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Physicochemical properties of soil with crest and basin formation as affected by MSW in a densely populated tropical region

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Abstract: *This research took place in Anambra state, along Onitsha-owerri road disposal site Obosi. The samples studied were collected at three different locations. The first sample collected at the untainted area which was at fifteen meters away from the disposal site serves as control. Other two was collected at the crest formation and basin formation of the site at different depths at 30cm interval. Standard methods was used to analyse the collected samples for the physical and chemical properties such as the pH, organic matter content, total nitrogen, heavy metals (lead, zinc, iron) and cation exchange capacity etc. Chi-square was used to determine its statistical mean difference at 5% level of significance. The result shows increase in the parameters as the depth increases. The pH value, total nitrogen, zinc and iron are higher at the crest formation, while lead is higher at the basin formation. The aggregate stability decreased drastically at basin when compare to the untainted area. Also the calculated value for the tested parameters for control, crest and basin soil formation are within the critical value of 5.991, showing a mean difference at the depths. The high presence of the heavy metal show the level of soil pollution and the toxicity level of soil as depths increases. The metals can move through the soil profile into the groundwater, also having a high salt concentrations equally inhibit the growth of vegetation and makes the soil structure unconstructive. Therefore, there is need to improve the management of municipal solid waste by creating National Inspection Agency for Solid Waste Recycling and Disposal (NIASWARD) in order to educate the public on the importance of recycling of solid wastes before disposal. This can be enhanced by organizing workshops or seminars.*

Keywords: *metals, municipal solid wastes, organic waste, physicochemical properties, soil*

I. Introduction

Municipal solid waste (MSW) is a type of waste made up of daily items that are discarded as a byproduct of human activities in an urban setting. It is commonly known as garbage in United States and as refuse in United Kingdom. According to Nyangobobo and Hanya (2000)[1], municipal solid wastes are refuses produced as a result of human activities which they classified as solids, semi-solids or liquid in containers thrown out of houses, commercial and industrial premises. The composition of MSW varies greatly from one metropolitan area to another and also with time. In densely populated municipalities without significant recycling activity like Onitsha in South Eastern State of Nigeria, the major MSW includes food waste, plastic containers, product packaging materials, scrap metals, machinery and other miscellaneous solid waste from residential, commercial, institutional and industrial sources. This waste can be classified as biodegradable, toxic, hazardous, or electrical/electronic waste. In Onitsha the major waste can be classified as biodegradable waste commonly known as biodegradable municipal waste (BMW). Inadequate disposal of waste can be expressed by the contamination of surface and groundwater through leachate, soil contamination through direct waste contact or leachate, air pollution by burning of waste, spreading of diseases by different vectors like birds, insects and rodents, and or uncontrolled release of methane by anaerobic decomposition of waste (Zurbrugg, 2002)[2]. Production of methane and other greenhouse gases has become the main environmental threat from biodegradable waste. The local sanitation authority collect, transport and dump MSW at a designated site and burn them. Several waste dumpsites are located at various parts of Onitsha Municipal and environs, apparently based on convenience rather than proper planning and burnt intermittently. Some of these sites are indiscriminately located at open fields, water canals and in abandoned borrow pits. According to Bhatia (2009)[3], during the dry season, MSW are usually burned which releases to the environment particulate matter such as ash, smoke, dust and fumes that contain gaseous oxides of nitrogen, sulpur and carbon. These gases dissolve in rainwater and infiltrate into the soil. Rain water leach the constituents of MSW from the burning or decomposition deep into the soil while percolation cause the subsurface to be contaminated by organic and inorganic solutes (Jeyariya and Sasectharam, 2010)[4]. Due to rapid urbanization as a result of increased population in most countries, there is decrease in agricultural lands and spaces for construction of structures especially buildings. This has given rise to urban agriculture and the construction of high-rise buildings mostly on areas previously designated and used as dumpsite for MSW. The incessant collapse of buildings in Nigerian cities has also led credence into the search of factors that can cause the collapse. One of the areas being looked at is the pre-foundation activities on the affected site. Many dump site in Onitsha is now being converted to gardens and some used for buildings due to increased population and unavailability of space. According to Civeria and Lavado (2006)[5] soil intensively affected by human activities might present special features such as mixed horizons, foreign materials and thin deposit. Eventually, these characteristics might have a detrimental effect on the soil by either affecting plant growth or submitting the particular environment to loose soil that may subject it to various erosion processes (Vetterlein and Hittle (1999)[6], [7]Scharanbroch *et al,* (2005). Urban soils present different characteristics compared to rural ones, their intrusive properties and rehabilitation techniques have not yet been sufficiently studied (Scharanbroch *et al.,* 2005)[7]. In South Eastern Nigeria with growing mega cities credence has not been given on the effect of MSW on the soil physicochemical properties. Therefore, the major objective of this study is to highlight the danger posed by MSW to agriculture and structural foundation in Onitsha South Eastern Nigeria. Edward and James, (1987)[8]; Nanda, (2011)[9], refers the increasing level of solid waste as a serious problem in the urban areas of the world, which was compounded by the high rate of population growth and increasing per-capita income. These result in the generation of enormous solid waste posing serious threats to quality of soil and water. The threats are more in the developing countries where large quantities of solid waste are dumped haphazardly, thereby, putting pressure on scarce land and water resources and at the same time affecting the properties of soil. According to Wallace and Wallace (1986)[10], to obtain high crop yield, the soil must have a proper physical properties.

II. Materials And Methods

2.1 Site Description

This study was carried out in Onitsha metropolitan. Onitsha is a major business district located in tropical rainforest zone of South Eastern Nigeria on Latitude 6.15^{o}N and Longitude 6.79^{o}E. Onitsha has. a mean temperature of 28.9°C with a relative humidity of 73.3%. According [11] Onitsha has a population of 561, 106 people. The research sites have served as refuse dump sites for more than 20 years on a surface approximately 7 hectares (each) size and about 6 meters high without being covered. Nearly 10-15 tons of wastes are dumped each day on each site and burnt incompletely. The waste consists of mainly metals, used batteries, beverages, cans, ferrous materials, used papers, rags, polythene bags, plastics and organic materials (food remnants, decaying leaves, fruits and vegetables, etc).

2.2 Sample Collection

Soil samples were collected from two different locations of the dump sites within Onitsha city metropolis namely: Obosi crest deposit area and Obosi basin deposit area situated at Onitsha-Owerri Road, Onitsha Municipality, Anambra State, South Eastern Nigeria. Control samples were also collected at 15 meters away from the dumpsites.

2.3 Experimental Procedure

The samples were collected at intervals of 0 - 30, 30 - 60, 60 -90(cm) from each of the sites with three replicates making a total of 27 samples. The bulky materials were separated and were sieved with 5mm mesh, after which it was taken for laboratory analyses. Analyses were carried out for the particle size distribution, pH, Organic Matter content(OM), Total Nitrogen, Cation Exchange Capacity(CEC) and heavy metals. The particle size was determined using the hydrometer method of bouyoucous [12]. The soil pH was determined electrometrically with a glass electrode pH meter KCL using a soil: liquid suspension ratio of 1:2:5 as modified by [13]. The determination of organic matter was achieved using the dichromate wet oxidation method [14] as modified by [15]. The organic carbon was calculated as: percentage organic carbon in soil =

$$\frac{(Mek_2\ Cr_2\,O_7 - MeFeSO_4) \times 0.003 \times 100 \times 1.33(F)}{gram\ of\ air\ dry\ soil} \quad \ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(1)}$$

Where; Me = Normality of solution $\times$ 1ml of solution used.

F = Correction factor. The determination of Total Nitrogen in the soil sample was determined by Kjeldahl method as described by [16] and the exchangeable cations was extracted using ammonium acetate method, potassium, sodium were determined on a flame photometer while calcium and magnesium were measured by titrating with EDTA [17]. Most importantly, heavy metals attribute major effect on soil properties. The [18] digestive method was used to determine the heavy metal content. The soil aggregate stability was determined using the mean diameter method as described by [19]. The results obtained from the laboratory analysis for the untainted area (control), crest formation and basin formation are presented in table 1-3 respectively.

2.4 Analysis Using Chi-Square Test

Chi-square was adopted to determine soil data statistical mean difference at 5% level significance for each parameter. The results for chi-square for all the parameters at its different depths were presented in table 4-27 for pH, OM, TN, CEC, LEAD, IRON, ZINC, and AS respectively.

III. Results And Discussion

The results of the analyzed soils show the presence of some heavy metals like lead, iron and zinc and some other parameters tested for the three locations, via, untainted area, soil crest formation and basin formation at three different depth interval, 0-30, 30-60, and 60-90 which show that the values obtained increases along with the increase in depth. The pH value, organic matter, total nitrogen content, and zinc was higher at the crest formation, while the content of lead, iron, and Cation Exchange Capacity were much higher at the basin formation. The level of values obtained at the crest and basin formation of the soil sample, compared with the untainted soil shows the high rate of toxicity impaired by the dumped solid waste on the surface of the soil. The reason for this increase could be as a result of decomposition and mineralization of the biodegradable solid waste in the site which released the mineral to the soil as well as basic cations which cause further increase in the soil pH.

Table 1: Untainted Area (Control)

Tested Parameters	0-30cm	30-60 cm	60-90cm
Soil Ph	15.75	51.87	115.02
Organic Matter Content	60.04	290.34	677.64
Total Nitrogen	0.94	3.55	7.90
Cation Exchange Capacity	111.04	460.99	1053.94
Lead	25.32	95.67	211.02
Iron	241.10	1021.10	2341.10
Zinc	1.48	6.52	15.16
Aggregate Stability	9210.60	39543.60	91116.60

Table 2: Crest Formation of the Soil

Tested Parameters	0-30cm	30-60 cm	60-90cm
Soil pH	148.61	609.11	1372.61
Organic Matter Content	103.46	425.06	926.66
Total Nitrogen	25.70	114.05	265.40
Cation Exchange Capacity	60.14	250.34	566.54
Lead	284.64	1206.99	2768.34
Iron	987.30	4219.80	9749.80
Zinc	97.71	420.06	967.41
Aggregate Stability	8223.10	35442.10	81741.10

Table 3: Basin Formation of the Soil

Tested Parameters	0-30cm	30-60 cm	60-90cm
Soil pH	137.57	596.92	1313.27
Organic Matter Content	121.43	479.63	1071.83
Total Nitrogen	25.30	104.80	238.30
Cation Exchange Capacity	81.87	409.47	989.07
Lead	362.11	1524.16	3487.21
Iron	1069.80	4032.30	8884.80
Zinc	57.70	250.15	577.60
Aggregate STABILITY	6544.60	27922.60	64240.60

Infiltration rate and leaching has made the deeper depth to be more contaminated and it affects the water table, soil foundation of buildings and agricultural sectors. [20] indicates that in plants, the toxicity is localized in the root system. From ”Table 1”, the untainted area of the soil sample shows that the aggregate stability of the tested soil is superior to the crest and basin formation of the soil as a result of the heavy dump of MSW. This revealed that the aggregate stability decreased drastically when compared with the untainted area. The increase of OM at the different formations decreases its AS. [21] recorded that the soil texture, soil structure, and the type of clay mineral, organic matter content and type, cementing agents as well as cropping history of a particular land collectively influence the aggregate stability. The high presence of lead and iron contribute to the instability of the soil aggregate. However, it was shown that solid wastes increased the soil pH, CEC, heavy metals, aggregate stability, organic matter content and total nitrogen when compared to adjacent uncontaminated soil.

Table 4: Chi-Square Test On Ph Value For Control, Crest, And Basin At 30cm Depth At5% Significant

PH LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	15.72	100.6233	-84.9033	7208.565	71.63915
CREST	148.61	100.6233	47.9867	2302.723	22.88459
BASIN	137.57	100.6233	36.9467	1365.059	13.56603
X^2=					108.0898

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS the PH is within the critical value therefore there is a mean difference in PH value at 30cm depth.

Table 5: Chi-Square Test On Ph Value For Control, Crest, And Basin At 60cm Depth At 5% Significant

PH LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	51.87	419.2581	-367.388	134974	321.9354
CREST	609.11	419.2581	189.8519	36043.74	85.9703
BASIN	596.92	419.2481	177.6719	31567.3	75.29504
X^2=					483.2007

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS the PH is within the critical value therefore there is a mean difference in PH value at 60cm depth.

Table 6: Chi-Square Test On Ph Value For Control, Crest, And Basin At 90cm Depth At 5% Significant

PH LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	115.02	934.5399	-819.52	671612.8	718.6561
CREST	1375.61	934.5399	441.0701	194542.8	208.1696
BASIN	1313.27	934.5399	378.7301	143436.5	153.4835
X^2=					1080.309

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The PH Is Within The Critical Value Therefore There Is A Mean Difference In PH Value At 90cm Depth.

Table 7: Chi-Square Test On Om Value For Control, Crest, And Basin At 30cm Depth At 5% Significant3

OM LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	66.04	96.96697	-30.927	956.4774	9.863951
CREST	103.46	96.96697	6.49303	42.15944	0.434781
BASIN	121.43	96.96697	24.46303	598.4398	6.171584
X^2=					16.47032

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The OM Is Within The Critical Value Therefore There Is A Mean Difference In OM Value At 30cm Depth.

Table 8: Chi-Square Test On Om Value For Control, Crest, And Basin At 60cm Depth At 5% Significant

OM LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	290.34	398.3035	-107.963	11656.12	29.26441
CREST	425.06	398.035	27.025	730.3506	1.83489
BASIN	479.63	398.3035	81.3265	6614	16.60543
X^2=					47.70473

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The OM Is Within The Critical Value Therefore There Is A Mean Difference In OM Value At 60cm Depth.

Table 9: Chi-Square Test On Om Value For Control, Crest, And Basin At 90cm Depth For 5% Significant

OM LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	677.64	903.9529	-226.313	51217.54	56.65952
CREST	962.66	903.9529	58.7071	3446.524	3.812725
BASIN	1071.83	903.9529	167.8771	28182.72	31.1772
X^2=					91.64945

Df=3-1=2, CHI CRITICAL VALUE= 5.991, Thus The OM Is Within The Critical Value Therefore There Is A Mean Difference In OM Value At 90cm Depth.

Table 10: Chi-Square Test On Tn Value For Control, Crest, And Basin At 30cm Depth At 5% Significant

TN LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	0.94	17.3116	-16.3716	268.0294	15.48264
CREST	25.7	17.3116	8.3884	70.36525	4.06463
BASIN	25.3	17.3116	7.9884	63.81453	3.68623
X^2=					23.2335

Df=3-1=2, CHI CRITICAL VALUE= 5.991, Thus The TN Is Within The Critical Value Therefore There Is A Mean Difference In TN Value At 30cm Depth.

Table 11: Chi-Square Test On Tn Value For Control, Crest, And Basin At 60cm Depth At 5% Significant

TN LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	3.55	74.12592	-70.5759	4980.96	67.19593
CREST	114.05	74.12592	39.92408	1593.932	21.50303
BASIN	104.8	74.12592	30.67408	940.8992	12.69325
X^2=					101.3922

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The TN Is Within The Critical Value Therefore There Is A Mean Difference In TN Value At 60cm Depth.

Table 12: Chi-Square Test On Tn Value For Control, Crest, And Basin At 90cm Depth For 5% Significant

TN LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	7.97	170.5396	-162.57	26428.88	154.9721
CREST	265.4	170.5396	94.8604	8998.495	52.76484
BASIN	238.3	170.5396	67.7604	4591.472	26.9232
X^2=					234.6601

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS the TN is within the critical value therefore there is a mean difference in TN value at 90cm depth.

Table 13: Chi-Square Test On Cec Value For Control, Crest, And Basin At 30cm Depth At 5% Significant

CEC LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	111.04	84.34157	26.69844	712.8064	8.451425
CREST	60.14	84.34157	-24.2016	585.716	6.944571
BASIN	81.87	84.34157	-2.47157	6.108658	0.072428
X^2=					15.46842

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS the CEC is within the critical value therefore there is a mean difference in CEC value at 30cm depth.

Table 14: Chi-Square Test On Cec Value For Control, Crest,And Basin At 60cm Depth At 5% Significant

CEC LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	460.99	373.5626	87.42736	7643.543	20.46121
CREST	250.34	373.5626	-123.223	15183.81	40.64596
BASIN	409.47	373.5626	35.9074	1289.341	3.451473
X^2=					64.55864

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS the CEC is within the critical value therefore there is a mean difference in CEC value at 60cm depth.

Table 15: Chi-Square Test On Cec Value For Control, Crest, And Basin At 90 Cm Depth For 5% Significant

CEC LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	1053.94	869.763	184.177	33921.16	39.00046
CREST	566.54	869.763	-303.223	91944.19	105.7118
BASIN	989.07	869.763	119.307	14234.16	16.36556
X^2=					161.0778

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The CEC Is Within The Critical Value Therefore There Is A Mean Different In CEC Value At 90cm Depth.

Table 16: Chi-Square Test On Lead Value For Control, Crest, And Basin At 30cm Depth At 5% Significant

LEAD LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	25.32	224.0009	-198.681	39474.11	176.223
CREST	284.64	244.0009	40.6391	1651.536	6.768567
BASIN	362.11	224.0009	138.1091	19074.12	85.15199
X^2=					268.1435

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The LEAD Is Within The Critical Value Therefore There Is A Mean Different In LEAD Value At 30cm Depth.

Table 17: Chi-Square Test On Lead Value For Control, Crest, And Basin At 60cm Depth At 5% Significant

LEAD LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E	
CONTROL	95.67	942.1791	-846.509	716577.7	760.5536	
CREST	1206.99	942.1791	264.8109	70124.81	74.42833	
BASIN	1524.16	942.1791	581.9809	338701.8	359.4877	
X^2=					1194.47	

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS the LEAD is within the critical value therefore there is a mean difference in LEAD value at 60cm depth.

Table 18: Chi-Square Test On Lead Value For Control, Crest, And Basin At 90cm Depth For 5% Significant

LEAD LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	211.02	2155.308	-1944.29	3780255	1753.928
CREST	2768.34	2155.308	613.032	375808.2	174.3641
BASIN	3487.21	2155.308	1331.902	1773963	823.067
X^2=					2751.359

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The LEAD Is Within The Critical Value Therefore There Is A Mean Different In LEAD Value At 90cm Depth.

Table 19: Chi-Square Test On Iron Value For Control, Crest, And Basin At 30cm Depth At 5% Significant

IRON LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	241.1	765.9901	-524.89	275509.6	359.6777
CREST	987.3	765.9901	221.3099	48978.07	63.94087
BASIN	1069.8	765.9901	303.8099	92300.46	120.4982
X^2=					544.1168

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The IRON Is Within The Critical Value Therefore There Is A Mean Difference In IRON Value At 30cm Depth.

Table 20: Chi-Square Test On Iron Value For Control, Crest, And Basin At 60cm Depth At 5% Significant

IRON LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	1021.1	3090.758	-2069.66	4283482	1385.9
CREST	4219.8	3090.758	1129.042	1274736	412.4347
BASIN	4032.3	3090.758	941.542	886501.3	286.8233
X^2=					2085.158

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The IRON Is Within The Critical Value Therefore There Is A Mean Difference In IRON Value At 60cm Depth.

Table 21: Chi-Square Test On Iron Value For Control, Crest, And Basin At 90cm Depth For 5% Significant

IRON LEVEL	O	E	O-E	(O-E)^2	(O -E)^2/E
CONTROL	2341.1	6991.201	-4650.1	21623438	3092.95
CREST	9749.8	6991.201	2758.599	7609868	1088.492
BASIN	8884.8	6991.201	1893.599	3585717	512.89
X^2=					4694.333

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The IRON Is Within The Critical Value Therefore There Is A Mean Difference In IRON Value At 90cm Depth.

Table 22: Chi-Square Test On Zinc Value For Control, Crest, And Basin At 30cm Depth At 5% Significant

ZINC LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	1.48	52.29144	-50.8114	2581.802	49.37333
CREST	97.71	52	45.41856	2062.846	39.44901
BASIN	57.7	52.29144	5.40856	29.25252	0.559413
X^2=					89.38175

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The ZINC Is Within The Critical Value Therefore There Is A Mean Difference In ZINC Value At 30cm Depth.

Table 23: Chi-Square Test On Zinc Value For Control, Crest, And Basin At 60cm Depth At 5% Significant

ZINC LEVEL	O	E	O-E	(O-E)^2	(OE)^2/E
CONTROL	6.52	225.5541	-219.034	47975.94	212.7026
CREST	420.06	225.5541	194.5059	37832.55	167.7316
BASIN	250.15	225.5541	24.5959	604.9583	2.682098
X^2=					383.1163

Df=3-1=2, CHI CRITICAL VALUE = 5.991 THUS The ZINC Is Within The Critical Value Therefore There Is A Mean Difference In ZINC Value 60cm Depth.

Table 24: Chi-Square Test On Zinc Value For Control, Crest, And Basin At 90cm Depth For 5% Significant

ZINC LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	15.16	520.0047	-504.845	254868.1	490.1266
CREST	967.41	520.0047	447.4053	200171.5	384.9417
BASIN	577.6	520.0047	57.5953	3317.219	6.379209
X^2=					881.4476

Df=3-1=2, CHI CRITICAL VALUE = 5.991 THUS The ZINC Is Within The Critical Value Therefore There Is A Mean Difference In ZINC Value At 90cm Depth.

Table 25: Chi-Square Test On As Value For Control, Crest, And Basin At 30cm Depth At 5% Significant

AS LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	9210.6	7991.967	1218.633	1485065	185.8198
CREST	8223.1	7991.967	231.133	53422.46	6.68452
BASIN	6544.6	7991.967	-1447.37	2094871	262.1221
X^2=					454.6264

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The AS Is Within The Critical Value Therefore There Is A Mean Difference In AS Value At 30cm Depth.

Table 26: Chi-Square Test On As Value For Control, Crest, And Basin At 60cm Depth At 5% Significant

AS LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	39543.6	34299.34	5244.264	27502301	801.8319
CREST	35442.1	34299.34	1142.76	1305900	38.07363
BASIN	27922.6	34299.34	-6376.74	40662813	1185.528
X^2=					2025.433

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The AS Is Within The Critical Value Therefore There Is A Mean Different In AS Value At 60cm Depth.

Table 27: Chi-Square Test On As Value For Control, Crest, And Basin At 90cm Depth For 5% Significant

AS LEVEL	O	E	O-E	(O-E)^2	(O-E)^2/E
CONTROL	91116.8	79024.93	12091.87	1.46E+08	1850.218
CREST	81741.1	79024.93	2716.17	7377579	93.35762
BASIN	64240.6	79024.93	-14784.3	2.19E+08	2765.917
X^2=					4709.492

Df=3-1=2, CHI CRITICAL VALUE= 5.991 THUS The AS Is Within The Critical Value Therefore There Is A Mean Difference In AS Value At 90cm Depth.

Comparison Of The Three Locations Using The Chi Square Statistical Analysis At 5% Significant Treatment, The Analytical Results Show That The Tested Parameters Are Within The Critical Value And There Are Mean Differences In Each Of The Different Parameter Depths. It Also Showed That There Was An Interaction Between The Solid Wastes And Depths Of The Soil. [22], [23], Opine That Municipal Solid Wastes Increase The Soil Organic Matter And Nutrients. Similarly, The Higher Value Observed In The Dumpsites Relating To The Control Was As A Result Of The Deposited Waste. The High Content Of Organic Matter Found In The Topsoil Increased Soil Porosity Thus Allowing More Water To Infiltrate And Percolate Into The Subsoil. The Percolating Water Transports Clay Particle To The Subsoil Where They Cause Low Porosity, Increased Soil Mass And Low Hydraulic Conductivity. Low Water Infiltration Rate Results To High Overland Flow Which Can Cause Soil Erosion And Nutrient Loss.

IV. Conclusion

The Findings Of This Study Showed The Pollution Level Of The Dumpsites When Compare To The Control Area. In Construction, It Is Paramount To Consider The Soil Cohesiveness And Strength, In Order To Achieve Stable Structure. The Results Show That Crest And Basin Formation Of Tested Soils Are Polluted. The Pollution Has Affected The Aggregate Stability, Indicating Inadequacy For Construction And Even For Farming. The Municipal Solid Waste Dumpsites Have A Significant Impact On The Environment. Thus, It Is Necessary To Give Sufficient Consideration To The Compounds Of Wastes At The Dumpsite Before They Are Finally Disposed. The Appearance Of Some Polymer Materials In The Dumping Site, When Considered For Construction Utility Affect The Compaction Factor And Create Voids. Additionally, It Is Also Necessary To Test The Contaminated Areas Properly Before Further Utilization For Beneficial Purposes, Such As Erection Of Structures, Recreational/Event Center, Road Construction And Potability Of Groundwater. It Is Recommended That A Functional Inspection Agency That Monitors And Enforces The Need To Recycle Solid Wastes Before Disposal Will Be Created [National Inspection Agency For Solid Waste Recycling And Disposal (NIASWARD)], Educating The Public On The Importance Of Recycling Of Solid Wastes Before Disposal By Organizing Workshops Or Seminars.

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