the wastes, while face-masks and work-suits were used for protection oneself during the sampling and measurement period.

3.6 Field Observation

The field observations concern characteristics of dump-sites and general environmental sanitation. The field observations were based on a checklist in relation to such items as spatial extent of dump-sites, location and stage of decomposition of materials. It also consists of interview with dumpsite attendants and close-by residents. From the two hundred and thirty (230) samples, seventeen (17) respondents wrongly completed their questionnaire and were subsequently cancelled. However, only two hundred and thirteen (213) samples were subsequently used for the study.

3.7 Methods of Data Analysis

The methods used for analysis of data consisted of descriptive statistics of frequency count, mean, tabulation and percentages to summarize the data into meaningful form. Also, analysis of variance (ANOVA) in SigmaStat 3.5 Package was employed in order to determine the significant difference on thegeneration of wastes among the household groupson one hand and waste collections by the authorities on the other handas well as average waste generationbetween the three major income groups (high, middle, and low) in the four residential areas namely, Mararaba, Masaka, Ado and New Karu. Statistical test for significance was based on 5% level of significance (95% confidence level). Graphs were plotted with Microsoft Excel 2010 version.

4. *Results and Discussion*

4.1 Socio-economic Characteristics of the Respondents

The traits of the respondents were examined and the results presented in Table 1. The result showed that Masaka has the highest female respondents with (16.0%), followed by Mararba with(14.6%) then Masaka and Ado with (14.1%) respectively. For the males, (12.2%)responded in Mararaba, (10.3%) in Ado while (9.4%) responded in Masaka and New Karu. The ages of the respondents are between 21–50 years with higher proportion of the aged group 21-30 (35%). Followed this is the 30-40 years age-group (27.0%) and 40-50 years of age-group (22.0%).

However, less than 20 years of age and over 50 years of age respondents constitutes the least percentages about (7.0%) and (9.0%), respectively. The result obtained is fairly the same as the overall pattern when the data was broken down into the respective wards.

The primary occupations of the respondents were assessed in this study Table 1. It was clear from the data that(8.9%) of the Masaka and Ado respondents are civil servants while New Karu and Mararaba has (8.5%)and (7.5%) respectively. Further, (9.4%) of the respondents in Masaka are business men and women, (7.5%)were recorded in both Ado and New Karu, while(7.0%)was recorded in Mararaba. Furthermore,(9.9%) of Mararaba respondents are students, (6.1%)in Ado,(5.6%) in New Karuand(4.7%) was reported in Masaka. In addition, Mararaba and Masaka recorded (2.3%) farmers while only (1.9%)was recorded in Ado and New Karu. However, the result showed that the civil servants generate most of the wastes than others in the area.

Also, the businessmen and students constitute the second and third generator of wastes through their consumption rate and this corroborates with observations of Adewumi, *et al* (2005)who reported that the rate of refuse disposal increases due to the differences in income and thus the greater the purchasing power and therefore probability of generating more refuse.

The analysis showed that the respondents with tertiary qualification constitute the highest percentage in Mararaba (17.8%), Masaka (16.9%), Ado (15.9%), and New Karu (12.7%). However, the number of respondents with secondary qualification was more in New Karu, Ado and Mararabaand less in Masaka; with (8.9%), (8.0%),(7.0%) and (3.8%), respectively. Further, (1.9%) drop outs from the respondents are recorded in Masaka,(1.4%) in Mararba, while (0.5%)and (1.9%) from Ado and New Karu respectively.

4.2 Household Waste Characterization and Volume Generated

The household waste characterization and volume of waste generated by the respondents in the study area was determined and the results presented in Figure 1. It showed that in Mararaba, food wastes, ashes and other wastes constituted the largest components of solid waste generated in the area; amounting to some (27.0%), (14.0%) and (19.0%) of the wastes respectively. Bottles and glasses (10.0%), wood (10.0%), nylon (6.0%), metals and cans constitute about(6.0%), rags made-up the (4.0 %) respectively, while paper and rubber wastes amounted to some(2.0%) of the total waste generated. In the New Karu residential area, food wastes are the largest waste generated wastes constituting (33.0%) of total solid waste. Other wastes (18.0%), bottled glass wastes (12.0%), ashes (11.0%), Nylon (4.0%), metals and cans (6.0%) papers accounted for the (4.0%) and woods (10.0%).

Fig. 1: Household Waste Characterization in Mararaba, Masaka, Ado and New Karu

Masaka

Ado

New Karu
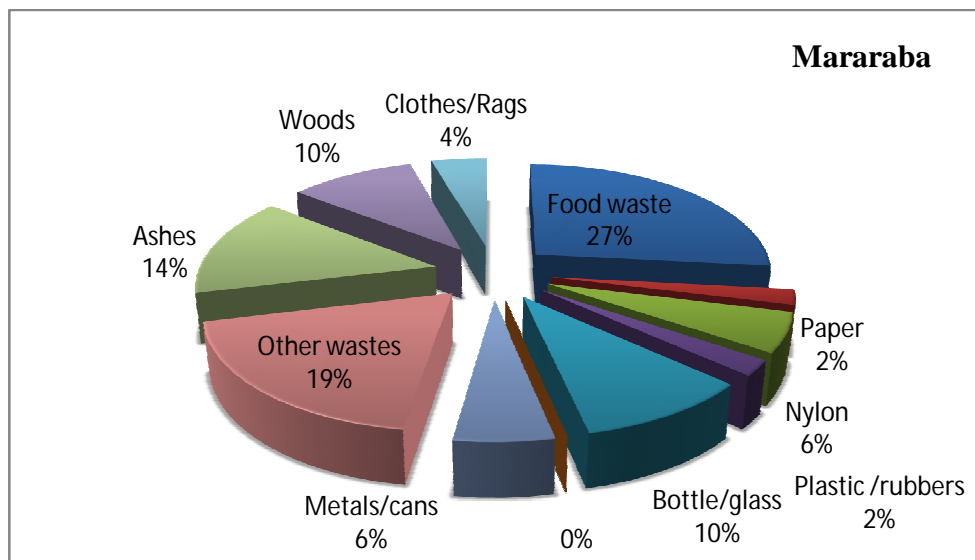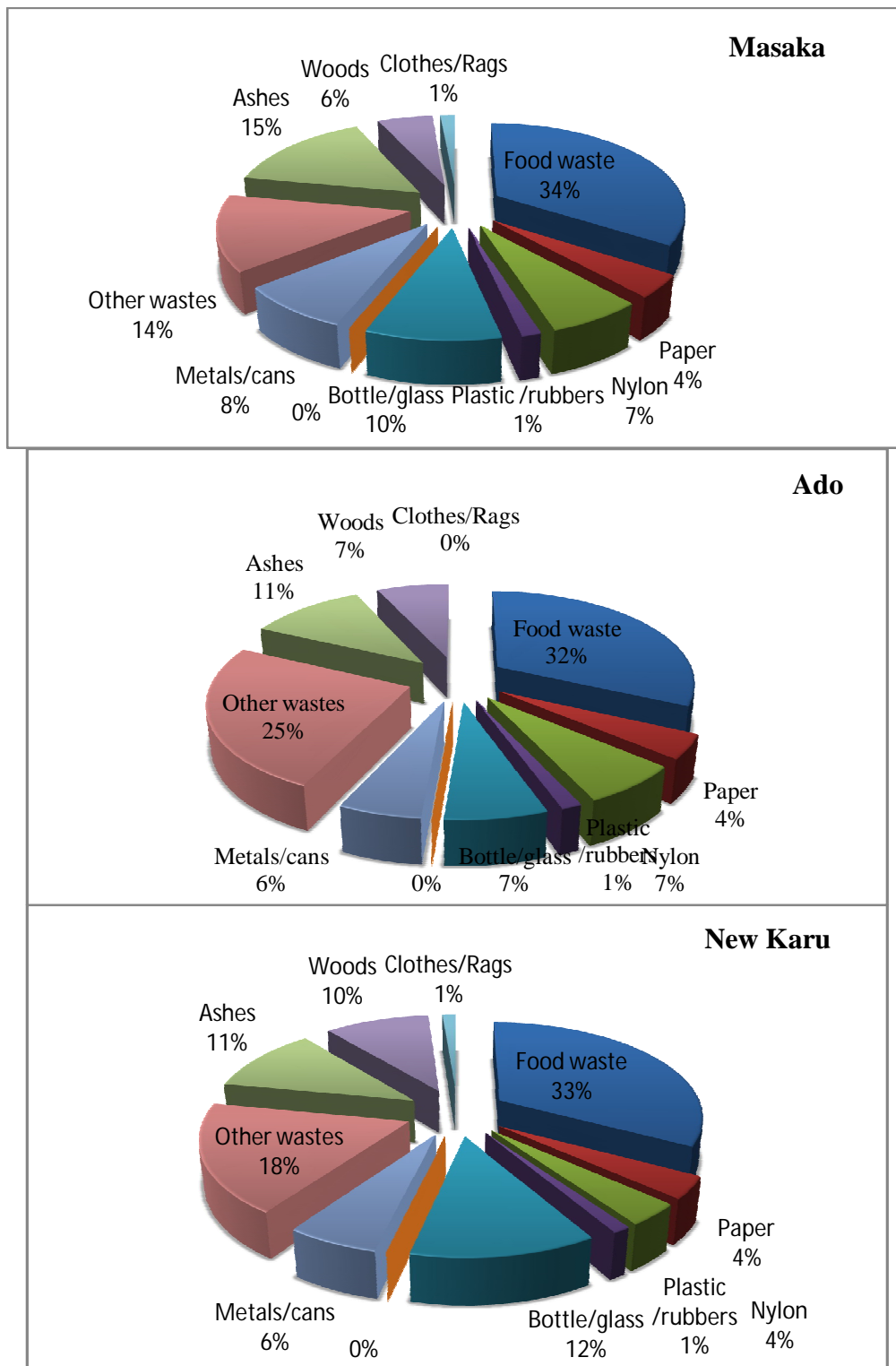
Source: Authors

In the Masaka residential area, food wastes constituted(34.0%) of total waste, followed by ash waste (15.0%) while other wastes accounted for (14.0%), bottled glasses (10.0%), metal cans (8.0%), and woods accounted for (6.0%), papers (4.0%), Nylon (7.0%), clothes and rags constituted some (1.0%) and plastic rubber (1.0%) of the total wastes generated.

In Ado area however, food wastes also comprises the largest waste load amounting to (32.0%) of total solid waste, while other wastes (25.0%), ashes (11.0%), bottle glass (7.0%), Nylon (7.0%), metal cans (6.0%), papers (4.0%) and wood (7.0%) of the solid wastes. However, plastic rubber constituted a small proportion of (1.0%)

4.3 Methods of Waste Disposal in the Study Area

The study examined various methods of solid waste disposal and handling practices and the results are presented in Fig. 2. Waste disposals which includes, burning, a direct dumping in open pits, waste bins and compositing. It shows that open burning of waste is the most commonly used in Mararaba, Masaka and New Karu with respondent values of (7.5%), (5.6%) and (5.2%) respectively with the exception of Ado which recorded low value of(4.7%).

Fig. 2: Methods of Solid Waste Disposal in (%)
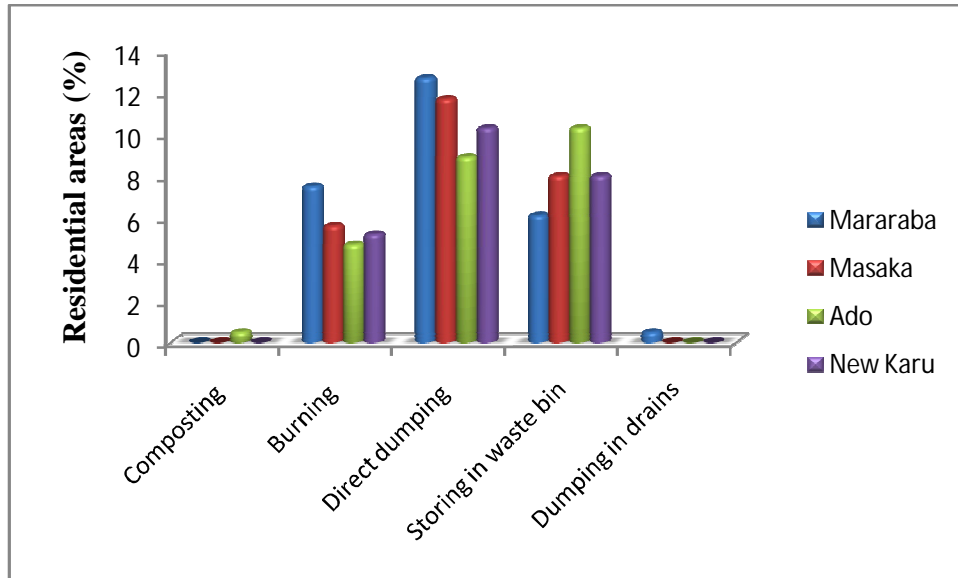
Source: Authors

It is obvious that the direct dumping in the open space is common in Mararba area (12.7%); followed by Masaka (11.7%) and New Karu(10.3%). This showed that the authorities concerned with management of solid waste disposal of the area do not supply designated dumpsites around the areas but at the outer region of the area, making the distance farther away.However, storing in waste bin wasthe most commonly used in Ado (10.3%), followed by Masaka and New Karu (8.0%) and Masaka (6.1%). This particular method of waste disposal tends topollute the environment and poses danger to ecological receptors.

4.4Distance to the Dump Sites

The distance to the disposal points were further determined and the result was presented in Table 2. It shows the distance of various disposal points in metres. About (19.7%) of the respondents have their disposal point located at a distance of 1- 50 metres in Masaka, (10.3%) inMararba, (9.4%) in Ado and (8.9%) in New Karu showing the proximity of the designated dumpsite in the area. At a distance of 51 -100metres, Mararaba recorded (9.4%), Ado,(7.0%), New Karu,(6.1%) and Masaka,(3.3%).In Mararaba and Ado, (4.2%) of the respondents dispose their waste at a distance of 101 -150 metres, and (3.3%)in New Karu while Masaka has only (1.4%) of the respondents.It was also observed that in New Karu about (5.2%) dispose their refuse at a relative distance of 150metres and above, while (3.8%)and (2.8%) disposed refuse in Ado and Mararaba respectively.

It is evident from the result that the farther thedesignated dump-sites, the lesser theuse by the respondents. This shows that people are of the habit of dumping their refuse within a close range to their residence or where they carry out their daily activities due to distance apart and it accounts for huge heaps of accumulated refuse found along the road-sides, streets, and gutters.This further explains why people tend to disregard the use of designated official dump-sites and create alternative points.

4.5 The Capacity and Challenges FacingSolid Waste Management Agency Karu Zone

The study examined the capacity of the solid waste management agency in terms of personnel and facilities available in the study area. The result is presented in Table 3. Generally, all solid wastes produced in Karu are collected for final disposal at various designated sites by the Waste Management Agency Karu zone. It was revealed that theagency was not able to cope with the environmental problems in the area since the amount of solid wastes produced often exceeds the rateof disposal. This is largely due to inadequate equipment; funding, trained personnel coupled with the attitudes and perception of the public on environmental issues which tend to compound the problem of solid waste collection and disposal.It was observed that the waste management agency, Karu zone has only three functional refuse vans for the collection and transportation of solid wastes from the town to designated dumpsites and one pay-loader which they used to compact the waste before burning. It was observed that most of the available facilities are either inadequate or not functional to cover the entire area in the process of collecting, transporting and disposal of solid waste. In addition, the staffing strength of the agency was low in that it has only twenty eight staff instead of one hundredstaff that is required for the effectiveness of the job.

This explains in part why the frequency of refuge collection takes rather too long to be evacuated. Thestudy indicates that the bigger challenges facing the authority has to do with finance, shortage of staff, inadequate disposal facilities and non- challant attitude of the inhabitants towards waste disposals and collections. It was reliably gathered that most of the available facilities such as refuse vans are either broken down or functional ones are not able to carry out the job of refuse evacuation effectively. Further, the number of workers on the field was found to be grossly inadequate. Otherchallenges are inadequate funding, free-care attitude of inhabitants, lack of physical planning; inadequate disposal points are among the contributing factors.

5. *Recommendations*

Instituting appropriate waste collection and disposal agency and establishing more government approved dump-sites in the area. Also, the provision of more collection receptacles and regular waste collection is imperative. At present, the number of receptacles provided are inadequate and they are not emptied until the waste has completely spilled over, becoming a health hazard. Moreover, there should be adequate provision of adequate funds by the government for maintenance of the equipment and acquiring of new ones.It is important to increase the number of qualified and trained personnel to manage and operate various waste management systems and equipment.

Establishing strong public awareness campaign and the effects of wastes on human health becomes imperative. It will go along way to increase community knowledge in developing positiveattitude to environmental hygiene and participate actively in the crusade towards reducing the volume, type and toxicity of hazardous wastes as wells assisting in their environmentally sound management. There is a need for education, training and sensitization among media personnel to help equip the residents with the awareness on emerging issues on waste management. Provision of monitoring and enforcement of new and existing legal framework: The units will help in enforcing the waste management laws so as to prevent irregular wastes disposals and ensure efficient waste management practices.

There is need to intensify efforts towards generating relevant data with respect to the waste generation, collection, volume, characterization, sources and composition in the area. Data bank is essential for meaningful environmental planning and the sustainability of waste management practices.

Further still, there should be provision for sanitary landfill facilities for a proper deposition of solid waste. This will help minimize pests, disease, air pollution, ground, surface waste pollution and also improve aesthetic values because it offers a final resting place for solid waste.It has been emphasized by (Victor and Choji, 2006) the encouragement of waste re-cycling, composting and reuse thus, resource recovery from solid waste will become an important method of solid waste management and private agencies need to be encouraged to participate in reusable waste recovery and general waste management efforts.

6. *Conclusion*

Municipal solid waste management agency is a major organ of the government and as such should be given necessary attention it deserves in her efforts towards sustaining the aesthetic and quality of the environment.Issues involving human health should be addressed with all sincerity of purpose.

Indeed, government at all levels should collaborate with private individuals, corporations and agencies to ensure sound sanitation and hygienic environment devoid of common virus and communicable diseases for a healthy society. It is obvious from the study that the solid waste management agency in Karu Nasarawa State, Nigeria has been incapacitated to cope with the mandate saddled on it especially in the area of collection, disposal and managing the wastes generated in the area. The situation is more compounded with inadequacy of funds, modern equipment,inadequate qualified personnel and laissez-faire attitude of the public to waste management.The ugly situation can be improved upon by mounting enlightenment campaign on mass media alerting the public on the danger of environmental deterioration and as faithful stewards, the society is required to preserve, conserve and sustain the environmental resources.

References

Abel, O.A. &Afolabi, O. (2007).Estimating the quantity of solid waste generation in Oyo, Nigeria.Waste Management and Research.SAGE Journals.25(4): 371-379.

Adekunle, I. M.,Adebola, A. A.,Aderonke, K. A., Pius, O. A.&Toyin, A. A.(2011). Recycling of organic wastes through composting for land applications: A Nigerian experience.Waste Management Resources. 29(6): 582-93.

Adewumi, I. K,,Ogedengbe, M.,Adepetu, J. &Fabiyi, Y. L. (2005). Planning organic fertilizer industries for municipal solid wastes management.Journal of Applied Sciences Research, 1(3): 285-291.

Afon, A.O.(2006).Estimating the quantity of solid waste generation in Oyo, Oyo State, Nigeria.Journal of Institute Town Planners. 19(1): 49 -65.

Ajani, O.I.Y. (2007). Determinants of an effective solid waste management in Ibadan Metropolis Oyo State, Nigeria. Journal of Food, Agriculture and Environment, 6(1): 152-157

Awomeso, J.A., Taiwo, A.M., Gbadebo, A. M. &Arimoro, A.A. (2010). Waste disposal and pollution management in urban areas: A workable remedy for the environment in developing countries.American Journal ofEnvironmental Science. 6:26-32.

Awomuti, A. A.(2008). An Analysis of waste generation rate and pattern in Ilorin, Nigeria.Lapai International Journal of Management and Social Sciences, 1(1): 171- 183.

Babayemi, J. O. & Dauda, K. T. (2009). Evaluation of solid waste generation, categories and disposal options in developing countries: A case study of Nigeria. Journal ofApplied.Science. 13(3:83 – 88

Bamgbose, O.A., Arowolo, T.A.;Oresanya, O. and Yusuf, A.A.(2000). Assessment of urban solid waste management practices in Lagos, Nigeria. African Science 1(1): 23-31.

Bassey, B.E;Benka, M.O,Aluyi, H.S.A, (2006).Characterization and management of solid medical wastes in the Federal Capital Territory, Abuja, Nigeria. African Health Sciences 6(1): 58-63.

Blight, G.E. and Mbande, C.M. (1996).Some problems of waste management in developing countries.Journal of Solid Waste Technology and Management. 23:19-27.

Dauda, M; Osita, O. O. (2003). Solid waste management and re-use in Maiduguri, Nigeria:Towards the Millenium Development Goals. 29th WEDC International Conference, Abuja, Nigeria. Pp. 20-23.

Doan, P.L.(1998). Institutionalizing household waste collection: The urban environmental management project in Cote d'lvoire.Habitat.22: 27-39

Igoni, A. H.,Ayotamuno, M.,Ogaji, S. O. T.,Probert, S. D. (2007).Municipal solid waste in Port Harcourt.Nigeria.Applied Energy.Elsevier. 84(6): 664-670.

Momoh J.J. and Oladebeye, D. H. (2010).Assessment of awareness, attitude and willingness of people to participate in household solid waste recycling programme in Ado-Ekiti, Nigeria.Journal of Applied Sciences in Environmental Sanitation. 5 (1): 93-105.

Nkwocha, E. E., Pat-Mbano, E. C. and Dike, M. U. (2011), Evaluating the efficiency of solid waste collection services in Owerri municipality, Nigeria. International Journal of Science and Nature. 2(1): 89-95.

Ogu, V. I.(2000). Private sector participation and municipal waste management in Benin City, Nigeria Environment&Urbanization. 12: 2

Ogwueleka, T. C. (2009). Municipal solid waste characteristics and management in Nigeria.Iran.Journal of Environmental Health Science. 6(3):173-180

Okeniyi, J. O. &Anwan, E. U. (2012). Solid wastes generation in Covenant University, Ota, Nigeria: Characterisation and implication for sustainable waste management. Journal ofEnvironnemental Science. 3(2) :419-424

Onwughara, I. N., Nnorom, I. C. &Kanno, O. C. (2010). Issues of roadside disposal habit of municipal solid waste: Environmental impacts and implementation of sound management practices in developing country Nigeria. International Journal of Environmental Science. 1(5): 409-418.

Seadon, J. K. (2006). Integrated waste management: Looking beyond the solid waste horizon. Waste Management.(26):1327-1336.

Sharama B.K. (2005).Solid, toxic, and hazardous waste.Environmental chemistry, Goal Publishing, India.Pp. 455-466.

United Nations Environmental Protection (UNEP) (2002).International Source Book on Environmentally Sound Technologies for Municipal Solid Waste Management.(ETC) Technical Publication, USA.

Victor, I. &Choji, I. D.(2006).Composting: A viable option for urban waste management in Nigerian cities. Journal of EnvironmentalStudies 2(5):21-26

Table 1:Socio-Economic Characteristics of the Respondents in the Study Area

Traits	Residential Areas								Total	
	Mararaba		Mararaba		Ado		New Karu			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	
Gender:-										
Male	26	12.2	20	9.4	22	10.3	20	9.4	88	41.3
Female	31	14.6	34	16.0	30	14.1	30	14.1	125	58.7
Age-group:-										
0-20	6	2.8	1	0.5	3	1.4	4	1.9	14	6.6
21-30	26	12.2	15	7.0	19	8.9	15	7.0	75	35.2
31-40	16	7.5	14	6.6	17	8.0	14	6.6	59	27.7
41-50	6	2.8	14	6.6	12	5.6	14	6.6	47	22.1
Over 50 Years	3	1.4	10	4.7	1	0.5	10	4.7	18	8.5
Occupation:-										
Civil Servant	16	7.5	19	8.9	19	8.9	18	8.5	72	33.8
Business	15	7.0	20	9.4	16	7.5	16	7.5	67	31.5
Students	21	9.9	10	4.7	13	6.1	12	5.6	56	26.3
Farming	5	2.3	5	2.3	4	1.9	4	1.9	18	8.5
Level of Educ.:-										
Primary	1	0.5	6	2.8	-	-	-	-	7	3.3
Secondary	15	7.0	8	3.8	17	8.0	19	8.9	59	27.7
Tertiary	38	17.8	36	16.9	34	15.9	27	12.7	135	63.3
Drop-outs	3	1.4	4	1.9	1	0.5	4	1.9	12	5.6

Source: Authors

Table 2: Distance to Disposal Dump-Sites in the Study Area

Distance (m)	Residential Areas									
	Mararaba	%	Masaka	%	Ado	%	New Karu	%	Total	%
1 – 50	22	10.3	42	19.7	20	9.4	19	8.9	103	48.4
51- 100	20	9.4	7	3.3	15	7.0	13	6.1	55	25.8
101-150	9	4.2	3	1.4	9	4.2	7	3.3	28	13.1
> 150	6	2.8	2	0.9	8	3.8	11	5.2	27	12.7

Source: Authors

Table 3: The Capacity, Equipment and Personnel in the Study Area

Type	Number required	Number present	Condition of the vehicles (Functional/Disrepair)
Refuse vans	10	3	Functional
Tippers	5	3	Functional
Other vehicles	5	-	-
Others (Bulldozer, Pay loader etc.	3	1	Functional
Total	23	4	Functional
Types and number of personnel			
Type of workers	Number required	Number present	-
Administrative	30	10	-
Technical	20	5	-
Labourers	40	10	-
Casual workers	10	3	-
Total	100	28	-

Source: Authors