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ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES OF SOIL FROM THE DUMPSITES OF KAFANCHAN, KADUNA STATE, NIGERIA.

D. K, Wunzani[1]*,M. S, Dauda[2*],F .W, Abdulrahman[2*]A, Bawa[1]*

D.A. A, David[1]*

1* Department of Applied Science, Kaduna State College of Nursing and Midwifery, Kafanchan Campus, Kaduna State, Nigeria. Corresponding author: wunzanidams@gmail.Com GSM; 08026877400.

2* Department of Chemistry University of Abuja, FCT, Abuja, Nigeria.

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Abstract:

Assessment of physico-chemical properties of soil from solid waste dumpsites in Kafanchan metropolis of Kaduna state, Nigeria was carried out. Representative samples of the solid wastes were collected from three selected dumpsites in Kafanchan metropolis respectively. Control samples were obtained from Government Reserved Area land at about 200m away from the dumpsites, using standard sampling methods. Physical and chemical properties of these samples were assessed after extraction. Classical and Atomic Absorption Spectrophotometric methods were used for the analysis. Results obtained were subjected to statistical analysis for the range, mean, standard deviation and Variance using Analysis of variance (ANOVA) and its shows that, the concentration of most of the parameters were significantly different within the dumpsites. The comparison of the results of the dumpsites and control, shows that, most of the parameters from the dumpsites were higher than that of the control site. Therefore, the soil from the dumpsites are rich with plants micronutrients and macronutrients. Thus, the dumps from the dumpsites can be used as compost for soil amendment.

Keywords: Assessment, Physico-chemical, Properties, Solidwaste, Dumpsites, Micronutrient, Macronutrient& Compost.

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INTRODUCTION:

In most cities of developing countries, migration of rural population in search of better livelihood, resulted to the rapid growth of population.This heightened the usage of consumer's products and manufacturing process and thus, led to generation of large quantity of solid wastes in these cities. Solid wastes contain all source of unsorted wastes such as commercial, refuse, construction and demolition debris, garbage, electronic waste etc., which are dumped indiscriminately [1].

Monohara&Belagali, [2] observed that, compost of these solid wastes contain a considerable variety of micro and macro nutrients as well as relatively stable source of organic matter essential for plant growth. Prabha&Priya, [3 state that, recycling biodegradable waste have high content of macro- nutrients like nitrogen, phosphorous, potassium, calcium, magnesium and other micro-nutrients such as iron, zinc, copper and manganese, which play a major roles in solid waste management and soil amendment. Agriculture application of municipal solid wastes (MSW) as natural source for plant and soil conditions is the most cost effective option because of its advantages over the tradition method of land fill or incineration [4].

Amadi et al., [5]. Observed that, soils are easily obtained from dumpsites and are used for planting of vegetables and food crops. Also observed by Nwachukwu et al.,[6] was that, in developing countries, sites previously used as dumpsites are often converted to farmland.

There is significant variation of the physical and chemical properties content of the soil within the dumpsites and this was suggested that, the sites of the dumpsite, economic activities of the people within the dumpsites are some of the contributory factors to these variations [4].

In Kafanchan metropolis of Kaduna state Nigeria, the researcher observed that there are indiscriminatedumping of solid wastes in the dumpsites with varieties of solid wastes ranges from metal scraps, leathers, plastic woods ceramics etc. These solid wastes are compost by farmers to be used as manures while some dumpsites are directly used as farmland for crops cultivation. Thus the researcher was not certain on the extent of which these solid waste contribute to the enrichment of the soil with the micro and macronutrient or affect the soil physico- chemical properties of the soil within the dumpsites.Hence, the aim of the research work was to assess the physico chemical properties of the soil from the solid waste dumpsites in Kafanchan metropolisof Kaduna state,Nigeria.

MATERIAS AND METHODS

Sampling sites

Kafanchan is a town in southern Kaduna state in north central Nigeria. It is located at 9.58 latitude and 8.29 longitude and situated at 733meters above sea level with a population of 79,522. It is a location of junction state of Nigeria railway[7]. The three dumpsites, were selected withinKafanchan metropolis.

Sample Collection and Sample Preparation

Soil samples were collected from different parts of the selected dumpsites, with the aid of a stainless steel sampler. The quadrate crate sampling method was used[8]. The samples were pooled together and homogenized to obtain the composite samples. The control soil samples were also, collected from Government reserved area away from the dumpsites. The samples were placed into appropriately labeled polyethene bags and taken to the Federal Ministry of Agriculture soil laboratory complex, Kaduna in Kaduna state for preparation and analysis.

Methods

Soil particle size (Clay, Silt and Sand), pH, and Electric Conductivity (EC)were determined using Hydrometer method, pH meter using soil to water ratio solution of (w/v) 1:2 after calibration with buffer and digital conductivity using soil to water suspension (ratio w/v 1:2) respectively[9], [10]While, Walkley and Black rapid titration, Kjeldahl distillation and Bray and Kurz-1 and Olsen methods were used to determine Organic Carbon & Organic Matter, Total Nitrogen and Available phosphorous respectively [11]. Cation Exchange Capacity (CEC) was determination using soil extract of Ammonium acetate from which the K & Na and Ca&Mg were determined by Flame Photometer and Atomic Absorption Spectrophotometer (AAS) respectively. [4], [12]. (Fe, Zn, Cu&Mn) determination, 10g of each of the air dried sample was extracted using 50ml of0.1M HCl[11]. Metals concentration were determined using Atomic Absorption Spectrophotometer(AAS) Pg990.

All samples were analyzed in the maximum analytical replication measurement in triplicate. Glass ware were properly cleaned, the reagents used were of analytical grade and double distilled water was used throughout the studies. The standard solutions were prepares according to the specified guides [13]. The assurance program were further conducted by carrying out % recovery study and blank analysis. The result

obtained was subjected tostatistical analysis for range, mean, standard deviation and variance using fixed model analysis of variance (ANOVA).

RESULTS AND DISCUSION

Table 1: Physico chemical properties and trace metals content of soil from solid waste dumpsites

properties	D1	D2	D3	Range	Mean	P>0.00(F)
pH	7.41	8.10	7.76	7.41 – 8.10	7.76±1.13	0.06
EC. dSm-1	0.869	2.737	1.878	0.869 – 2.737	1.828±0.94	0.87
Sand %	86.85	87.40	86.79	86.85 – 87.40	87.01±0.34	0.33
Silt ,,	12.99	11.91	11.20	11.20 – 12.99	12.03±0.57	13.25
Clay ,,	0.16	0.69	2.01	0.16 – 2.01	0.96±0.95	71.71
Organic Carbon ,,	5.076	4.590	5.813	4.590 – 5.590	5.160±0.62	2.65
Organic Matter ,,	8.801	7.921	10.085	7.921 – 10.085	8.936±1.09	1.68
Total Nitrogen ,,	0.311	0.324	0.264	0.264 - 0.324	0.300±0.04	0.10
Available Phosp,''	0.836	1.433	1.091	0.836 – 1.433	1.120±0.30	0.98
Na. Meq/100g	2.642	3.062	2.331	2.331 – 3.062	2.678±0.37	4.98
K ,,	1.206	0.384	1.313	0.384 – 1.313	0.968±0.51	23.02
Mg ,,	0.402	0.383	0.434	0.383 – 0.434	0.406±0.003	0.07
Ca ,,	2.265	2.571	1.888	1.888 – 2.571	2.241±0.34	111.48
CEC ,,	6.517	6.401	5.966	5.966 – 6.517	6.294±0.29	1.70

Fe	mg/Kg	24.93	24.34	24.64	24.34-24.93	24.64±0.42	0.00
Mn	‘’	79.84	54.31	67.07	54.31-79.84	67.07±18.05	0.37
Cu	‘’	1.88	4.31	3.09	1.88-4.31	3.10±1.72	0.21
Zn	‘’	4.50	81.82	43.16	4.50-86.82	43.16±54.67	25.90

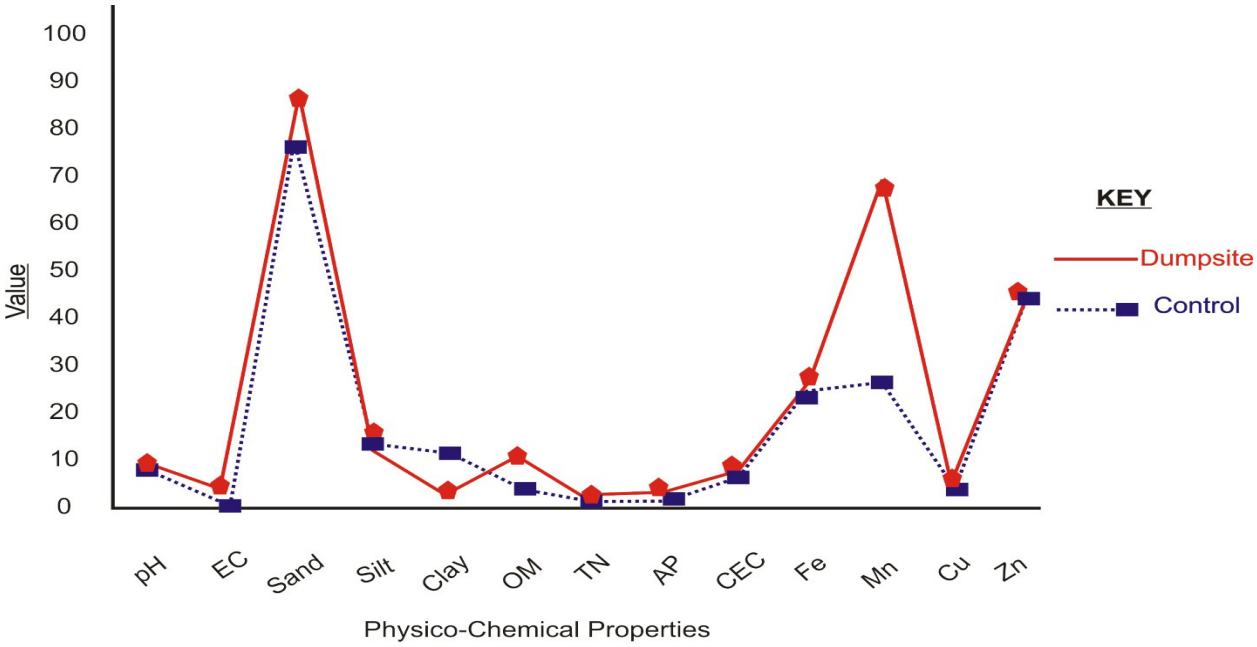

Fig. 1: A Graph Of Physico-Chemical Properties Of Soils from Dumpsites and Control

NB: D1- D3 = Dumpsite 1 - 3

Physico chemical concentration of the soil from the solid wastes dumpsites and control

Most of the values of the physico- chemical properties in the soil from the solid wastes dumpsites were higher than the values from the control site as indicated in Fig. 1. Other researcher [14] also recorded a tremendous increased in thephhysico- chemical contents of the soil from the solid wastes dumpsites as compared with control site. This was suggested to be the influence of solid wastes at the dumpsite which might have affected soil properties as a result of decomposition of solid wastes.

The micro- nutrients or trace elements concentrations were high as shown in table1. Most solid wastes such as motor vehicle parts, metals alloys, ceramics, glasses etc are eithercomponent of Zinc and manganese which might have contributed to these high values [15]. Although Francisco et al., [16] observed that wet blue leather contain high amount of nitrogen and most of the solid wastes constitute of leathers, but, the problem is the non-biodegradable nature of this solid wastes which was reflected in the small amount of nitrogen in the solid waste soil.

From Fig. 1, it is shown that the values of silt clay compared to the values of the control site were small. This was also reflected on the concentration of organic carbon. This could be as a result of low percentage of biodegradable solid wastes [4].

The ($F > 0.05$) in table 1, shows that the concentration of silt, clay, Na, K, Ca& Zn, were significantly different within the dumpsitesbut, the concentration of pH, sand, Organic matter, total nitrogen, available phosphorous, Mg, Cation Exchange capacity, Mn&Cuwere not significantly different within the solid waste dumpsites. The variance might be as a result ofdifferences in the composition of solid waste in dumpsites [15].

Implication of the physico chemical properties and trace metal contents in soil from solid wastes dumps to agriculture.

The higher percentage of sand as recorded in table1, might lead to higher tendency of leaching, couple with lower binding sites of micro and macro nutrients as a result of lower clay content and organic matter. However, the higher pH values will decrease the solubility of most basic cation/ trace elements and might reduce the loss of these nutrients [8], [15].Nevertheless, the micronutrients/ trace elements (Fe, Zn, and Cu&Mn) and macronutrient (Ca, Mg, K,) were quantitatively recorded. Other elements that were recorded in fairly good amount were, phosphorous and nitrogen.Table 1.These elements are very essential for the proper growth of the plant and also good for animal metabolism.

Conclution

Most of the physical and chemical properties of the soil within the solid waste dumpsites were higher than the values recorded in the soil from control site and they varies within the solid waste dumpsites.

The micronutrients/ trace elements (Fe, Zn, and Cu&Mn) and macronutrients (Ca, Mg, K,) were quantitatively recorded at the dumpsites. Other elements that were recorded in fairly good amount were, phosphorous and nitrogen. Thus, the soil from the solid waste dumpsites are rich with micronutrients and macronutrients, therefore, the compost from the solid waste dumpsites could be used as manure/ compost for soils amendment for cultivation of crops.

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