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Environment, Health and Wealth: Towards an Analysis of Municipal Solid Waste Management in Ota, Ogun State, Nigeria

David O. Olukanni and Michael O. Akinyinka

Department of Civil Engineering, Covenant University, P.M.B. 1023, Ota, Ogun State, Nigeria.
E-mail: david.olukanni@covenantuniversity.edu.ng +234-08030726472

Abstract

The management of municipal solid waste is one of the challenges facing the developing countries because governments, institutions, and private sectors have given solid waste management low priority and ignoring the implication it has on the general public. This is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal. This paper presents the current solid waste management method adopted in Ado-Odo Ota local government and its associated challenges. Four locations (Iganmode area, Joju area, Ota market and toll gate area) were selected. These sites are points where the waste bins are located. A field work that involves the characterization and types of the waste generated, and frequency of collection from each site was carried out. A representative sample of 280 kg was used for the waste characterization and the result shows that about 64% of the wastes are recyclable with lots of organic waste that comprises of food and agricultural waste which can be used as compost. The only dump site in Ota was visited in order to obtain useful information concerning the present state of solid waste management. The study revealed that there is presently no investment made to the existing development plan to introduce a modern waste management system. The study suggests new approach that could be used by institutions and government agencies for municipal solid waste management to achieve sustainable and effective sanitation.

Key words: *Ota, Municipal solid waste, waste characterization, effective sanitation, recycling, disposal*

1. Introduction

Ota metropolis, Ogun State in South-Western Nigeria has witnessed a rapid urbanization over the past decades providing a large market for manufacturing industries and organizations. Its population growth has led to the rapid expansion of the city which has resulted in urban sprawl and uncontrolled increase of occupancy ratios in existing housing units and infilling of vacant plots in existing residential area. However, the lack of proper and comprehensive land use planning has hindered effective sanitation thus reeling under indiscipline and haphazard way of dumping refuse in an objectionable manner. The waste generated include refuse from households, non-hazardous solid waste from industries, commercial and institutional establishments (including hospitals), market waste, yard waste, and street sweepings. The general practice in the municipality has been indiscriminate disposal of solid waste thereby creating unsanitary environments in many part of the metropolis. In addition, the waste disposal site is faced with poorly developed dumping ground that is potentially threatening to public and environmental health. Agunwamba (1998; 2003) expressed that political, economical and sociological factors among other factors are attributable to an inadequate formulated and poorly implemented environmental policy that complicates such problems. The public health consequences of poor management of solid waste in the city are becoming enormous while on the other hand the need to minimize wastages and make the most valuable use of some materials from the generated waste is attracting interest.

Ogwueleka (2009) pointed out that solid waste management in Nigeria is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal of solid waste. The mountainous heaps of solid wastes that deface Nigerian cities and the continuous discharges of industrial contaminants into streams and rivers without treatment motivated the federal government of Nigeria to promulgate Decree 58 for the establishment of a Federal Environmental Protection Agency (FEPA) in 1988. A national policy on the environment was formed and the goals of the policy include:

securing for all Nigerians a quality of environment adequate for their health and well being, raising public awareness and promoting understanding of the essential linkages between the environment and development, and to encourage individual and community to participate in environmental protection and improvement efforts (FEPA, 1989 in Agunwamba, 1998). As fallout of this decree, many States of the Federation established their own waste management authorities for the safety and development of the environment within their jurisdiction: Ondo State Integrated Waste Recycling and Treatment Project (OSIWRTP), Lagos Waste Management Authority (LAWMA), Ogun State Environmental Protection Agency (OGEPA), Oyo State Environmental Protection Agency (OSEPA), Kaduna State Environmental Protection Agency (KASEPA), River State Environmental Protection Agency (RSEPA), Enugu State Environmental Protection Agency (ESEPA) and Anambra State Environmental Protection Agency (ANSEPA) among others. The agencies are charged with the responsibility of handling, employing and disposing of solid waste generated. These agencies generate fund from subvention from state governments and internally generated revenue through sanitary levy and stringent regulations with heavy penalties for offenders of illegal dumping and littering of refuse along streets (Ogwueleka, 2003; 2009). In addition, the federal government instituted national integrated municipal solid waste management intervention programme in seven cities of Nigeria. The seven cities are Maiduguri, Kano, Kaduna, Onitsha, Uyo, Ota, and Lagos (Ogwueleka, 2009). However, development project may be judged unsustainable and not cost-effective if it threatens human health. The goal of municipal solid waste management is to promote the quality of the urban environment, generate employment and income, protect environmental health and support the efficiency and productivity of the economy (Ogwueleka, 2003).

Agunwamba (2003) expressed that planned recycling does not exist in Nigeria as it does in developed countries and suggested that waste recycling and composting activities should be encouraged since this approach is considered to be the right measure in attaining sustainability in waste management. However, recycling measures are still faced with many problems such as lack of financial resources, collection and transportation facilities and lack of advanced technology. Recycling reduces the amount of waste needed to be collected, transported and disposed of, and extends the life of disposal facilities, which saves money to environmental agency. Birly and Lock (1998) pointed out that good waste management is frequently concerned with identifying problems, assessing their importance and proposing solutions. It was further stressed that collection and disposal of refuse can consume up to 50 per cent of a municipal operating budget. Where markets for solid waste exist there is usually a thriving trade which supports many destitute people who may live or work on refuse dumps that are often cited in peri-urban areas (Furedy, 1996; Birly and Lock, 1998). Proper management of municipal solid waste at all stages of a project is expected to be beneficial to the health and sustainable development as well as economic well-being of a community. Ogwueleka (2009) pointed out that a different approach is required for developing countries in the management of solid waste because most developing countries have solid waste management problems different from those found in developed countries in areas of composition, density, waste amount, access to waste collection, awareness and attitudes, political and economic framework.

While stressing the need for recycling, it is also important to discuss the health implications of improper waste disposal. Health impact assessment consists of identifying health hazards, assessing health risks and proposing risk mitigation measures. There are potential risks to the environment and human health from improper handling of solid wastes. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. Epidemiological studies have shown that a high percentage of workers who handle refuse, and of individuals who live near or on disposal sites, are infected with gastrointestinal parasites, worms and related organisms. Disease transmission by houseflies is greatest where inadequate refuse storage, collection and disposal is accompanied by inadequate sanitation. Once collected in poorly designed or poorly operated disposal sites, rubbish may contaminate groundwater with nitrates, heavy metals and other chemicals. Incineration of wastes may pollute the air with particulates and oxides of sulphur and nitrogen.

The slag and ashes from incinerators may result in leachate that is rich in heavy metals and other potentially toxic substances (WHO, 1985). This study emanates from the need to address the solid waste management problem in Ota. The major thrust of this investigation is to assess the solid waste management problem and document the potential environmental and health implications, and resources that could be annexed from the municipal solid waste generated in Ota, Ogun State, Nigeria.

2. Materials and Method

Study Area

Ota is the capital of the Ado-Odo/Ota local government area and has the third largest concentration of industries in Nigeria (Salako, 1999). It covers an area of 878 square kilometers and lies between latitude 6°41′N and 6°68′N and longitude 3°41′E and 3°68′E. Ado-Odo/Ota Local Government has an estimated population of 527,242 (Male 261,523 and Female 265,719) (2006 Census) with about four hundred and fifty (450) towns, villages and settlements. Other towns and cities include Ado-Odo, Igbesa, Agbara, Sango-Ota, and Itele. It also possesses a large market and an important road junction, found north of the Tollgate on the Lagos-Abeokuta expressway. Ota is also well known to be the location of the Canaan Land where the mega church Winner's Chapel, renowned as the world's largest single auditorium is situated. Ota is gradually becoming a busy place because of its proximity to Lagos thereby increasing the migration of people it.

Field Work

This study is both quantitative and descriptive with field works and assessment that involved the characterization of the waste from four waste bin locations. Data were collected from both primary and secondary sources. The location of the collection points, type of waste generated, collection duration and frequency were collected. The dump site was visited which happen to be the only one in Ota. Discussion and interviews were held with some of the residents, scavengers and key officials in order to confirm the practice and problems facing solid waste management. The Ota township map is presented in Figure 1 with the four collection points labeled for identification while Table 1 shows the description of the selected locations.

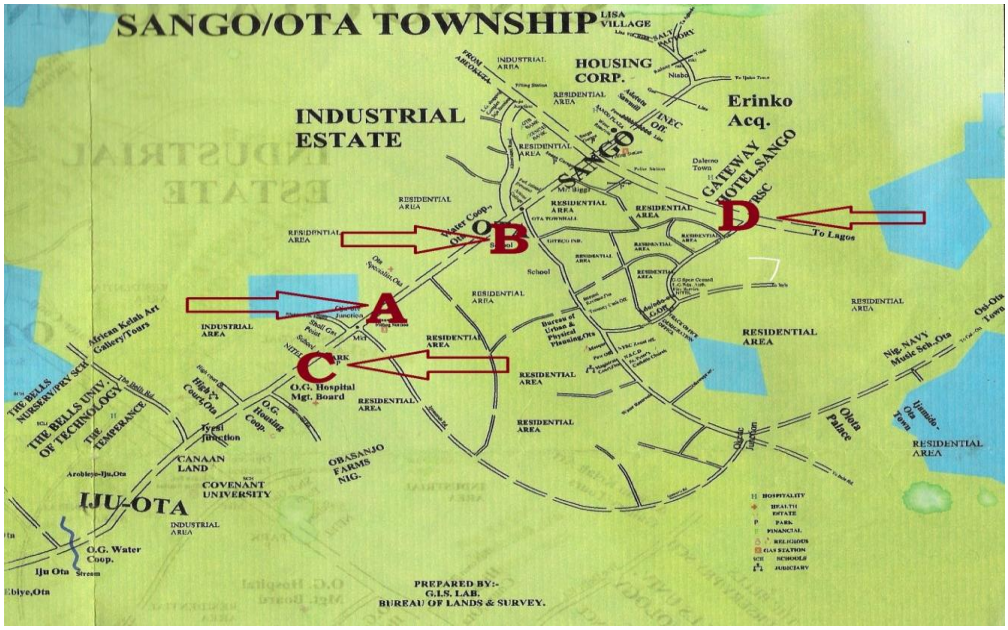

Figure 1 A Map of Ota Township, Ogun State (study area).

The indiscriminate disposal of waste in Ota is a concern to the Ado-Odo Ota local government waste management agency and this gave rise to the provision of waste bin along the road side for

ease of generation and collection. The volume of the waste bin provided by the local government waste management authority is $7m^3$. A representative sample of 280 kg was collected from a loaded $7m^3$ waste bin and its surrounding in each of the location to represent the municipal solid waste generated. The weighing scale was used in determining the weight of solid waste collected. Glove and nose guard were used for safety measure. Thereafter, sorting of the waste was done in order to classify the waste into glass, food waste, textile, rubber, plastics, cartoon, paper etc., and subsequently, the characterized waste was weighed and recorded for each of the sites. The quantity of characterized waste varies with site.

Table 1 Selected sites in Ota and quantities of waste bins provided.

Site	Location	Quantity of bins
A	Iganmode Grammar School.	4
B	Joju Junction.	2
C	Ota Market.	3
D	Toll Gate.	1

The quantity of waste bins supplied is based on the population and the activity in such area. Iganmode area has four waste bins because it is a residential/commercial area, while Ota market also has three due to the commercial activities there. Joju has two waste bins because it is also a residential area and toll gate has only one waste bin because it is a transition point with varying population for motorist and people moving in and out of Ota. Figure 2 shows the manual collection of waste around the waste bin and bagged to be disposed.

2a 2b

Figure 2 Waste Collection bin provided by the Local Government and the ad-hoc workers parking the waste into sacks for unward tranfer into the bin.

Characterization of Waste Composition (%)

$$Characterisation..of..Waste..Composition.(\%) = \frac{Weight..of..Waste..Composition.(kg)}{Weight..of..Total..Solid..Waste.(kg)} \times 100\%$$

3. Results

From observation and inquiries made, the local government provides waste bins for the storage of waste to reduce the indiscriminate disposal of solid waste on the road side. These waste bins are generally at open spaces along street ends or junctions. Tables 2-4 show the composition of the inorganic and organic wastes of the 280 kg from the collection points.

Table 2 Composition of inorganic and organic waste of the 280 kg from collection points

LOCATION	TYPE OF WASTE	
	Inorganic (%)	Organic (%)
Igannode Grammar School	60.28	39.72
Joju Junction.	65.38	34.62
Ota Market.	63.51	36.49
Toll Gate.	61.11	38.89

Results in Table 2 shows that a larger percentage of the waste generated by the people of Ota is inorganic which the same is relative over the entire sampling points.

Table 3 Representative Composition of Inorganic Waste in Ado-Odo Local Government

LOCATION → / MATERIAL ↓	Igannode Grammar School Site A Percentage (%)	Joju Junction Site B Percentage (%)	Ota Market Site C Percentage (%)	Toll Gate Site D Percentage (%)
PAPER	4.55	3.92	4.26	3.03
CARTON	11.36	11.76	14.89	9.09
PLASTICS	9.09	5.88	12.77	18.18
TEXTILE	13.64	9.8	6.38	9.09
RUBBER	6.82	5.88	10.64	12.12
GLASS	11.36	15.69	8.51	21.21
TIN CAN	4.55	7.84	12.77	12.12
SACKS	9.09	9.8	17.02	9.10
NYLON	29.55	29.41	12.77	6.06
TOTAL	100	100	100	100

As shown in Table 3, carton, plastic, textile, glass and nylon dominated the waste stream, followed by rubber, tin and sacks. This data informed on the kind of materials used mostly by the inhabitants. These waste all have potential for recycling if they are all sorted out from source as done in developed nations.

Table 4 Representative Composition of Organic Waste in Ado-Odo Local Government

LOCATION	Igannode Site A	Joju Site B	Ota Market Site C	Toll Gate Site D
MATERIAL	Percentage (%)	Percentage (%)	Percentage (%)	Percentage (%)
FOOD WASTE	31.03	59.26	48.15	38.09
AGRICULTRAL WASTE	6.89	3.7	14.81	4.76
OTHERS(DECOMPOSED)	62.07	37.04	37.04	57.14
TOTAL	100	100	100	100

Table 4 shows that food waste takes a significant amount of the organic waste stream which when used appropriately could be of great benefit in composting. The remaining decomposed waste stream if annexed could be used to generate biogas or could serve as an alternative energy source**.**

Discussion

Planning and Management of the Waste Management Authorities in Ota

Private participation in waste management has not been successful in Ota because such companies are profit driven and they are not monitored or regulated by government. The initiative for the private sector to participate in the waste management is to strengthen the system. Waste management in Ota has this facility but suffers funding as such it is not stable. Funding has made the waste management to experience a step back because solid waste management is very expensive. There is little financing even for the private sector participation. Therefore, waste management agencies cannot meet the demand of collection effectively. The present analysis highlighted that the existing system of waste collection and its disposal within the municipality is not only inadequate and insufficient but also unscientific. Proper management of municipal solid waste should have minimum effect on environment. The role of the informal sector in waste collection is significant. This sector could be responsible for removing a significant percent of total generated waste in the urban areas. In some public places and markets, people pay scavengers to clean the front of their shops. Scavengers salvage repairable and rentable materials to sell for recycling. To achieve sustainable and effective waste management of municipal solid waste, there is need to consider the political, institutional, social, economic and technical aspects. It is imperative that the local government realizes that increasing environmental education and awareness are key factors to changing the current paradigm.

High-income earners consume more packaged products, which results in a higher percentage of inorganic materials – metals, plastics, glass, and textile. Waste characteristics also vary according to season, income level, population, social behaviour, climate, and industrial production, the size of markets for waste materials and the extent of urbanization, effectiveness of recycling, and work reduction. The organic fraction of municipal solid waste is an important component, not only because it constitutes a sizeable fraction of the solid waste stream, but also because of its potentially adverse impact upon public health and environmental quality. A major adverse impact is due to its attraction of rodents and vector insects for which it provides food and shelter. Impact on environmental quality takes the form of foul odors, unsightliness, land, water and air pollution. Unless an organic waste is appropriately managed, its adverse impact will continue until it has fully decomposed or otherwise stabilized.

Environmental status of collection points and disposal sites

Waste management's agency determines the frequency of the collection. The collection in Ota is designed to be on a weekly basis but unfortunately, the weekly basis is not adhered to which then causes the indiscriminate disposal around the waste bin and individuals hipping up bags of waste along the road side. Due to the numbers of waste bin and location, it would be suggested that collection should be twice a week and consistency should be enforced. The population, consumption and frequency of waste generation have made it obvious that the waste bins in Ota are not enough to serve the disposal

need of the community. Other locations should be created for more generation point. The collection system is also not efficient due to the inadequate collection vehicle. Infrequent collection and rapid decomposition of wastes provide an attractive feeding and breeding site for flies, rats and other scavengers. The collection system is the conventional hauled container system and there is no form of processing. The waste accumulates in open dumps at roadsides. The open dumps provide harborage for diseases causing organisms, bacteria, insects, and rodents. Some individuals use the waste bins provided by the local government as generation point. There is no form of on-site sorting of waste at the generation or collection point and as such different waste are dumped. The waste is collected and taken by collection vehicles directly to the disposal site. There is no house-to-house service and most cases, residents pack their waste in bag and sacks and placed by road sides which last for days before the local authorities come to pack them. Residents also are in the habit of dumping waste at any vacant plot, public space, and river or burn it in their backyard, thereby polluting the air.

Cart pushers also dispose waste collected at a certain fee from house-holds that do not have access to the provided waste bin. Because of the frequency of disposal, there is always spill of waste around the bin which is non-hygienic. The transportation is such that waste bins are taken directly to the dump site emptied and returned to their original location. The disposal site, owned by the local government, is a steep land whereby waste disposed are pushed and burnt. This site emanates foul smell and become a breeding ground for flies, rodent and pest. These impacts are not confined merely to the disposal site. On the contrary, they pervade the area surrounding the site and wherever the wastes are generated, spread or accumulated.

Reuse and Recycling

Recycling is a means of using some waste materials as a substitute for virgin materials for production of goods. It is the recovery and reuse of materials from wastes. Recycling reduces the amount of waste that needs to be collected, transported, and disposed of which ultimately extends the life of disposal facilities. In Ota, there is no form of sorting of the collected waste from the generation sources to the disposal site, but scavengers pick materials which are reused and the bulk of the waste are burnt. A significant number of scavengers pack refuse for a fee and salvage any recyclable prior to the disposal of the waste. Other repairable items (old furniture, waste paper, bottles and glass, and metal scraps) are bought by the scavengers in some cases. Waste materials can be put back into the raw product stream, either as base material, as with glass, plastics and paper, or as reusable product as with returnable milk bottles. Some scavengers go around the town pushing their trucks and pay individuals that has some recyclable materials like metal scraps and plastics. Facilities could be provided where sorting of materials to be recycled is carried out. The recovery of materials in this way would reduce the need to use natural resources directly, and may reduce emissions from extraction and processing of raw materials. These could offset the benefits of recycling to some extent. Food from households is feed to animals, some are home composted and used to condition the soil. The waste could be converted to compost or used to generate biogas or used as fertilizer. It is apparent that the local government takes responsibility for their waste and should begin to incorporate recycling and reuse into their solid waste management plans.

The amount of energy that is wasted by not recycling paper, printed material, glass, plastic and aluminum and steel cans could be much. Plastic can be recycled and reused depending on the quality. Recycling process of plastics involves washing, shredding, drying, wet grinding; extrusion, pelletizing and the final product are package and sold to consumers. Paper recycling saves the forest of trees which would produce new paper. It reduces the quantity of solid waste disposed and the pollution also reduces during manufacturing because the fibers have been processed once. Reuse of aluminum saves precious natural resources, energy, time and money. It is sustainable metal that can be recycled again and again. It involves re-melting scrap aluminum after its initial production. Compost/organic fertilizer can be obtained from the food waste by converting biowaste into organic fertilizer. This is an aerobic process whereby micro-organism decomposes biodegradable waste to produce organic fertilizer in the presence of ample oxygen.

This waste has its usefulness rooted in fertilizer generation which would be of great benefit and in fact cheap for farmers.

Health Impact of Waste Management

There are potential risks to environment and health from improper handling of solid wastes. The environmental problem arising from unscientific and indiscriminate disposal of municipal garbage is a real menace for the whole society. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. The main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats. The most obvious environmental damage caused by municipal solid wastes is aesthetic, the ugliness of street litter and degradation of the urban environment and beauty of the city. Foul odor is emitted at the disposal site due to continuous decomposition of organic matter and emission of methane, hydrogen sulphide and ammonia. Odor is also emitted at the collection points if quick removal of wastes is not practiced. Spreading of the waste in the area adjacent to the dustbin due to activity of rag pickers causes degradation of aesthetic quality.

4. Conclusion

Environmental management Ota metropolis requires collaboration at all levels between different stakeholders and pooling of all expertise to be involved in the entire sanitation process. It is important that resources for running the waste management are harnessed and attention should be paid to storage, collection, transport, and intermediate transfer to bulk transport and final disposal. The frequency of collection and route planning for collection vehicle should be developed for the ease of collection from all generation point. The public should be sensitized on the locations for disposal of waste and there should be stringent policies to facilitate it. Solid waste recycling should be integrated with other solid waste management options to abate degradation in the environment. This can be achieved through promotion of economical, efficient and environmentally sound practices in managing municipal waste. Recycling also can be promoted by encouraging separation at source. The best way of waste separation at source can be stimulated by financial incentives, legislation and to raise environmental awareness. It is recommended therefore, that the existing open dumping system in Ota metropolis be converted to a sanitary landfill with proper environmental protection measures in order to minimize environmental pollution. However, it is also proposed that the government, if possible, should adopt the waste-to-energy treatment system since it is not possible by sanitary landfill to eliminate all the negative impacts to the environment.

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