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MICROBIOLOGICAL QUALITY OF AIR AND SOIL OF REFUSE DUMP SITE AREAS IN SOKOTO METROPOLIS

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ABSTRACT: *The study on Microbiological quality of Air and Soil of Refuse Dump site Areas in Sokoto Metropolis was conducted. The air and soil samples were collected using sterile Swab sticks and exposing sterile petri dishes containing the Nutrient Agar (NA) and Potato Dextroxe Agar (PDA) to air at the site. The samples were collected from different dump site including Sultan Bello Mosque site, Vegetables market, Sultan Abubakar Road, Ahmad Bello Way and Iraki refuse dump site. The bacteria isolated from Air and Dump site were: Staphylococcus aureus, Bacillus licheniformis, Staphylococcus cohnii, Bacillus mycoidis, Bacillus sphericus, Bacillus alveri, Bacillus megatarium, Bacillus firmus and Staphylococcus carnosus. While the Fungal pathogens recovered were Aspergillus niger, Aspergillus flavus, Fusarium solani, Rhizopus orizae and Tricudermer herzianom among others. It can be concluded that the open dump system of waste disposal is hazardous to human health as such concern authorities and other relevant bodies should take measures and embark on public awareness on the danger of indiscriminate waste disposal and the open dump system of waste disposal. So as to curtail and adopt the most suitable safe and appropriate waste disposal system in the metropolis.*

KEYWORDS: Microbiological Quality, Air, Refuse Dump Site, Sokoto Metropolis, Nigeria

INTRODUCTION

Waste can be described as unwanted or unusable materials. Waste may be generated during the extraction of raw materials, the processing of raw materials into immediate and final products, the consumption of final products and other human activities. Residuals recycled or reused at the place of generation are excluded (UNSD, 1997). With population increase, there is increase in solid waste production making garbage population a serious problem (Williams and Hakam, 2015).

A waste is hazardous if it is infectious, meaning containing viable microorganisms or their toxins which are known or suspected of causing disease in animal or human (Obire *et al.*, 2002). In rapidly growing cities of the developing world, urban solid waste management is currently regarded as one of the most immediate problem. Various types of waste are causing adverse effect on living organisms and environment. As a result, human and animal diseases occur, the air and soil environment are spoiled and the entire natural ecosystem balance is disturbed. Previous studies showed that on an average, each person in urban areas produces half a kilogram of garbage each day (Zaved *et al.*, 2008)

MATERIALS AND METHODS

Study Area

The study was conducted in Sokoto metropolis, which is located in the extreme North-western part of Nigeria. The State geographically lies along longitude 11^{o} 30^{1} to 13^{o} 50^{1} East and latitudes 4^{o} to 6^{1} North and covers a total land mass of 26,648.48 square kilometres. Sokoto State shares boundary with Kebbi State to the south, Zamfara State to the east and the Republic of Niger to the north. The State has an estimated population of about 4,742,459 people as of 2015 with 95.9 persons per square kilometre, and 3% growth rate annually based on 2006 population census (NPC, 2007). Modern Sokoto city is a major commercial centre in leather crafts and agricultural products (MOI, 2008). There are 23 Local Government Councils (LGC) in the State with Sokoto as the capital. The State is divided into four (4) agricultural zones namely, Sokoto, Gwadabawa, Isa and Tambuwal.

Collection of Samples

Air and soil samples were randomly collected from the identified major refuse dump site areas within Sokoto metropolis using swab sticks. The open dump sites selected in themetropolis includes Sultan Bello Mosque site, Vegetables market, Sultan Attahiru Road, Ahmad Bello Way,yar iraki refuse dump site and Magajin gari Area. Similarly, petri dishes of nutrient agar medium and Potato Dextrox Agar (PDA) were exposed to Air at the dump site area of the metropolis.

Bacteriological Analysis of the Samples

For each swab samples following serial dilution, 0.1ml from 10^{-5} to 10^{-6} dilutions was taken using a sterile syringe and transferred onto the centre of prepared nutrient agar. It was spread all over the agar surface with sterile L-bend glass using spread method technique. The inoculated plates were labelled properly for easy identification and then incubated at 37^{o}C for 24 hours (Ogofure *et al.,* 2015). Similarly plate that were expose to air incubated at 37^{o}c for 24 hours. The colonies on each plate were counted; this was done to determine the bacterial concentration in a given sample from each area and to compare the amount of growth of bacteria under various condition as described by Onyeagba (2004).

Distinct colonies were sub-cultured, in accordance with method described by Fox (2011) onto appropriate selective and differential media including manitol salt agar medium (MSA) and Blood agar medium (BAM) incubated at 37^{o}c for 24 hours.

Identification / Characterization of Bacterial Isolates

The suspected colonies of bacterial isolates were stained and further identified using appropriate biochemical test. These tests include Catalase test, Methyl red, Voges-proskaeur test, Citrate utilization test, TSL and H_2S gas production as described by Oyeleke and Manga (2008) and Cheeesbrough (2000).

Fungal Analysis of the Samples

The method of Samson *et al.* (1995) was employed in the mycological analysis of the garden eggs sample.

One ml of each sample solution in a test tube containing $X10^{-3}$ was inoculated into PDA plates differently and then incubated for 72 hours at room temperature (25^0C). The plates were observed for colony morphology. Those PDA plates that show mixed growth were sub-cultured on to fresh PDA plates to obtain pure culture. Similarly plates of PDA medium expose to air were incubated for 72 hours at 25^oc. A small portion of each different fungal colony was singly placed in the centre of potato dextrose agar (PDA) plate and incubated at room temperature (25^0C) for 5- 7 days. The developing fungal colonies were sub-cultured repeatedly as described by Chiejina (2006) using sterile cork-borers to cut out 2mm disc from advancing region of the cultured colonies on fresh PDA plates until pure cultures of isolates were obtained.

The isolates were identified by comparing characteristics under microscope with diagrams in text book of mycological atlas. Identification were based on colonial appearance, pigment production and micro morphology of the spore produced in accordance with Bamett and Hunter, (1999) and Alexopoulous *et al.* (2002).

RESULTS

The result obtained from this study showed that bacterial species identified to be accumulated in air and refuse dump site in Sokoto Metropolis were: *Staphylococcus aureus*, *Bacillus lichenformis*, *Staphylococcus caprae*, *Bacillus mycoidis*, *Bacillus sphericus*, *Bacillus polymyxa*, *Bacillus megaterium* (see detail in Table 1).

Moreover, result obtained from this study indicated that the fungi recorded were: *Aspergillusniger*, Aspergillus *flavus*, *Aspergillusfumigatus*, *Rhizopusorizes*, *Aspergillusorizes.* (See detail in Table 2).

Similarly, the frequency of occurrence of bacterial pathogens were *Staphylococcus aureus*16 (16%), *Bacillus lichenformis* 44 (44%), *Staphylococcus caprae*16(16%) *Bacillus mycoidis* 4(4%), *Bacillus sphericus* 12(12%) and the least in occurrence were *Bacillus polymyxa* 4(4%), *Bacillus megaterium* 4(4%) respectively (Table 3).

The frequencies of occurrence of fungal pathogen recorded were: *Aspergillusniger*30(30%), *Aspergillusflavus* 18(18%), *Aspergillusfumigatus*, 16 (16%), *Rhizopusorizes* 21(21%) and the least prevalently occurred were*Aspergillusorizes* 15(15%).

Table 1: Distribution of Bacteria Positive for growth and their prevalence

Bacteria isolated n=100	No of samples positive	Percentage (%) Prevalence
Staphylococcus specie	32	32
Bacillus specie	68	68
TOTAL		100

Table 2: Distribution of Fungi Positive for Growth and their Prevalence

Fungal specie	No of positive	Percentage (%) prevalence
Aspergillus niger	30	30
Rhizopus orizes	21	21
Total	100	100

Table 3: Frequency of Occurrence of Identified Bacterial Isolates

Bacteria specie	No of positive	Percentage (%) Prevalence
Staphylococcus aureus	16	16
Staphylococcus caprae	44	44
Bacillus lichenformis	16	16
Bacillus mycoides	4	4
Bacillus spehricus	12	12
Bacillus polymyxa	4	4
Bacillus megaterium	4	4
Total	**25**	**100**

Table 4: Frequency of Occurrence of Identified Fungal Isolates

Fungal specie	No of positive	Percentage (%) prevalence
Aspergillus niger	30	30
Aspergillus flavus	18	18
Aspergillus fumigatus	16	16
Rhizopus orizes	21	21
Aspergillu sorizes	15	15
Total	**100**	**100**

DISCUSSION

The results obtained in this study correlates with that of Noah *et al*. (2008) in consonance, the results show that the mean total bacteria and fungi obtained from the dumpsite area were relatively higher with the bacterial pathogens obtained from the air having the highest concentration. The high load of bacteria and fungi which are the most prevalently pathogens n the dump site is associated with factors including diverse human activities in the area, identified to be rearing of animals, raising dust through walking and various farming practices, fermentation activities, uncontrolled disposal of solid wastes and sewage and indiscriminate in the dumpsites faeces disposal.

The high number of *Staphylococcus aureus* is an indication that the environment is hazardous and constitutes serious health risk and threat to both the waste workers and residents of the nearby community. This is in agreement with the report by Scarpino *et al*. (2010) who opined people close proximity to dumpsite is hazardous to human health and can cause serious odours emanating from the site, discomfort due to the odours, loss of sleep, possible allergic manifestations, respiratory difficulties and other ailments.

CONCLUSION

From this study, it can be concluded that the open dump system of waste disposal is indeed a potential environmental quality problem which takes the form of unsightedness, land and water pollution, reduces the quality of air by the emission of foul odours and different gases derived from the anaerobic decomposition as well as occasional burning. It also serves as a

potential source of air contamination and promotes the dispersion of bacterial pathogens to another sterile environment. These pathogens when suspended in air are of less importance but become a source of immediate concern when they settle on surfaces as they cause varying kinds of infectious diseases, respiratory diseases, cancer, and so on, that require specialist's care.

Government should encourage small and medium scale industries that convert these wastes into useful products and change the open system of waste disposal.

Generally, enlightenment of the populace especially those residing at the refuse dumpsites on the dangers of pollution and microbial contamination in the promotion of health is paramount and therefore should be encouraged

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