Quest Journals
Journal of Research in Environmental and Earth Sciences
Volume 9 ~ Issue 2 (2023) pp: 25-33
ISSN(Online) :2348-2532
www.questjournals.org

Research Paper

Improper Municipal Solid Waste Management Practices: A Significant Barrier Towards Achieving Sustainable Development In Nigeria

TadenikawoAramide
Social Sciences Unit
School of General Studies
University of Nigeria, Nsukka

Environmental pollution caused by municipal solid waste is mostly as a result of human anthropogenic activities, including the quest to adopt contemporary technologies, urbanization, industrialization, with a corresponding inefficient waste management strategy (Rajaganapathy, et al.2011).Solid waste management is the supervised handling of solid waste materials from generation, separation, storage collection, transportation, treatment to its proper disposal (Zhang et al, 2010).Communal solid waste storage points in several cities of Nigeria serve as a breeding ground for mosquitoes as well as rodents, in addition, scattering of waste by wind, scavenging by birds, animals and humans (waste pickers) create aesthetic nuisance (Abah and Ohimain, 2010). Malicious odour emanating due to the degradation of the solid waste in such containers has nuisance effects and decrease the economic and social value of such locality. In addition to hydrogen sulphideand ammonia gases which are responsible for the foul odour, huge piles of solid waste also emit methane and carbon (iv) oxide, which are two of the leading greenhouse gases. All of these are barriers towards achieving sustainable development. The objective of the study is to review the impacts of communal solid waste points on ambient air quality and ultimately; sustainable development. This will be achieved through the extensive review of relevant literatures.

Keywords: *environmental pollution, solid waste management, ambient air quality, sustainable development*

Received 25 Jan., 2023; Revised 07 Feb., 2023; Accepted 09 Feb., 2023 © The author(s) 2023. Published with open access at www.questjournals.org

I. INTRODUCTION

Background

Environmental pollution caused bymunicipal solid waste is mostly as a resultof human anthropogenic activities,including the quest to adopt contemporary technologies, urbanization as well as industrialization, with a correspondinginefficient waste management strategy(Rajaganapathy, et al.2011). The composition and quantity of wastegenerated and disposed vary both in spaceand time in relation to human activity,socio-economic status, presence and sizeof industry, and the quantity and type ofproducts that communities consume,(Hudson, 2007).

The challenge that comes with solid wastegeneration is not only coping with thequantity, but also the composition; andhaving the ability to design andaccomplish its management in an efficient and sustainable manner (Agbesola, 2013). Several reasons have been given for the increase in solid waste generation and its associated problems in urban cities. These include rapid rate of urbanization, high population density, changes in consumer and social attitude of urban dwellers, changes in earnings of Nigerian workers and the use-once and discard philosophy of products designed (Afon, 2005).

Waste should be disposed in a safe way, bearing in mind the health of the environment and that of the public, while ensuring non-detrimental effects on generations to come (Ali, Cotton and Westlake, 1999). Prior to 1999, environmental laws and regulations were put forward and enforced by theFederal Environmental ProtectionAgency (FEPA); however, thesesubsequently became a role ofthe Federal Ministry ofEnvironment. In order to ensure protection of the environment is bettermanaged, allstates in Nigeria (and their local governments) have been given the capacity to createrelated environmentalestablishments, the sovereignty of which islimited to the state or localgovernment area it has been established (Ogwueleka, 2009). Efficiency in solid waste management is actively pursued in developed countries, but it is not the same in developing countries; where inadequate access to funds, weak institutional framework, lack of access to appropriate technology, little staff encouragement, emergence of less environmental compatible products, unending change in consumption trend, lack of political will, failure to give adequate priority, inadequate environmental education, lack of adequate information on quantity and composition of waste generated, development of industries and so on are hindering sustainable efficiency in the solid waste management sector (Oteng-Ababio, 2011). Dumping of solid waste generated from households, markets, educational institutions and other places of commercial activity, in highly inappropriate places like middle of roads and unauthorized disposal sites are common practices in many developing countries (Igbinomwanhia, 2011), Nigeria inclusive. It is not also uncommon to see overflowing communal solid waste storage containers awaiting collection by relevant local authorities in many of our urban settlements. Gases, such as methane, carbon di oxide, nitrogen oxides (which are greenhouse gases). are emitted when organic constituents of the solid waste are broken down by bacteria present within a waste body (Bogner et al 1995); (Agency for toxic substances and disease registry, 2001). Hydrogen sulphide, a colourless gas which is produced when organic compounds that contain sulphur is decaying, and has a rotten egg smell and ammonia with a pungent odour is also emitted from decomposing organic matter in solid waste piles (Hendrickson et al, 2004)

The communal solid waste storage points serve as a breeding ground for mosquitoes as well as rodents, in addition, scattering of waste by wind, scavenging by birds, animals and humans (waste pickers) create aesthetic nuisance (Abah and Ohimain, 2010). Several studies have been carried out to assess the impact of open dumpsites on ambient air quality (Rim-Rukeh, 2014;Weli and Adekunle, 2014; Ezekwe et al, 2016), and human health implications (Yongsi, 2008;Ndukwe et al, 2019). The same can however not be said of communal solid waste storage points, which are often overfilled to the point where they could pass for actual dumpsites (figure 1). This was what informed the objective of this study

Figure 1. Communal solid waste storage point at beach junction, Nsukka, Enugu State

The aim of this study is therefore to arouse the awareness of possible contributions of communal solid waste storage points to air pollution in members of the public, while the specific objective is to review the impact of communal solid waste storage points on ambient air quality, human health and sustainable development.
The study will rely on secondary data, specifically books, peer reviewed journal articles,unpublished papers and organizational web pages

2). THE CONCEPT OF WASTE

Most human activities generate waste. While in natural ecosystems, waste (that is oxygen, carbon di oxide and dead organic matter) is used as food or a reactant, waste materials resulting from human activities are often highly resilient and take a long time to decompose (Amasuomo and Baird, 2016).
White, et al (1995) defined waste as the useless byproduct of which physically contains the same substance that are available in the useful product, whileDjikema et al (2000) defined waste as materials that people would want to dispose of even when payments are required for their disposal.

2.1). Classification of Waste

There are several characteristics that can be used in the classification of waste. The most common of which are:
2.1.1) Physical state: This refers to solid, liquid and gaseous waste.
2.1.2). Source: This includes household/domestic, industrial, agricultural, commercial, construction and demolitionwaste among others.

2.1.3) Environmental Impacts: This includes hazardous and non-hazardous waste.Waste can also be classified into hazardous and non-hazardous based on management; that is, who handles the waste? Hazardous waste is usually regulated at the national level, while the latter is regulated at the regional or municipal (local) level.Due to the limited scope of this study, discussions will be restricted to solid waste with specific reference to municipal solid waste.

2.2). MUNICIPAL SOLID WASTE

Solid waste is referred to as unwanted or needless non liquid substances which can be referred to as garbage or refuse as opposed to liquid waste which are known as effluents (Angaye and Abowei, 2017). Municipal solid waste on the other hand, as described byKaseva and Gupta (1996) is the waste collected by city authorities, which include refuse from households and non-hazardous solids from industrial, commercial, institutional and non-pathogenic hospital waste. Municipal solid waste is an important waste stream which though not hazardous, can have serious environmental and health impacts if left uncollected and untreated. In other words, municipal solid waste can have negative impacts on the environment and the wellbeing of the public if not properly managed (Addaney and Oppong, 2015)

2.3). MUNICIPAL SOLID WASTE MANAGEMENT

As populations and purchasing power of people increase, more goods are produced to meet the increasing demands, thereby leading to the generation of more waste, (Vergara and Tchobanoglous, 2012).Municipal solid waste management (MSWM) is a supervised handling of solid waste materials from generation,separation, storage, collection, transportation,treatment, to its proper final disposal, (Zhang et al, 2010).The inability to sustainably maintain these key processes will result in defective and improper waste management, which in turn results in negative impacts of municipal solid waste on the environment, (Vergara and Tchobanoglous, 2012).

Awopetu et al (2014) also defined solid waste management as a process which encompasses all the activities undertaken or required to minimize the impact of solid waste on health, the environment, the economy and aesthetics.Municipal solid waste management is an important part of urban infrastructure that ensures the protection of environmental and human health, (Abila and Kantola, 2013). In developing countries however, planning of MSWM has remained a difficult task due to a lack of data at all levels, (be it ward, district or municipality), and where available is scattered, unorganized and generally unreliable. Ideally, the underlisted must be considered before arriving at any method of MSWM:

2.3.1 Waste characteristics: The impact of waste characteristics, both quantity and composition on the design and selection of solid waste management method is of utmost importance, because there is a variation in waste characteristics from one place to another, (Yukalang et al, 2017). The following are some of the reasons waste characteristics vary:

Cooking and eating habits: In some countries, the shops sell mostly food that has largely been prepared, either frozen or canned. In other countries and in smaller communities however, poultry is purchased alive and vegetables are bought with considerable extra material in addition to the part that is consumed (e.g maize is mostly bought together with the cob as well as the shaft).

Social and economic factors: Differences in lifestyle can be big, even within a city. This not only affects the type and amount of kitchen waste that is generated, but also the amount of paper waste. In the same vein, more affluent citizens are more likely to discard durable items such as clothing and electrical equipment as they become obsolete instead of repairing them.

Recycling and reuse: In some towns, much of the waste is fed to livestock and poultry. Food and drinks containers may be reused for household purposes.

Architecture: In cities where the housing is constructed mainly on mud brick and the floors and courtyards are not paved, there are large quantities of soil and dust in the waste. The lack of adequate toilets may also increase the amount of excreta in the waste.

Climate and geography: In tropical climates, large amount of vegetation can be expected in the waste, and heavy rainfall increases the moisture content of solid waste stored in the open.

2.3.2). Social and economic factors: Apart from the nature of the waste, there are other impacts of social and economic factors which must be considered when designing a solid waste management system (MacAllister, 2015), these include

Service level: This refers to the frequency and convenience of the waste collection service that is expected by the residents. Some residents might expect daily collection service, where the waste will be picked up at their doorstep. In contrast, some other residents might be willing to carry the waste they generate to a shared container at street level probably on a weekly basis.

Willingness to pay: Different people have different disposition when it comes to paying for waste management services. While some people might believe municipal authorities should provide a free waste collection service, others however might be accustomed to making their own arrangement for waste collection and paying for this service directly.

Attitudes to littering: Some social groups are very careful to always put all the waste they generate in the appropriate containers, whereas others regard the street as an appropriate place for dumping litter and domestic waste, even though they might keep their houses and yards very clean.

Labor costs and unemployment: Because of high wage levels, industrialized countries have developed capital intensive technologies for collecting solid waste in order to keep wage bills and total cost down to the minimum. Low income countries on the other hand have large pools of unemployed laborers who are willing to work for very low salaries, and in such cases labor intensive approach may be appropriate.

Environmental awareness: Since the 1960s, there has been a gradual process of extending the boundaries of environmental concern from neighborhood to nation, and now, with the concern about climate change, to the global level. However, this process is at different stages in different countries and is proceeding at different speeds. Therefore it cannot be assumed that residents will be interested in whether waste is dumped illegally or taken to an approved disposal site, provided that it is taken out of the immediate neighborhood. This is often referred to as the "NIMBY" (not in my backyard) factor. City officials may show the same lack of concern with regards to the destination of the waste, and may give solid waste management in general a low priority.

2.4).WASTE MANAGEMENT PROCESSES

Waste management process apart from being a set of activities which involves the generation, separation, storage, collection, transportation, treatment and disposal of waste; also involves the control, monitoring and regulation of the production, and prevention of waste production through in-process modification, reuse and recycling.This study will however limit its discussion to waste storage with reference to communal waste storage.

2.4.1). Waste Storage

Storage is an essential element of any solid waste management system. Compatibility between storage, loading and transport is essential to ensure proper operation. In other words, they should all fit together and be designed with the others in mind. The objective should be to develop a fullyor partly containerized storage, loading and transport system which does not allow the waste material to come in contact with the ground at any stage of the collection system.Solid waste storage facilities for domestic waste may be classified as household (that is household bins or bags, sometimes known as primary storage) and communal (that is containers or bunkers, each used by many households known as secondary storage). A solid waste bin or other storage facility must satisfy certain requirements (Sasikumar and Krishna, 2009), amongst which are:

Convenience: It should be convenient to use. Not too high for children to use and with a large enough opening so that all acceptable objects can be placed inside. This is especially important if the container is used by more than one household, because there is a risk that waste will be dumped near it rather than in it if it is not convenient to use. And when there is waste around the container, this will discourage others from putting waste inside, since they will not want to walk on the surrounding waste.

Size: It should be large enough to accommodate the waste that need to be stored in it, taking into account the longest expected interval between visits of the collection team and fluctuations in waste generation.

Loading: The loading of the waste into the collection vehicle should be economical (considering both the labor required and the time that the collection vehicle is waiting), hygienic, (so that the collection laborers and others in the vicinity are exposed to the smallest possible risk) and safe (not presenting a serious risk of injury or cuts from lifting.

Shape: Containers should be tapered (that is having bigger dimensions at the top than at the bottom) so that they are easy to empty when tipped, even if the waste has been compacted into them.

Isolating the waste: It is desirable that there is no access to the waste for flies, animals and rain, but these objectives may be difficult to achieve in practice especially if the container is used by many people. A well-fitting lid can be effective for these purposes, provided that the lid is kept closed most of the time. However, users might fear getting their hands dirty, thereby making them unwilling to open the lid, and so they drop waste nearby. If the lid is already open, users may be unwilling to close it, in which case flies have access to the waste for laying their eggs, animals and birds scatter the waste and entering rainfall adds to the weight that is to be collected and accelerates decomposition.

Durability: Especially for communal waste storage containers, they should be considerably durable, resistant to mechanical damage, corrosion, ultra-violet radiation and in many cases, hot ashes or fire.

2.4.2). Communal waste storage: The use of community containers, filled either directly by residents or primary collection vehicles (such as tricycles or handcarts) is particularly appropriate in densely populated residential areas. The required capacity or volume for a community container depends on:

1). The volumetric generation rate forthe
household and commercial premisesthatare expected to use the container.

2). The number of people expected to use the container.
3).Type of container: A taller container may provide more compaction of the lower layers of waste caused by the waste above, however tall containers may be difficult for children to use, leading to more waste being dropped outside the container.
4).Other types of waste that are expected to be put in the container, such as street sweepings, garden waste, construction and demolition waste and commercial waste.
5). The longest expected intervals between emptying.
6). Seasonal, weekly and random variations in the quantities of household waste should be allowed for.

3).ASSOCIATED RISKS OF COMMUNAL SOLID WASTE STORAGE

A number of risk factors has been associated with poor solid waste management practice; they include:

Air Pollution: Solid degradable waste in synergy with environmental factors and bio-degraders or both comes with environmental impacts that limit the quality of air, soil, as well as both surface and ground water. For instance, under aerobic and anaerobic conditions, bacteria can aid the release of CO_2 (Amuda *et al.*2014), as well as methane gas respectively, (Nayono 2014), which degrade air quality and also aid the incidence of global warming. Where large quantities of dry waste are stored in hot climates, fire hazard might breakout which results in smoke pollution. Foul odor is emitted at the storage site due to continuous decomposition of organic matter and emission of hydrogen sulphide and ammonia (Olukanni and Akinyinka, 2012).

Effects on morale: The most obvious environmental damage caused by municipal solid waste is aesthetic, the ugliness of street litter and degradation of urban environment and beauty of the city (Olukanni and Akinyinka, 2012). Environmental degradation is inevitable, when there is unsafe and precarious dumping of untreated municipal solid waste on fragile components of ecosystem, as well as the corresponding attendant effects of physicochemical and natural agents that transform waste. In addition, municipal solid waste (MSW) could limit the aesthetic values of key resource in the environment. For instance, MSW have the ability to plug drainage channels which can lead to excessive flooding during precipitation (Oyekan and Sulyman, 2015). The effect of living in an unhygienic and untidy environment may lead people to become demoralized and less motivated to improve conditions around them. Waste attracts more waste and leads to less hygienic behavior in general.

Disease transmission: The environmental problems arising from indiscriminate disposal of municipal garbage is a real menace to the society at large. Direct health risks concern mainly the workers in the field, who need protection as much as possible from contact with waste. The main risk of health [i]is indirect and arise from disease vectors, primarily rodents, mosquitoes and flies. Oyekan and Sulyman (2015), reported that insects and vectors that transmits major diseases of public health are usually found in dumpsites, due to the fact that dumpsites provide substrate for breeding, feeding and habitation of pathogenic organisms and vectors of public health importance.,Flies may play a major role in the transmission of faecal-oral diseases, (such as typhoid, cholera, polio and so on) particularly where domestic waste contains feaces. Rodents may increase the transmission of diseases such as lassa fever, leptospirosis and salmonella, they may also attract snakes to waste heaps. Solid waste may also provide breeding sites for mosquitoes. Mosquitoes of the *Aedes* genus lays eggs in water stored in discarded items like cans and tins; these are responsible for the spread of dengue and yellow fevers. Such conditions may also attract mosquitoes of the *Anopheles* genus which transmit malaria. Mosquitoes of the *Culex* genus breed in stagnant water with high organic content (Huzortey et al, 2022) and transmit microfilariasis, and appropriate conditions are likely to arise where leachate from waste enter pooling water.

4). AIR AND AIR POLLUTION

Air is the layer of gases which makes up the atmosphere, surrounds the planet earth and is retained by earth's gravity (Valero, 2014), while air pollution occurs when harmful or excessive quantities of substances including gases, particles and biological molecules are introduced into the atmosphere.

The atmosphere protects life on earth by creating pressure that allows liquid water to exist on the earth's surface, absorbing ultraviolent solar radiation, warming the earth's surface through heat retention (the greenhouse effect) and reducing temperature extremes during day and night (the diurnal temperature variation), (Kamide, 2000). Air is composed of dry air and water vapourandother constituents

4.1). Standard dry air: Unpolluted standard dry air is manly composed of three gases which are nitrogen, oxygen and argon. Together, these three gases make up about 99.96% of dry air. Standard dry air (table 1) also contains a small amount of carbon iv oxide and very small amounts of neon, helium, krypton, xenon and methane.

Table 1: Unpolluted Standard Air Composition

Nitrogen	78.084%
Oxygen	20.946%
Argon	0.934%
Carbon dioxide	360 ppm (variable)
Neon	18.18 ppm
Helium	5.24 ppm
Methane	1.6 ppm
Krypton	1.14 ppm
Hydrogen	0.5 ppm
Nitrous Oxide	0.3 ppm
Xenon	0.087 ppm

Source**:** Valero, 2014

4.2). Water vapor (Humidity): The amount of water vapor in air at ground level can vary quite a bit, from almost zero to about five percent. Many factors, such as temperature, influence the amount of humidity in the air at a given location and time.
4.3). Other constituents: These other constituents are usually present in trace amounts and they reflect local conditions. Local additions to the composition of air can be very site specific. They depend on the immediate surroundings including wind direction, time of day and season of the year. Nonstandard components may be present due to natural processes (biological or geographical), or human activities (industrial, transportation, agricultural, solid waste management, e.t.c). Some common nonstandard components include methane, Sulphur dioxide, ammonia, nitrogen dioxide and carbon monoxide.
Improperly managed municipal solid waste serve as a major contributor to air pollution, because certain gases, generally known as landfill gases are emitted into the atmosphere through the processes of bacterial decomposition, vaporization and chemical reactions of the solid waste materials.

4.4). Landfill gases
Landfill gas is composed of a mixture of hundreds of different gases. By volume, it typically contains 45% to 60% methane and 40 to 60% CO_2. Landfill gas also includes small amounts of nitrogen, oxygen, ammonia, sulphides, hydrogen, carbonmonoxide and nonmetal organic compounds (NMOCs), such as trichloroethylene and benzene. Landfill gas are produced as an aftermath of the following processes (ASTDR, 2001)

Bacterial decomposition: Bacterial decomposition occurs when organic waste is broken down by bacteria naturally present in the waste. Bacteria decompose organic waste (which include food, garden waste, textiles, wood and so on), in four phases and the composition of gas changes during each phase.
Phase 1: During the first phase of decomposition, aerobic bacteria consume oxygen while breaking down the molecular chains of complex carbohydrates, proteins and lipids that make up organic waste. The primary byproduct of this first phase of decomposition is CO_2, and it continues until available oxygen is depleted. Depending on how much oxygen is present, when waste is dumped, phase 1 decomposition can last for days or even months.
Phase 2: After the oxygen in the landfill has been used up, phase 2 decomposition starts using an anaerobic process. Bacteria converts compounds created by aerobic bacteria to acetic, lactic and formic acids as well as alcohols such as methanol and ethanol. The landfill becomes highly acidic. As the acids mix with the moisture present in the land-fill, they cause certain nutrients to dissolve, making nitrogen and phosphorus available to the increasingly diverse species of bacteria.The gaseous byproducts of phase 2 are carbon dioxide and hydrogen.
Phase 3: Phase 3 decomposition starts when certain anaerobic bacteria consume the acids produced in phase 2 and form acetate. This process causes the landfill to become a more neutral environment in which methane producing bacteria begin to establish themselves.
Phase 4: Phase 4 decomposition begins when both the composition and production rates of landfill gas remain relatively constant. Phase 4 landfill gas usually contains approximately 45% to 60% methane by volume, 40-60% CO_2 and 2-9% of other gases such as sulphides.
Volatilization- Landfill gases can be created when certain waste particularly organic compounds change from a liquid or a solid into a vapor through a process called volatilization of certain chemicals in the landfill.
Chemical reaction– Landfill gases including nonmethane organic compounds are secreted by the reactions of certain chemicals present in the waste. An example is the reaction of chlorine bleach and ammonia which results in the production of hazardous gases.The rate and volume of gases produced ata specific site depends on the characteristics of the waste as well as a number of environmental factors. The following factors can have an influence on production of gases from solid waste (ASTDR, 2001).
Waste composition: The more the organic waste, the more landfill gases that will be produced.

Presence of oxygen in the landfill: Bacteria begin to produce methane only when oxygen is completely used up. If oxygen is available, oxygen dependent bacteria live longer and produce carbon di oxide and water for longer periods.
Moisture content: The presence of a certain amount of water in waste piles increase gas production because moisture encourages bacterial growth and transports nutrients and bacteria to all areas within the pile of waste Moisture may also promote chemical reactions that produce gases.
Temperature: As the temperature within the waste pile rises, bacterial activity increases, resulting in increased gas production.
Age of refuse: Age of refuse affects gas production in that more recently disposed waste will produce more gas than older waste.
In addition to the rotten egg odour and the pungent odour of hydrogen sulphide and ammonia respectively, short-term exposures (typically up to about two weeks) to elevated levels of both gases in air can cause coughing, irritation of the eyes, nose, andthroat, headache, nausea, and breathing difficulties (State of New York DOH,2010). However, the emission of methane and carbon di oxide, both of which are important greenhouse gases from solid waste dumps is probably the gravest impact on the environment because of their global warming potentials.

4.2) GREENHOUSE GASES

It has been known since the work of Swedish scientist GustavArrhenius at the end of the 19th century that certain gases presentin Earth's atmosphere in trace quantities exert a thermal blanketingeffect that keeps the planet's surface much warmer than it wouldotherwise be (UNDP, UNDESA and WEC, 2000). These are called 'greenhouse gases' because theywork in a way analogous to one of the functions of the glass in agreenhouse, letting sunlight in but trapping outgoing heat byabsorbing it and re-radiating some of it back to the ground.The most important greenhouse gas naturally present in Earth'satmosphere is water vapor (Lacis et al, 2010), next in importance is carbon dioxide(CO_2), followed by methane (CH_4) and nitrous oxide (N_2O). Theconcentrations of these gases in the atmosphere before the start of the industrial revolution kept the mean global surface air temperatureabout 33 degrees Celsius warmer than it would have been in absenceof an atmosphere with such natural levels of greenhouse gases. This natural 'greenhouse effect' is highly beneficial to life on Earth,since without it the average temperature would be far below freezing. Although water vapor contributes the largest part of the naturalgreenhouse effect, its concentration in the atmosphere globally (on which the size of the water-vapor contribution to the greenhouseeffect depends) is not significantly affected by emissions ofwater vapor from human activities. The most important anthropogenicgreenhouse gas emissions are those of carbon dioxide (CO_2), whicharise mainly from decomposition of organic constituents of municipal solid waste, combustion of fossil and biomass fuels and fromdeforestation An important indirect effect of humanactivities on the atmospheric concentration of water vapor resultsfrom increased evaporation of water from the surface of Earthbecause of the warming caused by increasing concentrations ofanthropogenic greenhouse gases in the atmosphere. The resultingincrease in atmospheric water-vapor content further warms earth'ssurface, this is significant positive feedback in the anthropogenic greenhouse effect.

5).IMPLICATIONS ON SUSTAINABLE DEVELOPMENT

In our quest as humans to develop our economy and society, and due to our ever-increasing population, it is only normal for solid waste generation to increase as a result of increase in production and consumption of goods and services. However, such development can only be said to be sustainable if there is a concurrent development in the environment. In its 1987 report, titled Our Common Future, the World Commission onEnvironment and Development (WCED) defines sustainable developmentas development that meets the needs of the present withoutcompromising the ability of future generations to meet their ownneeds. The report further describes sustainable developmentas a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development,and institutional change are all in harmony and enhance both currentand future potentials to meet human needs and aspirations. That is to say sustainable development involves the right mix of the trio of social, economic and environmental development. Environmental development in this regard refers to proper solid waste management practices, starting from the generation of waste, through its separation / sorting, storage, collection, transportation, treatment and proper final disposal.
The relationship between municipal solid waste and sustainable development is in two dimensions. The first is that in the pursuit of social and economic development, it is inevitable for solid waste not to be generated. The second dimension is that the so generated solid waste must be properly managed such that it does not have any deleterious effect on the environment.

6). CONCLUSION

This study concludes that industrialization and urbanization are two leading causes of increase in populations in developing countries. This has resulted in an increase in production and consumption of goods and services and a resultant increase in solid waste generation. Solid waste management poses a lot of difficulties to several of these countries largely due to a lack of information on waste characteristics (quantity and composition) at all levels. In communities where storage bunkers are provided for residents, they are usually overflowing to a point where they could pass for open dumps. This is due to inadequate, number, size and shape of the containers or late collection by the responsible local authorities, or both.

The municipal solid waste stored in these communal bunkers, as a result of bacterial decomposition of organic matter emit hydrogen sulphide. Apart from its odour, inhalation of hydrogen sulphideinhibit oxidative phosphorylation, and may lead to rapid loss of consciousness and death (Hendrickson et al,2004) as well as carbon di oxide which is an important greenhouse gas that contributes immensely to global warming. However, it is not safe to say that methane, another important greenhouse gas is emitted from such bunkers because of the possibility of them being collected before the onset of anaerobic bacteria activity, and the availability of oxygen which elongates the activity of aerobic bacteria

Finally, the study concludes that these communal solid waste storage points pose a significant barrier towards achieving sustainable development because they have negative effects on the environment and human health, through environmental pollution and disease transmission.

7). RECOMMENDATIONS

Some of these communal solid waste storage points could be mistaken as open dumps. There is also a likelihood that part of the waste had been stored for some time at the household level before they are deposited in the communal bunkers. This has implications on the age of the refuse. This study therefore recommends that ambient air quality assessments be carried out in areas with close proximity with communal solid waste storage points, to determine the actual ambient air quality of such areas.

The study also recommends adoption of the 3R solid waste management approach of reuse, recycling and recovery of materials in Nigeria. This could help in realization of the sustainable goal number 12 (responsible consumption and production) thus bringing the nation closer to achieving sustainable development.

REFERENCES

[1]. Abah, S. O., &Ohimain, E. I. (2010). Assessment of dumpsite rehabilitation potential using the integrated risk based approach: a case study of Eneka, Nigeria. World Applied Sciences Journal, 8(4), 436-442.

[2]. Abila, B., &Kantola, J. (2013). Municipal solid waste management problems in Nigeria: Evolving knowledge management solution. International Journal of Environmental and Ecological Engineering, 7(6), 303-308.

[3]. Addaney, M., & Oppong, R. A. (2015). Critical issues of municipal solid waste management in Ghana. Jenrm, 2(1), 30-36.

[4]. Agbesola, Y. (2013). Sustainability of municipal solid waste management in Nigeria: A case study of Lagos.

[5]. Agency for Toxic Substances and Disease Registry (ATSDR). (2001). Landfill Gas Primer–An Overview for Environmental Health Professionals. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, Division of Health Assessment and Consultation.

[6]. Ali, M., Cotton, A., & Westlake, K. (1999). Down to earth: solid waste disposal for low-income countries. WEDC, Loughborough University.

[7]. Amasuomo, E., & Baird, J. (2016). The concept of waste and waste management. J. Mgmt. & Sustainability, 6, 88.

[8]. Angaye, T. C. N., &Abowei, J. F. N. (2017). Review on the environmental impacts of municipal solid waste in Nigeria: challenges and prospects. Greener Journal of Environmental Management and Public Safety, 6(2), 18-33.

[9]. Amuda, O. S., Adebisi, S. A., Jimoda, L. A., &Alade, A. O. (2014). Challenges and possible panacea to the municipal solid wastes management in Nigeria. Journal of Sustainable Development Studies, 6(1).

[10]. Bogner, J., Spokas, K., Burton, E., Sweeney, R., & Corona, V. (1995). Landfills as atmospheric methane sources and sinks. Chemosphere, 31(9), 4119-4130.

[11]. Centers for Disease Control and Prevention. (2001). Agency for Toxic Substances and Disease Registry. Strategic Plan forPublic Health Workforce Development. Toward a Life-long Learning System for Public Health Practitioners. Washington, DC: US Department of Health and Human Services.

[12]. Ezekwe, C. I., Agbakoba, A., &Igbagara, P. W. (2016). Source Gas Emission And Ambient Air Quality Around The Eneka Co-Disposal Landfill In Port Harcourt, Nigeria. Gas, 2(1).

[13]. Hendrickson, R. G., Chang, A., & Hamilton, R. J. (2004). Co-worker fatalities from hydrogen sulfide.American journal of industrial medicine, 45(4), 346-350.

[14]. Hudson, R. (2007). Regions and regional uneven development forever? Some reflective comments upon theory and practice. Regional studies, 41(9), 1149-1160

[15]. Huzortey, A. A., Kudom, A. A., Mensah, B. A., Sefa-Ntiri, B., Anderson, B., &Akyea, A. (2022). Water quality assessment in mosquito breeding habitats based on dissolved organic matter and chlorophyll measurementsbylaser-induced fluorescence spectroscopy. Plos one, 17(7), e0252248.

[16]. Kamide, Y. (2000). Our life is protected by the Earth's atmosphere and magnetic field: what aurora research tells us.Biomedicine& pharmacotherapy, 55, s21-s24

[17]. Kaseva, M. E., & Gupta, S. K. (1996). Recycling—an environmentally friendly and income generating activity towards sustainable solid waste management. Case study—Dar es Salaam City, Tanzania. Resources, conservation and recycling, 17(4), 299-309..

[18]. Lacis, A. A., Schmidt, G. A., Rind, D., & Ruedy, R. A. (2010). Atmospheric CO2: Principal control knob governing Earth's temperature. Science, 330(6002), 356-359.

[19]. McAllister, J. (2015). Factors influencing solid-waste management in the developing world. digitalcommons.usu.edu

[20]. Nayono, S. E. (2014). Anaerobic digestion of organic solid waste for energy production (Vol. 46).

[21]. Ndukwe, V. A., Uzoegbu, M. U., Ndukwe, O. S., &Agibe, A. N. (2019). Environmental and health impact of solid waste disposal in Umuahia and Environs, Southeast, Nigeria. Journal of Applied Sciences and Environmental Management, 23(9), 1615-1620.

[22]. Ogwueleka, T. (2009). Municipal solid waste characteristics and management in Nigeria. Journal of Environmental Health Science & Engineering, 6(3), 173-180.

[23]. Olukanni, D. O., &Akinyinka, O. M. (2012, November). Environment, Health and Wealth: Towards an analysis of municipal solid waste management in Ota, Ogun State, Nigeria. In International Conference on Clean Technology and Engineering Management,Covenant University, Ota, Nigeria, ICCEM (2012) (pp. 51-71).KIT scientific Publishing.

[24]. Oteng-Ababio, M. (2011). Missing links in solid waste management in the Greater Accra Metropolitan Area in Ghana. GeoJournal, 76(5), 551-560.

[25]. Oyekan, T. A. &Sulyman, A. O. (2015). Health impactassessment of community-based solid waste managementfacilities in Ilorin West Local Government area, KwaraState, Nigeria. Journal of Geography and RegionalPlanning, 8(20, pp. 26-36.

[26]. Rim-Rukeh, A. (2014). An assessment of the contribution of municipal solid waste dump sites fire to atmospheric pollution. Open Journal of Air Pollution, 3(03), 53.

[27]. Sasikumar, K., & Krishna, S. G. (2009). Solid waste management. PHI Learning Pvt. Ltd..

[28]. UNDP, UNDESA, WEC, (2000). World Energy Assessment.

[29]. Vallero, D. A. (2014). Fundamentals of air pollution. Academic press.

[30]. Vergara, S. E., &Tchobanoglous, G. (2012). Municipal solid waste and the environment: a global perspective. Annual Review of Environment and Resources, 37(1), 277-309.

[31]. Weli, V. E., & Adekunle, O. (2014). Air quality in the vicinity of a landfill site in Rumuolumeni, Port Harcourt,Nigeria. Journal of Environment and Earth Science, 4(10), 1-9.

[32]. Yongsi, H. N. (2008). Pathogenic microorganisms associated with childhood diarrhea in Low-and-middle income countries: Case study of Yaoundé–Cameroon. International journal of environmental research and public health, 5(4), 213-229.

[33]. Yukalang, N., Clarke, B. D., & Ross, K. E. (2017). Solid waste management in Thailand: An overview and case study (ThaKhon Yang sub-district). Reviews on Environmental Health, 32(3), 223-234.