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Microbiological Assessment of Soil from Dumpsites in Oduduwa University Campus

Fakorede Cecilia Nireti*, Adeyemo Mariam Adetoun, Adeyemi Oluwaseun Abayomi

Department of Biological Science
Oduduwa University Ipetumodu, Osun State, Nigeria
E-mail: olaniretifakorede@yahoo.com
Corresponding author: C.N. Fakorede

ABSTRACT

Dumpsites are a prime source of environmental pollution that constitutes a habitat for vector and other nuisance organisms capable of transmitting or causing diseases. The aim of the research is to determine the dominant microorganisms present in soil from various dumpsites in Oduduwa University campus. A total of 8 soil samples labelled A-H, collected from four dumpsites and a control sample obtained from soil devoid of waste in the campus were serial diluted to investigate bacterial and fungal populations. Isolates obtained were identified and characterised using staining techniques and biochemical tests. Total bacterial count ranged from 1.23 x 10^6 cfu/g to 9.70 x 10^8 cfu/g with least bacterial count in sample A and highest in sample H. Fifteen Gram negative bacterial isolates and 43 isolates positive to Gram staining were obtained. The dominant bacteria were Staphylococcus aureus. A total of 49 fungal isolates were obtained with the dominant organism been Aspergillus spp. From experimental results, microbial load recovered from top soil from dumpsites is far higher than those obtained from control soil sample. Pathogenic microorganisms were discovered to be present in soil samples from various dumpsites.

Keywords: *Dumpsites, soil, pathogenic, heterotrophic count.*

INTRODUCTION

Waste (also referred to as rubbish, trash, refuse, garbage, or junk) can be described as unwanted or unusable materials [1]. The problems arising from waste disposal methods all over the world have continued to grow with human advancement and there is no method of waste disposal worthy to be labelled as completely safe. Areas or lands where wastes or refuses are deposited are referred to as dumpsites [2], and it is a common practice in Nigeria to allow these sites pile up with wastes until they are taken away by respective waste management agents after some time. Therefore, runoffs from these sites heavily contaminate the surrounding water bodies and the leachates pollute the soil and seep into and contaminate underground waters which are major source of water for household and food industries. Microorganisms are capable of breaking down the degradable organic constituents of dumped waste and utilize them as source of nutrients hence; dumpsite soil is a home to viable microorganisms including those that are etiological agents of infectious human and animal diseases. A significant number of microorganisms in the soil form dumpsites are pathogenic [3]. Comprehensive long-term monitoring according to Kalwasinska *et al.* [4], is required for acquiring adequate knowledge of the influence of dumpsites on the environment, human and soil health and

its importance cannot be overemphasized, particularly due to the re-use of reclaimed dumpsites for recreational purposes. Studies have shown that some microbes (bacterial indicators) of public health significance can persist in dumpsites [5]. Hence, this study hopes to provide research-based information to contribute to the information on the identity, abundance and distribution of microorganisms in dumpsite soils.

MATERIALS AND METHOD

Sample area:

Soil samples were collected from dumpsites located behind two hostels and staff quarters within the premises of Oduduwa University campus located on the latitude and longitude coordinates 9.0820 °N, 8.6753 °E in Ipetumodu, Ile-Ife, Osun state, South West Nigeria.

Sample collection:

The top soil sample was collected at a depth of 2 - 20 cm with the aid of a sterile spoon. Prior to sampling, the surface debris of the soils were removed. At each boring, about 100 g of the respective soils were obtained and the soils were collected into sterile containers in duplicates and labelled. Soil sample from site without dumps was obtained to serve as control.

Total heterotrophic bacterial count:

A weight of 1 g of soil samples were weighed and dissolved into 9 ml of distilled water diluents under Aseptic conditions. Serial fold dilutions were then made up to 10^{-4} and aliquots of each dilution were cultured on plates of autoclaved Nutrient Agar (NA) for mean heterotrophic bacterial count by pour plate method. Plating was done in duplicates and the culture plates were swirled, allowed to solidify and incubated at 37°C for 72 h for the mean heterotrophic bacterial counts.

Identification and characterization of bacterial isolates:

Bacterial colonies were sub-cultured on freshly prepared nutrient agar plates and incubated at 35°C for 24 h to obtain pure cultures. The colonial characteristics of the sub-cultured bacterial colonies were recorded. The bacterial isolates were further identified by gram staining and biochemical characterization tests such as catalase, coagulase, indole, oxidase, methyl-red, Voges-Proskauer, and citrate utilization.

Total fungal population:

A weight of 1 g of soil samples were weighed and dissolved into 9 ml of distilled water diluents under aseptic conditions. Serial fold dilutions were then made up to 10^{-4} and aliquots of each dilution were cultured on plates of autoclaved Sabouraud Dextrose Agar (SDA) for mean fungal count by pour plate method. Plating was done in duplicates and the culture plates were swirled, allowed to solidify and incubated at ambient room temperature for 72 h to obtain mean fungal count.

Fungal isolation and identification

Fungal colonies were sub-cultured on freshly prepared Savoured dextrose agar plates. The sub-cultured fungal isolates were identified on the basis of their morphological and microscopic features. Their microscopic attributes were examined using the wet mount technique. Both Methylene blue and distilled water

were used respectively as mount ants. The microscopic structures observed were recorded and compared.

RESULTS

The control soil sample had bacterial and fungal counts of 1.9×10^4 cfu/g and 1.3×10^3 cfu/g. Table 2 shows the total fungal count which ranged from 3.22×10^4 cfu/g to 5.13×10^6 cfu/g. A total of fifty-eight bacteria were isolated; fifteen were Gram negative and forty-three were Gram positive. Of the 58 bacteria isolated, 2 (3.45%) were *Klebsiella* sp., 15 (25.86%) were *Staphylococcus aureus,* 2 (3.45%) *Citrobacter* sp., 11 (18.97%) were *Streptococcus* sp., 5 (8.62%) were *Enterococcus* sp., 8 (13.79%) were *Staphylococcus epidermidis,* 3 (5.17%) were *Escherichia coli,* 1 (1.72%) was *Pseudomonas* sp., 2 (3.45%) were *Salmonella* sp., 2 (3.45%) were *Neisseria* sp., 1 (1.72%) was *Shigella* sp., 1 (1.72%) was *Vibrio cholerae,* 1 (1.72%) was *Campylobacter* sp., 1 (1.72%) was *Mycobacterium* sp., 3 (5.17%) were *Enterobacter* sp. A total of forty-nine (49) fungi isolates were obtained, of which 11 (22.45%) were confirmed to be *Aspergillus* sp., 4 (8.16%) were *Microsporium* sp., 4 (8.16%) were *Penicillum* sp., 5 (10.20%) were *Trichophyton* sp., 2 (4.08%) were *Pullaria* sp., 1 (2.04%) was *Gliocladium* sp., 4 (8.16%) were *Mucor* sp., 1 (2.04%) was *Entamophythorales,* 2 (4.08%) were *Phialospora* sp., 2(4.08%) were *Trichoderma* sp., 1 (2.04%) was *Trichosporonmucoides,* 3 (6.12%) were *Geotrichumcandidum,* 3 (6.12%) were *Absidia,* 1 (2.04%) was *Cladosporium,* 3 (6.12%) were *Scopulariosis,* 2 (4.08%) were *Saccharomyces* sp.

Table 1: Total heterotrophic bacteria count of soil samples

Samples	Heterotrophic bacteria count (cfu/g)
A	1.23×10^6
B	3.5×10^7
C	5.5×10^8
D	4.1×10^8
E	7.6×10^7
F	1.80×10^8
G	5.21×10^8
H	9.7×10^8

Table 2: Total fungal count

Sample	Fungal count (cfu/g)
A	3.22×10^4
B	1.40×10^5
C	5.13×10^6
D	3.57×10^6
E	2.23×10^4
F	3.53×10^6
G	4.21×10^6
H	5.10×10^6

DISCUSSION

Isolation of bacteria species *Escherichia coli, Klebsiella* spp*, Pseudomonas* spp*, Staphylococcus aureus* and *Streptococcus* spp*,* and fungi isolates *Aspergillus niger, Mucor* spp*, Penicilluim* spp and *Saccharomyces* spp corresponds with the report of [6]*,* who also reported these isolates were present in soil from dumpsites. This according to [6] is an indication that microorganisms are not only ubiquitous in nature, but also populates the soil hence, increased nutritional value of soil. The majority of the isolated bacteria and fungi species are pathogenic and have been shown to be etiological agent of man and animal This agrees with [11]*,* who stated that the quantity and quality of nutrients available in the soil determines the total microbial count in such location.

CONCLUSION

The presence of coliforms particularly indicator organisms and the abundance of Mycotoxin-producing fungi indicate the poor health condition of dumpsite soils. This could pose serious risks to the health of people living close to these sites. Persons and authorities in charge of waste diseases. Fungi, especially *Aspergillus* spp secrete mycotoxins that are poisonous to health when contacted [7]. The potentially pathogenic bacteria agents isolated in this study is in agreement with the studies of [8] and [9]. The presence of *E. coli* and *Enterococcus sp* in the dumpsite soils indicated that human and animal faecal wastes were dispersed with the refuse. This is capable of causing outbreak of food and water borne diseases such as typhoid, diarrhoea and gastroenteritis [10]. The difference in microbial counts observed in the control sample and the dumpsite soils and may be attributed to a difference in nutrient concentration.

management must develop more integrated and effective strategies which are essential to achieving and maintaining an improved environmental health.

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