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Evaluation of the Heavy Metals Status of Soil of Oko (Oshimili South L.G.A) Delta Nigeria Using ATI Unicam AAS

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Abstract

The concentration of heavy metals in the soil of Oko was investigated in this study. The heavy metals were Fe, Pb, Cd, cu, Zn Mn, Ni, V, Cr and Hg. The research area was mapped out into five (5) Research Stations. From each of the stations, samples were randomly collected from (10) sampling sites. Analysis of the samples was carried out using composite samples and the analytical methods adopted were ApHA 20th edition and ASTM D3223. The heavy metals were determined using ATI unicam atomic absorption photo spectrometer model 939. The mean result obtained for iron lead, cadmium and copper for both wet and dry seasons were 2568.200 ± 643.533 and 4661.400 ± 619.339 mg/kg, 0.996 ± 0.234 and 1.590 ± 0.502mg/kg, 0.020 ± 0.00 and 0.020 ± 0.00mg/kg. The zinc manganese, nickel, vanadium copper, concentration in both seasons were 16.53 ± 2.000 and 21.82 ± 77 mg/kg, 5.682 ± 0.712 and 7.328 ± 0.740 mg/kg; 8.3700 ± 0.711 and 9.058 ± 1.005 mg/kg 5.682 ± 0.740 and 7.32 ± 0.691 mg/kg, 5.006 ± 0.490 and 4.416 ± 1.089 mg/kg respectively. Also the chromium and mercury were 13.874 ±

0.797 and 19.716 ± 0.793mg/kg and 0.001 ± 0.00 and 0.001 ± 0.000 mg/kg. The values of the heavy metals were subjected to test of significance with F-test distribution and t test statistics at 0.05 significance level and degree of freedom df-9. The F distribution calculated value was 0.660 while the F table value was 2.05. The t test calculated value was 0.012 and t-table was 1.050. The results of the statistical analyses revealed no significant difference in the heavy metals concentration of Oko soil.

Oko is located at the western flood plain which stretches from Onitsha gap to the first bifurcation of the River Niger at rivers Num and Forcardos (Allen, 1990). Though a quiet settlement without any visible industrial activities, her being contiguous with Asaba, the Delta state capital makes it a recipient of the industrial effluent discharges during the rainy season when the flood crest is high.

Soil pollution resulting from industrial effluent discharges has been the subject of many studies, (Korokawa and Tatsuawa, 1990; Paezada, 1989; Kelly and Tate, 1998; Adriano, 2001; Adekola et al, 2001; Viklander, 1998; Osibanjo et al, 1993; Oyibo and Agboola, 1983; Ogwu, 2009).

This study focused on the assessment of the heavy metals concentration of Oko soil.

Materials and Methods

This study was an ex-post facto study of Oko soil. Oko is a linear settlement along the cost of River Niger. It lies at latitude 6.05 and longitude 6.42E. It is about two kilometers from the Delta State capital Asaba. Oko is at the base of welldrained Asaba, lying on the lowland, it receives the runoffs and floods from Asaba and alluvial deposit from the River Niger.

The research area was mapped out into five research stations corresponding to the villages that make up Oko clan. These are Oko Obiokpu, Oko-Anala Station, Odifulu Station ,Amaka and Oko- Ogbele Stations. From each of the stations, soil samples were collected from (10) samples sites at the depts Of 0-10 and 15 to 20cm with the aid of soil augar using herringbone sampling design. The samples were then bulked and a composite was drawn fixed with HNO_3 and preserved in ice cool boxes in which they were taken to the laboratory for analysis. The samples collection were carried out in two Nigerian seasons, wet season (June to August 2010) and dry season (January to March 2011).

Analysis of Samples

The analytical methods adopted were APHA 20th edition and ASTM D3223 The heavy metals were determined using ATI unicam atomic absorption spectrophotometer model 939 as indicated below.

CD,Zn, Fe, Ni, Cr, Pb and Cu: APHA 20th edition 3111B

V APHA 20the edition 3111D

H_g APHA 3112B and ASTM D3223

SN	Parameters	Samples analyses result				
		A	B	C	D	E
1	Fe	2256	3245	3215	2219	1906
2	Cd	0.02	0.02	0.02	0.002	0.02
3	Zn	18.98	17.6	14.58	15.25	16.28
4	Mn	0.05	0.05	0.05	0.05	0.05
5	Ni	8.98	9.76	8.21	7.34	7.56
6	Cr	14.32	12.86	13.34	14.87	13.98
7	Pb	1.65	1.09	0.75	0.97	0.54
8	Cu	3.88	4.78	5.01	4.43	3.98
9	Hg	0.001	0.001	0.001	0.001	0.01
10	V	5.28	4.69	5.99	6.43	6.02

Table 1; Heavy metals content of OKO soil mg/kg (dry season) January to March 2011

Station Description

A Oko Obiokpu

B. Oko Anala

C. Oko Ogbele

D. Oko Odifulu

E. Oko Amakon

Table 2: Heavy Metals Content of OKO Soil mg/kg (Wet Season) June to August 2010

SN	Parameters	Samples analyses result				
		A	B	C	D	E
1	Fe	2256	3245	3215	2219	1906
2	Cd	0.02	0.02	0.02	0.02	0.02
3	Zn	18.98	17.6	14.58	15.25	16.28
4	Mn	0.05	0.05	0.05	0.05	0.05
5	Ni	8.98	9.76	8.21	7.34	8.20
6	Cr	14.32	12.86	13.34	14.87	13.98
7	Pb	1.65	1.09	0.75	0.97	0.54
8	Cu	3.88	4.78	5.01	4.43	3.98

9	Hg	0.001	0.001	0.001	0.001	0.001
10	V	5.28	4.69	5.99	6.43	6.02

Station Description

A. Oko Obiokpu
B. Oko Anala
C. Oko Ogbeele
D. Oko Odifulu
E. Oko Odifulu
F. Oko Amakon

The mean results of the heavy metals in OKO soil were further subjected to treatment with mean, standard deviation and standard error of mean and the results presented as pairs statistics as follows.

Table 3: Paired Sample Statistics Soil

	Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair $OKOF_eW$	2568.2000	5	643.5333	276.977715
$OKOF_eD$	4661.4000	5	619.33973	349.78959
Pair $OKOP_bW$	1.0000	5	.68035	.18783
$OKOP_bD$	1.5900	5	.42000	.22492
Pair $OKOC_dW$	.0200[a]	5	00000	00000
$OKOC_dD$	.0200[a]	5	00000	00000
Pair $OKOC^uW$	4.4160	5	1.08976	.21942
$OKOC_uD$	5.0060	5	.49064	.30595
Pair $OKOZ_nD$	16.5380	5	2.00948	.79531
$OKOZ_nD$	21.1820	5	1.77838	1.09311
Pair $OKON_iW$	8.3700	5	.71176	.44982
$OKON_iD$	9.9360	5	.98464	.31885
Pair OKOV W	5.6820	5	.74083	.30938
OKOVD	7.3280	5	69179	.47426
Pair $OKOC_rW$	13.8740	5	.79751	.35465
$OKOC_rD$	19.7160	5	.79302	.58921
Pair $OKOH_gW$	.0010[a]	5	00000	00000
$OKOH_gD$	.0010[a]	5	00000	00000

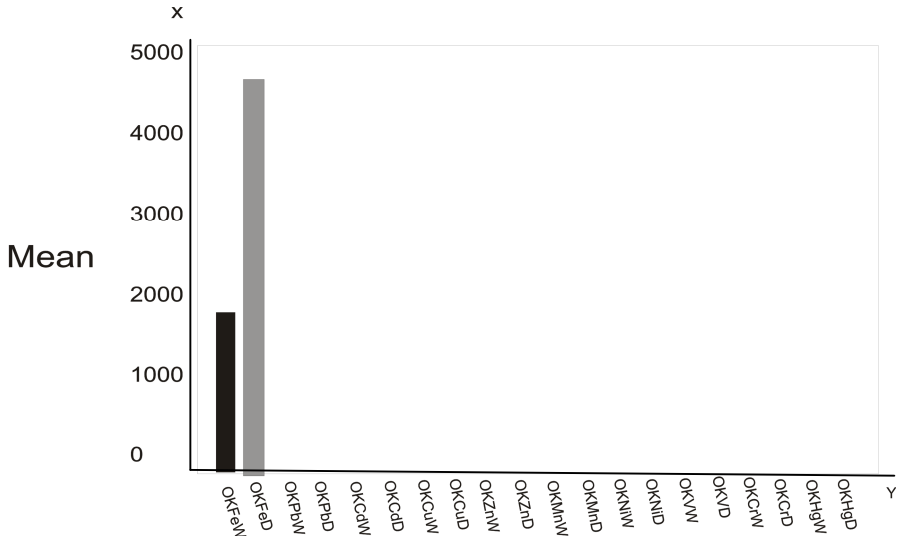
The correlation and t cannot be computed because the standard error of difference is 0

Legend

Oko - Oko
W - Wet season
D - Dry Season

The results were then graphically presented as bar charts as shown below

Fig 1: Bar chart showing heavy metals concentrations of soil of Oko



Discussion

There is no provision for standard limits for heavy metals in the soil by the Federal Ministry of Environment (FME) and World Health Organization (WHO). The mean results of heavy metals concentration of Oko soil for both wet and dry seasons were then subjected to test of significance with F distribution test and t test statistics at 0.05 level of significance and degree of freedom (df) 9. The F distribution calculated value was 0.660 while the table value was 2.05. The t-test calculated value was 0.012 and the table value was 1.050. The result of the statistical analyses revealed no significant difference in the heavy metals concentration of Oko soil. Heavy metals concentration in the soil as a result of man's activities have been reported by Adekola 2002; McDonald et al, 1991; Viklander, 1998; Topuoglu, 2002; Adriano, 2002; Paez-Osuna, 1986; Adekanbi, 1998; Odu, 1977; Gustagan, 1987; Jinadasa et al, 1997; Dudka et al, 1996; and Davis 1997.

Though, the result of this study was in disagreement with the studies above, it is however in consonance with Nwakodi (1992), who reported no heavy metal pollution in River Niger and its distributaries.

Conclusion

The quality of the environmental variables, the land, air and water has remained the concern of environmentalists. The soil quality is an issue of vital importance in the use and management of land, water and air. Clearly the soil must be maintained in a state that will be suitable for agriculture and devoid of contaminants that are injurious to our health (Adeniyi, 2001). The guide for industrial waste treatment and effluent discharge standards is contained in the Federal Ministry of Environment (FME) and World Health Organization (WHO) guidelines and standards

for environmental pollution control in Nigeria (1991). Though the result of heavy metals analysis in Oko soil revealed no significant difference, it is imperative that the industries in Asaba be monitored closely to avoid deviation from the operational norms and to ensure that world best practices are adopted in all production lines of the organizations. A "stitch in time saves nine" the saying goes.

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