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Evaluation of the Heavy Metal Contents of Soil and *Zea- Mays (*Corn) Grown in Gosa Dumpsite of the Federal Capital Territory Abuja

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Abstract: ***Decayed and composted waste enhance soil fertility which is why most dumpsites in urban and su-urban centers in Nigeria use dumpsites as farmland but These wastes often contain heavy metals in various forms and at different contamination levels. Contamination of vegetables and other foodstuffs by heavy metals is a major concern as the use of open solid waste dumpsites for cultivation of vegetables and edible fruits is practiced without consideration for the health hazards this may cause to humans and animals thus leading to an urgent need to conduct studies in heavy metal contamination of food crop grown in GOSA dumpsite.) The aim of this study was to evaluate the heavy metal content of the soil and Zeamays (Corn) grown within Gosa dumpsite. Purposive and line transect technique was applied. Twenty –three (23) elements were tested in the soil and corn (Zea mays) with the aid of an XRF instrument, it was observed The most concentrated metals at the dumpsite (Gosa) are Al, Si, P, Ca and Cu while the least concentrated are Cr, Mn, Ni, Cd, Ba. Soils in the various dumpsites have high concentration of heavy metals than its counterpart agricultural land.***

Keywords: Dumpsite, Heavy Metals, Zeamays, Soil

1. Introduction

The use of dumpsites as farmland is a common practice in urban and sub – urban centers in Nigeria because of the fact that decayed and composted wastes enhance soil fertility [1] These wastes often contain heavy metals in various forms and at different contamination levels [2]. Contamination of vegetables and other foodstuffs by heavy metals is a major concern, as these foodstuffs are important components of human diet especially on the issue of food safety and quality assurance [3] Heavy metals enter the body system when these plants are directly or indirectly consumed and bio accumulate over a period of time [4]

Heavy metals are described as those metals with specific gravity higher of more than 5 g/cm. [5] Most common elements are copper, nickel, chromium, lead, cadmium mercury and iron. Elements like iron and nickel are essential to the existence of all forms of life if they are low in concentrations. However, elements like lead, cadmium and mercury are toxic to living organisms even in low concentrations, and they cause anomalies in metabolic activities [5]

Heavy metal pollution of the environment, even at low – levels and their resulting long – term cumulative health effects are among the leading health concerns all over the world [2]. Bioaccumulation of lead (Pb) in human body interferes with the functioning of mitochondrion, thereby impairing respiration and also causes constipation, swelling of the brain, paralysis and eventual death [6].The situation is even more worrisome in the developing countries where research efforts towards monitoring the environment have not been given the desired attention by the stakeholders. The concentration of heavy metal in the environmental cannot be credited to geological factors alone, but human actions do modify significantly the mineral composition of soils. Sometimes wastes are dumped recklessly with no regards to the environmental consequences, while in some dumpsites wastes are brunt in the open and ashes abandoned at the sites. The burning of wastes rescinds the organic materials and oxidize the metals, with a leftover of ash richer in metal contents. After the processes of oxidation and corrosion, these metals will dissolved in rain water and leached into soil. [2]

2. Material and Method

Study Area

The Federal Capital Territory has a land area of 8,000 KM2.It falls within latitude 7° 25' N and 9° 20° North of the Equator and longitude 5° 45' and 7° 39 '.It shares boundary with Kaduna State, Niger State, Nasarawa State and Kogi State (www.fct.gov.ng)

Collection of samples was done using Purposive technique and line transect at different distances and along four different directions from the center of the dumpsites. Soils were collected using an auger at the same locations as the maize plant. Twenty –three (23) elements were tested in the soil and corn (*Zea mays*) grown in the dumpsites to ascertain the heavy metal concentration by comparing with farmlands approximately 2km away from the dumpsite and the permissible limit given by WHO/FAO

Analysis was achieved with the aid of an X-Ray Florescence oxford instrument

Preparation of sample

Corn samples were mashed and air-dried, while soil samples were used as collected. No weighing or volumetric measurement was required. Samples were easily placed on trays which had10 positions of time saving unattended operation was used as the unique design of the instrument guaranteed high precision, consistent, repeatable results from every tray position

Readings

The press of the start bottom started the analysis which gave results and live updates in form of graph in 5 seconds after measurements started. The results were obtained using empirical calibration for highest accuracy and traceability, saved and printed.

3. Results and Discussion

The concentration of heavy metals in soil and corn samples obtained from each dumpsite was compared to those from farmlands approximately 2km away from each dumpsite. The independent samples T – test at a 95% confidence level was employed to carry out these comparisons. Results from Gozadumpsite revealed that the heavy metal concentration of Mg, Al, Si, Fe, Co and Mo in both soil samples were not significantly different (P – value >0.05) while others were significantly different (P – value < 0.05). In soil sample pairs were significant differences exist, the concentration of heavy metal in soil samples from the dumpsite were generally higher than those of the farmland samples. Results also revealed that only the concentration of Al, Si, P, Ca and Cu were significantly different (P – value < 0.05) for the corn samples and in these, the concentrations from the farmland were significantly higher than those from the dumpsite with the exception of those of Ca and Cu. There were no measureable levels of Cr, Mn, Ni, Cd and Ba in both corn samples

Table 1: Heavy Metal Concentration at Goza Dumpsite and Farmland 2km Away

Metal	Soil Samples (mg/kg)		P – value	Corn Samples (mg/kg)		P – value
	Dumpsite	Farmland		Dumpsite	Farmland	
Mg	2147±341	1893±255	0.583	101±7.18	81±6.24	0.105
Al	3276±134	3957±870	0.482	181±9.17	209±3.56	0.023*
Si	3592±322	4499±210	0.320	107±13.30	229±23.43	0.001*
P	714±37.48	467±54.23	0.003*	150±40.33	290±27.62	0.008*
S	961±68.53	254±82.76	0.02*	209±15.39	261±23.67	0.109
Cl	307±99.87	150±46.64	<.0005*	49±9.32	49±7.68	0.972
Ca	4528±231	2833±187	0.002*	20±4.72	BDL	<.0005*
Ti	1433±268	974±31.45	<.0005*	40±7.88	31±13.43	0.321
V	861±31.12	BDL	<.0005*	0.34±0.07	BDL	0.095
Cr	102±49.21	12±11.18	0.002*	BDL	BDL	ND
Mn	453±109	164±29.75	0.001*	BDL	BDL	ND
Fe	3970±365	3717±410	0.526	21±9.12	42±19.39	0.062
Co	38.15±15.7	35.93±13.96	0.921	1.56±0.23	BDL	0.058
Ni	79.32±17.34	BDL	<.0005*	BDL	BDL	ND
Cu	85.42±13.10	6.76±6.34	0.001*	2.35±0.6	BDL	0.009*
Zn	1014±647	79±52.42	<.0005*	10.45±0.40	11.76±1.19	0.354
Br	70.41±14.42	BDL	<.0005*	1.27±0.27	BDL	0.061
Mo	1.27±0.64	BDL	0.054	0.57±0.87	BDL	0.210
Cd	16.11	BDL	<.0005*	BDL	BDL	ND
Sn	5720±699	2083±133	<.0005*	1366±292	1336±196	0.925
Ba	BDL	26.76±9.07	<.0005*	BDL	BDL	ND
Hg	19.53 ±5.03	BDL	<.0005*	1.12 ±0.51	BDL	0.052
Pb	16.12±4.30	5.29±3.12	0.011*	1.17 ±0.24	BDL	0.056

Value presented as Mean ± Standard Error

Key: BDL = Below Detectable Limit; ND = Not Determinable; * = Corresponding values significantly different at a 95% Confidence Level.

4. Conclusion

The most concentrated metals at the dumpsite (Gosa) were Al, Si, P, Ca and Cuwhile the least concentrated were Cr, Mn, Ni, Cd, Ba. Soils in the various dumpsites have high concentration of heavy metals than its counterpart agricultural land.

5. Future Scope

Findings suggest evaluation of every dumpsite in the FCT and proper legislation on the use of dumpsite soils for cultivation of food crop to be given appropriate attention and a distance of 200 meters away maintained before any farming activities is allowed as consumption of food with high heavy metal content is exposing the populace to possible health risks

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