

ENVIRONMENTAL DEGRADATION AND MUNICIPAL SOLID WASTE MANAGEMENT IN EKET- NIGERIA

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ABSTRACT

Environmental degradation is the deterioration of the environment through the depletion of resources such as air, water, soil and the destruction of ecosystems. Waste management involves collection, transport, processing, recycling or disposal, and monitoring of waste materials. These methods include; Source reduction, recycling, incineration, composting, landfilling, anaerobic digestion. Four major markets were selected in Eket to ascertain the quantity and type of waste generated to proposed the method of waste management. Of the total waste generated, 82% of the solid waste originate from markets and households while about 18% are from commercial and institutional or industrial premises. Of the waste from markets and households, a substantial proportion consist of various putrescible materials, paper, metal, glass, textiles, rubber, leather, wood, vegetable, dust and sand. Anaerobic digester was designed to help in this scenario. Some equations were generated for the design. Some constraints in the management of waste in Eket and potential health hazard were critically analysed. Recommendations were made for the construction of the biogas plant.

Keywords: Eket, Environmental Degradation, Waste Management, Biogas Plant,

INTRODUCTION

Environmental degradation is said to occur when the environment becomes less valuable or damaged. It is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems and the extinction of wildlife. There are many forms of environmental degradation. When natural habitats are destroyed, biodiversity is lost, or natural resources are depleted, the environment is hurt. Environmental degradation can occur naturally, or through human processes. The largest areas of concern at present are the loss of rain forests, air pollution and smog, ozone depletion, and the destruction of the marine environment. Pollution is occurring all over the world and poisoning the planet's oceans. Even in remote areas, the effects of marine degradation are obvious. In some areas, the natural environment has been exposed to hazardous waste. In other places, major disasters such as oil spills have ruined the local environment (Ferrari 1988).

Environmental Change and Human Health, a special section of World Resources describes how preventable illnesses and premature deaths are still occurring in very large numbers. If vast improvements are made in human health, millions of people will be living longer, healthier lives than ever before. In these poorest regions of the world an estimated one in five children will not live to see their fifth birthday, primarily because of environment-related diseases. Environmental degradation is as a result of the dynamic inter play of socio-economic, institutional and technological activities (Pickford 1983). Environmental changes may be driven by many factors including refuse disposal, economic growth, population growth, urbanization, intensification of agriculture, rising energy use and transportation, Poverty still remains a problem at the root of several environmental problems. Hence, the objective of this study is to study the current trend in refuse disposal in Eket local government of Akwa Ibom State; to explore various methods of waste management methods in urban metropolis; and to develop a waste management system for Eket local government of Akwa Ibom state

METHODS OF WASTE MANAGEMENT

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials (Beede et al 1995). The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. These methods include; Source reduction, recycling,

Ogbonna, D. N. et al (2002), Ekpo, D. D(2010), Adedibu A.A(1983) and Ekugo E.I(1998) for details.

HISTORICAL OVERVIEW OF EKET LOCAL GOVERNMENT AREA HISTORICAL BACKGROUND

Eket local government created in 1997 with a land mass of 1,731 sq. km. It is an offshoot of the Qua Iboe District of 1885 administered by vice consul white house. The Qua Iboe District embraced what is today most part of Akwa Ibom State including Esit Eket, Onna, Ibeno, Nsit Ubium, Etinan, Abak, Etim Ekpo, Mbo, Oron, Uruefong/Oruko, Udung Uko, etc. Between 1893 and 1899, Eket became one of the consular posts with the first consul appointed in 1898. By 1905, the area was reduced to Oron, Eket, Esit Eket and part of Nsit Ubium. Although the British signed a treaty with Eket people on September 1884, British Administration really in 1885 by the vice consul white house who later became consul in Calabar.

GEOGRAPHICAL LOCATION

Eket local government occupies the south central portion of Akwa Ibom state territorial expanses spanning northwards between latitudes 4 33' and 4 45' and eastwards between longitudes 7 52' and 5 02'. Eket is bounded on the east by Esit Eket local government area, on the west, by Onna local government area and on the south by Ibeno local government area/Bight of bonny (Ministry of Environment, Eket).

MARKETS IN EKET METROPOLIS

Eket local government is an oil rich city with about four major markets, namely; Udo Inyang, Nka, Ikot Idiong and ofiong-Etuk markets.

WASTE GENERATION IN EKET METROPOLIS AND MARKETS

Eket metropolis is becoming one of the fastest growing cities in Akwa Ibom state due to the economic impact of the oil industries/servicing companies. This section reveals survey of the urban refuse (solid waste) generation profile in Eket metropolis; a rapidly growing city in Akwa Ibom state, south-south, Nigeria. The area surveyed covered the market, low, medium and high density residential houses, representing high, medium/low income groups in the area. Results of the survey in 2002, according to the department of environment in Eket local government show that approximately 82% of the solid waste generated in the area originate from markets and households while about 18% are from commercial and institutional or industrial premises. Of the waste from markets and households, a substantial proportion consist of various putrescible materials, paper, metal, glass, textiles, rubber, leather, wood, vegetable (36-57%) with ash, dust and sand (combined) forming another significant proportion (21-41%). From the non-household sources, putrescible matter is also significant (23-45%). The quantity of plastics/cellophane materials from markets, households and non households sources was however comparable (6-10%). There was more paper from commercial and institutional premises (9-12%) than from the markets and households or industrial premises (2-4%). Glass (0.1-6.9%), metals (mostly cans and bottle corks, 0.7-3.4%) and textiles (0.3-6%) from only a minor proportion of the waste across generators

WASTE DISPOSAL IN EKET MARKETS

Waste disposal in Eket markets are very poor due to lack of dumpsites and other waste disposal methods. The wastes are just disposed by the side of the markets which does affect the populace leaving in the environs and the entire city. Eket markets and the metropolis have no formal collection and disposal system or designated functional dumping areas. So wastes are disposed at the nearby bushes/side of buildings and in the gutters which poses serious treat to public health and the surrounding environment.

POTENTIAL HEALTH HAZARDS

Some of the health problems associated with poor water quality arising from inadequate waste disposal and waste-management practices include typhoid fever, diarrhoea, cholera, hepatitis, hook worm infestation, skin diseases, malaria, etc. Ground or surface water pollution occurs, especially when there is a shallow aquifer, and permeable and/or semi-permeable soil types (as found in most of the coastal areas of the Niger Delta). In such areas, liquid wastes, leakages from accumulated solid wastes, could readily percolate down to the groundwater and cause pollution. The nature and strength of the leakage will depend on the composition of the waste, the length of time that the infiltrating water is in contact with the refuse and the amount of water that infiltrates it (Adedibu 1983).

Waste dumps are unsanitary and destroy the aesthetic appeal of the environment. They harbor flies, fleas, mosquitoes, rats, and other disease vectors. Some of the diseases carried by rodents and insect vectors

include Lassa fever, malaria, filariasis, yellow fever, etc. These waste areas provide food, water, and habitats, and breeding areas for these disease-carrying agents

According to Ekugo 1998, Pollution of rivers and lakes results in extensive fish kills and destruction of other forms of aquatic life due to an increased organic load and the concomitant depletion of dissolved oxygen in the water. When fish or other aquatic organisms are not immediately killed, they accumulate pollutants, which are eventually transferred to man through the food chain . Airborne pollutants and noxious gases produced from refuse dumps contribute to the increase in pulmonary diseases among the populations near dump sites, as well as degradation of the physical environment (Ogbonna et al 2002).



WASTE DISPOSAL AREA NEAR DOWRYANG MARKET



WASTE DUMPED AROUND NKA MARKET

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WASTE DUMPED GROUND IKOT IDRONG MARKET

CONSTRAINTS IN WASTE DISPOSAL IN EKET LOCAL GOVERNMENT

Eket local government, the system has been one of the worst in the state. Presently, many households, markets and commercial areas have no place for the disposal of waste.

This is due to so many reasons listed below as source from the Ministry of Environment, Eket;

- (1) Lack of fund by the local government council; Here government are not paying any attention to the environment as regards sewage or urban refuse disposal, the hazards of waste disposal to the environment, and the environmental degradation implications (flooding, erosion and pollution).
- (2) Lack of dumpsite; presently, it is only one dumpsite in the whole of Eket local government, privately owned which is not even in good condition. It is situated behind Qua steel company along Ibeno road. It covers about 200 square-metres which even at good condition not still adequate for a big city like Eket local government.
- (3) Lack of trucks; there is no truck functioning at present for disposal of refuse in Eket local government. The only one that is available which is not functional was donated by the Niger Delta Development Commission (NDDC). For sometimes now, since its breakdown, government has not even have interest in repairing it.
- (4) Politics; this appears to be the worst of all the reasons. The local governments have been politicizing the appointment of the members to the department of environment in the local government. They appoint mediocre and party loyalist to the committee instead of involving the professionals and people that have knowledge on environmental management. So, the little effort they could put would be hindered by these people that want to capitalize on the least fund to make wealth for themselves instead of discharging their responsibilities. This turned many of the urban councils and municipal planning authorities including Eket into purposeless bodies and a drain on the regional state governments. These people have an adequate experience and training (31).

PROPOSED WASTE DISPOSAL SYSTEM IN EKET LOCAL GOVERNMENT AREA DESIGN FACTORS

The rate and efficiency of the anaerobic digestion process is controlled by:

- The type of waste being digested, Its concentration, Its temperature, The presence of toxic materials, the pH and alkalinity, the hydraulic retention time, The solids retention time, the ratio of food to microorganisms, the rate of digester loading, and the rate at which toxic end products of digestion is removed.

PH

Methane producing bacteria require a neutral to slightly alkaline environment (pH 6.8 to 8.5) in order to produce methane.

Hydraulic Retention Time (HRT)

Most anaerobic systems are designed to retain the waste for a fixed number of days. The number of days the materials stays in the tank is called the Hydraulic Retention Time or HRT. The Hydraulic Retention Time equals the volume of the tank divided by the daily flow

$$(HRT=V/Q)$$

SOLIDS RETENTION TIME (SRT)

The Solids Retention Time (SRT) is the most important factor controlling the conversion of solids to gas. It is also the most important factor in maintaining digester stability. It is the quantity of solids maintained in the digester divided by the quantity of solids wasted each day.

$$SRT = \frac{V C_d}{Q_w C_w}$$

Where V is the digester volume; C_d is the solids concentration in the digester; Q_w is the volume wasted each day and C_w is the solids concentration of the waste.

DIGESTER LOADING (KG/M³/D)

The loading in (kg / m³ / d) is simply:

$$L = \frac{Q C_i}{HRT(c_i)}$$

Where C_i is the influent waste concentration in grams. Increasing the loading will reduce the digester size but will also reduce the percentage of volatile solids converted to gas.

FOOD TO MICROORGANISM RATIO

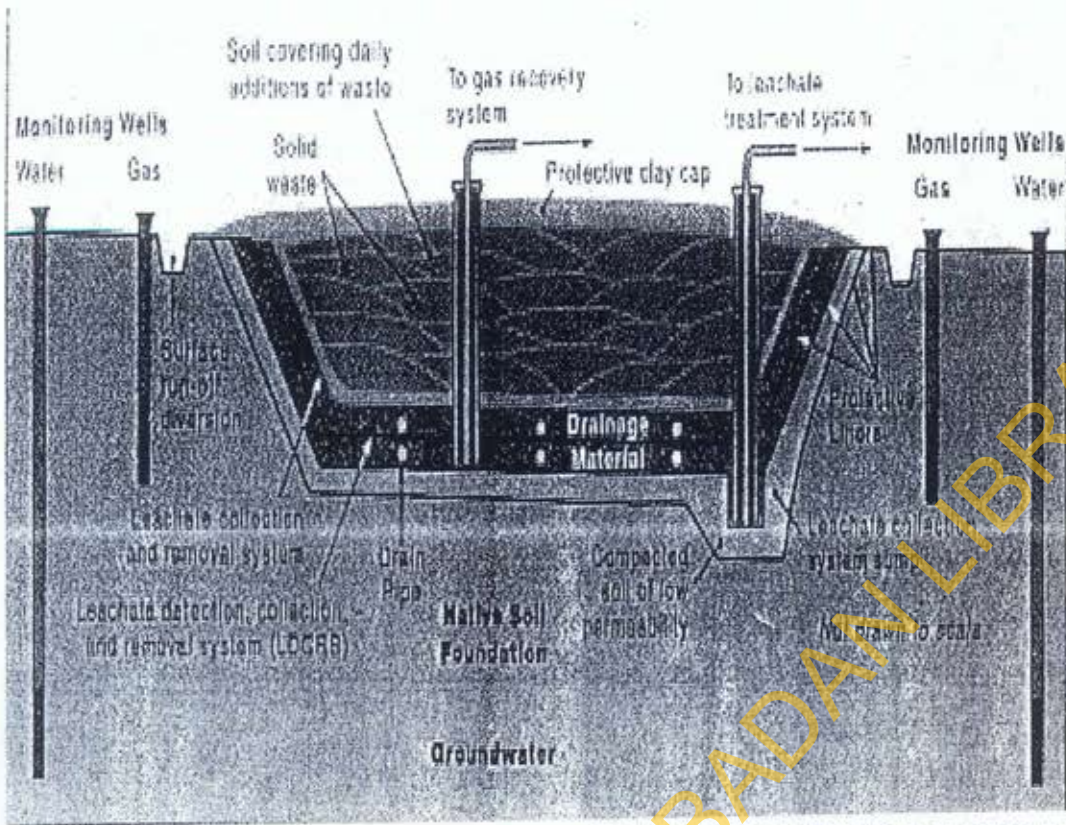
The F/M ratio would simply be the digester loading divided by the concentration of volatile solids (biomass) in the digester ;

$$(L / C_d)$$

For any given loading, the efficiency can be improved by lowering the F/M ratio by increasing the concentration of biomass in the digester. Also for any given biomass Concentration within the digester, the efficiency can be improved by decreasing the loading. In this case F/M ratio is equal to the VS loading divided by the digester VS measured (VSD) minus the unprocessed Volatile Solids (VSUP).

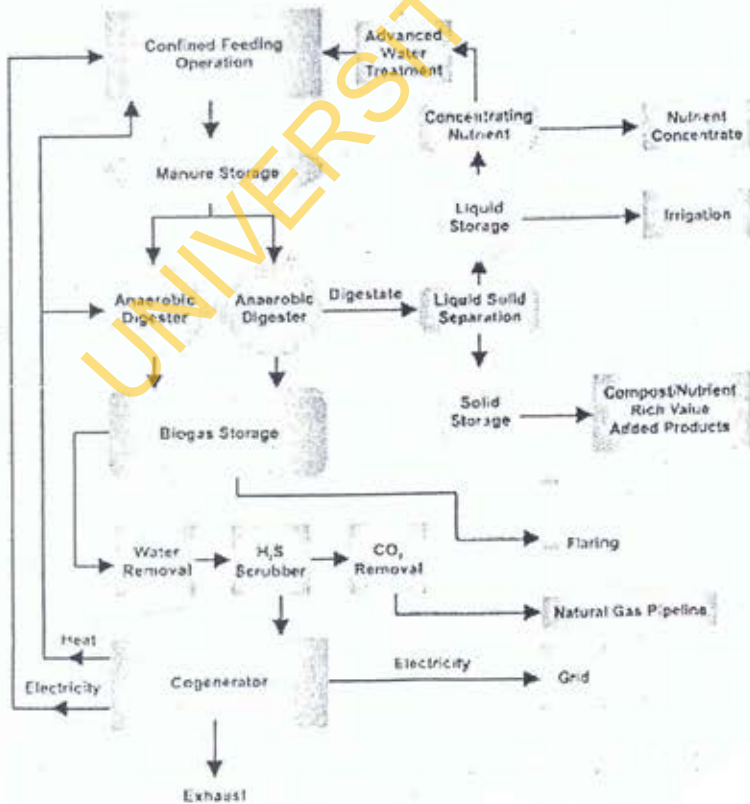
$$\frac{F}{M} = \frac{L}{VSD - VSUP}$$

DESIGN PROTOTYPE OF THE LANDFILL (BIOGAS)



MODERN SANITARY LANDFILL

SCHEMATIC DIAGRAM OF AN ANAEROBIC DIGESTER PLANT



CONCLUSION

Most of the problems associated with waste management policies and programs. Therefore, the Government of Nigeria should encourage private domestic waste-management firms, with expertise in handling the waste generated by diverse human settlements/activities. The decentralization of industrial and infrastructural development would, to a large extent, reduce/minimize the migration of people from rural to urban areas. In addition, regular organization of environmental seminars and workshops by government and industries both in the rural areas and cities would help to create environmental awareness and better waste-management strategies.

Environmental management and protection should be a joint government/industry/community participatory program. Participatory environmental management should have the people as its focus and uphold their needs, perceptions, knowledge, and values. It will, however, be necessary to remove the obstacles to effective popular participation in environmental policies. Such obstacles include illiteracy, ignorance, certain negative cultural and religious beliefs, etc.

Waste segregation practices should be encouraged at the point source of waste generation. Separation of wastes will contribute to better management of the total waste mass.

Recycling of wastes after sorting is an important feature in handling waste products. The recycling of paper wastes, for example, will reduce pressure on the source of the raw materials used for paper production. This could contribute to increased economic development in Nigeria. In this way, materials that were formerly classified as waste may become valuable raw materials. Various forms of fertilizers could be produced from recycled sewage and other domestic refuse and garbage.

Moreover, Waste management plays an integral role in human activity. Not only does it involve rational decision making about whether to bury, burn, recycle, or produce less waste, it must also consider impacts to health, society, and the environment. Assessing the benefits and costs of various waste management policies and projects is complex because it involves numerous, interconnected economic, social, and biological components. The barriers to effective municipal solid waste management are not simply lack of policy, but lack of infrastructure, education, social awareness of problems and solutions, and lack of institutions promoting sustainable actions.

Finally, as it is the practice for many developed economies; environmental legislation should allocate the responsibility for environmental protection to corporate, government, and voluntary agencies. This will mean that officers of such corporations and community leaders (including family members) can be held criminally liable for any pollution resulting from indiscriminate dumping of wastes. This will also ensure a more effective participatory approach to waste-management problems.

RECOMMENDATIONS

A number of recommendations are made here, aimed at the development of an integrated and sustainable system for solid waste management in Eket.

- (1) A properly sited engineered landfill should be constructed as recommended in the project. Operation of this site should be contracted to the private sector.
- (2) To minimize costs, an improved waste storage and collection system is required. Here, a sanitary landfill (Anaerobic digester) has been proposed and design for construction which will curb the environmental problems since there is no place for waste dumping presently.
- (3) Each household should use standard waste bins that are placed outside for ease of collection. In areas, where this is not appropriate, centrally located waste collection points should be established that are shared by a number of households.
- (4) The capacity of the private sector to provide reliable waste collection services, and of the public sector to supervise them, should be strengthened.
- (5) Vehicles need to be appropriate to the local conditions, Vehicles specifically designed for carrying wastes should be used wherever possible to avoid material being lost during transportation. A programme of regular vehicle maintenance is required and appropriate vehicles should be used.
- (6) Training needs to be provided, particularly for drivers operating waste tipping equipment, and more vehicles will be needed to cope with increasing waste generation.
- (7) There is need to be a continuing programme of public awareness concerning waste management.
- (8) Wastes need to be increasingly sorted at the source, to separate materials that can be recycled and to reduce the amount of wastes requiring collection and disposal.
- (9) Co-operation is required among communities, the informal sector, the formal waste collectors and the authorities if recycling rates are going to increase (which would in turn reduce the quantities of

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- residual waste for collection and disposal, and also the need for a separate collection system).
- (10) Increased involvement and integration of the informal sector so that the collectors can collect separated materials for recycling from households. Informal waste collectors could also provide an 'official' door-to-door collection service in areas that are inaccessible to larger vehicles. This would need to be integrated with formal collection services through waste transfer stations; the collectors should be provided with space at the transfer station to sort recyclable materials, to avoid the current problem of illegal dumping after separating the saleable items.
 - (11) All wastes dumped along roads, underneath bridges, in culverts and in drainage channels in Eket need to be cleared as a matter of urgency.
 - (12) Unlike most developed and some developing countries, there is no clear policy in Nigeria on compost. Sorting would be required to exclude hazardous and non-degradable components like plastics, metals and glass from the waste and this is where co-operation from householders is needed to separate degradable waste at source. The removal of subsidies on fertilizers in Nigeria has created a demand for alternatives, and a market for compost exists. Small-scale composting plants could enhance the development of low-capital and labour intensive industries that promote employment, income generation and poverty alleviation in Eket.
 - (13) Enforcement of waste management legislation is required, as a proper policy and planning framework for waste management.
 - (14) The government must control unauthorized use of land, and this should be achieved by enforcing relevant clauses in the development guidelines.
 - (15) There is also a need for accurate population data so that waste management systems and infrastructure can be properly planned. The Master Plan should be updated (or revived) in terms of its provisions for waste management infrastructure.
 - (16) Funding and affordability remain among the major constraints and challenges. An element of specific user charging will be needed to supplement municipal and national taxes. A system for making micro-credit available to the informal sector would aid its development as part of an integrated and sustainable waste management system.
 - (17) Addressing the problems in an integrated way (as outlined above) would also increase the likelihood of multilateral donor funding for major investments, such as in the landfill site, transfer stations or new vehicles.

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