Waste Management a Tool for Clean Environment in Residential Areas of Minna, Nigeria

P. Ayuba[1], S. Oyetola[2], O. F. Adedayo[3], R. E. Olagunju[4], T. Ogunmola[5]

[1] Department of Architecture, Federal University of Technology
Minna, Niger State, Nigeria

[2] Department of Architecture, Federal University of Technology
Minna, Niger State, Nigeria

[3] Department of Architecture, Federal University of Technology
Minna, Niger State, Nigeria

[4] Department of Architecture, Federal University of Technology
Minna, Niger State, Nigeria

[5] Department of Architecture, Federal University of Technology
Minna, Niger State, Nigeria

ABSTRACT— ***Humans need to dispose unused substances as waste. This natural cycle is beyond human control. Though waste cannot be eliminated completely, it can however be managed. Developed countries have gone a long way to manage and re-use such waste. In third world countries like India, Nigeria and other African countries, management of waste is proving a hard nut to crack. It is observed that many houses in Minna metropolis don't have adequate access for waste Disposal and collection when necessary. This raises a question as to how the waste generated by occupants of these houses is managed. This paper aims at assessing the current municipal waste management practices in Minna metropolis with a view to suggesting better approaches if need be. In the course of the study, observation plays a key role in identifying the problem in these areas, while structured interview of occupants is used to shed more light on the root causes of the problem(s) observed. Data gathered is collated and analyzed, and from which deductions are made. From the findings it showed that the food remnants formed the highest percentage of waste with about 50% of the wastes examined while plastics waste was at an average of 13%. Recommendations are made as to how best to manage municipal waste in residential areas of Minna, Nigeria.***

Keywords— environment, municipal waste, residential, waste disposal, waste management

1. INTRODUCTION

The relationship between man and the environment he lives in is one that has been in existence since the dawn of time. Man has existed and learnt to live within the environment he has found himself thus it is the backbone of his existence as it provides him with all he needs to stay alive. The environment can be described as all the external factors affecting an organism [11]. This includes factors which are living and non living organism that makes up the structure of the organism. The environment has a tremendous effect and utmost importance to man and his activities hence there is the need to take care proper care of it. The environment provides the structure for all activities whether social, economical, physical and even psychological and thus one cannot live without it, [6]. However due to mans exploits in the environment there has been an increase in activities that threaten the environment and the harmonious balance. These activities have different effects on the environment, some have negative effects such as; environmental degradation, deforestation, fire hazard, and accumulation of waste.

Waste was not a major issue during the wandering years of man but after discovery of a sedentary life style and communities, waste began to emerge. Nigeria today has several centers of urban development with the problems associated with infrastructural development. This leads to generation of more waste which becomes difficult to manage. The discharge and dumping of waste has over the years proven to be an activity that has negative impact on the environment [1]. Waste is the disposal of solid, semi-solid, liquid materials that are unwanted as a result of human and animal activities and can easily be categorized into biodegradable and non-biodegradable waste. Mans exploits have found out that the ability to decompose such solid and semi-solid biodegradable waste can be used as a resource and has

lead to the development of the biogas technology a better and effective management of such waste and better care for the environment [2]. The waste disposal methods available in Nigeria are unsafe to man and his environment. There are carcinogenic potentials and other health related hazards present in the kind of waste generated and disposal method applied today in Nigeria. Physical degradation of the environment, fire hazard from uncontrolled burning of refuse are amongst other emerging problems. Landfills are so poorly done that what is obtainable are open dumps that leach flow of poisons into surrounding water bodies and ground water, while others are collapse and cause building to sink especially when built on landfiled site that have not settled properly [3].

The solid and hazardous waste regulation section I, S.I.15 1991 stated some policies which include the following;

1. Research should be undertaken into possible reduce, re use and recycling of waste.
2. Identification of solid waste that is dangerous to public health. (Solid and hazardous waste regulation, 1991).

From the above policies initiated by the federal Government of Nigeria it is seen that there is a clear need to research into the reuse of waste and better management of such waste that becomes a problem to public health and the environment. This is the case in Minna where open dump is the major disposal technique; this has various environmental concerns considering the various sources of waste. Agriculture which provides a number of services such as crop production and animal rearing, has become a known source of waste due to its demand [8]. Human waste has also increased as a result of increase in population in the state with Minna, the capital city of Niger State, Nigeria has a total population of approximately 510,000. The average population density in Minna is about 3448 persons per km2 [11]. The continuous population growth in the state implies more people more waste, and more waste also implies more resources needed for waste management, the increased population inflow should be considered in designing a waste management plan [7]. Being a small and densely populated town, Minna is potentially vulnerable to the outbreak of any infectious diseases. The combination of all of the above has lead to growth of waste in general.

Non biodegradable waste has some kind of value and is sometimes retrieved by scavengers and smelter. Biodegradable waste in the city has so far been overlooked and underutilized as a resource material [5]. Waste management is a global issue which needs maximum attention. In developing countries, waste management agencies lack the resources and trained staff to provide their rapidly growing populations with the necessary facilities and services for solid waste management to support good quality of life [9] within the framework of sustainable development.

It can be inferred that human activities cannot exist without generation of waste it is a passive action which raises the following question, which is how can waste be managed effectively in urban areas.

The uniqueness of environmental problem is that the activity may take place locally but the consequent pollution and degradation on the environment is felt worldwide [10]. This has made it a principal problem in the minds of everyone from the government to the non-governmental organizations. The problem cannot be over emphasized as it brings about the following:

(i) Pollution and gathering of waste.

(ii) Ground water contamination and pollution.

(iii) Increase of green house gases carbon-dioxide and methane in the atmosphere from landfill and open dump emissions.

(iv) The environment loses its natural and aesthetic values.

(v) Deteriorating hygienic conditions due to poor waste management.

These problems listed above exist due to lack of a proper plan considering the constant population increase, a lack of proper projection and economically rewarding experience for participants. According to [13] the increases in population and income have contributed to the volume of solid waste generated. It implies that as cities grow waste management should be an important part of the city planning. Population increase has been identified by several researchers [4], [12] &[14] as the cause of increase in waste management problem, in Nigeria the influx of migrants from rural to urban areas is the contribution factor to population growth. These problems, if left unchecked will affect man and his environment, socially, health, economically as all these play a role in mans day to day activity.

The aim of this paper is to examine the effectiveness of municipal waste management in the residential areas of minna metropolis. And in achieving this aim the following objectives are developed.

1. To analyze various types and sources of waste in minna metropolis.
2. To identify the waste collection/disposal technique and it efficiency waste management system practiced in Minna.

3. To proffer a more effective waste management system if the one in place is ineffective.
4. To proffer a source of sustainable development that can be compatible with environmental management.

1.1 Causes of Improper Waste Management in Minna

Attitude towards work

Employee productivity level of a Nigeria civil servant is very low when compared to available human and natural resources. The people mandated with cleaning of the environment are not passionate about their work and just do it for a living. Their remuneration is very poor when compared to other sectors of the civil service hence the low morale of the workers, the workers also see this job as their last resort. The attitude of the Nigerian civil servants in government establishments where there is often a lack of commitment by the workers is also a key factor.

Inadequate Vehicles, Plants and Equipment and Necessary Tools

Waste has to be transported from the point of collection to the final disposal point. Hence effective and efficient collection system id needed so trucks, tipper, pay loader, bull dozer and compactor must be well maintained and provided. The collection of refuse from generation source is an aspect that has been ignored and is not considered during the development of most formal and informal human settlements.

Corruption

Corruption has eaten deep into every level of our society the budget allocation for these agencies are inadequate and often times not all what is allocated to them get to them while it not all that get to them that is used for cleaning up of the environment. The exclusive management of municipal waste by government does not give room for competition and the non-payment of fees by the people being served makes business of waste management as practiced in Minna not sustainable and unattractive for the private sector.

Waste disposal habit of the people

People are not conscious of their waste as they litter the street with their waste some pour this waste into river or drainages while some leave it to rot and pollute the environment. The mentality of majority of the population not seeing the adverse effect of improper waste management as a function of their activities is a problem. The disposal of waste by many people at night is another bad habit as it is disposed indiscriminately.

Overlap of Function of Enforcement Agencies

This has been a source of confusion as so many agencies are saddled with enforcement of law and they don't corporate with each other to achieve a common goal. In an attempt to claim jurisdiction over certain functions in waste management in the city, the job is not done anyone. The ambiguity in the laws setting up some of these agencies is a factor since most of them do not have clearly defined roles for each agency and how they are to interface with each other.

2. METHODOLOGY

The sources of data collection for this research work were through observation, interview and simple random sampling method. The study population surveyed by the research project where the inhabitant of Minna, workers of Niger State Environmental Protection Agency (NISEPA) and Niger State Ministry of Environment. The sampling method adopted for this work was systematic sampling which entailed randomly selecting the areas visited in minna metropolis, which covered areas such as Tudun Fulani, Bosso, Tunga , Kpakungu, Maitunbi, Shango and Chanchaga. The information for this paper was gathered from field work undertaken on the 20th of April 2012 to 30th of September 2012. The analysis of data was done using spss while the results are presented in tables, charts, the plates are used in the presentation of observation of identified problems. The observation method allows for spot assessment of the problem and also for comparison with data from other sources. The choice of the waste management agencies was to determine the effectiveness of the method adopted by the agencies and to understand the problems associated with waste collection in the city.

3. DISCUSSIONS AND RESULTS

Analysis of Municipal Waste Generated and It Generators in Residential Areas of Minna

Table 1: Sources and Types of municipal Waste in Minna

Source	**Waste generators**	**Types of muncipal waste**
Residential	Single and family dwellings	Food waste, paper, cardboard, plastics, textile, leather, wood, ashes, glass, metal, and special waste.
Industrial	Small and medium workshops and factorys, milling and craft	Housekeeping wastes, packaging,food waste, construction demolition material, hazardous and special waste
Commerial	Stores, hotels, restaurants, markets, markets, office buildings etc	Paper, cardboard, plastics, wood,food wastes, glass, metals, special and hazardous waste.
Institutional	Schools, hospitals, prisons, government centers.	Same as commercial
Construction and Demolition.	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plant	Street dirts,landscape and tree trimmings, general wastes from parks, and other event centres.

Source Field survey 2012

It could be observed from table 1 the source of municipal waste, the generators of these wastes and the composition of the wastes. From the table we can see that food remnant is generated by most of the waste generator. These food remnants are the causes of odour and pollution; they are biodegradable so they decompose to pollute the environment. They can be used as valuable resource in composting plant and biogas plant to generate energy, fuel and fertilizer has they can serve as raw material for these plants. There is need to encourage sorting of waste into biodegradable and non-biodegradable wastes at the sources; such as homes, offices and factories.

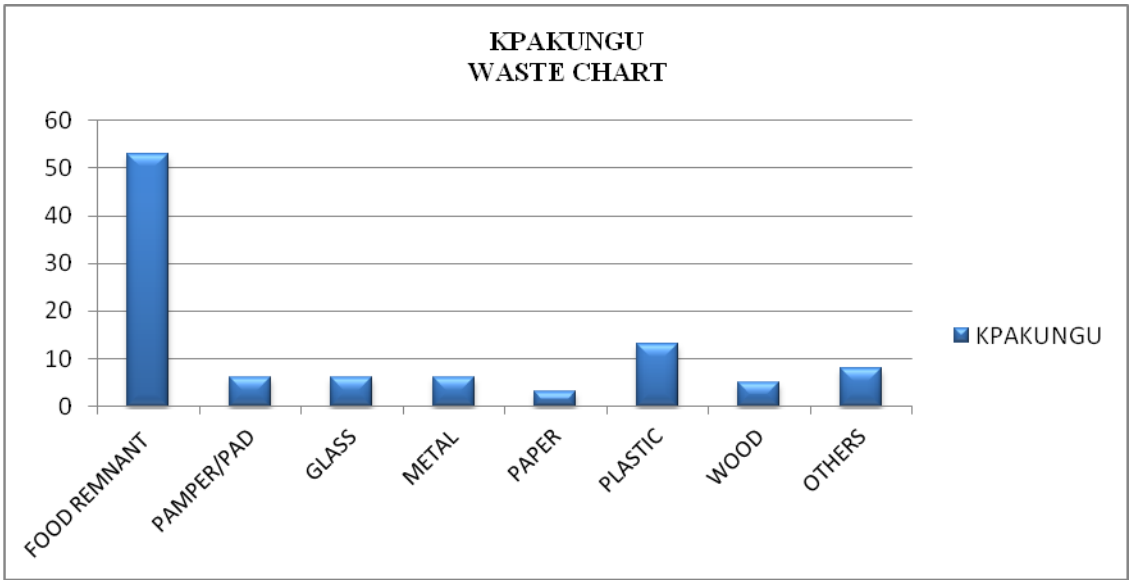

Figure 1: Showing municipal waste composition

Figure 1 show the heterogeneous waste composition in Kpakungu district with food remnant (organic Waste) having 52% while inorganic waste amount for 42% and other 6%, this is mainly of because of commercial and residential activities in the area. It implies that if the organic waste is properly sorted out and reused in the form of renewable energy and fertilizers, the quantity of waste would be reduced by approximately 50% and the effect on the environment will be significant reduced.

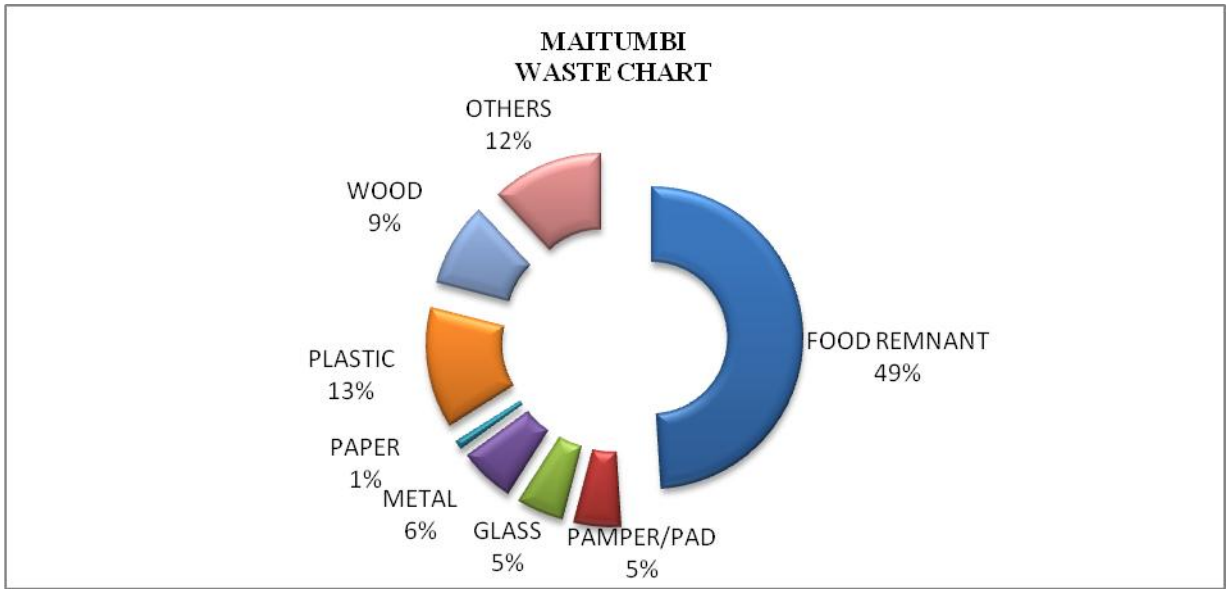

Figure 2: Showing municipal waste composition

While figure 2 shows that of Maitumbi were organic waste is 49% and inorganic waste 39% but here some of the waste could not be properly categorized due to difficulties encountered, hence the percentage of others is high 12%. This settlement has a high percentage of commercial buildings however; it can be observed that food remnants still form a high percentage of the waste. This also gives room for the reduction of waste and opportunity to reuse the organic waste. The percentage of wood, plastic and metals shows there is an opportunity to recycle some of the waste generated.

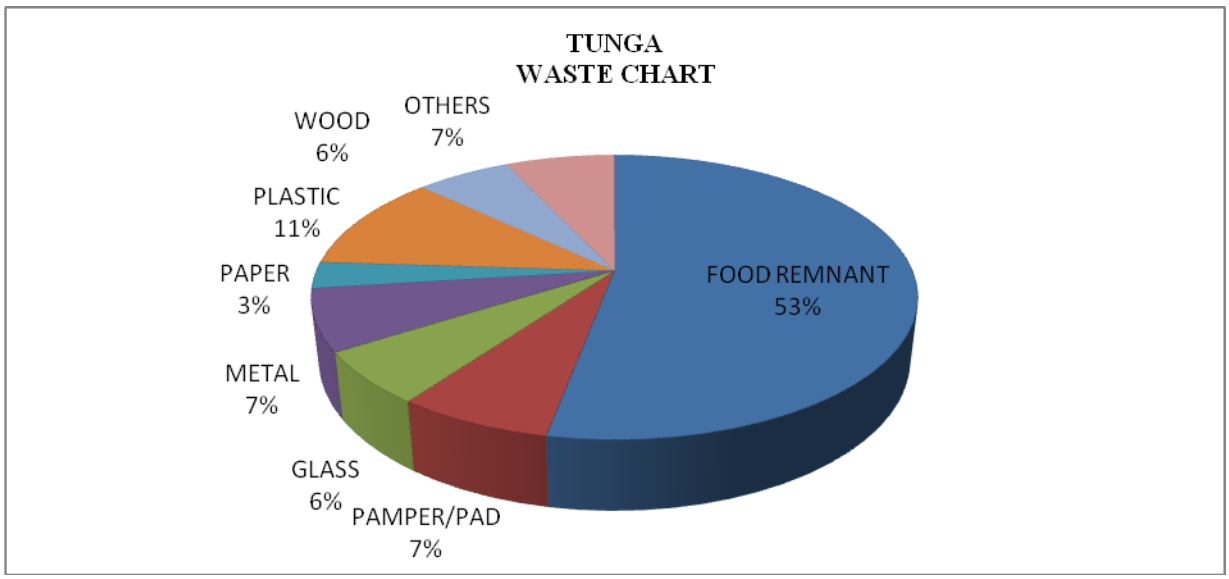

Figure 3: Showing Municipal Waste Composition in Tunga District

Figure 3 shows the heterogeneous composition of waste in Tunga food remnant amount for 53% of total waste composition while inorganic waste is 40% and others is 7%. This part of the city has a high percentage of middle and high income earners living and working here. The type of waste generated is quite similar to other parts of the city hence it offers similar benefits for waste management. The offices found in this section of the city also contribute to the type of waste in terms of paper waste generation.

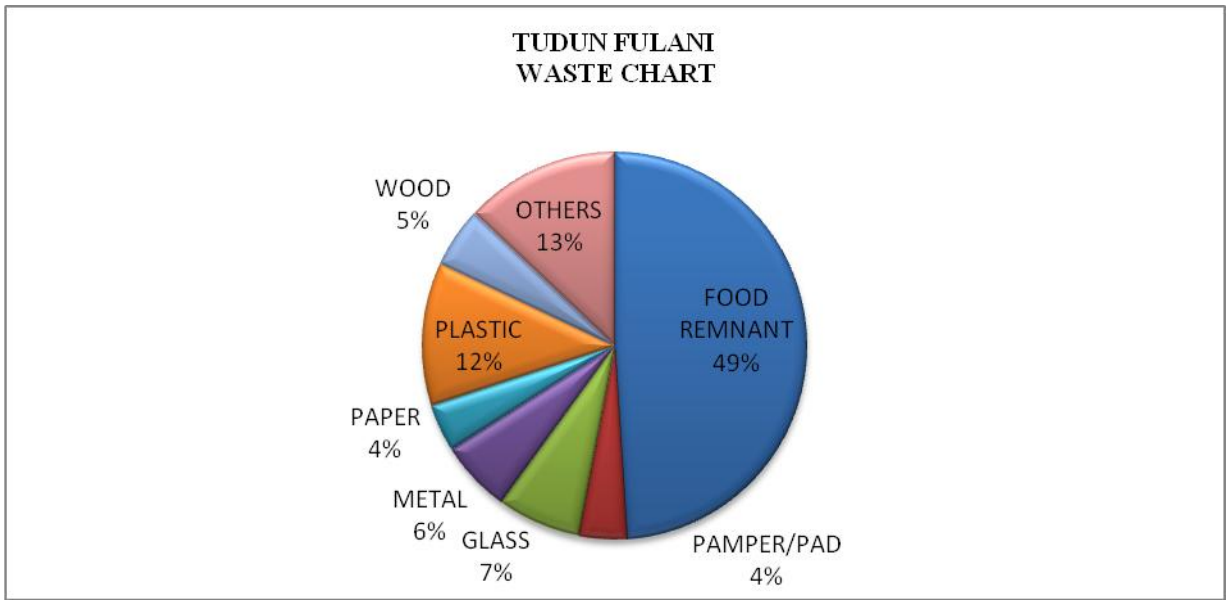

Figure 4: Showing Municipal Waste Composition in Tudun Fulani.

While figure 4 shows that of Tudun Fulani has organic waste at 49% inorganic at 38% and others at 13%, others is high due to difficulties encountered hence waste could not be properly categorized due to difficulties encountered. This particular section of the city is made up informal settlements and the unplanned nature of the settlement makes refuse collection a difficult task. The bulk of the plastic wastes are made up of sachet water polythene bags which are usually dumped indiscriminately. The residents in these settlements usually dump their refuse by the roadside for the waste management company to evacuated and in some case the refuse is disposed undeveloped plots within the community.

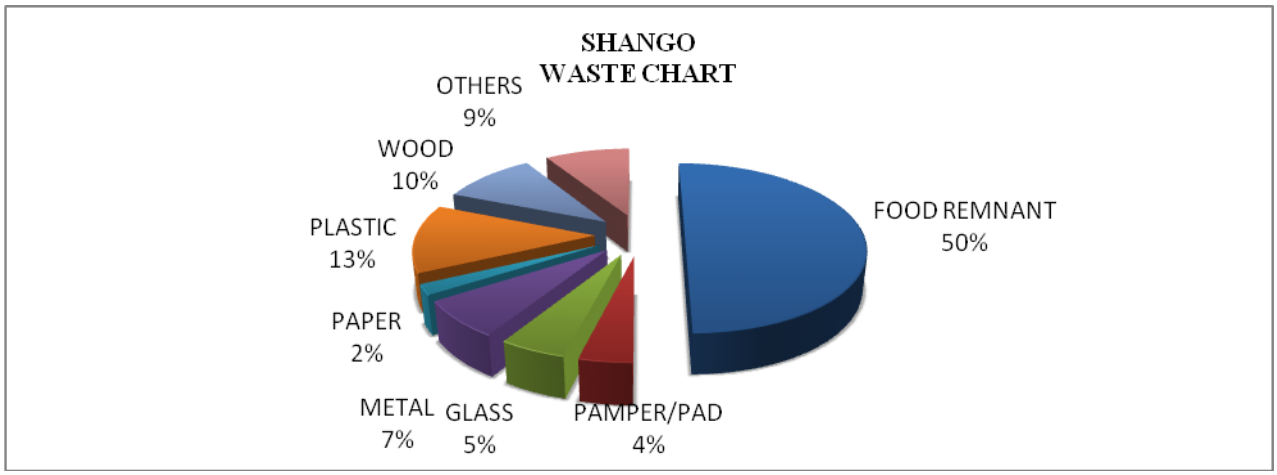

Figure 5: Shows Municipal Waste Composition

Figure 5 shows waste composition in Shango area of Minna metropolis food remnant amount for 50% inorganic 41% while others is 9%. Wood is high due to the presence of lumber mill and timber sell sheds. The waste from lumber mills can be used as a source of fuel if properly harnessed. The common method used in disposing of wood waste is through burning which affects the environment. However food remnants are equally high because of the presence of restaurants and the residences. The method of waste management is similar to other sections of the society.

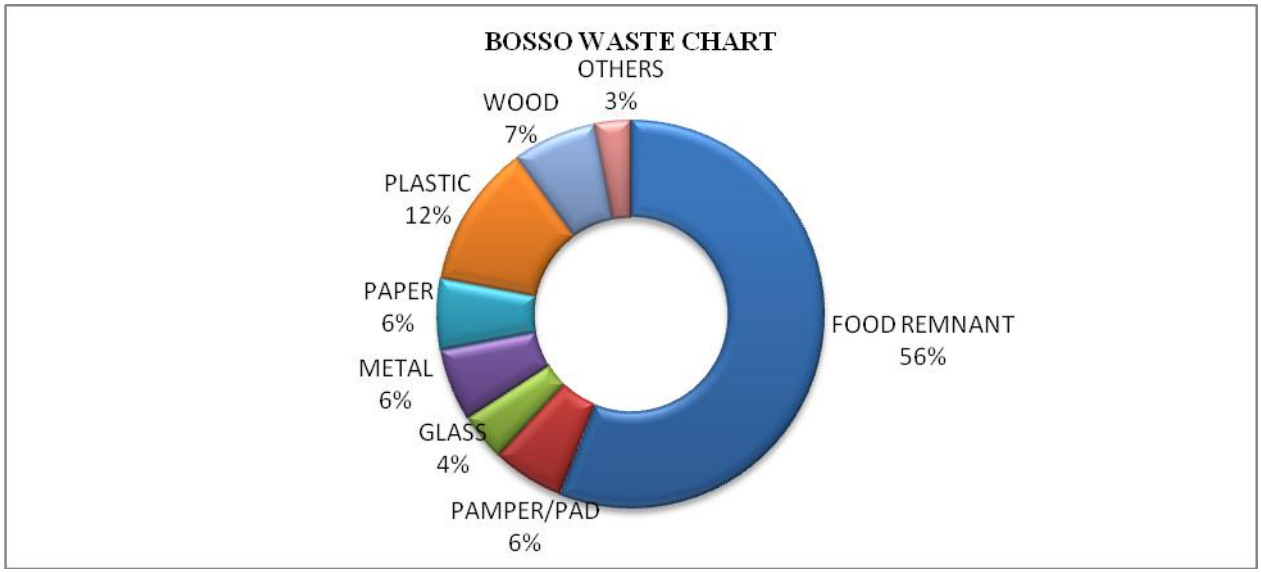

Figure 6: Shows Municipal Waste Composition

Figure 6 show waste composition of Bosso food remnant is 56% this is because of high residential and commercial activities inorganic 41% and others 3%, paper is high due to educational and printing activities in Bosso. The location of the university in this settlement makes it a densely populated area. There is a high percentage of informal settlements in this part of the city hence the problem of waste management. Polythene bags of water sachets are a major composition of the plastic waste in this community while the paper waste is predominantly from the university.

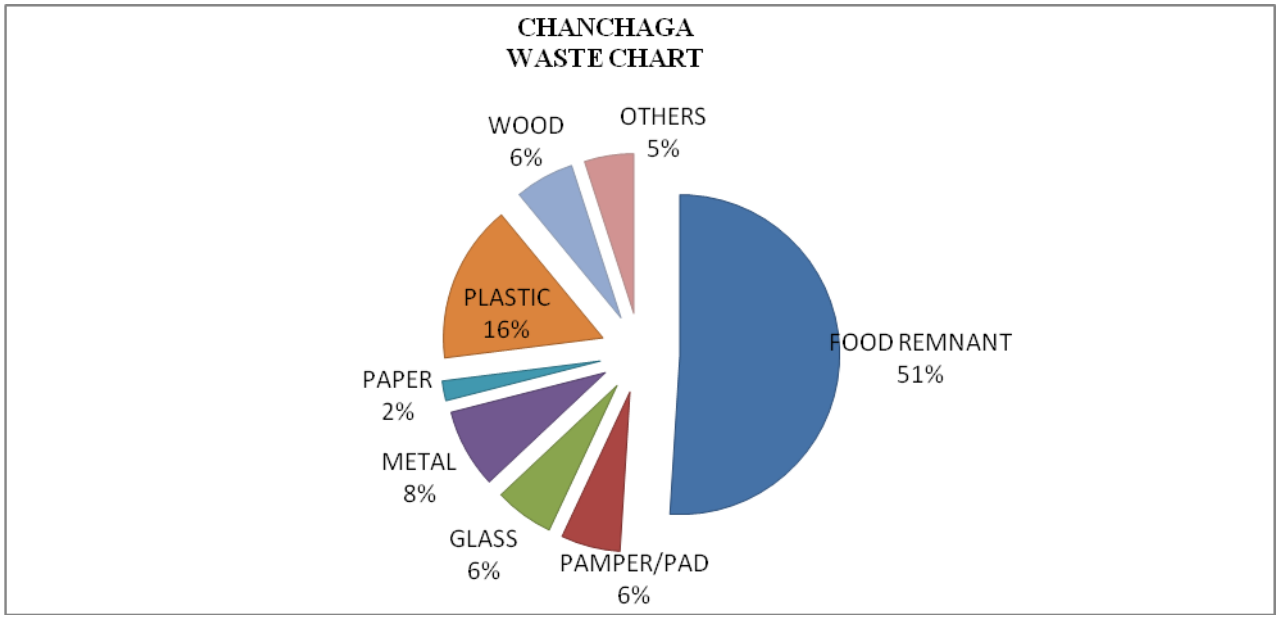

Figure 7: Shows Municipal Waste Composition in Chanchaga

Figure 7 shows waste composition in Chanchaga organic waste is 51% and inorganic at 44% and others at 4% metal is high due to activities of welders in the area. A high percentage of the waste generated in this section of the city is from residential area. It houses a large proportion of the low income earners of the society. For a waste management company interested in recycling of plastic waste, this section of the city offers a good source of raw material.

The results of the waste composition analyzed shows that the generated waste in the city is largely organic matter that is biodegradable which can be composted and also used as substrate for anaerobic digestion for biogas production. The waste is also heterogeneous in composition comprising of both degradable and non-degradable materials, therefore sorting of the materials is important so that the non-degradable waste is recycled, while the degradable materials is composted.

3.1 Mitigating Measures

Expanding recycling programme can help reduce municipal waste pollution but the key to solving severe municipal waste problems lies in reducing the amount of waste generated there are several methods of waste disposal used to improve and mitigate the issue of waste management. Such systems that can or may be adopted are:

i.) Recycling

ii.) Bio treatment

iii.) Incinerations

iv.) Neutralization

v.) Secure sanitary landfill

vi.) Composting.

The three- (3) **R"s :** Reduce, Re-use and Recycle

Table 2: Present Waste Collection Technique in Minna By Nisepa And It Efficiency.

District	**Method/ technique of disposal**	**Frequency of collection**	**Efficiency**
Chanchaga	Open dumps, burning and disposal into rivers	Four times a week.	poor
Bahago round about – tudun fulani	Open dumps, burning and disposal into drainage, streams.	Thrice on working days and saturadays.	poor
Tunga	Open dumps, dumpsite, waste bins.	dialy	Average
Govt house area	Waste bins	daily	Good
Kpakungu - mawo	Open dumps, burning	Twice a week	poor
Dustsen kura, fadikpe	Open dumps, burning and disposal into river	Thrice a week	Very poor
Maitunbi/ Anguwan daji	Open dumps and dumpsite	Once a week	Very poor
Old secettariat	Open dumps and burning	Four times a week	poor
Pot roundabout – new secretariat	Open dumps , waste bins.	Working days	Average
Mobile roundabout – bahago round about	Open dumps, waste bins	Working days	Average
Mobile roundabout- federal secretariat	Open dumps, waste bins	Working days	Average
New secretariat – M I Wushishi estate.	Open dumps, waste bins	Working days	Average
Pot roundabout – mobile paiko,IBB road.	Open dumps , waste bins	Working days	Average

Source Field Survey 2012.

Table 2 shows the method of waste disposal and collection by NISEPA in thirteen district examined and it can be observed that the illegal open dumps is the predominant means of waste disposal in all eight district and this is worsen by these wastes are poured out and left exposure to air, wind, rainfall and sunshine which leads to soil, air water pollution. We can also see that no adequate provision for collection of waste as if it grossly inadequate as collection is only in areas with tarred roads and it is not done on a regular bases in other areas where there is no access roads they wait for the waste to accumulate into heaps before they are packed in most case they burn them to reduce the volume. Most areas pour their dirt into nearby streams and rivers making these rivers dumb site these is leading to erosion, water pollution, air pollution and damage of aquatic life. These wastes are taking and dumped in open dump in the outskirt of minna as the only waste management plant the composting plant along Kpakungu – Gidan Kwano road is not function due to vandal activities on the plant.

4. CONCLUSIONS AND RECOMMENDATIONS

From all the analysis above It is clear that the highest waste type is food remnant which is organic waste and biodegradable hence a valuable resource to recycle to biogas hence government should convert this valuable

resource(waste) to fuel, heat and energy. The highest generator of waste are from residential building hence resident should be provide with waste bins, waste bags and they should drop them in the nearest collection point (dumpsite) where it can be collected by NISEPA workers. The non biodegradable waste which is about 48% of total waste generate should be recycled, landfiled or incinerated. Depended on how suitable the waste are., the following recommendations are made.

i. Disposal sites should be provided in slums and ghetto so that collection of waste will be easier.

ii. Regulations regarding littering and improper disposal of solid waste should be formulated, and stiff penalties should be imposed on defaulters.

iii. Public awareness about the environment should be strengthened and campaign on sanitation of the environment should be inoculated in the life of every citizen.

iv. The waste reduction program on plastic by bags should be encouraged and promoted and other waste reduction program on metal, glass and other items should be introduced to reduce the volume of waste been generated.

v. Government should increase the budget and allocation of fund so that the number of staff of NISEPA and people in environmental related jobs can be increased, so they can cope with the volume of waste generated in the city.

vi. The composting plant in the city should be patch up of all damages caused by vandals and brought back to full operation, while work should continue in the recycling plant under construction.

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APPENDIX
LIST OF PLATES

Plate 1: A dump site in the outskirt of Minna . showing already burnt waste.

Plate 2: Aerial view of Anguwan biri Bosso, minna showing cluster of housing and no access for NISEPA trucks to collect waste.

Plate 3: A dump site at Tudun Fulani area of Minna

Plate 4: A dump site in Shango area of Minna