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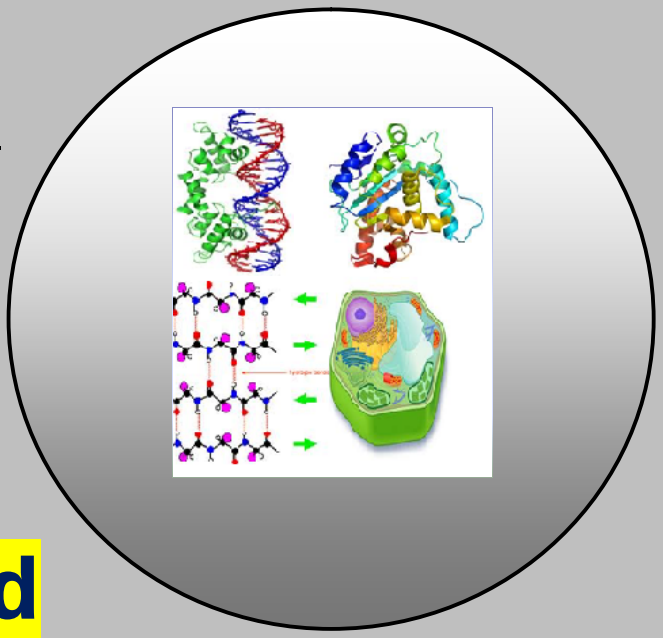

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An Assessment of Solid Waste Management Practices in Abeokuta, Southwest, Nigeria

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ABSTRACT

The rapid and constant growth of urban population has led to a crucial socio-economic and environmental impact in solid waste management practices. This study focused on identifying waste management problems and evaluating the current performance of waste handlers in Abeokuta. A total of 430 structured questionnaires were administered. Putrescibles were the highest (26.3%) in the waste stream. Of the respondents, 58.14% had no means of estimation of waste; 56.05% do not sort their waste; 41.86% do not have their wastes collected at all; 27.14% recycle their wastes; 47.44% dispose waste through burning; 45.6% pay for waste management services and 42.78% throw their wastes indiscriminately into the nearby bushes. It was recommended that recycling of wastes should be formalized and publicized among residents; waste management planning should not be left entirely to the discretion of the local government. In addition, laws on waste management should be enforced and offenders duly punished.
Key words: Solid Waste Management, Generation, Collection, Recycling, Disposal.

INTRODUCTION

Solid Waste Management (SWM) practices include collection of generated wastes, waste separation or segregation, storage, transfer and transport, transformation, treatment and disposal.

The rapid and constant growth of urban population has led to a dramatic increase in urban solid waste generation, with a crucial socio-economic and environmental impact.

Solid waste management (SWM) has been a big challenge to both the developed and developing countries all over the world. Basically, municipalities are giving preferences only on the collection of the waste and dumping it, while the principle of 3R's (waste reduction, reuse and recycle), are not prioritized by the municipalities for a sustainable solid waste management. Increasing public awareness to the necessity of clean environment for good health, at both local and national governments are facing public pressure to the proper management of the municipal waste (Karavezyris *et al*., 2002).

This study is as a result of an increase in solid waste generation and an inadequate organized system of waste handling for a major part of the city. It therefore focused on identifying waste management problems, evaluating the current performance of waste handlers (i.e. waste management workers at the State Ministry of Environment, private contractors and individual waste generators) in Abeokuta and gave recommendations for an effective solid waste management practice. An understanding of what materials are in the waste stream will enable for a better and informed waste management practice (Ministry for the Environment, 2007).

Comparative analysis of municipal solid waste composition carried out by Ogwueleka 2003, Dauda and Osita, 2003 and Agunwamba *et al* 1998, showed that putrescibles were the highest in comparison to plastics, paper, textile, metal, glass and "others" (dust, ash, ceramics, rubber, soil and bones). Therefore, a great majority of the total solid waste generated in Nigeria is organic. Solid waste generation in Abeokuta, Ogun state, was estimated to be 0.60kg/person/day (Adewumi *et al*., 2005). Some of the factors influencing solid waste generation in Nigeria and locally in Abeokuta include inadequate technology, facility for separation at source, strength of solid waste management policy and enforcement, environmental education and awareness and income status of individuals among others (Adeoye, 2003 and Abel, 2009). Waste collection is an important aspect of waste management. Over the years, various waste collection methods have been adopted in different parts of various countries. Lasisi (2007) identified six methods including house-to-house, communal depots, curbsides, block systems, commercial and industrial collection and bulk loading. Babayemi and Dauda 2009, reported that in Abeokuta, waste collection was initiated by both public and private sectors, although the effectiveness of this is largely a function of location; and where the collection is done by private sectors, it is a function of income of the owner of the waste to be able to pay the amount charged.

Recycling is defined as the removal of materials from a solid waste stream and the use of those materials in other innovative ways (California Integrated Waste Management Board, 2004). It offers social, economic and environmental benefits. It serves as a source of income; saves energy; water and generates less pollution than obtaining virgin raw materials, which translates into lower operating costs; reduces the amount of wastes to be collected, transported and disposed off, and extends life of disposal facilities (Medina, 1993). Disposal of solid waste generated in a community is the ultimate step in a SWM system. In the advanced technologies, disposal is preceded by engineering activities such as sorting, volume reduction and / or receding.

In Nigeria, refuse is generally buried and burnt (Igoni, *et al*., 2007); dumped openly on available spaces (Lasisi, 2007); burnt open on the side of the road (Ogwueleka, 2009); set on fire in a little corner in their backyard or in a very open place (Babayemi and Dauda, 2009); or incinerated which has been very uneconomical (Ogwueleka, 2003).

Kyessi and Mwakalinga 2009, explained some of the challenges facing solid waste management as being inadequate waste collection, accumulation of garbage on streets and on open spaces, lack of waste treatment and disposal sites, high operational costs and poor cost recovery, poor or inadequate resources, poor routing systems and inappropriate Information Management System.Others are unplanned growth and increasing pressure to provide services, non-rational routes for collection services, and lack of adequate authority to address people, infrastructure and resourcing problems (Zurbrugg, 2003).

Most developing countries, Nigeria inclusive have solid waste management problems different from those found in developed countries; hence, a different approach is needed (Ogwueleka, 2009).Nigeria needs low capital cost and labor-intensive solutions that reduce poverty (Ogwueleka, 2004). Informal waste collectors can be incorporated into public-private partnership. Regular trucks should be used for waste collection. Other practical steps are involvement of the private sector; income generation through planned collection services; refuse collection charges; practical and attitudinal changes of the citizens towards wastes in general. Also are support, transfer and dissemination of knowledge and technology or environmentally sound management of various waste streams within the African continent by the international community; and awareness and cultural exchange programs for integrated waste management (United Nations Economic and Social Council, 2009).

MATERIAL AND METHODS

Description of Study Area

The study was conducted in Abeokuta, Ogun State. Abeokuta is both the capital and administrative headquarters of Ogun State situated in the South-Western part of Nigeria with coordinates between latitude 7° 09′ N and 7° 19′N and longitude 3^0 29′E and $3^0$41′E (Akanni, 2005). The district was split into Abeokuta South and North Local governments in 1991 with their secretariat headquarters at Ake and Akomoje respectively.

Data Collection

Primary data used for this study were obtained through questionnaire administered to the Environmental Agencies' workers in Abeokuta South and North local governments, private contractors and scavengers involved in municipal solid waste management. The nature, history and socio-economic aspects of land-use in the study area were investigated.

Table 1. Distribution of Socio-Economic characteristics of respondents.

SOCIO-ECONOMIC CHARACTERISTICS		FREQUENCY	PERCENTAGE	MEAN
Age (years)				
	Less than 20	59	13.7	
	21 – 30	201	46.8	
	31 – 40	121	28.1	29.62
	41 – 50	32	7.4	
	Above 50	17	4.0	
Gender				
	Male	210	48.8	
	Female	220	51.2	
Marital Status				
	Single	221	51.4	
	Married	196	45.6	
Household Size				
	1 – 5	252	58.6	
	6 – 10	132	30.7	
	11 – 15	27	6.3	5.92
	16 – 20	11	2.6	
	Above 20	8	1.8	
Occupation				
	Civil Servant	88	20.5	
	Artisan	79	18.4	
	Farmer	22	5.1	
	Business Tycoon	123	28.6	
	Student	118	27.4	
Income per month (₦)				
	Below 10,000	162	37.6	
	11,000 - 20,000	103	24.0	
	21,000 - 30,000	61	14.2	19081.4
	31,000 - 50,000	57	13.3	
	Above 50,000	47	10.9	
Educational Level				
	Primary	48	11.2	
	Secondary	182	42.3	
	Tertiary	192	44.7	
	No formal education	8	1.8	

A total of four hundred and thirty (430) structured questionnaires covering the thirty-one (31) wards of Abeokuta South and North were administered using stratified random sampling. The sample size was adapted after Newman (1999) who stated that for a true representative sample size, 0.0625% of the total population size should be considered.

Data Analysis

SPSS was used for Regression analysis to test for significant differences between relationships, and one way Analysis of Variance (ANOVA) to analyse aspects of significant difference between respondents' opinions. Descriptive statistics such as mean and frequency distribution were used and results presented in tables, charts and graphs.

RESULTS AND DISCUSSION

Distribution of Socio-Economic characteristics of respondents

Table 1 summarizes the socio-economic characteristics of the respondents. Those who fall within the age group 21-30 years were the highest; 51.2% were females while the other 48.8% were males; 60.9% were from Abeokuta South while the remaining 39.1% were from Abeokuta North. A majority, 51.4%, are single closely followed by 45.6% who are married. 58.6% have between 1-5 people in the family; 28.6% were business tycoons, 27.4% were students; civil servants, artisans and farmers constituted 20.5%, 18.4% and 5.1% respectively.

Income distribution shows that a majority, 37.6% of them earned below ₦10, 000 per month. Those with tertiary education as their highest level constituted 44.7% while about 1.8% had no formal education.

Solid Waste Generation

Figure 1 shows that a greater percentage, 58.14%, had no means of estimating the amount of waste generated.

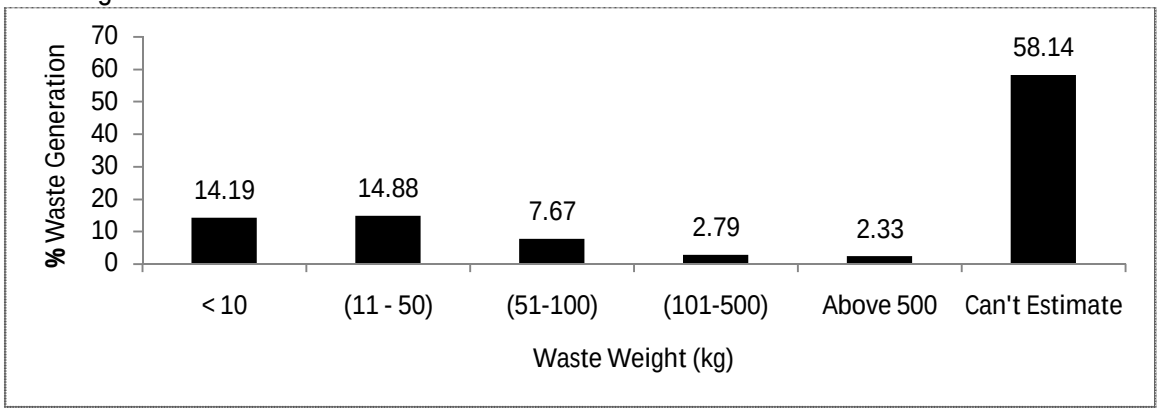

Figure 1. Percentage Composition of Waste Generation Rates in Abeokuta Metropolis

Solid Waste Composition.

Putrescibles (kitchen or food waste) has the highest percentage of 26.3%; and this is closely followed by paper, 25.57%; plastics, 24.95%; textiles, 9.48%, glass, 5.75%; metal, 5.26% and potentially hazardous waste, 2.69%.

Solid Waste Separation/Sorting

It was found out that 56.05% do not find it feasible to sort their waste and as such, never tried sorting before while 43.95% have tried one form of sorting or the other.

As presented in Figure 2, most of the respondents who sorted their wastes were able to do so as a result of a personal instinct or value system (15.89%), or cultural factor / tradition (7.55%), or the need to get monetary value for used materials (56.48%), or the compulsory patronage of scavengers (20.08%).

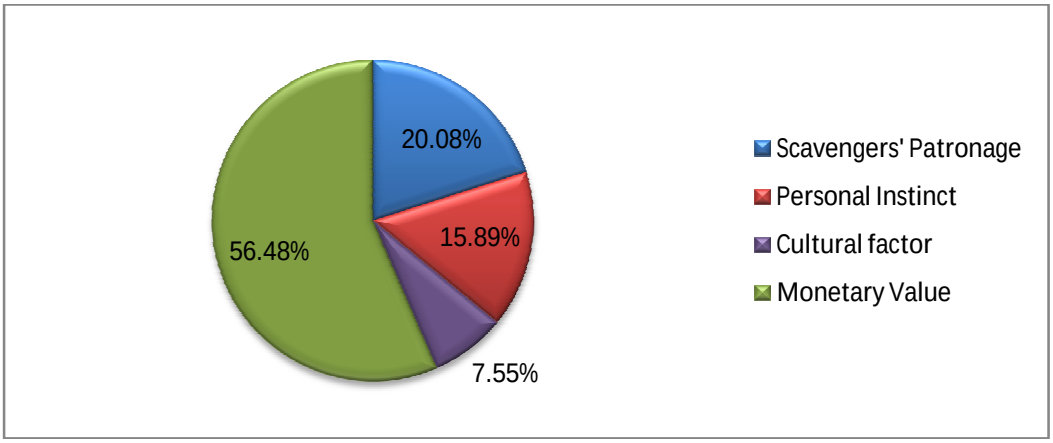

Figure 2. Percentage Composition of Rationales for Sorting Wastes among respondents in Abeokuta.

Waste Storage

The various waste storage facilities used were identified and it indicated that a majority (42.89%) made use of plastic waste bins; 28.44% used polythene bags; 15.15% used drums; while 6.99% and 6.53% made use of paper bags and sacks respectively.

Collection and Transportation of Waste

It was found out that 41.86% of the residents do not have their wastes collected at all by any category of waste worker, 16.75% had theirs attended to once-a-month; 15.58%, 18.37% and 7.44% of the residents had their wastes collected once-in-2weeks, once-a-week and regularly respectively. 80% of the waste management officials interviewed gave the total number of vehicles allotted to Abeokuta for waste collection to be twenty-seven (27).

Furthermore, on the reasons given by the local government authority for delayed and inconsistent evacuation of wastes from their residential houses to the dumpsite, 34.66% of the respondents attributed the reasons to lack of functioning vehicle; 23.67% to lack of manpower; 20.89% to logistic/traffic problems; 5.68% to shortage of petrol;

4.11 % to lack of fund. Individual's perception on the real problems for the inadequacy in the management of waste matters revealed that a majority, 20.76%, attributed the reason to inconsistency. 18.40%, 14.45%, 13.14%, 12.88%, 11.30% and 9.07% of the respondents attributed their reasons to indifference to environmental health, lack of commitment to duties, inaccessible locations, lack of government policy, nature of the work being unattractive and dirty and misappropriation of fund.

In order to enhance or improve the effectiveness of local government officials involved in waste management and that of the contractors, 16.50% of the respondents suggested consistency in picking up wastes; 16.15%, 14.90%, 14.01%, 13.20%, 13.11% and 12.13% suggested creating awareness through campaigns/radio/television programmes/feedback mechanism; construction of dumpsites/incinerators; provision of vehicles and good routes; enforcement of law and policy; monitoring of waste officials and private contractors and giving incentives to workers respectively.

Waste Re-use / Recycling

The practices of waste re-use/recycling revealed that 27.14% of the respondents, who sold some of their waste items, sold old books/ newspaper; 26.39%, 21.19%, 11.15%, 6.32%, 4.46% and 3.35% sold plastics, glass, foot wares, clothes, polythene bags and metals respectively. These items were sold either to scavengers (89.3%) or directly to the industries (10.7%) and those who do not sell theirs at all either dumped them in the bin (82.1%) or re-used them for other purposes (17.9%).

Waste Disposal

In Figure 3, 47.44% of the respondents which constitutes a majority, burn their wastes; 26.28% make use of open dump; 14.19% employ the cart-pushers; 6.28% bury theirs while the remaining 5.81% use the local government truck.

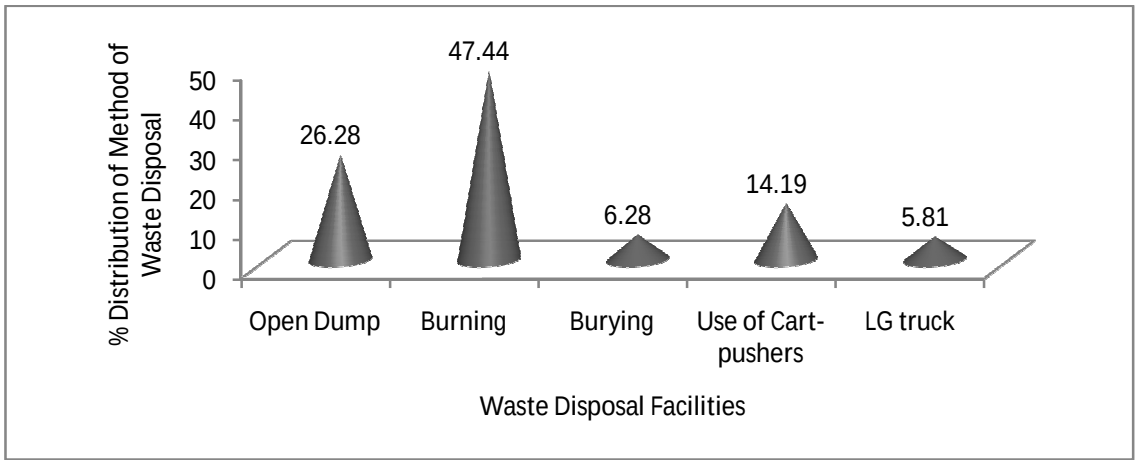

Figure 3. Percentage Composition of Methods of Waste Disposal by Respondents in Abeokuta Metropolis.

It was also found out that 42.78% of the respondents throw their wastes indiscriminately into the nearby bushes; 33.51%, 13.66% and 10.05% into the gutters, nearby houses and into a river respectively.

Efforts made by some communities to solve the problem of waste disposal include burning their wastes jointly at a communal dumpsite usually an illegal one (28.84%); observing the compulsory environmental sanitation (21.86%); doing nothing(21.63%); arranging for communal disposal by private individuals through constituted landlord associations (16.05%) and soliciting the intervention of the local government (11.63%).

Individuals think wastes can best be managed through burning (30.07%); services of private contractors (22.14%); communal management (21.91%); local government's intervention (14.45%) and recycling (11.42%) as shown in Figure 4.

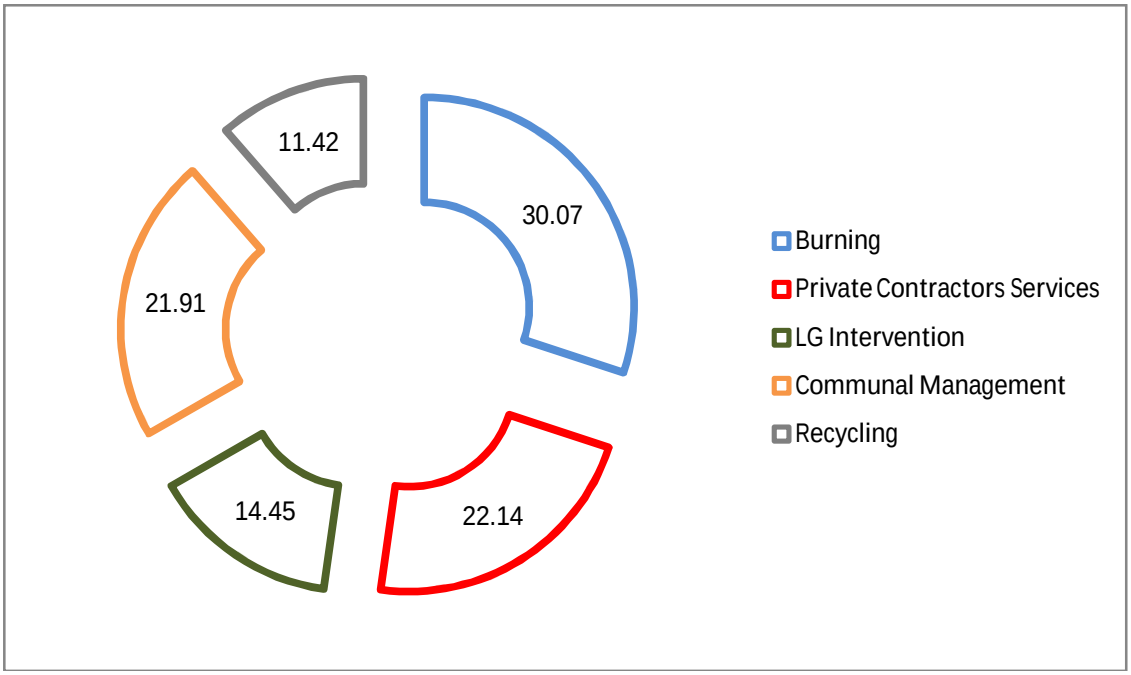

Figure 4. Individual's Perception/ Preference of Best Waste Management Practices.

Remuneration for Waste Management Services

Table 2 summarizes waste management issues related to remuneration such as payment for waste management services, willingness to pay and reasons for not paying.

Table 2. Remuneration for Waste Management Services by Respondents in Abeokuta Metropolis.

Payment for Waste Management Services	Frequency	Percent (%)
Yes	196	45.6
No	234	54.4
Amount Paid (₦) / month		
100 – 200	100	51.0
201 – 500	51	26.0
501 – 1000	32	16.3
1001 – 2000	10	5.1
Above 2000	3	1.5
Willingness to Pay (WTP)		
Yes	140	59.3
No	96	40.7
Amount Willing to Pay (₦) / month		
100 – 200	117	83.6
201 – 500	19	13.6
501 – 1000	4	2.8
Reason for not willing to pay		
Lack of money	13	13.3
Government's social responsibility	26	26.5
Payment of tax duty/ Fear of diversion of money	17	17.3
Preference to burn waste personally	29	29.6
Absence of waste management services	13	13.3

DISCUSSION

Waste is an inevitable by-product and part of our existence. Its generation is not limited to race, age or class. It is however affected by such socio-economic factors as marital status, size of household, occupation, educational level and level of income. Therefore, waste generation is increased by an increase in the size of household, level of income and also by marital status {Abel (2009) and Adeoye (2003)}.

Waste composition in Abeokuta is typical of what can be observed in any part of the tropical areas as shown by Diaz *et al* (1999). The waste stream revealed a greater percentage composition of organic materials and is least for potentially hazardous wastes.

Separation of wastes at source in Abeokuta is not a feasible exercise; however, sorting at source can be attained and effective if people are encouraged to do so by attaching monetary value to the wastes collected.

Recycling of wastes in Abeokuta is informal according to Cointreau and de Kadt (1991).

Different storage facilities used to store wastes in Abeokuta include plastic waste bin which constitute the highest; polythene bags, paper bags, drums and sacks.

In improving and enhancing the effectiveness of the local governments in waste collection services and waste management processes in general, a majority of the respondents suggested consistency in picking up stored wastes from the residences. Others suggestions were construction of dumpsites / incinerators; provision of vehicles and good routes and monitoring of waste officials and contractors (Ogwueleka, 2009).

A majority burn their wastes while only a few percent make use of the local government truck. This is a very bad practice as burning causes environmental (air) pollution by the release of obnoxious gases and ultimately contributes locally to global warming effect (Seo, *et al*., 2004). The practice of dumping of wastes in nearby bushes, gutter, near houses or river bodies as practiced by the respondents need to be stopped. This can only be effective if waste management services are given to them and consistent enough for them not to look for alternatives in dealing with the problem of waste (Haan, *et al*., 1998).

It is however disturbing that a greater part of the respondents consider burning as the best method of waste disposal. This only ascertains the fact that they are not really aware of the implications of such practice to environmental health.

Remuneration for waste management services in Abeokuta is not encouraging as a greater percent of the respondents do not pay for these services.

In general, waste management practices have not been effective in Abeokuta. It can be inferred that waste management processes have been carried out haphazardly.

CONCLUSION/SUGGESTIONS

The study revealed that waste generation is higher than collection which leads to waste accumulation overtime, thereby, degrading the environment. Burning remains the most commonly used method of waste disposal and waste collection is irregular. Waste collection is constrained by unplanned and inaccessible road networks among other factors which in turn restrict the movement and efficiency of the private and public waste collection agents.

Payment for waste management services is not popular in Abeokuta metropolis as residents display varying attitude towards the issue. It is however important to educate them on the importance of paying for waste management services as it will facilitate the process.

From the study, it is recommended that recycling of wastes should be formalized and publicized among residents; waste management planning and co-ordination should not be left entirely to the discretion of the local government. OGEPA and Ogun State Ministry of Environment should be actively involved. In addition, laws and policies on waste management should be enforced and offenders duly punished.

If the fore-going are adopted and implemented, the problem of waste management in Abeokuta will be solved to a large extent.

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