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DETERMINATION OF SOME ELEMENTAL COMPOSITIONS IN SOME SELECTED SOIL FROM DUMP SITE WITHIN GOMBE METROPOLIS

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Abstract

The purpose of the study was to assess the levels of heavy metals and a few physicochemical characteristics in soil collected from dumpsites in the Gombe metropolitan area. The following five distinct dumpsites locations in Gombe town from which five soil samples are taken: Bomala bye pass, Herwagana, Nassarawo (BCGA), and INEX area close to FCE (T) Gombe. The control was FCE (T) Gombe, which is located in the Gombe metropolitan. Atomic absorption spectrophotometer analysis (AAS) was performed on the collected samples after they were digested using concentrated hydrochloric and nitric acids in a 1:3 ratio. The heavy metals Ni, Cu, Cr, Cd, As, and Pb have all been analyzed. While Na, K, Ca, and Mg are the non-heavy metals. According to the results, Pb is the highest value in A1, Cd is the lowest, and Pb is 1.580 mg/Kg. In A2, Pb is 2.106 mg/Kg, and As is 0.062 mg/Kg. In A3, Pb is 1.226 mg/Kg, and As is 0.080 mg/Kg. In A4, Pb is 0.716 mg/Kg, and in As 0.038 mg/Kg is the lowest. In the control, A5, Ni (0.220 mg/Kg) is the highest and Cd is 0.006 mg/Kg is the lowest. The control does not notice the As. For non-heavy metals, Mg

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(10.823mg/Kg) is highest and K 1.850mg/kg is lowest in A1, Mg 8.483mg/Kg is highest while K (3.196mg/Kg) is lowest in A2, Mg (16.670mg/Kg) is highest and Ca (2.120mg/Kg) is the lowest.The results of the study do not indicate any serious pollution or contamination risk.

INTRODUCTION

Dumpsite is a designated place for dumping of refuse (solid waste) while places that accumulates high amount of solid waste are refers to as refuse dumps (Awokunmi, et al., 2010).Heavy metals are those elements that has high relative atomic mass and the term is used to describe transition elements of the type Cu,Pb, As, Hg, Zn, Cd, Fe, Cr etc(Solomon, 2019).Heavy metals are defined according to soil chemistry as special group of elements that exert toxic effect on plant upon their high concentrationin the soil (Vodyanitskii, 2016). Heavy metals are among the common contaminants found in dumpsite soil, and when these contaminated soil are used for agricultural purposes, they may lead to the accumulation of heavy metals either by physical or chemical interaction between the contaminated soil and the cultivated crop plant (Anhwange and Asamave, 2012).Heavy metals have become a major sources of global problem because they pose a multi-dimensional negative effects on living organisms (Uwah et., al 2011). The usual pollutant from dumpsites are heavy metals and hence the contamination of cultivated crops with dumpsites soil is of greater concern for all humans (Anhwange, 2012). Most of these heavy metals goes in to the dumpsites as a result of disposing and burning of refuses that contained high proportion of these toxic metals(Ali et al., 2005). In order to curtail the problems associated with solid waste generation and other related problems, the Federal Government of Nigeria has promulgated various laws and regulations to safeguard the environment. According to the Federal Environmental Protection Agency Act(FEPA 1991), each state and local Government in the country should set up its own environmental protection body within its jurisdiction. Like many other towns, the people of Gombe town are not left behind in the use of dumpsite soil as manure/fertilizer in their farmlands for agricultural purposes, hence the need to access the level of heavy metals in the dumpsite soil of Gombe town.

Statement of the problem

The study examined the presence of heavy metals and the physicochemical parameters in soil from dumpsites in some selected locations in Gombe metropolis. Many heaps of waste dumps are patronized by local farmers in Gombe and Nigeria at large because of the fertility they contain. Although these soils are fertile, they are as well as dangerous to human and animals due to their constituents. Lack of adequate knowledge by these

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farmers, lack of money for fertilizer as well as lack of awareness has contributed to the ignorant continuous use of these solid wastes in farm lands by farmer. A standardized analysis for these heavy metals is well researched on and has good pretty validity and reliability as the waste dumps are selected at random from across the metropolitan council.

Objectives of the study

The objectives of this study are aimed at achieving the purposes as stated below:

- Determine some heavy metals in some selected soils from dumpsites within Gombe metropolis.
- Determine some physicochemical parameters of the soil from these dumpsites.
- Compare the concentrations of these heavy metals with approved national and international standards.

MATERIALS AND METHOD

Samples Collection

4 samples were collected from 4 selected sites and the samples were measured. The temperature was measured and recorded at the sampling locations. The dumpsites were cleared both north, south, east, west and even middle of the dumpsites up to 3-4 cm and the samples taken from five (4) different points, mixed and put into the clean polyethene containers.

The samples were kept at room temperature to dry, and were screened to remove lager object such as stones, plastics, grass fragments wooded etc. The sieved samples were further ground to finer particles and kept for analysis in the laboratory.

Sample Preparation

Sample were mixed frequently to expose fresh surface to dryness. The sample were mixed, grinded after drying and sieved through a 2mm mesh sieve and the coarse particle discarded. The powdered form was then stored for digestion and subsequent analysis.

Samples Digestion

From the sieved materials, 1g of each of the 4 samples were weighted into five 250ml volumetric flasks. To each of the volumetric flasks, 30ml of concentrated nitric acid and 10ml of hydrochloric acid were added and swirled to ensure that the sample were wetted by the acid. The volumetric flasks were covered and were allowed to stand in a fume board for 10-15 minutes. The flasks were then placed on a heating mantle and were digested for 30 minutes. They were then allowed to cool at room temperature and 50ml

of de-ionize water was added and mixed thoroughly. The solution was filtered through wattman number one (1) filter paper into 500ml conical flask. The filtrate was made up to 150ml with de-ionize water.

The extract were then taken for subsequent analysis of heavy metals (Chen and Ma, 2001)

Method of Sample Analysis

Atomic absorption spectrophotometer (AAS), was used for the sample analysis.

RESULTS AND DISCUSSION

Elemental Compositions in Soil

Table 1 Shows the results of some elemental Compositions in soil samples from selected dumpsites in Gombe metropolis

Samples	Ni (mg/kg)	Cu (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	As (mg/kg)	Pb (mg/kg)
A1	0.837±0.0194	0.147±0.0042	0.509±0.0006	0.093±0.0032	0.127±0.0040	1.580±0.2081
A2	0.541±0.0056	0.236±0.0029	0.424±0.0026	0.075±0.0010	0.062±0.0030	2.106±0.0058
A3	0.230±0.0025	0.167±0.0055	0.536±0.0062	0.142±0.0032	0.080±0.0031	1.226±0.0321
A4	0.452±0.0075	0.306±0.0045	0.544±0.0111	0.063±0.0026	0.038±0.0031	0.716±0.0153
Control	0.220±0.0040	0.057±0.0021	0.014±0.0012	0.006±0.0012	BDL	0.022±0.0035

The concentration of elemental composition in the soils of the dumpsite investigated, which are most exposed to anthropogenic impact, varied in the following ranges Pb>Ni>Cr>Cu>Cd>As.

Results of elemental composition in soil samples from selected dumpsites in Gombe metropolis were presented in above table. All concentrations are recorded on a dry weight basis (mg/kg dry wt.). However, arsenic (As) is not detected in the control sample. It was found that the concentrations of heavy metals in soil samples were below the maximum limits set by WHO (2008).

Table 2. Trace Element in soil samples from selected dumpsites in Gombe metropolis

Samples	Na (mg/kg)	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)
A1	3.380± 0.031	1.850± 0.030	4.630± 0.095	10.823± 0.597
A2	5.480 ± 0.165	3.196± 0.035	7.313± 0.065	8.483± 0.129
A3	5.256± 0.040	2.730± 0.056	2.120± 0.026	16.67± 0.373
A4	2.923± 0.021	1.280± 0.044	3.536± 0.047	9.710± 0.420
Control	3.606± 0.051	2.238± 0.006	2.82± 0.110	5.452± 0.140

Physicochemical parameters were analysed in the soil samples. The results were presented in the form of tables and figure charts. All parameters with the mean value of

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the data with standard error were calculated. The parameters analysed from the soil samples includes; Ca, Mg, K and Na. The soil quality parameters analysed are within the threshold of the Standard Organization of Nigeria (SON).

Table 3 Results of the pH Analysis

Locations	p^H
A1	**7.61**
A2	**7.86**
A3	**7.77**
A4	**7.75**
Control	**7.56**

The pH of the samples was found to be slightly basic laying between 7.56 and 7.86. This goes to say that the metals will be in a basic medium and are likely to form a basic compound.

CONCLUSION

The soils in Gombe metropolis, Gombe state showed accumulated concentrations of the six heavy metals Arsenic (As), Cadmium (Cd), Chromium (Cr), Manganese (Mn), Copper (Cu), Nickel (Ni) and Lead (Pb) are below the maximum limits. These anomalous concentrations may be as a result of anthropogenic activities, including smelting procedures, chemical and metallurgical processes, and the indiscriminate industrial waste disposal on the unprotected soil. The concentration of all studied parameter was below the maximum permissible limits for agricultural soil set by WHO/FAO 2001.

RECOMMENDATIONS

Based on the findings from this research work, it is recommended that:

- Other methods of analysis of metals in soil should be adopted for the same samples;
- Research work should be carried out to study the accumulation of heavy metals in the crops in the metropolis.

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