**Nigerian Research Journal of Engineering and Environmental Sciences**

**Journal homepage: www.rjees.com**

**RJEES**

**Original Research Article**

# Evaluation of Solid Wastes Generation in Abraka, Delta State, Nigeria

**\*Peretomode, O.V., Eyenubo, O.B. and Bulouebibo, L.**

Department of Science Laboratory Technology, Faculty of Sciences, Delta State University, Abraka.  PMB 1, Abraka, Nigeria.

\*obipere@gmail.com; verblarry@yahoo.com; eyenokero2013@gmail.com

## ARTICLE INFORMATION

## ABSTRACT

*Evaluation of monthly variations of solid wastes generated in Ethiope east local government area of Delta State, Nigeria was carried out in this study. This study was conducted in four different dump stations in Abraka, Ethiope East Local Government Area. Results for waste generation showed that the percentage of glass waste in station 2 was highest in October (2.62%) and lowest in August (0.90%). Metal waste in station 2 was highest in January (3.61%) and lowest in December (2.55%). Other waste in station 2 was highest in March (5.04%) and lowest in September (1.61%). Results of monthly variation showed that the percentage of paper waste in station 2 was highest in September 2017 (34.98%) and lowest in October (1.15%).  The percentage of plastic waste in station 4 was highest in October (41.76%) and lowest in March (33.23%). 68% generate organic waste, 17% generates paper waste, 8% generate plastic waste, 4% generate glass waste, 2% generates metal waste, 1% generates other type of waste. Results for waste disposal methods show that 28% dispose their waste by burning, 26% by burying, 34% dispose waste on open dumps. 12% dispose with government agencies. It was observed that generation, disposal methods and government participation is dependent on predominant jobs or activities of residents, implementation of government policy and sufficient availability of government disposal facilities.*

## 1. INTRODUCTION

Waste is something which the owner no longer wants at a given time and space and which has no current or perceived market value (WHO, 2008). Waste therefore, is something which falls out of the normal commercial circle (Ayo and Gbadeyan 2010). Solid wastes include non-liquid and non-gaseous products of human activities, regarded as being useless. The wastes could take the forms of refuse, garbage and sludge (Akpofure, 2009)

Wastes can be generated by natural phenomena such as wind, erosion, precipitation, volcanic eruptions, flooding of river banks, atmospheric fallouts among others, and by human activities like domestic, commercial, industrial, agricultural practices and other sources (Sharholy *et al.*, 2008).

In urban cities of developing countries such as Abraka in Delta State of Nigeria, solid waste management is a highly neglected area (Ahmed and Ali, 2004). All classes of solid waste are collected and dumped together on an open space or roadside without bordering about segregating and differentiating the components of solid wastes (Onwughara *et al*, 2010).

The disposal of garbage and refuse in a semi urban centre such as Abraka which is the area of study has been a serious problem. Many ill planned dumpsites have reached and exceeded their capacities while others have been improperly maintained and are major sources of health concerns.

This paper seeks to evaluates the monthly variation of solid wastes disposed in Abraka, Ethiope east local government area of Delta State, Nigeria.

## 2. MATERIALS AND METHODS

### 2.1. Description of Study Location

This study was conducted in Abraka, Ethiope East Local Government Area of Delta State, Nigeria (Lat. 5' 51 N and 5' 54 N and long. 6' 08 E and 6' 12 E). This settlement is situated at the eastern bank of River Ethiope, and covers a total land area of about 21.2 km$^2$. The topography is a low plain and drained by River Ethiope as seen in Figure 1 (Delta State Government, 2007). Abraka has only one government approved dump site and several other illegal dump sites. For the purpose of this study, four dump sites were used (one government approved dump site and three illegal dump sites).
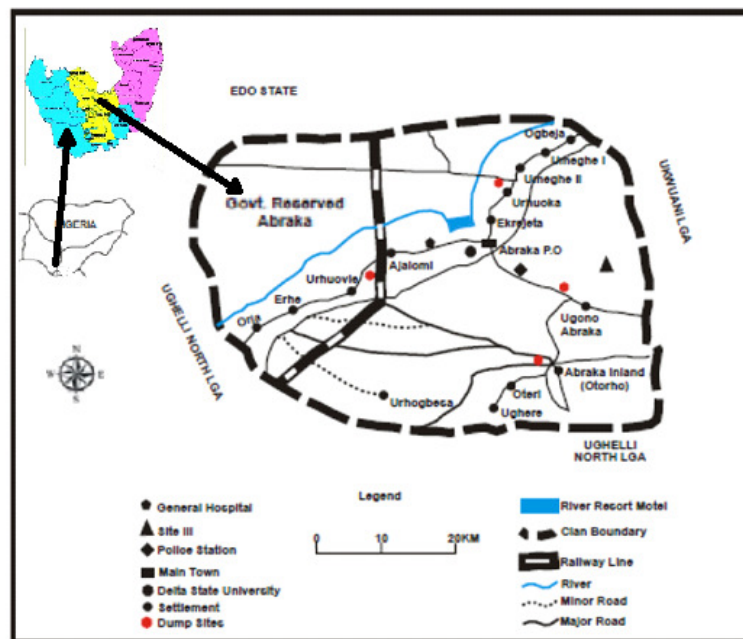


Figure 1: Map of Abraka town showing the study sites (Delta State Government, 2007).

**Station 1:** This is a government approved dump site, located along Abraka-Benin express road in Urhuoka community. Sand was collected from this site for construction purpose and it became a burrowed pit and was approved by the government to help reclaim the land. This dump site is off the road and communities close to this dump site are Urhoka, Ekrejeta, Umeghe II and the Delta state University. These communities dispose their wastes in this site and all kinds of wastes are found on this site. The quantity of waste on this site is very high due to the socio –cultural background and high economic activities.

**Station 2:** This is an illegal dump site that has been in existence for five years. It is located along Abraka-Ugono road, very close to Ugono River in Ugono community. Communities close to this dump site are Abraka P.O and Ugono. Waste disposed on this site overflows to the river bank.

**Station 3:** This is an illegal dump site that has been in existence for three years and it is located within Abraka inland in Otorho Community. Communities close to this dump site are Otorho and Oteri.

**Station 4:** This dump site is located along the railway track in Urhuovie community. Communities close to this dump site are Ajalomi, Urhuovie and Erhe.

## 2.2. Method of Sample Collection

On-site waste characterization was carried out at the dump sites in the study area by collecting fifty kilograms (50 kg) of waste from each of the dump site. The wastes collected from each of the dump site were weighed and sorted to know the type of waste that is predominant in each dump site. Weighing and sorting were done on each of the dump site once every month for eight (8) months.

A questionnaire-type survey was also conducted. The questionnaire was divided into two major parts: The first part was general information about the respondents. The second part of the questionnaire contained information about the research topic.

Seven hundred (700) copies of questionnaires were administered to seven hundred (700) community residents in the study area. The households were selected based on stratified random sampling technique. The samples were stratified according to ward's first, so that all areas of the community are represented in the study and then they were further stratified according to property values which were categorized as low income, lower-middle income, upper-middle income and high-income groups to get representation from people of all living standards. Of the seven hundred (700) administered questionnaires, six hundred (600) questionnaires were returned. Seventy (70) samples each were taken from ten (10) communities. These communities are Ekrejeta, Urhuoka, Umeghe II, Abraka P.O, Ugono, Otorho, Oteri, Ajalomi, Urhuovie, and Erhe.

## 2.3. Observation as a Tool

Observation is a process of systematically recording verbal and non- verbal behaviour and communication without asking specific questions. This was used in this project as it generated both qualitative and quantitative data. Observation method is quite essential as one can benefit a great deal in research through observation of occurrences in the field of the study (Mongtoem *et al*., 2014).

## 3. RESULTS AND DISCUSSION

### 3.1. Type of Wastes Generated by Different Households

Table 1 shows that four hundred and eight (408) respondents or 68% of the respondents generate organic waste. This is because these communities are rural communities and the type of job predominant in the area

of study is farming. These organic wastes are mostly from farming activities, market environment, food scraps, food remains and food processing. One hundred and two (102) respondents or 17% of the respondents generates paper waste; this is because of the presence of a university in the area of study. The university environment generates more paper waste. Forty eight (48) respondents or 8% of the respondents generate plastic waste. This type of waste is mostly from students' environment (hostels) and staff quarters. Twenty four (24) respondents or 4% of the respondents generate glass waste; this type of waste is mostly from students environment and staff quarters. Twelve (12) respondents or 2% of the respondents generates metal waste, this type of waste comes from mechanic workshops, student hostels and staff quarters. Six (6) responses or 1% of the respondents generate other type of waste from student environment, staff quarters and business centers. It can be observed from the above analysis that majority of the respondent generate more of organic wastes.

Table 1: Types of household wastes generated by Abraka residents.

| Type of wastes | Number of responses | Percentage (%) |
|---|---|---|
| Organic waste | 408 | 68 |
| Paper waste | 102 | 17 |
| Plastic waste | 48 | 8 |
| Glass waste | 24 | 4 |
| Metal waste | 12 | 2 |
| Other wastes | 6 | 1 |
| Total | 600 | 100 |

## 3.2. Waste Disposal Methods used by Abraka Residents

Table 2 shows that one hundred and sixty eight (168) respondents or 28% of the respondents dispose their waste by burning. These are mostly communities with farm settlements and they pile up wastes and allow the waste to dry. When they feel it's dry enough they burn them. One hundred and fifty six (156) respondents or 26% of the respondents dispose their waste by burying, These communities also have farm settlements especially those who engage in cassava farming. They dig a shallow pit and pour their cassava peels in it and then cover the pit up. They believe this method adds manure to the farm land. Two hundred and four (204) respondents or 34% of the respondents dispose their waste on open dumps. This is the most common method of waste disposal because these communities involved feels that the government approved dump site is far so they use illegal dump sites. While seventy two (72) respondents or 12% of the respondents dispose their waste with government agencies. The university environment and staff quarters fall under this category, they get to pay monthly for the services rendered.

Table 2: Waste disposal methods in Abraka

| Methods of waste disposal | Number of responses | Percentage (%) |
|---|---|---|
| Burning | 168 | 28 |
| Burying | 156 | 26 |
| Open dump | 204 | 34 |
| Government agencies | 72 | 12 |
| Total | 600 | 100 |

## 3.3. Frequency of Waste Disposal

The frequency of waste removal in the sampled areas in Abraka is presented in Table 3. Forty eight (48) respondents or 8% of the respondents disposed their wastes daily. Students' environment falls under this category. Wastes generated in the day are usually tied up in polythene bags and disposed on their way out. Three hundred and twelve (312) respondents or 52% of the respondents dispose their wastes weekly because government agencies come weekly to clear wastes for those in the university environment and staff quarters.

Some other residents also pile up their wastes and dispose them weekly too. One hundred and sixty eight (168) responses or 28% of the respondents dispose their waste monthly; This is so for markets because they pile up their wastes in a particular location within or in front of the market, and these wastes are disposed on sanitation days which is mostly ones a month. Seventy two (72) responses or 12% of the respondents dispose their waste at other times these set of people don't have specific times they dispose their wastes.

Table 3: Frequency of waste disposal

| Type of Response | Number of responses | Percentage (%) |
|---|---|---|
| Daily | 48 | 8 |
| Weekly | 312 | 52 |
| Monthly | 168 | 28 |
| Others | 72 | 12 |
| Total | 600 | 100 |

## 3.4. Waste Collection Mechanism Provided by Government

The responses to the availability of government agency responsible for waste removal in Abraka is presented in Table 4. One hundred and forty four (144) responses or 24% of the respondents indicated that government agencies come to remove their waste for disposal. The university environment, staff quarters and few residential buildings fall under this category. Four hundred and fifty six (456) responses or 76% of the respondents were of the opinion that no government agency is responsible for the disposal of their waste. It can be observed from the above analysis that government agencies do not come to remove waste of majority of the respondents. This is because government facilities for waste disposal are not sufficient and as such cannot completely satisfy these communities.

Table 4: Waste collection mechanism provided by government

| Type of Response | Number of responses | Percentage (%) |
|---|---|---|
| Yes | 144 | 24 |
| No | 456 | 76 |
| Total | 600 | 100 |

## 3.5. Request for Involvement in Waste Management Programme

The responses to the question of whether individual residents of Abraka would like to be involved in any waste management program is presented in Table 5. Five hundred and four (504) respondents or 84% of the respondents would like to be involved in waste management program while ninety-six (96) respondent's or 16% of the respondents would not like to be involved in waste management program. It is therefore apparent that majority of the respondents would like to be involved in a waste management program for efficient waste management in the area.

Table 5: Expression of interest in involvement of waste management

| Interest in waste management | Number of responses | Percentage (%) |
|---|---|---|
| Yes | 504 | 84 |
| No | 96 | 16 |
| Total | 600 | 100 |

### 3.6. Waste Generation

### 3.6.1. Organic waste

Monthly waste generation statistics presented in Figure 2 showed that the percentage of organic waste in station 1 was highest in October (95.49%) and lowest in September (61.11%). In station 2, it was highest in January (37.78%) and lowest in September (27.56%) while in station 3, monthly waste generation was highest in November (74.39%) and lowest in January (70.69%). Monthly organic waste generation in station 4, was highest in November (34.37%) and lowest in September (27.57%) as shown in Figure 2. This is because these communities in the area of study are rural communities and farming is the major activity here. Farming activities are highest during planting, harvesting and processing, these activities mostly takes place in October, January and November.
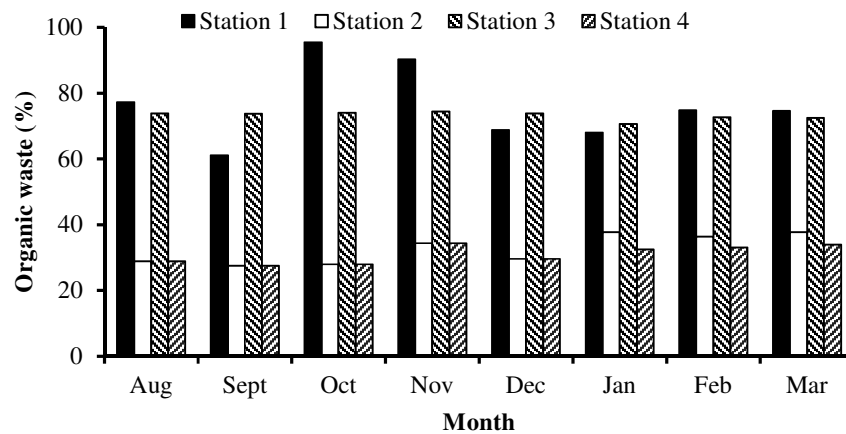


Figure 2:  Monthly variation of organic waste

### 3.6.2. Paper waste

Monthly waste generation statistics showed that the percentage of paper waste in station 1 was highest in September (34.98%) and lowest in October (1.15%) (Figure 3).  In station 2, the paper waste generation was highest in September (41.76%) and lowest in October (33.23%). In station 3, it was highest in January (16.82%) and lowest in November (11.72%) while in station 4, it was highest in September (41.76%) and lowest in October (33.23%). This is because of the presence of a university, secondary and primary schools in the study area, as they mostly generate paper wastes during resumption and examination, these activities are highest in September and January.
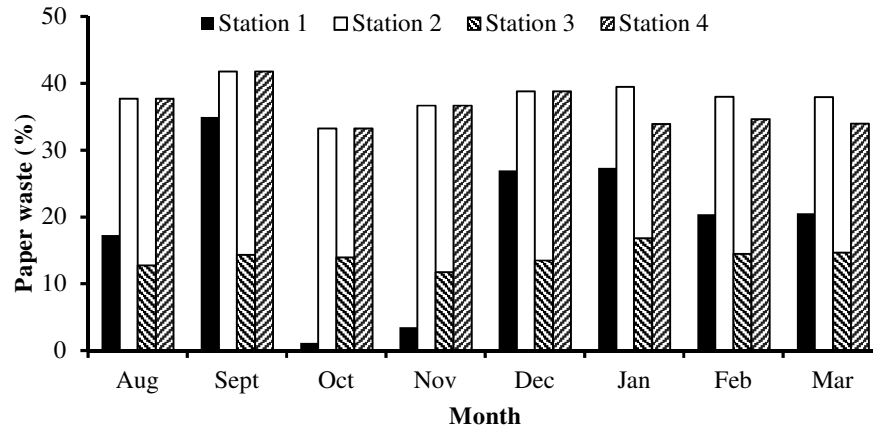
Figure 3: Monthly variation of paper waste

### 3.6.3. Plastic waste

Monthly variation showed that the percentage of plastic waste in station 1 was highest (2.8%) in November and lowest (0.75%) in October (Figure 4). In station 2, it was highest (18.4%) in October and lowest (3.1%) in January; in station 3, it was highest (15.1%) in November and lowest (3.1%) in January; while in station 4, it was highest (18.4%) in October and lowest (13.8%) in March. This is so because of the weather conditions in the months of October and November. These months are usually very hot and a lot of people are always thirsty so they take all sorts of drinks to quench their thirsts (water and drinks in different plastics).
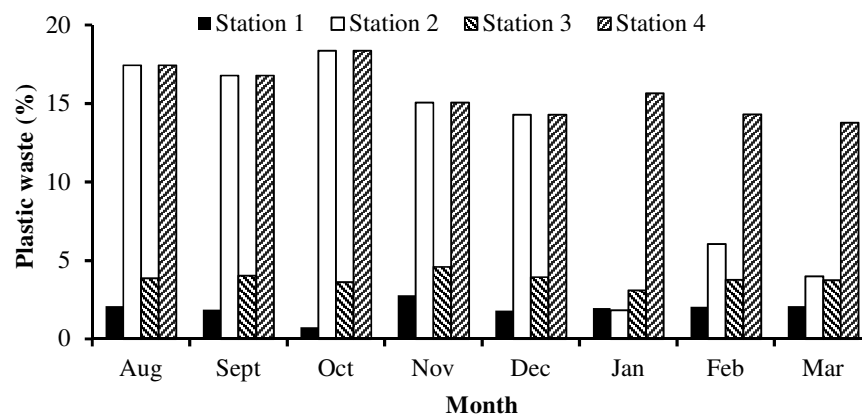


Figure 4: Monthly variation of plastic waste

### 3.6.4. Glass waste

Monthly variation showed that the percentage composition of glass waste in station 1 was highest in November (2.8%) and lowest in October (0.75%) (Figure 5). In station 2, it was highest in October (18.36%) and lowest in January (1.8%). In station 3, it was highest in November (4.59%) and lowest in January (3.09%) while in station 4, it was highest in October (18.36%) and lowest in March (13.76%). This is so

because of the activities within the university environment and also activities of drinks sellers. People tend to consume more drinks in the months of October and November because of the weather conditions.
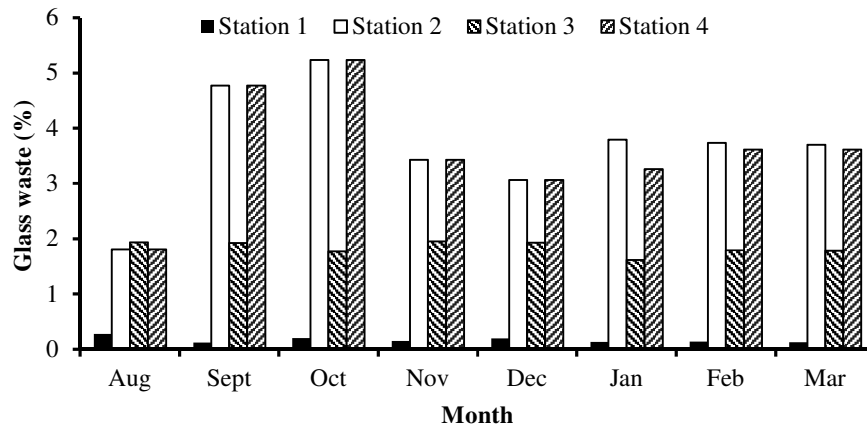


Figure 5: Monthly variation of glass waste

### 2.6.5. Metal waste

Monthly variation showed that the percentage of metals waste in station 1 was highest in November (2.92%) and lowest in September (1.62%) (Figure 6). In station 2, it was highest in January (7.21%) and lowest in December (5.1%). In station 3, it was highest in January (2.68%) and lowest in November (2.01%) while in station 4, it was highest in October (6.36%) and lowest in December (5.1%). This is so because of the activities within mechanic workshops and motor parks. These activities are at their peak in October, November and January because on the influx if students and other travelers.
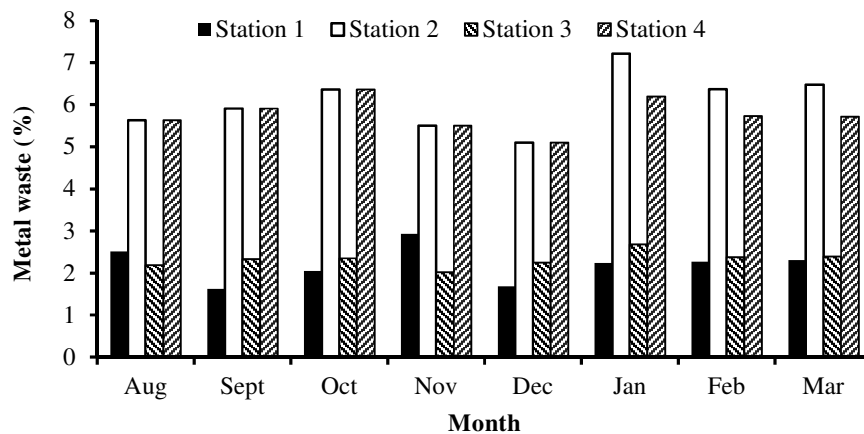


Figure 6: Monthly variation of metal waste

### 2.6.6. Other wastes

Monthly variation showed that the percentage of other waste in station 1 was highest in August (0.59%) and lowest in January (0.28%) (Figure 7). In station 2, it was highest in March (10.1%) and lowest in September

(3.21%). In station 3, it was highest in August (5.4%) and lowest in September (3.58%) while in station 4, it was highest in December (9.18%) and lowest in September (3.21%).
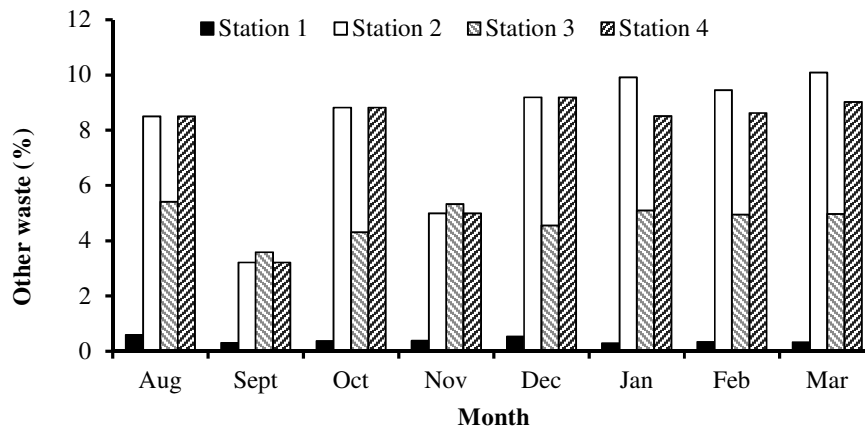


Figure 7: Monthly variation of other wastes

This study shows that residents in the study area generate mostly organic and recyclable wastes with most residence disposing these wastes on illegal open dumps. It was also observed that when there is increase in the number of people in a household, there is also increase in the volume of waste produced. The type of job that is prevalent in an area determines the type of waste generated. Most residents in the study area collect their household wastes and tie them up in poly or cellophane bag and dispose in the nearest dump site. Nigerian garbage "dumps" are located on the side of the highway at the fringe of cities and slums (Ogwueleka, 2003). Since there are no means for containment, waste often spreads into the road, blocking traffic.

## 4. CONCLUSION

From the results, it was observed that 52% of the respondents disposed their wastes more frequently (weekly) to avoid devaluing the immediate environment, prevent rodents and vectors like mosquito and flies. Sixty eight percent (68%) of the waste generated are organic waste mostly from farming activities, food scraps, food remains and food processing; This is because the communities in the study area are rural communities and the type of jobs predominant in the area is farming. It can generally be concluded that solid waste such as organic, paper, plastic, glass metal and other waste are highly generated in areas where activities such as farming, presence of a university, student hostels and mechanic workshops are predominant. It is also seen that government agencies are not doing enough in disposing waste generated by residence in most areas (76%) which is because government facilities for wastes disposal are not sufficient and as such cannot satisfy these communities.

## 5. ACKNOWLEDGMENT

## 6. CONFLICT OF INTEREST

There is no conflict of interest associated with this work.

**REFERENCES**

Ahmed, S. A. and Ali, M. (2004). Partnerships of solid waste management in developing countries: linking theories to realities**.** *Habitat International,* 28(3), pp. 467 – 479.

Akpofure, R. R. (2009). *Environmental science: An introduction.* Amah K., Kraft books limited. Sango, Ibadan, Nigeria, p. 419.

Ayo,C.K. and Gbadeyan, J.A. (2006). The Role of Technology in The Built Environment. In: *The Built Environment: Innovation Policy & Sustainable Development.* CU Press. pp. 446-451.

Delta State Government (2007). Map of Delta state. Retrieved June, 2014. From www.delta.state.gov.ng.

Mongtoem, Y., Fujiwara, T. and Sethy, S. (2014). Evaluation of household solid waste treatment and recycling method for Phom Penh, Cambodia. *Journal of Material Cycles and Waste Management,* 6, pp. 21-35.

Onwughara, I. N., Nnorom, I. C. and 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 Environmental Science and Development,* 1(5), pp. 409-418.

Sharholy, M., Ahmad, K., Mahmood, G. and Trivedi, R. C. (2008). Municipal Solid Waste Management in Indian Cities - *A review. Waste Management,* 28(2), pp. 459-467.

World Health Organization (WHO) (2008). Safe Water and Global Health.
http//Www.who/int/features/qa/70/en/index.htm.