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The Discussion should interpret the results clearly and concisely, and should integrate the research findings of this and past studies on the topic. Highlight the significant/unique findings of the research under conclusion.

The acknowledgment of people, grants or funds should be brief.

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IMPACTS OF SOLID WASTE DUMPS ON SOIL QUALITY: IMPLICATIONS FOR REGIONAL PLANNING AND MANAGEMENT IN OBIO/AKPOR LOCAL GOVERNMENT AREA.

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ABSTRACT
Dumpsites contain numerous contaminants which can pollute the soil of the affected area. The study examined the impacts of solid waste dumps on soil quality and its implications for regional planning and management in Obio/Akpor local government area of Rivers State.
The study adopted the experimental research design. The nature and source of data was through the primary and secondary sources. The soil samples were randomly collected at the dept of 20cm from both the waste dump sites and the non-dumpsite (control). The dump site locations were Mgbuoshimini, Rumuokwashi and Ozuoba, while the non-dumpsites (control) location was Iwofe (I.A.U.E). The samples obtained were taken to the laboratory for anlysis using standard methods. The parameter determined were p^H, Electrical Conductivity(EC),Magnesiim(Mg),Calcium (Ca), Sodium(Na),Available phosphorus(Ap), Nitrogen(N), Potassium(K), Bulk Density, Organic carbon(OC) Organic Matter(OM), Porosity, Exchangeable acid, Moisture content (MC), Textural class, Morphological properties of dumpsites and that of the non-dumpsites (control). Data acquired from the laboratory was subjected to statistical analysis (chi square). The results obtained during this period were put together to obtain a single mean for each sample location. Results showed that p^H values ranged between 7.02 and 7.68, recording slight variation for different dumpsites. There were no significant differences (p>0-05) across the study sites. Electrical Conductivity(EC) concentrations ranged from 362-1900 compared with the control which was 109.2. Mean p^H was 7.34 which equated the p^H of the soil gotten from sample one (Mbuoshimini). There was also no significant difference in the textual class bof the soils in the dumpsites and that of the control at 0.05 significant level; It was deduced that waste dumping has altered the physicochemical constituents of the soil. This was in line with the study carried out in Karachi, Pakistan in 2019 by Seema and Rubab. It was also deduced that the impact of solid waste on soil could be attributed to the type of waste deposited at the dumpsite and also the age of the dumpsite. It was therefore, recommended that waste creation should be minimized in the region to avoid dumping and subsequent management which will later cause harm to humans who are on the receiving end. Also, recycling and reuse of solid waste should be encouraged in the region.

Keywords: solid waste, dumpsites, soil quality, regional planning, management, Obio/Akpor.

1.0: Introduction

In the natural world, wherever humans are not dominant, there is essentially no waste. This is because the waste of the organisms becomes the nutrients for others. This natural recycling of nutrients follows one of the principles of sustainability (Miller Spoolman and Soares, 2010). On the other hand, humans produce huge amount of waste that go unused and pollute the environment. Waste and life cannot be separated. This is because as long as there is life, there must be waste generation. One major category of waste is solid waste which is any unwanted or discarded material we produce that is not liquid or a gas. There are two major types of solid wastes. They are industrial solid waste produced by mines, agriculture and industries that supply people with goods and services. The second type is the municipal solid waste (MSW). This consist of garbage and trash which consist of combined solid waste produced by homes and work places (Miller, et al, 2010).

The generation of waste has been a common feature in rural and urban communities right from the beginning of civilization. Due to the production of goods and services and the effective use of natural resources, waste is being generated (Uzoigwe and Agwa, 2012). The waste can be generated from various sources such as hospitals, restaurants, offices, commercial buildings, domestic residences, agriculture, institution, construction and offices. Bulk of the waste gotten from the sources mentioned above finally settle at the dumpsites.

In the African countries, thousands of tons of waste are being generated on daily basis (Asuma, 2013; Snakoh and Yan, 2013). In other developing countries such as Nigeria, open dumping of solid waste remains the predominant form of waste disposal. In Nigeria, the issue of waste management has become a difficult task. Olanrewaju and Ilemobade (2009) clearly stated that on a daily basis, waste generation in the country has been on an increase. This situation in the cities calls for proper handling and subsequent disposal for the environment and human beings living in that vicinity to be protected.

Individuals living close to dumpsites are of high risk due to the potential of waste to contaminate the water, food, land, vegetation, and air (Pjoroge, 2007). Across some cities in Nigeria, waste that are being collected are sometimes burnt outside the house and the ashes are disposed poorly on site. This act damage the organic components and causes metal oxidation while some left behind ashes enriches with metal cause pollution of the surrounding environment (Adeyi and Majolagbe, 2014).

According to Mpofu, et al (2013), the movement of pollutants from sites where waste are disposed of to adjoining ecosystems is complex and involves biological and physicochemical processes. Microbial and toxic chemical contamination of the soils at/of dumpsites could be caused by open dumpsites. As wastes accumulate on a particular site, a couple of physicochemical as well as biological processes occur within and around its surrounding environment (Sam-uroupa and Ogbeibu, 2020). This brings about accumulation of myriads of microbial pathogens there. Water can infiltrate through the refuse pile in the dumpsites. This can lead to the formation of leachates that are very rich in nutrients (nitrogen, potassium, and phosphorus), heavy metals and other poisonous substances including cyanide and dissolved organic matter. Waste composition influences the concentration of leachates constituents which may be absorbed on the soil during this diffusion (Shaikh et al, 2012). This process creates health hazards, soil and water pollution and offensive odour which increase with increase in ambient levels of temperature (Abdul-Salam, Ibrahim, and Fatoyimbo; 2011).

Several scholars have carried out researches on solid waste dumps on soil qualities. Their results revealed increase in nitrogen, pH, cation exchange capacity, percentage base saturation and organic matter concentration (Anikwe and Nwobodo, 2001). If there is an excess waste in the soil, it may bring about an increase in heavy metal concentration in the soil and underground water. Heavy metal in soil may have adverse effects on soils, crops and human health.
Heavy metal toxicity can bring about damaged or reduced mental and central nervous function, lower energy levels and damage to blood composition, lungs, kidney, liver and other vital organs. It can also cause blood, bone disorders, kidney damage, decreased mental capacity and neurological damage (Onyekwevre and Nwakanma, 2022).

Pollutants such as cadmium (Cd), copper (Cu), nickel (Ni), lead (Pb), Zinc (Zn) can change the chemical property of the soils and have negative effect on the organisms and plants. Solid waste contaminants serve as an external force affecting the physical and chemical of the soil which eventually bring the poor production of vegetation (Christiansen et al, 2014). Thousands of lives are lost every year to environment related diseases such as cholera, diarrhea, malaria fever, typhoid fever, river blindness and others. The air which is the source of life has been polluted with chemicals, pathogens and other offensive odour. These Situations have strong implications for regional planning and management.

Regional planning is the articulation of relevant objectives for dealing with certain types of problems experienced by people in specific localities within any society. Amongst such problems are problems of waste, of competition (Naluba, 2017; Akue, 2020).
Agan Uwamba, (2003) clearly posits that obio/Akpo is one of the largest producers of solid waste in Rivers State. The inhabitants of the region dump refuse as if it has no implications on their community health and social welfare. Inadequate management of waste, besides posing severe environmental health risk on human population is capable of inflicting permanent damage on the ecological systems. Moreover, lack of good habit of the people towards proper management of solid waste, corruption, weak government policy, poor work attitude, lack of funds, inadequate facilities such as sufficient evacuation trucks and manpower among others are factors militating against effective waste disposal and management in Obio/Akpor local government area. Solid waste management should include all the activities that seek to minimize the health, environmental and aesthetic impacts of solid waste. It is on this premise that the study seeks to examine the impacts of solid waste dumps in soil quality in in Obio/Akpor local government area of Rivers State. The specific objective of the study was to determine the morphological properties of the soils, examine the pH of the impacted soil and control and to examine the physical properties of soil impacted by solid waste and also to examine the chemical properties of solid waste impacted sites. The study is significant because it will assist the state government and other stake holders and regional development planners in tackling of waste problems in the region.

2.0: Material and methods

2.1 Geography of the study area.

The region known as Obio/Akpor local Government area is located between latitudes $4^{0}50^{l}0824^{ll}$ North and $4^{o}502^{l}2.49^{ll}$ North and longitudes $70^{0}2^{l}18.48^{ll}$ East and $70^{0}06^{l}05.20^{ll}$ East. It covers an area of approximately 393.71 square kilometers and with a 2006 population census of 464,789 and a population density of 2,236 persons per square km. Obio/Akpor local government area was created on the 3rd of May,1989 with its headquarters at Rumuodomaya. It is popularly known as the Gateway local Government area. It is one of the major centers of economic activities in Rivers state. It is bounded in the north by Ikwere and Etche local Government Areas, in the South by Port Harcourt city and Eleme local Government areas in the East by Etche and Oyigbo local Government areas and in the West by Emohua local

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Government area. The region is mainly constituted by the people of Ikwere Ethnic Nationality, but due to its urban state and the hospitality of the people, there is a sprawl of other nationalities to the local government area. The districts that make up the local government area are Rumuolumeni, Ogbogono, Ozuoba, Mgbuoshimini, Rumuepirikon,Oroigwe, Rumuokoro, Rumuodara, Rumuokwachi, Rumueme, Elelenwo, Rumuokuta, Eneka and others. There are four prominent Ikwere kingdoms that are constitute the Local Government area. They are: Akpor, Apara, Evo and Rumueme kingdoms. The areas is rich with land and natural resources such as land, soil, vegetation, water, coal, petroleum gas, widelife, clay, sand and gravel, etc.
Figure 1.0 shows the study area.

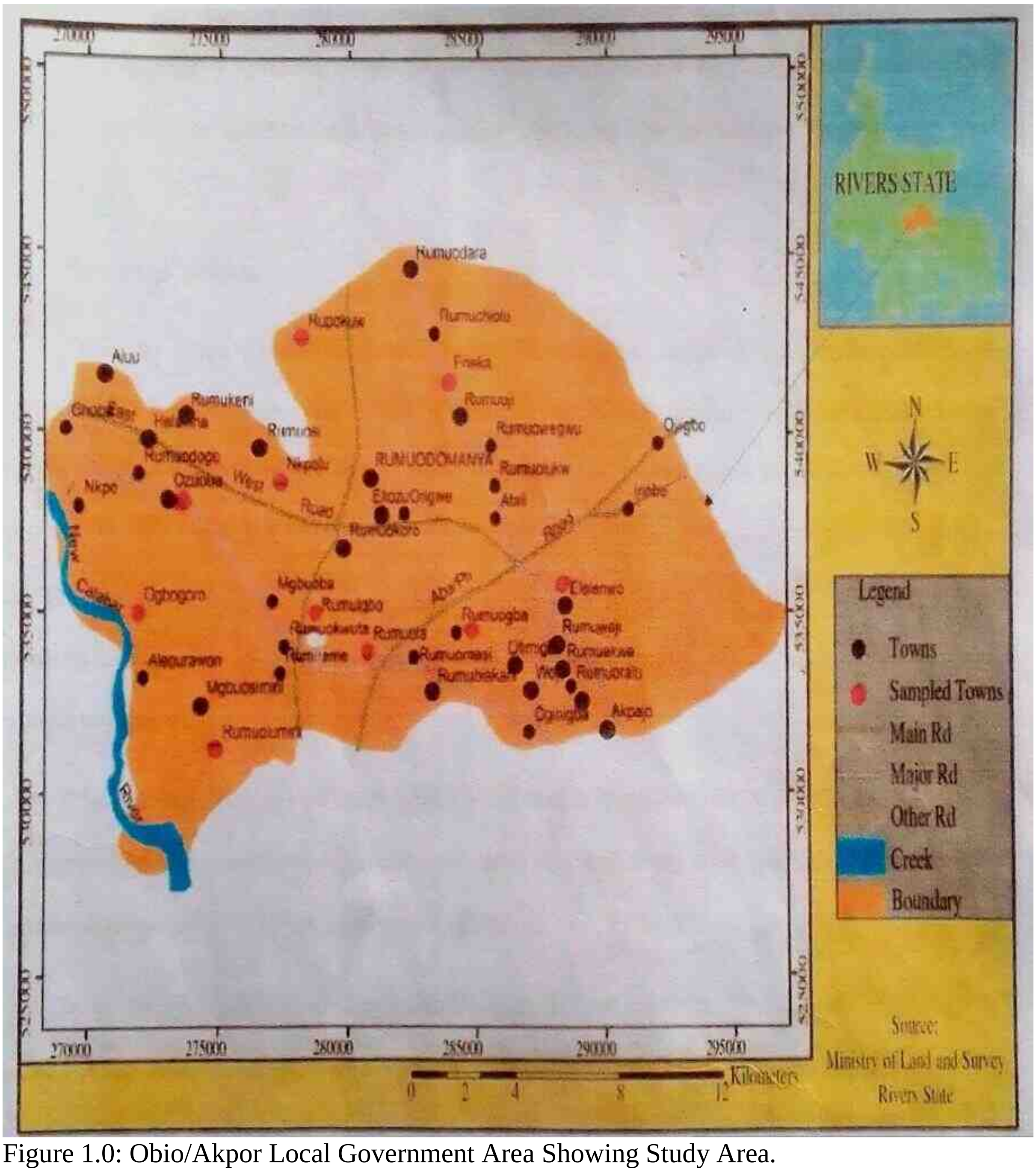

Figure 1.0: Obio/Akpor Local Government Area Showing Study Area.
Source: GIS Unit, Dept. Geo. & Envt. Studies, IAUE, P.H.

The topography of the region consists of lowland in the lower Niger Delta with an undulating topography that is prone to flooding and erosion. There is no outstanding relief features in the region. The plain surface of the area makes it better for life and other economic activities. The area is also characterized by a network of streams and rivers. The relief is generally lowland with an average elevation betwee20m and 30m above sea level. The geology of the area comprises of alluvial sedimentary basin and basement complex (Eludoyon, 2010). The vegetation consists of roffia palnus, thicks mangrove forest and patches of light, vain forest. The soil is usually sandy or sandy loam underlain by a layer of impervious pan and always leached due to the heavy rainfall experienced in the area. Generally, the soils of the area consist of reddish brown sandy clay loam, brown sandy soils, hight grew, slightly organic fine sand soils, silt clay and dark organic clay soil (Igwe, 2021; Clifford, 2021).
The area is well drained with both fresh and salt water. The study area experiences flooding almost every year due to continuous heavy rainfall and misses flow (Ayologha, 2010).

The area enjoys tropical hot monsoon climate due to its latitudinal position. The area experiences two seasons: wet and dry seasons with mean temperature recorded between January to April. Precipitation is at its peak in the month of September where on an average approximately 370mm of rainfall is observed. The driest month is in the month of December with a mean rainfall of 20mm. The harmatan is less pronounced with temperatures of about 27^0C throughout the year.

On socio-economic activities, the major occupation of the people is farming, fishing and trading. The area is accessible by water air and land. Presently, urban growth has ushered in several other activities into the area, such as, trading, transportation (land and air), oil exploration and production as well as craftsmanship and tourism. The area is also known for its commerce, industry, mines and agriculture. The activities include manufacturing such as food production, paper products, road construction, metal works, furniture, etc.
Services include: legal services, hospitality, medical, educational and engineering services, extractive industries liquefied oil and gas.

2.2: Research Methodology

The study adopted experimental research design. The nature and sources of data were through the primary source and also through the secondary sources. The primary data were generated through the collection and analysis of soil samples. The sample and sampling technique involved purposively selecting a total of seven (7) dumpsites from the dumpsites in the area while one dumpsite was used as control. The six dumpsites were Mgbuosimini, Rumuepirikon, Rumuolumeni, Ogbogoro, Rumuokwachi and Ozuoba. While Iwofe (IAUE) was used as control site. The method of data collection involved collecting soil samples from the selected dumpsites at a depth of 20cm using soil auger and labelled accordingly. The soil samples were then taken to the laboratory where they were air dried, crushed, passed through a sieve of 2mm diameter and put in clean polythene bags and stored at room temperature for laboratory analysis. The soil samples were taken to the laboratory and analyzed for pH, physical and characteristics. The soil color was also taken in the field. The physicochemical qualities of the soil samples were determined according to the Association of Official Analytical Chemists Standard Methods (AOAC, 2005). The parameters that were determined were pH, bulk density, moisture content, porosity of the soils, electrical conductivity, sand, silt and clay percentages, calcium potassium, phosphorus, sodium, and magnesium. The data obtained were presented as descriptive statistics and compared with National guideline limit set by the National Environmental Standards and Regulations Agency (NESEREA) and the World Health

Organization (WHO). The soil samples were analyzed using recommended procedures used in Nigeria. The particle size distribution was determined by Bouyoucos hydrometer method; Bulk density (core method), porosity (1-Bd/Pd x 10); soil reaction (pH) (calomel electrode methods); Available Phosphorus (AP) (electrophotometer method), Exchange Cations (Neutral Ammonium Acetate); Exchange calcium and magnesium (flame photometry); Organic carbon (Walkley and Black method); Total Nitrogen (Modified Macro Kjeldhal method); Electrical conductivity (EC) (Standard portable conductivity meter MW 301, Milwaukee, Wisconsin USA); potassium (K), calcium (Ca) and magnesium (Mg) by method of analysis described by Black (1998). The method of data analysis was by the one sample Chi-Square Statistical method.

3.0: Results and Discussion

3.1: Objective 1: Determination of the morphological properties of the soils.

Table 3.1: Morphological properties of the soils and the p^H of soils and control

S/N	Location	Depth (cm)	Coordinates	Color	Texture	Drainage	Land use	Vegetation	P^H
1	Mgbuoshimini	0-20	Lat. 4.808438 Log. 6.795443	10YR3/3 (dark brown)	S	Flat	Vegetables, plantain	Grasses	7.33
2	Rumuepirikon	0-20	Lat. 4.807690 Log. 6.974882	10YR3/4 (dark brown)	S	Valley bottom	Plantain	Secondary forest, shrubs.	7.25
3	Rumuolumeni	0-20	Lat. 4.819739 Log. 6.960106	10YR8/3 (very pale brown)	SL	Flat	Plantain	Shrubs	7.02
4	Ogbogoro	0-20	Lat. 4.851285 Log. 6.928942	10YR2/2 (very dark brown)	LS	Flat	Plantain, cocoyam	Grasses	7.68
5	Rumuokwachi	0-20	Lat. 4.866078 Log. 6.925650	10YR2/1 (black)	S	Flat	Pawpaw, coconut, banana	Grasses, shrubs	7.47
6	Ozuoba	0-20	Lat. 4.871388 Log. 6.929561	10YR3/3 (dark brown)	LS	Flat	Plantain, pawpaw	Grasses	7.43
7	Control (IAUE)	0-20	Lat. 4.806251 Log. 6.937519	10YR4/3 (brown)	S	Flat	Plantain, cassava, water leaf	Grasses, shrubs	7.18

Researchers fieldwork, 2022.

Table 3.1 describes the morphological structure of the soils under investigation. The table shows that the colour of the soils ranges from black, dark brown, very dark brown, to very pale brown for the six impacted soils as against brown for the control site. The textual class ranges from sand, Sandy loam and loamy sand as against the control which has same as it’s texture. The drainage ranges from flat to valley bottom for the six impacted soils under study while the control has flat drainage.

Land use for the six impacted soils were vegetables, plantain, cocoyam, pawpaw, coconut and banana. The control for the land use was plantain, cassava and water leaf. Vegetation include grasses, shrubs and secondary forest while the control included grasses and shrubs.

Objective 2: The p^H values of the soil samples from the selected dumpsites were similar. The value ranges from 7.02 to 7.68 with a mean of 7.33. The pH values were mostly alkaline. This alkaline pH could be due to the presence of metal scrap, waste materials in the dumpsites and other human activities taking place around the dumpsites. Sample 4 (Ogbogoro community) recorded the highest pH value of 7.68 and the lowest value of 7.02 was from sample 3 (Rumuolumeni). The sample sites 1, 2, 3 and 7 (Mgbuosimini, Rumuepirikon, Rumuolumeni, control Iwofe) were almost the same that is 7.02-7.33. The pH at these dumpsites could be as a result of anthropogenic activities which could introduce some liming materials overtime to the soil. The result indicate high levels of pollution and immobilization of the heavy metals may be attributed to alkaline pH in the study. However, there was no significant difference in pH>0.05.

Objective 3: Establishment of the physical properties of the soil impacted by solid waste.

Table 3.2: Physical properties of the soils.

S/N	Location	Depth (cm)	Coordinates	EC	% Sand	% Silt	% Clay	Textural Class	MC	BD	% Porosity
1	Mgbuoshimini	0-20	Lat. 4.808438 Log. 6.795443	399	88.6	3.4	8.0	Sand	12.99	1.22	53.99
2	Rumuepirikon	0-20	Lat. 4.807690 Log. 6.974882	1290	86.6	6.4	7.0	Loamy Sand	10.86	1.41	46.79
3	Rumuolumeni	0-20	Lat. 4.819739 Log. 6.960106	1900	84.6	7.4	8.4	Loamy Sand	32.28	0.79	69.89
4	Ogbogoro	0-20	Lat. 4.851285 Log. 6.928942	731	92.6	3.4	4.0	Sand	26.74	0.93	65.02
5	Rumuokwachi	0-20	Lat. 4.866078 Log. 6.925650	395	83.6	7.4	9.0	Loamy Sand	15.61	1.25	52.97
6	Ozuoba	0-20	Lat. 4.871388 Log. 6.929561	362	87.2	5.4	12.0	Loamy Sand	20.19	1.54	41.83
7	Control (IAUE)	0-20	Lat. 4.806251 Log. 6.937519	109.2	90.6	2.4	7.0	Sand	5.71	1.42	46.45

Researcher's fieldwork, 2022.

Table 3.2 shows that the electrical conductivity of impacted soils ranged from 362 to 1900. The mean for the experimental sites was 846 as against 109.2 recorded for the control (non-impacted soil site). Electrical conductivity of the soils ranged from 110-570 millisiemens per meter (Ms/m). Electrical conductivity that is too low indicating available nutrients. Likewise, excess nutrients in soil show high electrical conductivity on the soil. Electrical conductivity of the soil is primarily due to a rise in the concentration of soluble salts in the soil. Under prolonged conditions, soluble manganese leaches out of the soil. It should be noted that bacterial isolates with high frequency of occurrence are important human pathogens associated with a variety of infectious diseases such as gastroenteritis, typhoid fever, dysentery, cholera and urinary tract infection. The source of these pathogens is attributed to the biological degradation of waste materials in the dumpsites overtime.

Moisture content of the soil ranged from 12.99 to 32.28 and the mean value for the experimental sites was 19.78 as against 5.71 recorded for control. Bulk density ranged from 0.79 to 1.54 and the mean value 1.19 as against 1.42 obtained for the control.

Porosity of the soil samples ranged 41.83 to 69.89; while the mean value obtained from the six experimental sites was 55.08 as against 46.45 for the control. The decrease or increase in values of the various parameters in the experimental sites could be attributed to the impact of waste dumps on the impacted soils in the study area.

Objective 4: Evaluation of the soil chemical properties of solid waste impacted sites.

Table 3.3 Chemical properties of the soils

S/N	Location	Depth (cm)	Coordinates	% OC	% OM	C (mol/kg)						Ava. P (mg/kg)	% T. N.
						Ca^+	Mg^+	TEA	K^+	Na^+	CEC		
1	Mgbuoshimini	0-20	Lat. 4.808438 Log. 6.795443	2.15	3.69	11.20	4.20	1.20	5.13	4.35	24.88	22.75	0.08
2	Rumuepirikon	0-20	Lat. 4.807690 Log. 6.974882	1.99	3.43	24.20	5.60	0.96	18.59	8.69	57.08	12.25	0.09
3	Rumuolumeni	0-20	Lat. 4.819739 Log. 6.960106	1.05	1.82	46.00	7.20	1.12	17.94	16.30	87.44	12.25	0.09
4	Ogbogoro	0-20	Lat. 4.851285 Log. 6.928942	2.85	4.91	16.00	6.80	1.12	10.25	7.61	40.66	31.50	0.08
5	Rumuokwachi	0-20	Lat. 4.866078 Log. 6.925650	1.91	3.29	6.60	6.60	1.04	3.21	2.61	19.02	40.25	0.04
6	Ozuoba	0-20	Lat. 4.871388 Log. 6.929561	2.46	4.24	7.00	4.40	1.04	19.87	10.87	42.14	61.25	0.07
7	Control (IAUE)	0-20	Lat. 4.806251 Log. 6.937519	0.70	1.21	1.40	3.00	1.04	0.22	2.39	7.01	26.25	0.02

Researcher's fieldwork, 2022.

Table 3.3 shows organic content of the soils of the study area ranged from 1.05% to 2.85% and the mean value of the six experimental sites was 3.07% as against 0.70% for the control site. Soil organic matter of impacted soils ranged from 1.82% to 4.91%. the main value was 2.56% as against 1.21% for the control. Calcium ranged from 6.00cmol/kg with the mean as 18.50cmol/kg as the mean while the control has 1.40cmol/kg. magnesium ranged from 4.20cmol/kg to 7.20mol/kg and the mean is 5.8cmolkg as against 3.00cmol/kg for the control.

Total exchangeable acidity ranged from 0.96cmol/kg to 1.20cmol/kg. The mean was 1.08cmol/kg against 1.04cmol/kg for the control.

Potassium ranged from 3.21cmol/kg to 19.87cmol/kg with a means of 12.50cmol/kg as against 0.22cmol/kg for the control sodium ranged from 2.61cmol/kg to 16.30cmol/kg with mean value of 8.41cmol/kg as against 2.39cmol/kg for the control. Cation exchangeable capacity ranged from 19.02cmol/kg to 87.44cmol/kg with mean of 45.20 as against 7.01cmil/kg for the control. Available phosphorus ranged from 12.25mg/kg to 61.25mg/kg, while the value was 30.04mg/kg as against 26.25mg/kg for the control site. Lastly total nitrogen ranged from 0.04% to 0.09% with mean value of 0.075% as against 0.02% for the control. These results were compared with the WHO standard limits for soil. Soil parameters that exceeded the standard limits pose significant health and environmental risks to nearby residents.

3.2 Testing of hypothesis.

There is no significant difference between the pH of waste impacted soils and the control site in Obio/Akpor local Government Area of Rivers State. The one sample chi- square statistical tool was used in testing the hypotheses. Data for the experimental sites as well as the control were used as the observed frequencies while the corresponding means were used as the expected frequencies as in the table.

Table 3.4.1: Specific Data for measuring parameters

Sample	Observed frequency	Expected frequency
1	7.33	7.34
2	7.25	7.34
3	7.02	7.34
4	7.68	7.34
5	7.47	7.34
6	7.43	7.34
7	7.18	7.34

Researcher’s fieldwork, 2022.

Tables 3.4.2

Calculated x^2	DF	Level of sig	Critical ^{x2}	decision
0.17	6	0.05	12.59	Accept

From the table, the calculated chi square value of 0.04 is less than the critical value of 12.59, under 6 degree of freedom and 0.05 level of significance. Since the calculated value of 0.17 is less than the critical value of 12.59, we therefore accept the null hypothesis which states that there is no significant difference between the pH of impacted soil of waste dumps and the control (non-impacted soil). The soils in the experimental sites must have experienced anthropogenic activities which must have introduced some liming activities on the soil.

Ho2: There is no significant difference between the textural class of impacted soil and the textural class of control site in Obio/Akpor local Government Area.

Table 3.5.1: Specific Data for measuring parameter

Sample	% sand	% silt	% clay
1	88.6	3.4	8.0
2	86.6	6.4	7.0
3	84.6	7.4	8.0
4	92.6	3.4	4.0

5	83.6	7.4	9.0
6	87.2	5.4	12.0
7	90.6	2.4	7.0
Values of 1-6	87.2	5.6	8.0

Researcher's fieldwork, 2022.

Table 3.5.2

Calculated x^2	DF	Level of sign	Critical ^{x2}	Decision
2.09	2	0.05	5.99	HO2 Accept

Researcher's fieldwork and analysis, 2022

From the table 3.5.2, the calculated chi-square(x^2) value pf 2.09 as less than the critical value of 5.99 under 2 degrees of freedom and 0.05 level of significance. Hence, the null hypotheses which states that there is no significance difference between the textural classes of imparted soils and the control in the study area is therefore excepted. This implies that, there is no statistically significant differences between the textile of the soils impacted by waste disposal and management and that of non- impacted soil. This means that the wastes have no effect on the feel of the soil samples under study. However, there may be effect on the soil due to solid waste discarded in the soil. It was deduced from that the percentage of sand, silt and clay of the impacted soils have sand, loamy sand and sandy loam structure.

4.0: Discussion of findings

4.1: Soil textural characteristics

The textural characteristics of the soil samples collected around Obio/Akpor dumps were presented in table 3.1. the quality of the soil based on the suitability was unsuitable for agricultural purposes and that sit was considered as solid waste dumpsite. It was observed that the soil quality varied in three different locations. The texture of the soil in Mgbosimini, Rumuepirikon and Rumuokwachihas the same texture as that of the soil gotten at Iwofe (IAUE) control which has sandy (s) texture. The sand of Ogbogoro dumpsite and Ozuoba dumpsite have the same texture as loamy sand (LS). Whereas the soil at Rumuolumeni dumpsite has sandy loam (SL) as its texture. The textual analysis of soil indicated that soils have larger portion of sand content which indicated that leachates can seep deeper and ground water is at higher risk of contamination. The control (non-dumpsite) has almost the percentage of sand of that of the dumpsite found at Ogbogoro. The high percentage of sand content for polluted soil quality emanated from the deteriorated (MSW) municipal solid waste above the soil. This means that the large amount of sand is produced during the decomposition of municipal solid waste (MSW). Obio/Akpor local government area covers loamy sand type of soil with different sand, silt and clay content in soil as shown in table 3.3.the area is composed of two-third (2/3) of sand and the remaining are split into silt and clay. It is a subdivision of loam soil. The liquid limit decreases with increasing leachate concentration. This may be as a result of the presence of salts in the leachate. It has been observed that the presence of calcium ion can reduce the liquid limit of soil. The plastic limit of soil sample revealed in the trend upon the addition of leachate. The difference in plastic limit may be as a result of the resultant effect of increasing concentration of pollutants in the soil.

The moisture content of the soil is expected to be less than 20. The collected soil samples showed that moisture content is within the limit except for Rumuolumeni, Ogbogoro, and Ozuoba whose moisture content were 32.28, 26.74 and 20.19 respectively. A normal soil p^H could be within the limits of 6-8.5. but the p^H of the soil samples ranged from 7.02 to 7.78 and 7.18 for the control as in table 3.2. the higher significant amount of p^H recorded in the dumpsite soils could be attributed to presence of significant amount of liming materials and biological activities (soil microorganisms on the soil wastes). Organic matter (OM) ranged between 1.82 to 4.91 for impacted soil while the control has 1.21. This result shoed high and medium soil fertility class for upland crop cultivation in the study area. The area shows high organic matter in soil and microbial activity is also high due to high water holding capacity so that soil is suitable for crop production and not suitable for solid waste disposal. The electrical conductivity of the soil ranged from 362 to 1900 as against the control which has 109.2. the limit of the electrical conductivity is 1-2. High content of salt in the soil leads to exosmosis and plasmolysis leads to inhibition of water. This means that this condition of soil is not favourable for crops growth. Rumuolumeni site (waste dump) showed high concentration of salts and needs to stop the flow of fluid into the soil strata.

Potassium (K) ranged from 3.21 to 19.87 as against the control which has 0.22Cmol/kg. The limit of potassium is greater than 2Cmol/kg. Any soil that has less potassium (K) does not supply nutrient to grow plants and the water holding capacity of the soil become small. Phosphorus has a limit of 15mg/kg. The soil sampled ranged from 12.25 to 61.25mg/kg. This implies that soil in these areas are not favorable for soil growth but suitable for dumping of solid waste. This is because very high phosphorus will cause runoff, interflow as well as both ground water and surface water contamination in line of thought of Tirusew (2013). The unit of nitrogen is 0.15%. The total nitrogen of the soil samples ranged from 0.04% to 0.08% as against 0.02% for the control site. This was below the limit. This could be as a result of low nitrogen fixation in the soil and low microbial decomposition taken place in the soil. This means all the collected samples are unsuitable for production of crops and favorable for dumping of solid waste. Also the Bulk Density (BD), soil suitability index, Cation Exchange Capacity (CEC) and Exchangeable bases all revealed higher significant values. This affirms why farmers deliberately choose such sites for their farming activities.

Implication for regional planning and management

Solid waste handling, controlling and monitoring techniques in any region must be geared towards achieving environmental condition for man to live in. This is necessary to safeguard the health, productivity and quality of life of residents in the region. This situation requires proper planning and management. Waste disposal and management in any region should aim to do the following:

(i) Identify the waste disposal issues in the region.
(ii) Propose agreeable strategies and actions to solve the waste disposal issues.
(iii) Implement these strategies through coordinated public and private actions.
(iv) Monitoring and evaluating progress and making periodic adjustments.

(v) Strengthening environmental planning and management capacity in the affected region.

Conclusion and Recommendation

The study examined some physical, Chemical characteristics as well as the pH of some sampled in and around dumpsites in some communities in Obio/Akpor local government area of Rivers State. The study revealed that the deposition and decomposition of solid waste have led to significant impact on soil pH, bulk density, moisture content, porosity and electrical conductivity. However, no remarkable impact was noticed on the texture of the soils. There is a growing concern on the gradual building of toxic heavy metals at the dumpsites and there is likelihood of contamination of the soil posing a health hazard to the residents of the area. These toxic heavy metals can become available to plants and ground water over geological time whereby they will be biomagnified in food chain hence, health risk. The seepage of these pollutants through the soil of the waste dumpsites in Obio/Akpor can infiltrate through unsaturated zones to cause severe pollution problems. Therefore, solid waste handling, controlling and monitoring techniques in Obio/Akpor must be geared towards achieving environmental condition for man to live in.

Recommendations

1. The disposal of waste and subsequent management of the same must be a joint effort of all stakeholders and this must start from household and family level.
2. Putting waste into plastic container, polythene bags are measures taken in order to keep our environment clean and also reduce the indiscriminate dumping methods which degrades the environment especially the soil which is the uppermost layer of the earth crust on which plants grow.
3. Government must ensure that dumpsites are not anywhere close to residential areas as well as farmlands.
4. To ensure that waste does not affect the environment and also not cause health hazards to the residents, proper solid waste disposal and management has to be undertaken. To achieve this, the individuals, government, corporate organizations, etc. should embark on the following procedures:
   Proper segregation of waste at household level should be done and ensure that all organic matter be kept aside for composting. The organic matter can be composed and then used for fertilizer.
5. Material recycling and recovery should be used.
6. The use of plastic recycling should be promoted.
7. Municipalities should increase their level of service to the public regarding the sorting of waste.
8. Collection of hazardous waste at the collection points shall be secure, safe and performed in an environmental friendly manner.
9. There should be public enlightenment campaign and education on the harm caused by indiscriminate discarding of waste and this should be taught in all communities in the study area and beyond.
10. There should be proper water treatment prior to its use.

References

Adeji, A. A. and Majolagbe, E (2014). *Two major dumpsites in Lagos, Nigeria. Global journal science front Res*: B. Chem (internet). 14(7): 1 – 4. Available from: https://globaljournals.org/GJSFR/volume14/assessment_of_ground_water_quality.pdf

Agunawamba, C. O. (2003). *Environmental degradation: its effect on future generations.* American hygiene association. *Journal of the Nigerian business law practice.* Vol. 13. Pp 50-55.

Akue, L. O. (2020). *Basic elements of urban and regional planning. An introductory approach.* Port Harcourt colorfarm graphix Ltd. Pp 12-14.

Anikwe, M. A. N.; and Nwobodo, K. C. A. (2001). *Long term effect of municipal waste disposal on soil properties and productivity of sites used for urban agriculture in Abakaliki, Nigeria. Bioresources Technol*. 83:241-251.

Asuma, O. (2013). *Leachate characterization and assessment of ground water and surface Water qualities near municipal solid waste dumpsite in Effurun, Delta State, Nigeria. Journal of environment and earth sciences*. 3(9), 126-135.

Ayologha, G. (2010). Department of soil science, Rivers State University of Science and Technology. *Research journal of environment and earth science.* 3(4): 307-313,2001.

Christensen, D. Drysdale, D; Hasen, K; Vanhille, J.; Wolf, A. (2014). *Partnerships for development: municipal solid waste management in Kasese, Uganda. Waste management and research*. 32(11). 1063-1072.

Clifford, A. A. (2021). *The impacts of urban land use on soil characteristic in the Port Harcourt metropolis.* Unpublished Ph.D. thesis. Post graduate school IAUE, Port Harcourt.

Eludoyin, O. S. (2010). Department of geography and environmental management, University of Port Harcourt. *Research journal of environment and earth science*. 3(4): 307-313.

https://www.ajol.info/index.php/ajb/article/view/100707/89918.

https://doi.org/10.53623/tasp.v212.103

Igwe, A. A. (2021). *Geo-spatial analysis of the impacts of urbanization-induced activities on pollution status of Port Harcourt metropolis, Rivers State.* Unpublished Ph.D. thesis. Post graduate school IAUE, Port Harcourt.

Miller, T. C.; Spoolman, S. E. and Soares, J. (2010). *Environmental science. What can you do?* Canada Nelson Education Ltd.

Mpofu, K; Nzamugafata, P.; Maposa, I.; Nyoni, K. (2013). *Impacts on waste dumping on Pomona medium sand, clay, loam soils and surface water quality in Harave, Zimbabwe.* APRNJSCI Technol (Internet). 3(12): 1215-1221.

Naluba, G. N. (2017). *Repositioning environmental sustainability in the cities of the Nioger Delta sub region of Africa.* Journal of social sciences. Ignatius Ajuru University of Education, Port Harcourt. 14(1). 69-78.

Njoroge, G. K. (2007). *Environmental pollution and impacts on public health: implications of the Dandora municipal dumpsite in Nairobi, Kenya.* United nation environmental programme. P. 40. Avalaible from http://architectafrica.com/sites/default/files/UNEP.Dandora2007.pdf

Obot, E. E. (2013). *Foundation soils properties at old dumpsites under short term restoration from effect of municipal solid waste disposal. International journal lof engineering research technology* (IJERT). 02, issue 02, Feb. 2013. DOI:10.17577/IJERT V.2152556

Olanrewaju, O. O. and Illemobade, A. A. (2009). *Waste to wealth.*

Onyekwerre, P. and Nwakanma, C. (2022). *Investigating the effects of solid waste dumps on surrounding soil and ground water quality around Umuahia, Abia State, Nigeria.* Tropical aquatic and soil pollution research article 2(2), 2022. 126-133.

Sam-Uroupa F. R., Ogbeibu, A. E. (2020). *Effects of solid waste disposal on he receiving soil quality in Benin metropolis, Nigeria. Journal of applied science and environmental management.* 24(2). 393-401. DOI: https://dx.doi.org/10.43/jasem.v2412.27

Seema, J. and Ruhab. (2020). Municipal solid waste dumping and its impact on soil on soil Quality in Karachi institution of environmental studies, University of Karachi, Karachi Pakistan. International Journal of of Environmental quality. Vol. 36. 9-14.

Shaikh, P. R.; Bhosle, A. B.; Yannawar V. B. (2012). *The impacts of landfill on soil and ground water qualityof the Nwaded city.* Maharashtra Res (internet) cited 2017, May 7; 4(7): 56-63.

Snakoh, F. P. and Zan, X. (2013). *Problems of solid waste management in developing urban Cities: a case study of Freetown, Sierra Leone. American journal of environmental protection.* 2(5). 113-120.

Tiresew, E. A. (2013). *Solid waste site sustainability analysis using geographic information system (GIS) and remote sensing for Bahir Dan Town, North Western Ethiopia. African journal of environmental science and technology*. 7(11). 976-989.

Uzoigwe, C. L. and Agwa, O. K. (2012). *Microbiological quality of water collected from bore holes sites near refuse dumpsites in Port Harcourt, Nigeria. African journal of biotechnology.* 11(13): 3135-3139.