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Monitoring and Characterization of Waste Landfill in Rumuagholu, Rivers State, Nigeria

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Abstract

This study investigated waste characterization at a landfill in Rumuagholu, Rivers State, Nigeria, utilizing a mechanical sorting technique across two stations. The findings unveiled a composition of biodegradable elements, including paper, wood, wooden baskets, leaves, decaying food, fruits, and vegetables. Non-biodegradable materials, such as metals, bottles, tins, bulbs and plastic bags, were also identified. The study underscored the imperative for an enhanced and continuous waste management system to mitigate adverse pollution effects, encompassing odour, vermin infestation, mosquito proliferation, and heavy metal contamination in the immediate environment.

Keywords: Waste characterization, municipal solid waste, landfill

INTRODUCTION

Port Harcourt city is an urban center located in the heart of the oil-rich Niger Delta of Nigeria, Itis known for high levels of industrial activities which generate pollutants and therefore are subject to the menace of resultant indiscriminate disposal of both domestic and industrial wastes (Obute *et al*., 2001; Wegwu *et al*., 2002). Waste generation has been an issue for communities since the beginning of civilization. Waste is generated due to goods and service production and the utilization of natural resources. There are many barriers to the proper management of waste. In Nigeria, increasing population, industrialization and changes in consumption patterns have complicated solid waste management. The impact of poor waste management on human health and wellbeing cannot be overemphasized. Individuals living adjacent to dumpsites are at high risk due to the potential of waste to pollute water, food, land, vegetation and air. Waste comes from various sources; domestic residences, industries, offices, institutions, commercial buildings, restaurants, agriculture, construction and hospitals (Zhu *et al*., 2008).

The majority of the wastes generated from these sources end up in the dumpsites and ultimately in landfills. Across many cities in Nigeria, collected wastes are usually burnt outdoors and ashes are poorly disposed of on-site. This act destroys the organic components and causes the oxidation of metals; the ashes left behind are enriched with metal which results in pollution of the surrounding environment.

Nearly all human activities generate waste and the manner in which it is handled, stored, collected and disposed of, can pose risks to the environment and to public health (Zhu *et al*., 2008). The soil is very good at recycling waste but when the amount of wastes generated is far more than the earth can cope with; it poses a big threat to lives, a phenomenon called pollution. Pollution occurs at different levels and affects all lives ranging from plants, animals to man (Skye, 2006).

The movement of contaminants from sites where wastes are disposed of to the ecosystems is complex and involves biological and physiochemical processes. Open dumpsites could be a source of microbial and toxic chemical pollution of soils. This can also pollute hand-dug wells, posing serious health risks and leading to the destruction of biodiversity in the environment.

The decay of these solid wastes releases substances that can affect the soil nutrients content, increase the concentration of heavy metals in the soil, altering the natural balance of nutrients available for plant growth and development thereby affecting species diversity and agricultural productions. Water can percolate through the refuse pile in the dumpsites leading to the formation of leachates that are enriched in nutrients (Nitrogen, Potassium and Phosphorus), heavy metals and other toxic substances, including cyanide and dissolved organics. The composition of the wastes influences the concentration of the leachates' constituents which may be absorbed on to the soil during this diffusion. This process creates health hazards, soil and water pollution and offensive odours with increasing ambient temperature level.

Solid waste is the garbage, refuse, sludge and other discarded materials including solid, liquid, semi-solid or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities (Peavy, *et al*., 1985; Kumar, *et al*., 2016). Most of the commonly known discarded wastes which make up the day-to-day items being disposed by the general public are known as Municipal Solid Wastes (MSWs), and it includes all substances or objects thrown away as products of packaging, lawn cuttings, furniture, clothing materials, bottles/glasses, food scraps, electric appliances, newspapers, paint, and batteries, etc (Afon, 2006). Huge amount of municipal solid waste (MSW) (UN, 2003) is produced day by day since the generation rate is increasing even faster than the rate of urbanization (Hoornweg and Bhada-Tata, 2012), hence, the intensification of solid waste production within 10 years from 0.68 billion tons per year in 2000 to 1.3 billion tons per year in 2010 (Islam, 2016). It is anticipated to reach 2.2 billion tons per year by 2025 and 4.2 billion tons per year by 2050 (Hoornweg and Bhada-Tata, 2012). Municipal solid waste contains different heavy metals and organotin compounds which can be found in dumpsite leachate, air and soil produced either from plastic burning or smelting of scrap metals and electronic waste. Several studies have shown evidence of serious hazards caused by open waste dumping ultimately affecting the life cycles of plants, soil properties and significantly altering the behavior of its underlying soil (Kumar, *et al*., 2016). Many contaminants (particularly heavy metals) are trapped in the soil beneath dumpsites, resulting in long term contamination of the underlying soil in terms of pH and geotechnical properties.

Characterization of waste by manual sorting simply consists of separating the different fractions that compose it to determine the nature of each fraction, its percentage of occurrence, capacity for valorization and so on. Waste characterization is very important for appropriate MSW collection, selection of transportation equipment, energy transformation and its recovery, recovery of reusable matter, as well as the proper design and implementation of optimal disposal routes and methods. The changes in the trends of MSW generation and its composition have been as a result of the differences in the consumption behaviours of people coupled with rapid technological advances. Quantity and composition of MSW differs from one country to another country, from one neighbourhood to another, even from one community to another community. The differences could either be as a result of income level, socio-economic distribution, consumption habit, or disposal habits of people (Banar and Ozkan, 2008). Consequently, the aim of this study is to evaluate the monitoring and characterization of waste in Rumuagholu landfill, Nigeria.

MATERIALS AND METHOD

Study Area:

This study was carried out in Rumuagholu landfill (Fig. 1) in Obio/Akpor Local Government Area in Rivers State. Two stations were sampled and were adjacent to each other. Station 1 has a coordinate of 4°53'12"N, 6°58'40"E and station 2 was located 200m away with coordinate of 4°53'36"N, 6°59'0"E.

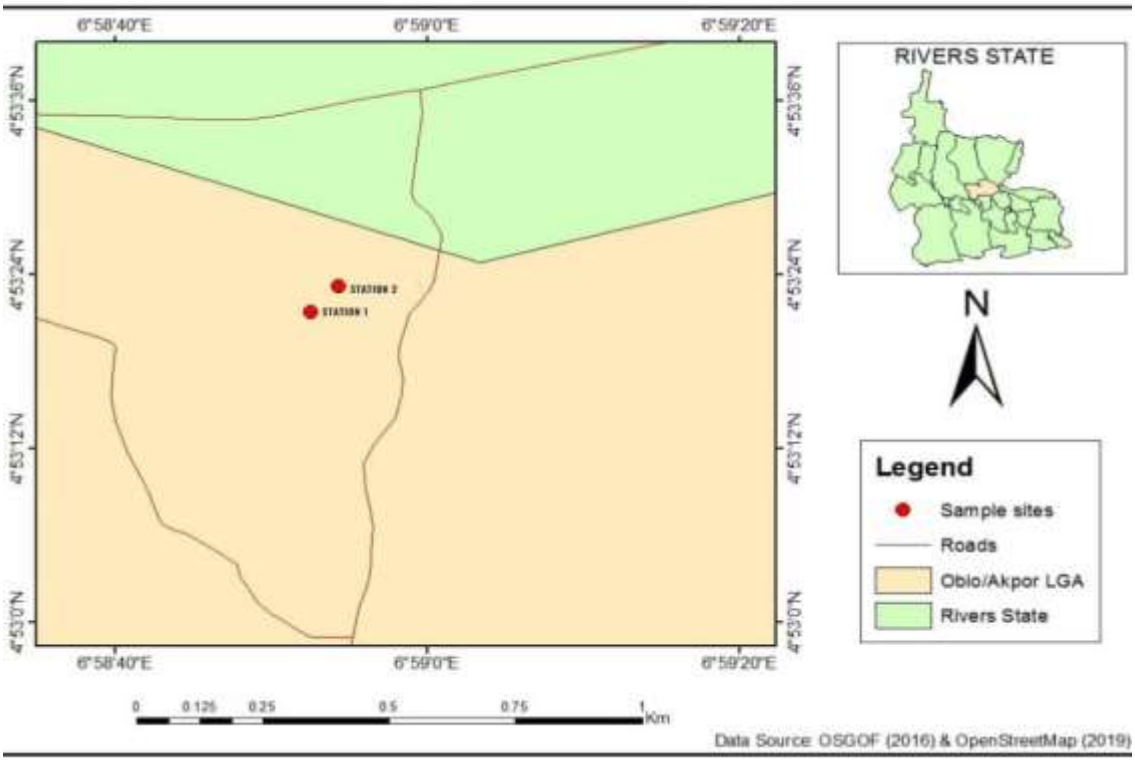

Figure 1: Map showing sample stations in Rumuagholu landfill

Sample collection: A systematic sampling technique was employed for field sampling. The sampling involved mainly the use of on-site observations and sampling was done mechanically by sorting.

RESULTS AND DISCUSSION

The result of this study showed that solid wastes in the landfill are characterized into biodegradable and non-biodegradable waste (Plate 1A & B). Biodegradable wastes which were observed include organic waste such as kitchen waste, vegetables, flowers, leaves, yard trimmings and fruits, combustibles such as paper, wood and dried leaves. Human and animal waste such as faecal matter, carcasses of dead livestock and other animals were also seen.

Plate 1A. Study area showing general biodegradable wastes in Rumuagholu landfill, Obio-Akpor LGA, Nigeria

Plate 1B. Study area showing plastic bottles at Rumuagholu landfill, Obio-Akpor LGA, Nigeria

Non-biodegradable wastes include non-combustibles such as metal, tins, cans, bottles and stones, electronic appliances such as cookers, radios and television and toxic waste such as electric bulb, spray cans, fertilizer and pesticide containers, batteries. Others are glass bottles, plastic bags and leather. The biodegradable wastes may compost into rich humic material which can improve water and nutrient retention and help grow healthier plants with less need for chemical fertilizers (Lui *et al.*, 2019). Although, these wastes generate bad odour and act as breeding grounds for carriers and vectors like mosquitoes and rats which spread so many communicable diseases (Kilian *et al.*, 1999). Non-biodegradable wastes like chemical pesticides and fertilizers make the soil acidic when in excess thereby affecting the soil fertility. More so, these substances can be washed away from the soil into nearby water bodies which may affect aquatic life and promote algal blooms.

CONCLUSION

The dual-edged nature of Rumuagholu landfill waste demands a multifaceted approach. While harnessing the potential of biodegradable materials for soil improvement is promising, the threat posed by non-biodegradable waste in Rumuagholu's landfill's poses significant risks to human health. To safe guard the community from diseases associated with rodents and mosquitoes, and to protect the nearby rivers. Immediate action is crucial. Implementing waste segregation, composting initiatives, and stricter controls on hazardous waste disposal are essential steps towards a healthier environment for Rumuagholu residents.

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