

Full Length Research Paper

Environment health hazard assessment of municipal wastes in Ilorin metropolis

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Air samples of the immediate environment of two government refuse dump receptacles in Ilorin metropolis were analysed. Key informant interviews using structured questionnaires were administered to nearby traders in the immediate environment of the refuse dump receptacles to ascertain the types of waste dumped in the receptacles, time waste accumulates before being emptied and recommendations on waste disposal. The samples were analysed and eight bacteria and nine fungi were isolated. The bacteria were *Staphylococcus aureus*, *Proteus vulgaris*, *Micrococcus sp*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, *Bacillus sp*, *Escherichia coli* and *Enterobacter aerogenes*. The isolated fungi were *Cephalosporium sp*, *Geotrichum candidum*, *Mucor mucedo*, *Fusarium sp*, *Rhizopus stolonifer*, *Penicillium italicum*, *Cladosporium sp*, *Aspergillus niger* and *Aspergillus flavus*. The presence of *Pseudomonas aeruginosa*, *Escherichia coli* and *Aspergillus flavus* were determined to indicate a potential health hazard to the environment.

Keywords: Municipal wastes, hazard, assessment, environment, Ilorin metropolis.

INTRODUCTION

In recent years there has been a remarkable growth of interest in environmental issues in sustainability and the better management of development in harmony with the environment. Associated with this growth of interest has been the introduction of new legislation that seeks to influence the relationship between development and the environment. Environmental impact assessment (EIA) is an important example (Glasson *et al.*, 1999). The number and types of microorganisms contaminating the air are determined by the source of contamination. For example, organisms are sprayed by coughing and sneezing from the human respiratory tract and dust particles are circulated by air current from the earth's surface. Suspended outdoor air contains pathogens. The tiny microbial propagule may be subjected to dessication, the damaging effects of radiant energy from the sun and the chemical activity of elemental gaseous oxygen to which it will be ultimately exposed (Adams and Moss, 1999).

The greatest environmental problem in Nigeria is air

pollution (Mike-Pearse, 2002). Nigeria faces increasing environmental problems due to urbanization. Population pressure has resulted in a shortage of agricultural land and employment opportunities in the rural areas, which has led to increased rural-urban migration. Dealing with environmental cost of rapid growth and urbanization represents a phenomenal challenge. This is especially so in the area of solid waste management. While cities are generating an ever increasing volume of garbage, the effectiveness of their solid waste collection and disposal system is diminishing. In the urban centres throughout Nigeria, less than half of the solid waste produced is collected. It is either indiscriminately thrown away at various dumping sites on the periphery of urban centres, or at a number of so called temporary sites-typically empty lots scattered throughout the cities. These open dump sites often have serious environmental impacts that extend beyond their boundaries, polluting nearby water sources and serving as breeding grounds for disease bearing rodents and insects (Osuntogun, 2001).

Munn, (1979) defined Environmental Impact Assessment (EIA) as the need to identify and predict the impact on the biogeophysical environment and man's health and well being. The presence of pathogens

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Plate 1: A refuse dump receptacle filled with refuse.

creates a significant hazard in the environment especially where the refuse dump receptacles are located in a trading or residential neighbourhood.

The objectives of this study are to examine air samples of different refuse dump receptacles and analyse them for the presence of pathogenic microorganisms and audit the public health implications.

MATERIALS AND METHODS

Sampling sites

Two (2) government refuse dump receptacles located within Ilorin metropolis were used for this study. The receptacles were hexagonal in shape, covered such that it has to be opened via either side when waste is to be dropped inside. They were both located in close proximity to trading shops and residential houses.

Administration of Questionnaires

Questionnaires were administered on nearby traders to ascertain first hand property of the refuse dump receptacles. A sample of the questionnaire used is included in Appendix 1.

Sample Collection

Air samples were collected using the settling plate technique. Sterile nutrient agar (NA) and potato dextrose agar (PDA) plates with 10% tartaric acid were exposed at the refuse dump receptacles for 10 minutes and taken back to the laboratory for both bacterial isolation using NA and fungal isolation using PDA with 10% tartaric acid.

The NA plates were incubated at 37°C for 1 day, while the PDA plates were incubated at 25°C for 2-5 days.

Microbial Identification.

Isolated bacteria were subcultured until pure cultures were obtained and identified based on their colonial, cellular morphology and biochemical characteristics. The isolates were identified using the Bergey's manual (Buchanan and Gibbons, 1974). Isolated fungi were identified on the basis of their cultural and morphological characteristics. They were identified with reference to Alexopoulos (1979) and Campbell and Stewart (1980).

RESULTS AND DISCUSSION

Plate 1 shows one of the refuse dump receptacles with refuse. Figure 1 is a pie chart showing the effect of the refuse dump receptacles on the immediate environment. Bad odour (33%), flies (33%), rats (20%) and insects (14%). Refuse is seen by the ordinary man as only a nuisance or an eyesore. A microbiologist sees refuse as a concentrated source of infectious agents especially those whose portal of entry is the mouth. It also offers an attractive rendezvous for arthropods, pests and rodents e.g. the common housefly which can rapidly transfer mechanically infective doses of enteric pathogens from domestic solid waste and deposit them in kitchens or food stores. Some of the pests infecting domestic solid waste also cross contaminate other pests that take their food from the same refuse thereby increasing the number of vector organisms. The most important relationship between domestic solid waste, pest and the home ensure that pathogenic organisms reach the home from the environment through pests thereby causing various

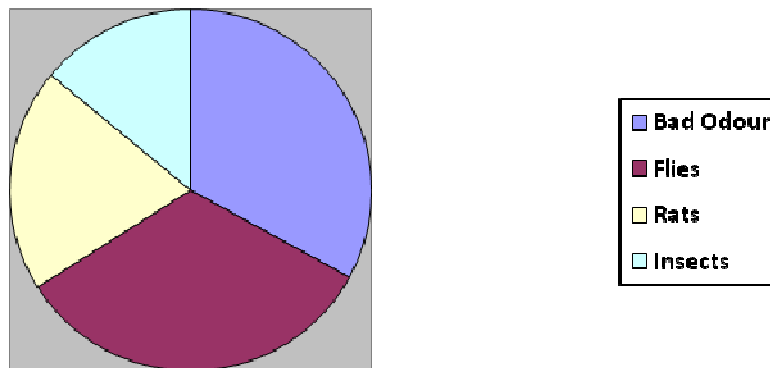


Figure 1: Pie chart showing the effect of the refuse dump receptacles on the immediate environment

Table 1: Some of the items deposited in the refuse dumps.

S/N	ITEMS	A	B	C	D	E	F	%
a.	Food materials	+	+	+	+	+	+	100
b.	Old clothes	+	+	+	+	+	+	100
c.	Paper	+	+	+	+	+	+	100
d.	Plastic	+	+	+	+	+	+	100
e.	Polythene bags	+	+	+	+	+	+	100
f.	Chemicals	-	-	-	-	-	-	0
g.	Mats	+	+	+	+	+	+	100
h.	Mattress	+	+	+	+	+	-	83
i.	Empty cans	+	+	+	+	+	+	100
j.	Furniture	+	-	+	-	+	-	50
k.	Metals	-	-	-	+	+	+	50
l.	Glass	+	-	+	+	+	+	83
m.	Cartons	+	+	+	+	+	+	100
n.	Leaves	+	+	+	+	+	+	100
o.	Tree branches	-	+	-	+	+	-	50

Key: + = Present; - = Absent; A - F = Respondents; % = Percentage.

diseases of man such as typhoid fever, cholera, bronchitis and other respiratory tract infections. (Mannaham, 1993).

Table 1 shows some of the items deposited in the refuse dump receptacles. Food materials (100%), Old clothes (100%), paper (100%), Plastic (100%), Polythene bags (100%), Chemicals (0%), Mats (100%), Mattress (83%), Empty cans (100%), Furniture (50%), Metals (50%), Glass (83%), Cartons (100%), Leaves (100%) and Tree branches (50%). According to Omojasola *et al.*, (2009), pathogens in wastes may enter the human body via wounds present on the skin. Sharp waste is particularly hazardous as it may deposit highly virulent and contagious pathogens in the subcutaneous layers of the skin if improperly disposed. Pathogens resistant to antibiotics and chemical disinfectants may also contribute to the hazards of poorly managed waste.

Staphylococcus aureus, *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterobacter aerogenes* and *Aspergillus flavus* where isolated from the refuse receptacles (table 2). These organisms are known pathogens (Nester *et al.*, 1996). The isolated *Micrococcus sp* might be present in milk products containing the organism dropped in the refuse dumps. It might also have originated from the skin of dead goats and dogs thrown into the refuse dumps. The skin is normally an effective barrier to pathogens, but skin may be broken, e.g. by wounding, surgery or the 'bites' of insects etc. Wounds may admit any variety of potential pathogens capable of causing systemic disease or localized disease (Singleton, 1997).

Staphylococcus aureus, *Staphylococcus saprophyticus*, *Proteus vulgaris*, *Escherichia coli* and *Pseudomonas aeruginosa* are opportunistic pathogens. Their presence

Table 2: Microorganisms isolated from the refuse dumps.

Microorganisms	A	B	C	D	E	F	G	H	I	J
<i>Staphylococcus aureus</i>	+	-	+	+	+	+	-	+	+	+
<i>Proteus vulgaris</i>	+	+	+	+	+	+	-	+	+	+
<i>Micrococcus sp</i>	+	+	+	+	-	+	+	-	+	+
<i>Staphylococcus epidermidis</i>	+	+	-	+	-	+	+	-	-	-
<i>Pseudomonas aeruginosa</i>	+	+	-	+	+	+	+	-	-	-
<i>Bacillus sp</i>	+	+	+	-	+	+	-	+	+	+
<i>Escherichia coli</i>	-	-	+	+	-	+	-	-	+	+
<i>Enterobacter aerogenes</i>	-	+	+	+	+	-	+	+	+	+
<i>Cephalosporium sp</i>	+	-	-	+	-	+	-	-	+	+
<i>Geotrichum candidum</i>	+	+	+	+	-	+	-	+	+	-
<i>Mucor mucedo</i>	+	-	+	+	+	+	-	+	+	+
<i>Fusarium sp</i>	+	+	+	+	+	+	-	+	-	+
<i>Rhizopus stolonifer</i>	+	-	-	+	-	+	+	-	+	+
<i>Penicillium italicum</i>	+	-	+	-	+	+	+	-	-	+
<i>Cladosporium sp</i>	+	+	+	+	+	-	-	-	+	+
<i>Aspergillus niger</i>	+	+	+	+	+	-	+	+	-	-
<i>Aspergillus flavus</i>	-	-	+	+	+	-	-	-	+	+

Key: + = Present; - = Absent; A - E= 5 weeks in refuse dump 1 ; F-J= 5 weeks in refuse dump 2.

in the environment of the refuse receptacles poses a significant health hazard. Akande (1999) reported *Staphylococci*, *Pseudomonas aeruginosa*, *Klebsiella*, *Escherichia coli* and *Proteus vulgaris* as pathogenic bacteria commonly isolated from waste. The presence of *Escherichia coli* is an indicator of faecal pollution (Prescott *et al.*, 2008). *Escherichia coli* and *Enterobacter aerogenes* cause urinary tract infections in compromised hosts (Baron and Finegold, 1990).

Nester *et al.*, (1996) reported that diseases can be transmitted by air and pathogens, particularly those that infect the gastro urinary tract can be transmitted through contaminated food or water. Hence, it is necessary to properly handle and dispose the waste in the refuse dumps. This is essential so that people in the immediate or distant environment from the refuse dumps will be free from infections.

The state government had really tried in ensuring that the state is clean. The government had placed several moveable refuse dump receptacles in divers locations in the state. The movable refuse dump receptacles are very good for proper refuse disposal in the state. However, with reference to the organisms isolated in this study, the refuse dump receptacles could be located away from houses and shops. The refuse dump receptacles have covers, but they are not covered most times. Some of the receptacles have also lost their covers. There should be timely emptying of the refuse so as to prevent overflows. There is the need for proper public enlightenment on the proper use of the dustbins. This study is supported by the results of Ali (1991 and 1992) who reported the importance of proper training programmes for proper

waste disposal. More of the refuse receptacles should also be made available in areas where they are presently not available.

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APPENDIX 1**University of Ilorin, department of microbiology****questionnaire**

Dear Sir/Madam,

You have been chosen to be part of a study on the air micro flora of the immediate environment of public refuse dumps in Ilorin metropolis. All information given will be treated with strict confidentiality.

Thank you for your assistance and co-operation.

1. Since when have you been trading around this refuse dump?-----
2. When exactly did this public refuse dump get to this area?-----
3. Is the refuse in the dump emptied regularly?-----
4. Does the refuse begin to overflow before it is emptied?-----
5. Please indicate by ticking (x) in any of these as effects of the refuse dump here.
 (a) Bad odour (b) Flies (c) Insects (d) Rats(e) Sickness (f) Disease
 (g) Others (Please Specify) -----
- (6) Do you think the location of this refuse dump is good?-----
- (7) If no, which other location can you advise the government to move it to?-----
- (8) Do you know where the refuse is being disposed of after the refuse dump is filled up?-----
- (9) What advise can you give to the government in connection with the dumps spread all over the state?-----

- (10) Please indicate by ticking (x) in any of these items as waste dumped in this site.
 (a)Food material (). (b)Clothes (). (c)Paper (). (d)Plastic (). (e)Polythene bags ().
 (f)Chemicals (). (g)Mats (). (h)Mattress (foam) (). (i)Furniture (). (j)Metals (). (k)Glass (). (l)Cartons (). (m)Leaves ().
 (n)Tree branches (). (o)Others-----
- (11) Before this refuse dump was placed here where do people dump their waste?-----

Thank you very much for your co-operation.