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Characteristics And Management Of Solid Waste In Ghanaian Markets - A Study Of WA Municipality

Patrick Aaniamenga Bowan[1*] Millicent Timol Tierobaar[2]
1.Lecturer, School of Engineering, Department of Civil Engineering, Wa Polytechnic, P. O. Box 553, Wa, Upper West Region, Ghana
2.Graduate, School of Engineering, Department of Civil Engineering, Wa Polytechnic, P. O. Box 553, Wa, Upper West Region, Ghana
* E-mail of the corresponding author: bowanaania@gmail.com

Abstract

Waste management occupies a vital place in the economies of both developed and developing countries. Urbanization in Ghana has made the management of solid waste very crucial in the areas of public health and the environment. Poor solid waste management in Ghana can be attributed to the failure of proper waste characterization in Ghana. Thus, the objective of this paper is to determine solid waste composition and bulk density in the Wa market. The study considered waste characterization at the Wa Central Market by determining the percentage by weight of the various solid waste components generated in the market within the months of June to August, 2013. Waste bins were placed at selected locations in the market for waste collection and sorting for the study. The study obtained the densities of solid waste as follows: organic waste, 468 kg/m^3; paper/card board, 142 kg/m^3; plastic waste, 79 kg/m^3; metals/cans waste, 244 kg/m^3; textiles/fabrics waste, 152 kg/m^3 and other waste has a density of 312 kg/m^3; thus, the bulk density obtained was 261 kg/m^3. Also, the study revealed that the solid waste in the Wa market is dominated by organic waste of 47% and other waste, 29%. Paper/card board made up 13% of the solid waste generated in the Wa Market; 5% was plastics; metals/cans waste and textiles/fabrics waste constituted 3% each of the solid waste generated in the Wa Market. The study thus recommended that, the Municipal Authorities should reduce the quantity of solid waste that goes to the dumping site through composting and recycling/reuse solid waste generated from the Wa Central Market.

Keywords: solid waste, waste characteristics, market, waste management, Wa

1. Introduction

Anthropogenic activities in society generate large quantities of wastes posing a problem for their disposal. Improper disposal leads to spreading of diseases and unhygienic condition besides spoiling the aesthetics (Nayana and Malode, 2012). Municipal solid waste management has emerged as one of the greatest challenges facing environmental protection agencies in developing countries (Ogwueleka, 2009).

Waste management is one of the important services provided by most urban authorities. Solid wastes need to be characterized by sources, generation rates, types of wastes produced, and composition in order to monitor and control prevailing waste management systems while improving the existing system (Chandrappa and Das, 2012).

Furthermore, according to Das and Bhattacharyya (2013), solid wastes are disposed of either in open dumps or sanitary landfills, or by incineration. As incineration and sanitary landfilling are expensive, both in initial investment and throughout their operation, their use is mostly confined to developed countries, while open dumping is the method used in economically developing countries, mainly due to its simplicity and low cost.

The possible common reasons for haphazard waste disposals are such like inadequate financial resources, lack of appropriate solid waste legislations, lack of political will, and public commitment, inadequate technical expertise and lack of planning on the available resources can be presented (Muller, 2002).

In Ghana, available literature indicate that some proportion of solid waste generated are not collected and thus end up in open spaces and drains. The effects of this phenomenon are threatening to both human life and the environment. These repercussions range from flooding, water pollution, spread of diseases and ugly sights of stinking and pest-infested piles of solid waste in some parts of urban areas (Boadi & Kuitunen 2004; Puopiel 2010 in Monney et al, 2013).

In recent years, management of solid waste has become an issue of increasing concern, becoming one of the primary environmental concerns of public debate (Rahman and Yousuf, 2007). This is due to the rapid growth of population, urbanization and high economic growth.

Furthermore, waste management occupies a vital place in the economies of both developed and developing

countries. Urbanization in Ghana has made the management of solid waste very crucial in the areas of public health and environment, especially in the capital cities, since these areas serve as the gateways to the country for foreign investors and tourists. Poor form of these cities can deter foreign investors (IRIN, 2004 in Abagale, 2012).

Solid waste management starts with solid waste characterization and quantification. It encompasses the full range of activities from generation to ultimate disposal of Municipal Solid Waste (MSW) that broadly comprises generation, storage, collection, transportation and disposal. Open dumps were the means of solid waste disposal in the three major cities of Ghana namely; Accra, Kumasi and Takoradi (Johannessen and Boyer, 1999) of which Wa is not an exception.

In Ghana 58% of the solid waste generated is dumped by households in designated dumping sites, 25% is dumped elsewhere in non-designated sites and only 15% is uncollected. The quantity of waste collected varies from place to place and could be as high as 20% as in Accra and Kumasi (GSS, 2000). However, in the upper west region about 65-70% of the solid waste generated is collected and dumped in non-designed dumping sites while about 35-40% is uncollected (Wa Municipal Assembly, 2010).

The objective of the paper is to determine solid waste composition and bulk density in the Wa market. The study considered waste characterization at the Wa Central Market by determining the percentage by weight of the various solid waste components generated in the market within the months of June to August, 2013.

The rest of the paper is organized as follows: Section 2 is the literature review. Following is the methodology in section 3. The results and discussion is presented in section 4. Lastly section 5 is the conclusion of the study.

2. Literature Review

Solid waste can be defined as useless, unwanted or discarded materials arising from domestic, trade, commercial, industrial and agricultural as well as from public services (World Health Organization (WHO) expert committee report, 1982 in Shyamala and Belagali, 2012). Managing solid waste is one of the most essential services which often fail due to rapid urbanization along with changes in the waste quantity and composition. Quantity and composition vary from country to country making it difficult to adopt waste management systems which are successful at other places (Chandrappa and Das, 2012).

Furthermore, according to Shukla et al (2000), the composition of MSW differs for different countries and regions, and developing countries have generally high food and yard wastes, whereas developed countries have a large fraction of paper and plastic content. Identification of waste composition is crucial for the selection of the most appropriate technology for treatment, taking essential health precautions and space needed for the treatment facilities.

The composition and the quantity of MSW generated form the basis on which the management system needs to be planned, designed and operated (Sharholy et al 2007). However, the problem of municipal solid waste management (MSWM) has acquired an alarming dimension in the developing countries during the last few decades. The quantity of solid waste generated has increased significantly and its characteristics have changed as a result of the change in the peoples' lifestyles due to swift industrialization and urbanization (ISWA & UNEP, 2002).

Rapid urbanization of the developing countries has increased the urban population significantly resulting in growth of industrial enterprises for the production of different consumer products. As a result, huge amounts of solid waste are being generated daily from urban areas that have put pressure on environmental management (ARRPET, 2004).

Furthermore, according to Chandrappa and Das (2012), waste management is one of the important services provided by most urban authorities. Solid waste needs to be characterized by sources, generation rates, types of wastes produced, and composition in order to monitor and control prevailing waste management systems while improving the existing system. They conjectured that, these data will help to make financial, regulatory and institutional decisions.

The beginning of a better SWM should be focused on the initial stage, which is the solid waste generation point. Generation of Solid Wastes is an inevitable consequence of production and consumption activities. Therefore the growth of population is nearly proportional to the growth of waste generation. However the waste generation can also vary with the urbanization trends, cultural variations, level of income, social and lifestyle changes, the food habits and seasonal variations (Mahees et al, 2011).

Thousands of tons of solid waste are generated daily in Africa. Most of it ends up in open dumps and wetlands, contaminating surface and ground water and posing major health hazards. Generation rates, available only for select cities and regions, are approximately 0.5 kilograms per person per day; in some cases reaching as high as 0.8 kilograms per person per day. While this may seem modest compared to the1–2 kg per person per day generated in developed countries, most waste in Africa is not collected by municipal collection systems because of poor management, fiscal irresponsibility or malfeasance, equipment failure, or inadequate waste management budgets (USAID, 2009).

Also, Waste separation is the key mechanism for the reduction in waste quantity. Further, it also helps to promote beneficial reuse of the wastes. However in many developing countries, it is not practiced widely and effectively except for certain urban areas, where public pressure and general awareness promotes this environmentally sound practice (ARRPET, 2004).

Collection of solid waste generated is a major challenge in most developing countries. Throughout most of sub-Saharan Africa solid waste generation exceeds collection capacity. This is in part due to rapid urban population growth: while only 35 percent of the sub-Saharan population lives in urban areas, the urban population grew by 150 percent between 1970 and 1990. But the problem of growing demand is compounded by broken-down collection trucks and poor program management and design. In West African cities, as many as 70 percent of trucks are always out of service at any one time, and in 1999 the City of Harare failed to collect refuse from nearly all of its residents because only 7 of its 90 trucks were operational (USAID, 2009).

3. Materials and Methods

The market area was surveyed to locate the best locations for placement of waste bins. The selection of the located points was such that each of the points was a location where particular types of goods are sold. Sellers around the location were informed to dump refuse into the bins.
Waste bins were placed at six (6) vantage points in the market and sorted out over one day for three (3) rounds. Samples were collected during markets and non-market days between the periods of June to August, 2013.
The waste bins were picked up from each point and sorted out. A bin each was sorted out each day. The content of each bin was spread over a plastic sheet for manual sorting into six (6) different categories into polythene bags. The six different components were organics, plastics, paper/card board, cans/metals, textile/fabrics and others.
The weight of the polythene bag was first taken and recorded. Each component in the polythene bag was weighed and recorded on a data sheet. The weight of the waste was then the weight of the polythene bag plus the weight of waste minus the weight of the polythene.

Mathematically,

$$weight\ of\ waste = weight\ of\ waste + polythene\ bag - weight\ of\ polythene\ bag\ only.$$

Each of the content was then poured into a graduated plastic container in loose form and their volumes taken and recorded against each weight.
Also, the average densities of the various components of waste generated in the Wa market for the three rounds of waste collected, were obtained by the addition of the densities of each of the component for the three rounds divided by three.

Thus, $$Average\ Density\ of\ waste = \frac{Sum\ of\ densities\ for\ three\ rounds}{3}$$

Furthermore, the percentages of solid waste generated from the Wa market were obtained from the equation:

$$Percentage\ weight = \frac{individual\ weight}{Total\ Weight} \times 100$$

4. Results and Discussion

4.1 *The waste types and composition in Wa Municipality*

The table below illustrates the waste composition in the Wa Municipality
Table 1: Waste Composition in the Wa Municipality

Waste Type	Proportions
Organic and food plant	52%
Paper	9%
Plastic	20%
Metal	13%
Inert material	2%
Others	4%
Total	**100**

Source: Municipal Waste Management Department, Wa, 2010

Knowledge on the composition of waste is essential for implementing the most appropriate treatment and disposal process (McDougal et al, 2001). The size and distribution of the components of wastes are important for recovery.

4.2 *Solid Waste composition in the Wa Market*

The pie chart below indicates the solid waste composition in the Wa market

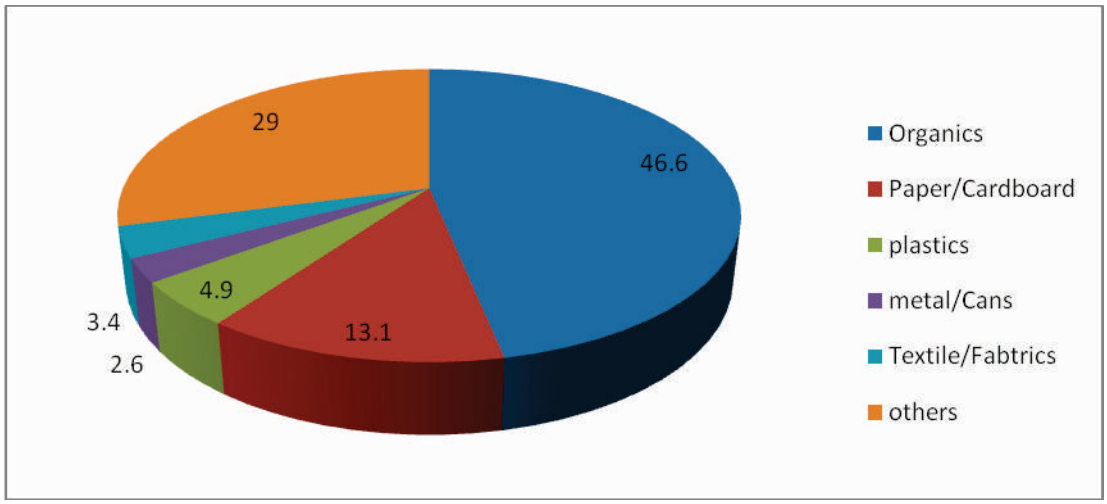

Figure 1: solid waste composition in the Wa market
Source: Authors' Construct, 2013

From the pie chart above, organic waste dominates the bulk of solid waste generated in the Wa market followed by other waste; organic waste constitutes 47% and other wastes, 29%. This is an indication that majority of the solid waste generated in the market can be composted or recycled.

4.3 *Densities of Solid waste constituents in the Wa Market*

The bar graph below shows the densities of the Solid Waste Components in the Wa market

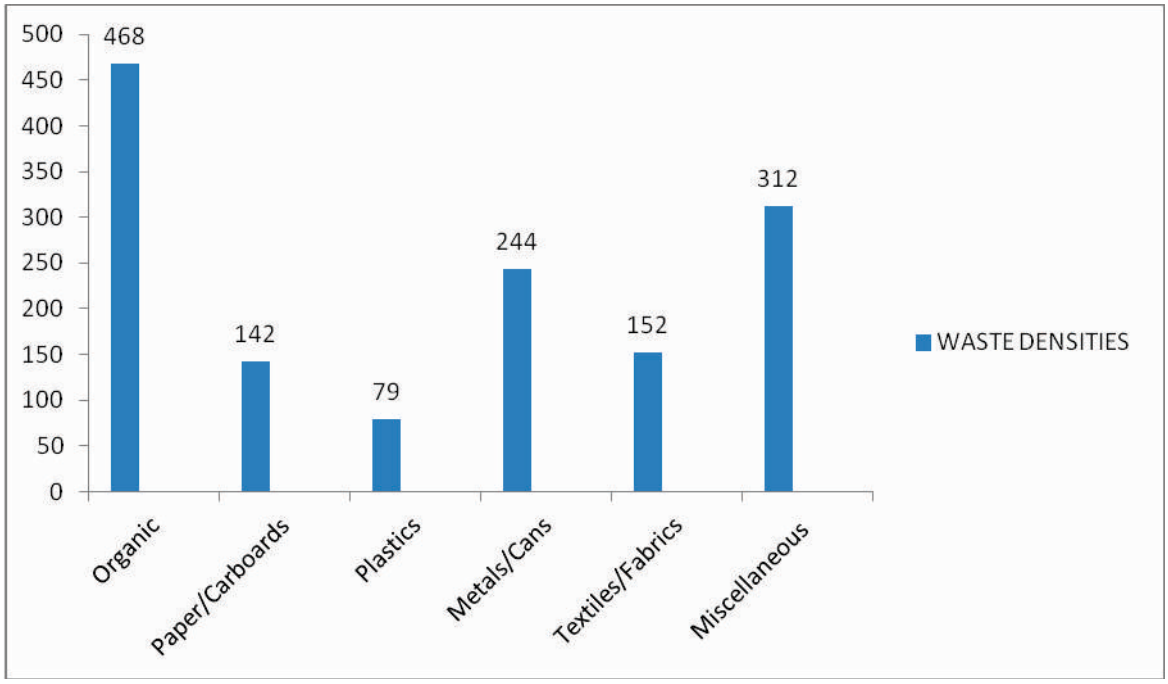

Figure 2: Densities of waste components in the Wa Market
Source: Authors' Construct, 2013

From the graph above, organic waste has the highest density value of $468\ kg/m^3$. Paper/ card board have a density of $142\ kg/m^3$; plastics, $79\ kg/m^3$; metals/ cans, $244\ kg/m^3$, textiles/ fabrics, $152\ kg/m^3$ and others, $312\ kg/m^3$. This gives a bulk density of $261\ kg/m^3$. According to the World Health Organization (WHO) expert committee report, (1982), bulk density values of solid waste ranges from 100-500 kg/m^3.This indicates that the density values obtained in this study fall within the acceptable density range for solid waste. Also, bulk density of waste determines the method of collection, storage and transportation of solid waste. Thus, as revealed from the study, communal collection will be the best mode of waste collection in the Wa market.

4.4 *Solid Waste Management in the Wa Market*

The Waste Management Department (WMD) is the public outfit tasked with the day-to-day collection, transportation and disposal of waste (solid and liquid), public education on waste management, public cleansing and supervision of private contractors engaged by Metropolitan, Municipal and District Assemblies (Oduro-Kwarteng 2011). However, due to lack of funds, limited logistics and personnel, this task has been mostly contracted to private waste management companies in the country. Currently, the WMD plays the role of facilitation, regulation and monitoring of solid waste management services by private waste management companies. Although there are several private waste management companies in the country, ZoomLion Company Limited has the greatest proportion of the waste management services across the country, including the Wa Municipal Assembly (Monney, et al, 2013).

However, the inability of the Municipal Assembly or any Government Agency to supervise the operations of Zoomlion Company Limited is affecting solid waste management in the Wa Market. Payment for the services of Zoomlion Company Limited to Wa Municipality apart the door to door service and other private organisiations or individual contracting Zoomlion, is made at source; the money is deducted from the Wa Municipal Assembly's share of the Common Fund. The Municipal Assembly does not determine or evaluate the operations of Zoomlion Company Limited before payment is made. According to the Municipal Waste Management Department, if the amount that is paid to Zoomlion Company Limited were given to the Department, they would have improved the solid waste management situation in the Wa Market better than what Zoomlion Company Limited is currently doing because 'the Waste Management Department has the technical personnel but lack the financial resources and equipment to manage solid waste whiles Zoomlion Company Limited has the financial resources and equipment but lack the technical personnel'. However, the Municipal Waste Management Department acknowledges that there has been an improvement in solid waste collection in the Wa Market since

Zoomlion Company Limited started their operations in the Wa Municipality.

5. Conclusion

The study revealed that the largest proportion of solid waste in the Wa Central Market consist of easily degradable components and the materials typically found in the market solid waste streams are organic, paper/card board, plastics, metals/cans, textiles/fabrics and others. The densities obtained for the various waste components are organic, $468\ kg/m^3$; paper/card board, $142\ kg/m^3$; plastics, $79\ kg/m^3$; metals/cans, $244\ kg/m^3$; textiles/fabrics, $152\ kg/m^3$ and other waste, $312 kg/m^3$. Thus the bulk density is $261\ kg/m^3$. The percentage compositions obtained for each component are organic waste (47%), other waste (29%), paper/card board (13%), plastic (5%), metals/cans (3%) and textiles/fabrics also, (3%). The study thus recommends that the Municipal Authorities should reduce the quantity of solid waste that goes to the dumping site through composting and recycling/reuse of solid waste generated from the Wa Central Market. The study further recommends future research on the solid waste generation rate in the Wa market. This study could not obtain sufficient data to determine the solid waste generation rate in the Wa market.

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