

# Effects of Municipal Waste Management on Human Health and Environment: Lagos State as a Case Study

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**ABSTRACT:** Waste management is the process of treating solid wastes and offers variety of solutions for recycling items that don't belong to trash. It is about how garbage can be used as a valuable resource. Waste management is something that each and every household and business owner in the world needs. Waste management disposes of the products and substances that you have use in a safe and efficient manner. This study exposes the correlation between efficient waste management system, human health and quality of the general environment. Waste management implies dealing with waste in an environmentally responsible way from its generation until it is finally disposed of. It requires everyone to be responsible by prioritising waste minimisation, treatment and recycling and then its final disposal. By so doing, both human life and the entire environment is preserved. This paper reviews the impact of waste management on water, soil, air quality, the environment and human health. The various method of handling and disposal of wastes was carefully reviewed against the standard practices with a focus on Lagos Metropolis. Poor waste management practice in five major dumping sites in Lagos and the dangerous health challenges and the environmental concerns were raised. The best waste management practice was recommended.

**Key words:** Dumping site, Environmental, Human health, Landfill, Wastes disposal,

## I. INTRODUCTION

This article addresses the impact of efficient waste management on both human health and the environment. In general sources of wastes includes all types of wastes from household waste, to garden and building rubble, commercial and industrial wastes, agricultural and forestry and

mineral wastes. There is a real-time correlation between urbanization, population growth, industrialisation and the amount of waste generation (Debnath et al. 2015 ; Minghua et al. 2009). However, management of these wastes is a major problem posing both health and environmental challenges in Lagos.

Waste management refers to all those activities and action required to manage waste from its inception to its final disposal. These include amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management and guidance on recycling etc (United Nations Environmental Program, 2013). Poor waste management causes degradation of human health, environmental pollution, unpleasant smell, growth and multiplication of insects, rodents, and worms. It leads to transmission of diseases like typhoid, cholera and hepatitis through injuries from sharps contaminated with blood (Babanyara et al. 2019). Improper waste disposal and management causes all types of pollution: air, soil, and water. Indiscriminate dumping and poor waste management results into contamination of surface and ground water supplies. In urban centres like Lagos, solid wastes clogs the drains, dams and drainages, causing stagnant water which results into mosquitoes and flooding. Uncontrolled burning of solid wastes and improper incineration contributes significantly to urban air pollution. Greenhouse gases are generated from the decomposition of organic wastes in landfills, and untreated leachate pollutes surrounding soil and water bodies. Health and safety issues also arise from improper waste management. Poor waste management system

breeds insects, mosquitoes and rodent vectors which can spread diseases such as cholera, typhoid, Lassa and dengue fever. Direct and indirect consumption of contaminated water or for bathing, food irrigation can also expose individuals to disease organisms and other contaminants. The U.S. Public Health Service identified 22 human diseases that are linked to improper Municipal Solid Waste Management. Waste worker and pickers in developing countries are seldom protected from direct contact and injury, and the co-disposal of hazardous and medical wastes poses serious health threat. Wastes from industrial

chimney, exhaust from vehicular activities, dust stemming from disposal practices and the open burning of waste also contribute to overall health problems. People know that poor sanitation affects their health, especially in developing and low-income countries like Nigeria, where the people are the most willing to pay for environmental improvements (Rathi, 2006; Sharholly et al, 2005; Ray et al., 2005; Jha et al., 2003; Kansal, 2002; UDSU, 1999; Kansal et al., 1998; Singh et al., 1998; Gupta et al., 1998; Tchobanoglous et al., 1993).



**Fig 1.** A typical Dumpsite in Lagos



**Fig 2** Wastes Management Method

### 1.1 OBJECTIVES OF STUDY

1. To examine the management of the wastes generated in industries towards sustainable development in Lagos.
2. To manage wastes conversion into necessary use instead of been a source of hazards or threat
3. To determine whether improper disposal and handling of wastes impact on environmental health

## 1.2 LAGOS STATE, NIGERIA AS A CASE STUDY

Nigeria with the population of over 200million million people (population equivalent to 2.57% of the total world population) is one of the highest producers of municipal solid waste in Africa. The country generates more than 32 million tons of waste annually while only 20-30% is collected and 70% are dumped in unsafe places. 10,000 tons of municipal wastes generated in Lagos per day, translates to an average of 3.65 million tons per year Bakare W (2016).Lagos is highly industrialized and one of the fastest growing cities in Nigeria. The population of Lagos state is currently estimated at around 22 million and still experiences population growth due to migration from other states and neighbouring countries. Waste generated in Lagos alone within six months is up about 1.83 million tons from several illegal dumping sitesSanusi (2018).

### 1.3 SOURCES OF WASTE

➤ **Household Waste:** These are wastes that originate from households. It includes paper, food scraps, kitchen wastes, glass, used containers etc.

- **Garden waste and building rubble:** These type of wastes emanates from gardens, parks, sidewalks and building activities. This includes branches, leaves, grass, soil and building rubble.
- **Commercial Waste:** This comprises of large quantities of paper and other packing material which originates from shops, offices, hotels and restaurants.
- **Industrial Waste:** These are residues originating from production processes at industries and refineries. They can be classified as hazardous and non-hazardous waste according to its physical, chemical and biological properties.
- **Agricultural and forestry waste:** Examples of these wastes include dung, stalks, hay, compost, chaff, branches and sawdust. Basically they are gotten from agricultural and forestry activities.
- **Mineral wastes:** Large quantities are generated annually, mainly in the gold and coal mining industries. The generation of power and the production of fuel from coal are also responsible for mineral waste.



Fig. 3 A Cartoon Depicting Refuse movement

### 1.4 CATEGORISING WASTE SOURCES

#### Waste hierarchy

The waste hierarchy refers to the "3 Rs" **Reduce, Reuse and Recycle**, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste; see: resource recovery. The waste hierarchy is represented as a pyramid

because the basic premise is for policy to take action first and prevent the generation of waste. All wastes form part of what can be referred to as the waste stream. There are many sources that feed the waste stream and these consist of the formal and informal waste stream.

- **FORMAL WASTE STREAM:** The formal waste stream consists of all the waste that follows a recognised path of disposal. The formal waste stream can be identified and controlled although it might involve making difficult decisions.

- **INFORMAL WASTE STREAM:** These are waste that does not follow a recognised disposal path. It is more difficult and very expensive to control. Sources of informal waste include litter, illegal dumping of industrial and household waste, human waste in areas without sanitation.

## II. METHODOLOGY

The Lagos State Waste Management Agency (LAWMA) is a body of Lagos State government responsible for managing wastes generated in Lagos state through a waste collection transportation and disposal structure. LAWMA's goal is to improve the environment with a view to

achieving significant changes in living conditions regarding health conditions and sanitation.

This paper is an extensive review of several past works on waste management and its impacts on both human health and the environment. Generally, wastes must be well managed from the point of generation to its final disposal and in between. Data concerning waste aggregates and population of Lagos was culled from literature search. The paper described efficient waste management and its benefits, the sources and methods of handling different types of wastes. It also describes the health and environmental hazards of poor waste management for the entire Lagos populace. Finally, recommendations given in order to attain the best waste management practices for healthy living and preservation of the environment.



Fig. 4 Waste Transportation System in Lagos

### 2.1 Ideal Waste Management Practice For Lagos

In order to eradicate the harmful effects of waste on both human health and the environment, the issue of waste management and disposal in Nigeria must be a collective effort starting from the households. The government must enact laws to ensure that all parties involved followed the best and international practices on all waste matters.

The government must focus on a very good and sustainable waste collection method so as to keep our environment clean and healthy. Indiscriminate dumping of wastes which is the root cause of pollution should be discouraged to avoid environmental pollution and increases the vulnerability of man to infectious diseases.



Fig 6 Different Types of Waste Bins

## 2.2 Recommended Waste Handling Methods

### 2.2.1 Collection

One major problem of waste management in developing countries amongst others is efficient and sustainable waste collection system. Waste matter is normally placed in drums, plastic bags and other containers. These containers are usually found at places of waste generation and are collected using vehicles. Sometimes waste is gathered at central transfer stations from where it is taken to the relevant waste disposal site. (Abd'Razack et al. 2013; Nwaka 2005; Omran et al. 2007). Sometimes the collection program seems ineffective in some areas as collection vehicle have difficulties in accessing the collection point (Nabegu 2010; Swapan 2008)

### 2.2.2 Transport

This takes place between place of waste generation and disposal site. It is frequently undertaken using dedicated trucks. Special regulation must be followed when transporting hazardous waste.

**2.2.3 Recycling:** Recycling is a resource recovery practice that refers to the collection and reuse of waste materials such as empty beverage containers, paper, bottles, plastics etc. The waste materials are salvaged and re-used for further benefits.

**2.2.4. Treatment:** Hazardous waste is treated using different chemical and physical processes to bring properties such as toxicity, reactivity, pathogenicity, corrosivity, flammability and pollution potential within acceptable limits before disposal.

**2.2.5 Storage:** Waste storage can be short term or long term. Storage of wastes in drums, bins, plastic, bags etc. are short term storage while the storage of hazardous wastes like radio active waste for a very long time until effective treatment/recycling or disposal methods have been developed is referred to as long term storage.

**2.2.6 Disposal:** The common waste disposal practice includes open dumping (waste dumped in a site not suitable as a waste disposal site, with no compacting or covering of the waste). Sanitary land-fills is another disposal method where waste are dumped in layers on a specially prepared disposal site, compacted and covered. This sites can later be used as sport fields, parking area etc. The third method is called encapsulation which involves hazardous non-biodegradable waste being encapsulated in reinforced concrete capsules at a suitable disposal site

## 2.3 METHODS OF WASTE DISPOSAL

### 2.3.1 INCINERATION

This is frequently used for decomposition of organic toxins. Incineration or burning involves burning waste in waste incinerators operating at very high temperatures above 500°C in order to reduce the volume and weight of solid wastes. It typically reduces waste volume by 90 % and mass by approximately 70 % and makes it lighter and less bulky to transport and landfill. Dangerous gases like nitrogen, particulate matters, micro pollutants, sulphur oxides, and hydrogen chloride gases generated are cleaned prior to discharge into the atmosphere.

### 2.3.2 SOLIDIFICATION/ENCAPSULATION

This technique requires reducing the mobility of hazardous constituents in waste by binding them into a solid matrix which prevents leaching due to low permeability of the waste matrix. The common binding agents used may be silicate based, cement based, organic polymer based or thermoplastic based.

### 2.3.3 COMPOSTING

Composting is alternative method of disposing solid waste. It is the controlled aerobic decomposition of putrescible material. It is a easy and natural bio-degradation process that takes organic wastes i.e remains of plants, garden and kitchen waste and turns them into nutrient rich food for the plants. Composting, normally used for organic farming occurs by allowing organic materials to sit in one place for months until microbes decompose it. During composting, the environmental consideration that must be considered include leachate, landfill gas, litter, vermin and noise.

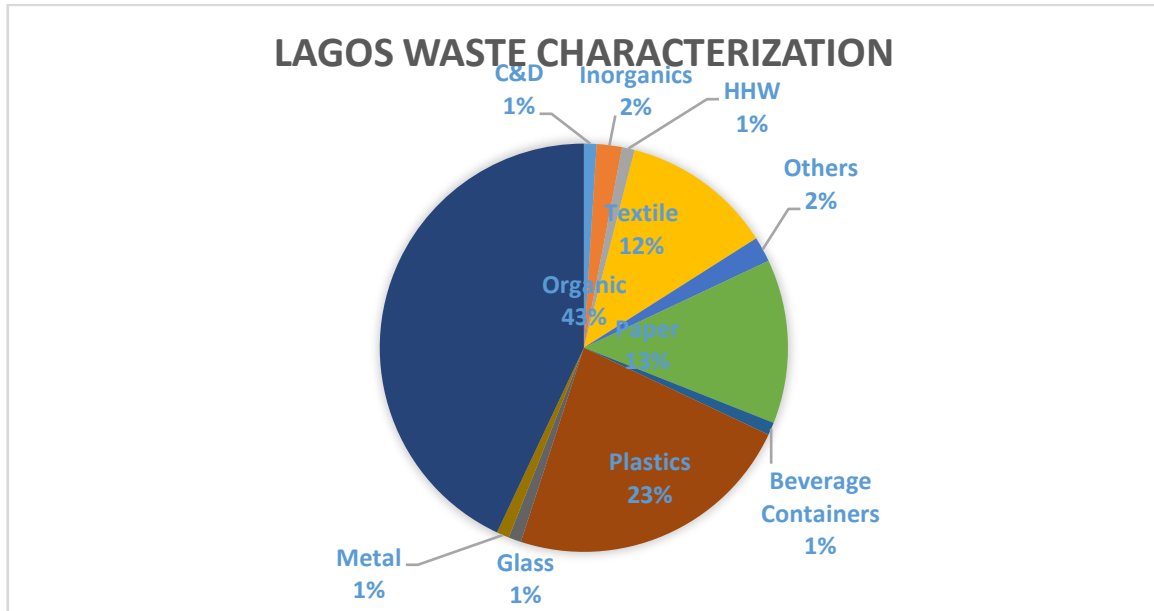
## 2.4 SOURCES AND TYPES OF TOXIC WASTES IN LAGOSMETROPOLIS

**2.4.1 Domestic waste water:** this contains ammoniac nitrogen and sulphide at levels up to 50 mg/l concentrations. They can cause damage to aquatic fauna unless if diluted.

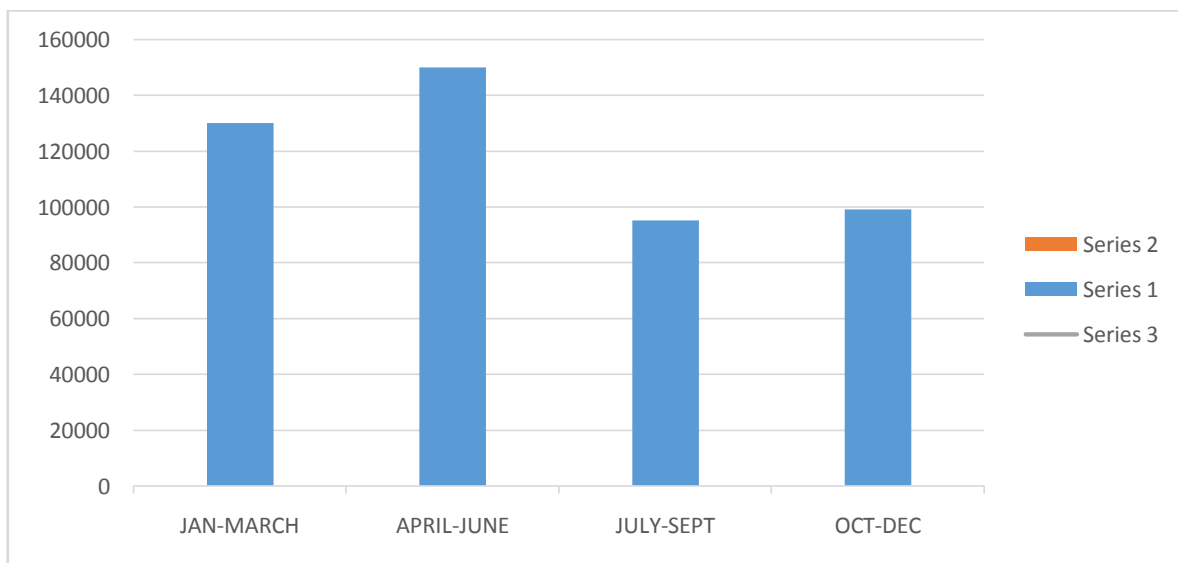
**2.4.2 Leachate:** A good number of harmful toxic substances can leach out of sites where solid wastes are disposed. The amount is usually aggravated if surface water or ground water can access it.

**2.4.3 Agricultural waste:** A wide variety of materials that are used for fertilizers and pest control. Fertilizers containing oxidised nitrogen can cause human toxicological problems. Pesticides and herbicides are very potent aquatic toxins.

2.4.4 **Industrial wastes:** The major types of industrial wastes and their toxins are shown in the table below.



**Fig 7 Waste Characterization**



**Fig 8 Chart Showing Quarterly Wastes Discharges**

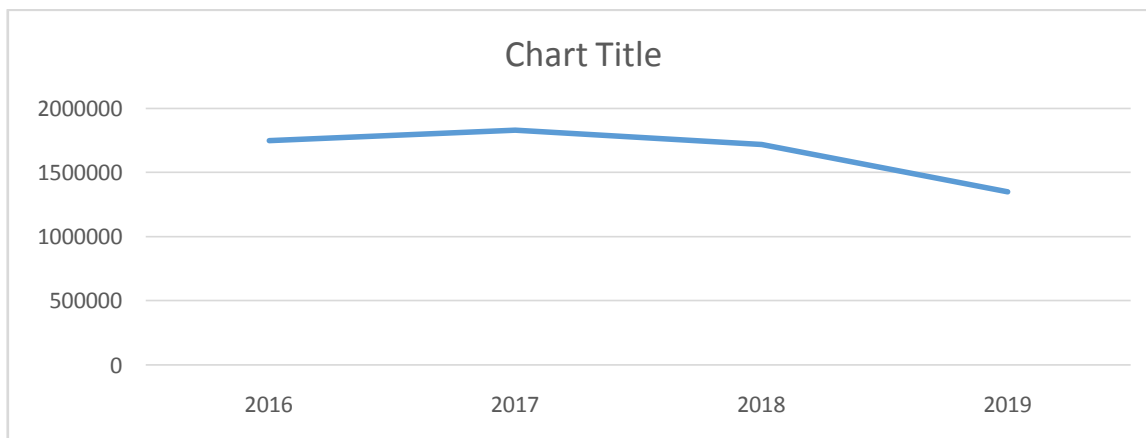


Fig 9 Graph Showing Wastes Discharges for a Four Yearly period

Table 1: sources of common toxins

Toxin	Source
Acid-pH< 6 mainly inorganic but with some organic acids	Acid manufacturing, battery manufacturing, chemical industry and steel industry
Alkalis-pH> 9	Brewery waste, chemical industry, textile manufacturing
Ammoniacal nitrogen	Fertiliser manufacturing and rubber industry
Chromium-mainly hexavalent	Metal processing
Cyanide	Gold mining
Detergents	Detergent manufacturing and laundries
Herbicides and pesticides	Chemical industry
Metal - mainly copper, cadmium, cobalt, lead, nickel and zinc	Metal processing Metal plating
Phenols	Oil refining and wood processing
Solvent – mostly benzene, acetone, carbon tetrachloride and alcohols	Chemical industry Pharmaceutical industry

### EFFECT OF POOR WASTE MANAGEMENT ON HUMAN HEALTH

Lagos has witnessed a lot of poor dumping sites and landfills which has adverse effect on human health particularly those living within that vicinity, a case study is the Olusosun dumping site in Ketu area of Lagos. The frequency of these landfills failure is very alarming Roche (1996). The landfill/dumpsite receive all waste generated (domestic, commercial, industrial, medical waste) in Lagos State. The site is where the commercial department destroys all approved obsolete or expired products from companies. Below are locations of some landfill/dumpsites in Lagos;

1. Olusosun – 42 hectares (Ojota)
2. Solous II - 8 hectares (Igando)
3. Soloces III – 11 hectares (Igando)
4. Ewu elepe – 8 hectares (Ikorodu)
5. Epe – 80 hectares (Epe)

The resulting effect ranges from contamination of environment with greenhouse

gasses, Volatile organic compound, toxins, leachates into the rivers and other water bodies, air pollution, and obnoxious smell. At one of its summit in 2000 (Uwaegbulam 2004) revealed that TheWorld Health Organization- (WHO 2004) and UnitedNations International Children Education Fund- (UNICEF2004) joint report in August 2004 that: Babout 2.4 billionpeople will likely face the risk of needless disease, health challenges and possibly deathby the target of 2015 because of bad sanitation and problems from poor waste management. The reportalso noted that bad sanitation, poor waste managment – decaying or non-existent sewagesystem and toilets- fuels the spread of diseases like choleraand basic illness like diarrhea, which kills a child every 21 s.The hardest hit by bad sanitation is rural poor and residents ofslum areas in fast-growing cities, mostly in Africa and Asia(Napoleon et al. 2011).

**IMPACT OF MUNICIPAL SOLID WASTE ON THE NATURAL ENVIRONMENT**

**Table 2 Impacts of different solid waste activities on the environment**

	Water	Air	Soil	Land	Climate
Activities					
Landfilling	Leachates (heavy metal)	CO <sub>2</sub> , CH <sub>4</sub> , VOC	Heavy metals synthetic Organic compound	Visual effect	Greenhouse gas emission
Incineration	Fallout of atmospheric pollutants	CO, CO <sub>2</sub> , SO <sub>2</sub> , NOX, HCL, HF, NO <sub>2</sub> , VOC	Fly ash, slags	Visual effect	Greenhouse gas emission (GHGs)
Composting	Leachate	Bio-aerosols, dust, odour CO <sub>2</sub> , CH <sub>4</sub> , VOC	Minor impact	Visual effect	Small emission of GHGs
Land spreading	Bacteria, viruses, PCBs, heavy metals, PAHs	Bio-aerosols, dust, odour	Bacteria, virus, heavy metals	Insect vermin	Small emission of GHGs
Recycling	Waste water	Dust, noise	Landfilling of residues	Small emission of GHGs	Minor emission of gasses
Waste transportation	Spills	CO <sub>2</sub> , SO <sub>2</sub> , NOX, Odour, Noise, Spills			Minor Contribution of CO <sub>2</sub>

**III. RECOMMENDATIONS**

Government should make good waste management policy and enforce laws that will resonate with the policy in order to ensure good compliance. There should be good support system to ensure every household and stakeholders involved prioritize waste matters in their daily activities and engagement.

**IV. CONCLUSION**

In this research we highlighted the correct and internationally recommended waste management practices that is capable of supporting human health, aquatic life, plants and the general environmental condition. The poor and unscientific waste management method is correlated with risks to people and the general environment. Poor municipal waste management has led to toxins and hazardous substances entering the human body and leaches into soil, water bodies which causes health failure, challenge to maintain the quality of water, air, and soil. The quantities and proportions of different constituents of wastes, their handling, transportation, treatment, and disposal methods in different dumping sites/landfills varies. Waste collection and access to some collection point and

event disposal methods have been found to be generally inadequate in most of the studies. We therefore concludes that development of efficient and workable waste management policies, plans, and protocols should be established. Also, training and orientation programs on proper waste management practices for all households and waste collection officers should be considered. Government should setup Research Centers to convert waste to energy and other useful resources.

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