

Waste Generation, Disposal and Management Techniques in an Urbanizing Environment: A Case Study of Ado-Ekiti, Nigeria

¹W.O. Adebayo, ²J.A. Bamisaye, ¹O.B. Akintan and ¹O.S. Ogunleye
¹Geography and Planning Science Department, University of Ado-Ekiti
²Civil Engineering Department, University of Ado-Ekiti

Abstract: Waste are materials that are not useful to the user and, at the same time create a menace to the environment. Questionnaire was used in collecting the data. The result shows that majority of the wastes generated in Ado-Ekiti were mainly agricultural products. Different ways of disposing the wastes were also considered. For a suitable and sustainable environment, suggestions were made for the techniques that could be used in managing the waste effectively without causing any havoc to the environment.

Key words: Waste, management, environment, generation, techniques

INTRODUCTION

Many definitions have been given to solid wastes but it can be regarded as any solid materials in the material flow pattern that is rejected by the society Tchonobagolous^[1]; Hoonweg,^[2]. It can also be defined as the useless and unwanted materials which have insufficient liquid content to be free Adebayo,^[3]. It includes the heterogeneous mass of throwaways household wastes and homogeneous accumulations of agricultural, industrial and mineral wastes Aribisala,^[4].

In the early societies, when people were nomadic in nature, wastes were discarded where they were generated as people moved away from them. But this is no longer the case as population increases and people began to live a more settled life. In this regard, waste must be removed from contact with the population. The scene in our urban centers, as it is seen in Ado-Ekiti now, is the gradual take over of any available open space as refuse dumps both in the core and periphery areas of the city. The rapid population growth of Ado-Ekiti is affecting the amount of solid waste that is generated daily in the community. Human existence on the planet earth would continuously generate waste because of its various activities in the environment.

The increase in population and socio-economic activities has influenced the volume of waste generated by human beings in the environment Adebayo,^[3]; Aribisala,^[4]. Areas with high population as in the case of Ado-Ekiti, relative to other towns in the state, is likely to have higher level of socio-economic activities and this tends to generate huge amount of garbage within and around the area.

The solid waste problem does not have a single solution. At present, comprehensive waste management

plans include source reduction, recycling and composting, waste-to-energy incineration and, safe environmental landfills United States Environmental Protection Agency,^[5].

Solid waste management engineering is the branch of public health engineering associated with the control of generation, storage, collection, transfer, transportation, processing and disposal of solid waste in accordance with the best principles of public health, economics, engineering, conservation, aesthetics and other engineering considerations Fantola,^[6]. Table 1 shows the time frame for wastes generated to degenerate as compiled by Tennessee Solid Waste Education Project TW-SWEP,^[7].

Solid waste can be classified according to their sources and basically from the origin of generation with a view of obtaining workable and efficient methods of storage, collection, treatment and disposal. Primarily, solid wastes are classified as garbage which includes the organic matter that results from the preparation and consumption of food ashes residue that result after cooking and heating process and rubbish which embraces most solid waste which are included in the other two classes Adedibu,^[8]; Adebayo,^[3]; RPDC,^[9].

Wastes could be classified as:

- household wastes-municipal wastes;
- industrial wastes-hazardous wastes and
- biomedical wastes-infectious wastes.

Municipal solid wastes are made up of household wastes, construction and demolition debris, sanitation residue and waste from the streets. Residential and commercial complexes generated the garbage that forms part of the wastes that is classified as

Table 1: Approximate time for wastes to degenerate

Types of waste	Approximate time
Organic waste vegetable, fruit peels, leftover foodstuff etc	1-2 weeks
Paper	10-30 weeks
Cotton cloth	2-5 months
Wood	10-15 years
Woolen items	1 year
Tin, aluminum etc	100-500 years
Plastic	1 million years?
Glass bottles	Undetermined

Source: TW-SWEP,^[7]

Table 2: Occupational distribution of waste generation in Ado-Ekiti

Occupation	Total waste generated	(%)
Farming	14 kg	26.4
Trading	16 kg	30.2
Civil servant	13 kg	24.4
Others	10 kg	18.9

Source: fieldwork, 2004

municipal/household wastes. With the rising of urbanization in Ado-Ekiti and, the change in lifestyles and food habits, the amount of municipal wastes have been increasing rapidly.

In the last few years, the consumer market has growth rapidly leading to products being packed in cans, aluminum foils, plastics, nylon and non-biodegradable items that can cause incalculable harm to the environment^[3,4]. Proper handling of biodegradable wastes will lessen the burden of solid waste that each city has to tackle^[2,10].

Hazardous waste (Industrial) may contain toxic substances. These could be highly toxic to humans, animals and plants; they could be corrosive, highly inflammable, or explosive and react when exposed to certain things e.g. gases. Household wastes that can be categorized as hazardous include old batteries, shoe polish, paint tins, old medicines and medicine bottles. Hospital wastes contaminated by chemicals (formaldehyde and phenols) used in hospitals is considered hazardous. For the industrial sector, the major generators of hazardous waste are metal, chemicals, paper, pesticide, dye, refining and rubber goods.

Hospital wastes are generated during the diagnosis treatment, or immunization of human beings or animals or during research activities. These may include sharps, soiled wastes, disposables and anatomical wastes, discarded medicines, chemicals wastes etc which could be in form of disposable syringes, swabs, bandages, body fluids, human excreta etc. Wastes of this nature are highly infectious. The main objective of this study is to assess waste generation, disposal and management methods in an urbanizing environment.

The specific objectives are to:-

- identify the type(s) of wastes that are generated in Ado-Ekiti
- examined the method(s) used in disposing the wastes;
- suggest techniques that could be used in managing the wastes.

MATERIALS AND METHODS

Ado-Ekiti, the capital of Ekiti State in the Southwestern, Nigeria, lies on Latitude 7°42' North of the equator and longitude 5°15' East of the Greenwich meridian, with an estimated population of about 175,000. The status of Ado-Ekiti has been raised since the creation of Ekiti State from the old Ondo State to a capital status in 1996. this has encouraged migration from other places/towns to Ado-Ekiti. The population increase is as a result of rural-urban migration.

A survey was carried out through the administration of questionnaires on the inhabitants of Ado-Ekiti, which was made up of people living in the core Irona, Atikankan, Erekesan Market and the periphery Basiri, Ajilosun, GRA, Adebayo areas. Random sampling technique was to interview 225 respondents. The data was analysed with simple percentages to be able to know the percentage contribution of waste generation and disposal method in Ado-Ekiti.

Solid waste generation in Ado-Ekiti: The spatial variation of socio-economic and demographic characteristics as well as the level of technological development of an environment has been found to influence waste generation. Economic activity of any community will determine the quality and type of waste that is generated by the people Adedibu,^[8]. The amount and volume of solid waste generation in Nigeria cities have increased and will continue to increase and there has not been any noticeable enhancement in managing the situation Mabogunje,^[11]. Socio-economic development, the level of industrialization and the climate affect the rate and type of waste generated in an environment. It has also been discovered that the amounts of waste generated vary according to the type of occupation (Table 2).

Commercial activities in Ado-Ekiti are considered as one of the major factors contributing significantly to the generation of wastes because traders do away with cans, papers, nylon, leaves etc during trading transactions.

Population increase and urbanization is largely responsible for the increase in solid waste generation thereby polluting the earth both at the local and global

Table 3: Municipal solid waste classification in Ado-Ekiti

Type of waste	(%)
Food waste	14
Paper and cardboard	27
Agricultural waste	40
Tins and cans	2
Plastic	17

Source: fieldwork, 2004

Table 4: Method of disposing wastes in Ado-Ekiti

Methods	(%)
Covering	4
Burning	36
Dumping along roadsides, drains and stream channels	57
Others	3

Source: fieldwork, 2004

level. Urbanization and rising incomes, has led to greater use of resources thereby increasing the rates of waste generation by individuals living in the city.

Garbage or waste generated daily by each household are items that are no longer in use and we intend to throw them away. Waste composition is also influenced by some external factors-geographical location, people's standard of living, source of energy and weather^[2].

Table 3 indicates the compositions of wastes generated in Ado-Ekiti. The high percentage of agricultural wastes (40%) is due to the fact that most agricultural food items such as maize, yam, cassava, vegetable etc are brought to town in raw (green) forms with their respective leaves and peels. In fact, this is the characteristics of agricultural wastes in tropical cities.

Methods of waste disposal in Ado-Ekiti: The disposal of solid waste is one of the greatest challenges facing public health engineering and environmentalists in recent times not only in Nigeria but all over the world as far as sustainable environment is concerned. Some of the older methods of solid waste disposal include open dump, sanitary landfill and incineration.

In Ado-Ekiti the methods of solid waste disposal include dumping of refuse to gutters, drains roadside and stream channels during raining season and burning of wastes on unapproved sites during the dry season. Table 4 indicates the percentage distribution of methods used for waste disposal in Ado-Ekiti.

These methods of waste disposal in Ado-Ekiti might not be able to provide a sustainable environment with the increase in the rate of urbanization and migration.

To achieve this there should be proper management techniques that would enhance proper wastes disposal in Ado-Ekiti.

Management techniques for wastes in Ado-Ekiti: Solid waste management comprises of unit of operations and

unit processes that must be performed in order to sanitarly eliminate refuse from the generating environment. Waste management deals with waste handling, controlling and monitoring the techniques used for waste management in any community. The following measures are suggested for managing waste in Ado-Ekiti.

- Refuse should be sanitarly stored in containers before and during transportation to disposal sites. The type of containers that could be used is include galvanized dustbins, plastic bins, paper bags, PVC bags etc. The characteristics of a good household dustbin include durability, lightweight, water-tightness, corrosion resistant, adequate capacity, ease of cleaning and fly-proof cover.

The capacity should depend on

- The number of people using it;
- Methods of reuse collection and
- Period between emptying.

The capacity should not be less than 55 liters and not more than 170litres Fantola,^[6].

- House to house collection is ideal, straightforward and facilitates revenue collection Nwalieji,^[12]. This might be difficult in Ado-Ekiti because of the bad layout, most especially in the periphery where rapid house development is taking place while in the core area houses are not easily accessible by road. To improve refuse collection, the following practical approaches could be adopted.

- maximizing house to house collection;
- use of mobile depots and transfer stations;
- modified Garchey method and
- the Chinese practice.

- Transportation is a vital aspect of urban solid waste management. There are many problems inhibiting the efficient refuse transportation programs in Ado-Ekiti. These problems occur as a result of the following:

- nature of refuse;
- traffic problems;
- improper location of dump sites;
- shortage of refuse vehicles;
- shortage of fund;
- distance to disposal sites; and
- lack of trained personnel. For a good solid waste management system, an efficient transportation system and an accessible road network should be in place.

In sustaining Ado-Ekiti environment, a practical approach should be put in place in managing the wastes. The following measures are suggested;

Sorting and salvaging: Is a process by which valuable items are sorted and salvaged from the bulk of the solid wastes. Some of which can be recycled (constructing waste like aggregates and brick waste) and others could be reused (glassware).

Pyrolysis: Thermal decomposition of the waste in an inert atmosphere. This leads to the production of a mixture of gaseous products, tars, water, insoluble oil and an aqueous solution of acetic acid, methanol and other organic compounds. The product of pyrolysis represent about 50% of the initial volume of the original waste fed into the system and can be converted into energy either to sustain the process or produce excess power. One great advantage of this method is that large quantities of potentially hazardous plastics e.g. PVC can be burnt without any problem of pollution.

Composition: Controlled aerobic and/or anaerobic degradation of prescribed material in a warm, moist environment by micro-organisms thus obtaining a stable product controlled by microbial reaction Aribisala *et al.*,^[10]. The end product though not fertilizer on its own when applied to soils makes crops to respond as if a commercial fertilizer has been applied.

CONCLUSION

Solid wastes which are heterogeneous, throw away, agricultural wastes, industrial wastes and mineral wastes Aribisala,^[4] had been identified as problems confronting urban areas all over the world. The way and manner of its generation and disposal in Ado-Ekiti had been identified. It is believed that the suggested techniques, if looked into by all stakeholders of wastes in the city of Ado-Ekiti, the city will soon wear anew and fascinating look and as well create a sustainable environment which will be a pride to all.

REFERENCES

1. Tchonobagolous, G., 1997. Educational Engineering. Mc-Graw Hills, Inc.
2. Hoornweg, D., 2000. What a Waste: Solid Waste Management in Asia. Urban Environmental Management, pp: 65-70.
3. Adebayo, W.O., 1995. Environmental consequences of wastes generation and disposal techniques along roadsides, drains and stream channels in a Trop. Urban Center Environmental Issues, pp: 1-4.
4. Aribisala, J.O., 1997. Waste transport in unsaturated soils. Intl. J. Enviro. and Development, pp: 49-54.
5. United States Environmental Protection Agency, 1990. Characterization of municipal solid waste in the Unites States. <http://eerc.ra.utk.edu/tnswep/7-12toc.htm>
6. Fantola, A., 1997. Introduction to solid waste management Engin. Bibis Press, Ibadan.
7. Tennessee Solid waste education project (TW-SWEP), 2004. The Problem is Too much to trash. <http://eerc.ra.utk.edu/tnswep/Default.htm>.
8. Adedibu, A.A., 1985. A Comparative analysis of solid waste composition and generation in two cities of a developing nation. The Environmentalist.
9. RPDC, 2004. Solid waste generation and disposal. <http://www.rpdc.tas.gov.au/soer/indicator/137/index.php>.
10. Aribisala, J.O., T. Omotoso and P. Folorunso, 2004. Waste Management Systems. Proceeding of National Civil Engin. Conference, Port Harcourt, pp: 17-20.
11. Mabogunje, A.L., 1980. Towards an environmental policy in Nigeria, Special lecture at 24th Annual NGA.
12. Nwalieji, V.I., 2003. Solid waste management in Ado-Ekiti. Department of Civil Engineering, University of Ado-Ekiti (Unpublished B.Sc thesis).