CHAPTER ONE

1.1 BACKGROUND OF THE STUDY

Mineral resources are the major sources of raw materials in several manufacturing industries all over the world such as tin smelting, glass, chalk, fertilizer, iron and steel, cosmetics and construction. The Nigerian government through the geological survey of Nigeria has played an active role in the exploration for these mineral deposits, which dates back to 80 years. Heavy metals are released into the environment by both natural and anthropogenic sources.

(Lenntech, 2004). The main natural sources of metals in soils are chemical weathering of mineral which are the anthropogenic sources and they are associated mainly with industrial, agricultural, mining, land disposal of waste, waste incineration, mechanic workshop and fuel filling station.

Heavy metals contamination of topsoil has been a major concern regarding their toxicity, persistence and non-degradability in the environment. Toxicity of these compounds has been reported extensively (Momodu and Anyakora, 2010*;* Anyakora *et al*, 2011). They accumulate overtime in soils, which act as a sink from which these toxicants are released to the groundwater and plants and end up through the food chain thereby causing various toxicological effects (Odiete,1999). Effects of elevated concentrations of heavy metals to soil functions, soil microbial composition and microbial growth have long been reported under both field and laboratory conditions (Tyler, 1989).

Health effect of elevated levels of Zn is severe vomiting, diarrhea bloody urine, liver, kidney failure and anaemia (Fosmire, 1990*)*. while excessive Pb poison causes inhibition of haemoglobin synthesis, dysfunction in the kidneys, reproductive systems and cardiovascular system (Ferner, 2001) Excess Cd have being reported to bring about renal dysfunction, anaemia, hypertension, bone marrow disorder, cancer, kidney damage, bronchitis , liver and brain disorder (Dara, 2000*)*. while high concentration of manganese could results in kidney failure, liver and pancreases malfunctioning (Underwood, 1977*)*. Human activities in urban areas largely contribute to the contamination of urban soils and this is a major health concern.(Laidlaw and Filippelli *et al* 2008).

The extent of human impact is now so pervasive and profound, that there is need to investigate the levels of heavy metals in soils from different anthropogenic sites. Mining is one of the important pathways by which soils are polluted (Ademoroti,1996). Mining has considerable effect on the air and water, loss of biodiversity, soil pollution and land degradation (Pandey and Kumar *et al*, 1996). Mining also results to clearing of vegetation, reduces essential nutrients and organic matter of the soil, reduces biological activity and decreases productivity of the soil (Brady and Weil *et al*, 2007)

(Pandey and Kumar *et al*,1996). Activity of the soil (Pandey and Kumar *et al*,1996). Mineral exploration directly or indirectly affects both the living things and non-livings things through the physical and chemical modification of the soil environment (Ratcliffe, 1974).

According to Bishop (2000), amongst all the classes of solid waste pose the greatest threat to life since it has the potential of polluting the terrestrial aquatic and aerial environmental land pollution by aerial environmental land pollution by components of refuse such as heavy metals has been of great concern in the last decades because of their hazard to main and other organism when accumulated within a biological system. Many metals act as biological poisons event at part per billion levels. The toxic elements accumulate in organic matter in soils and sediments are taken by growing plants (Dara, 1993). The metals are toxic as the condensed free elements but are dangerous in the form of cation and when bonded to short chains of carbon atoms.

The recent population and industrial waste which are indiscriminately dumped in landfill and water bodies without treatment. 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 waste enhances soil fertility

In Nigeria, little information is available on the types of micro-organism associated with waste dumpsite heavy metals present as well as the relationship between the microorganism and heavy metal. There is therefore the need to isolate characterize and identify the types of bacterial associated with waste dumpsite as well as study the contributions of selected municipal refuse dumps to heavy metals concentration in the soil in Ijero-Ekiti southwest Nigeria.

1.2 PROBLEM STATEMENT

Mining soil cause enormous damage to the fauna and flora which disrupt the local hydrological cycle and alters the characteristics of soil system due to destruction of the vegetal cover.

Specific soil related constraints to mine soil reclamation are low pH, soil erosion and elemental toxicity (e.g. Al, Mn, etc) and non- availability of N, P and K in the soil.

1.3 OBJECTIVE OF THE STUDY

The main objective is:

1. To determine the physicochemical characteristics of mining soil in Ijero-Ekiti

The specific objective is:

2. To assess the influence of various soil parameters such as soil pH, soil porosity, and soil color on pollutant bioavailability

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Soil

Soils are particulate materials of the outer crust of the earth surface formed from the continuous weathering of the underlying parental rocks.(Brady and Weird *et al* ,1999).

Therefore, the type of soil is a function of the nature of the underlying rocks. Soil formation has been reported to be combination of various interrelated factors of parental materials, climate, organisms, topography and time.(Adekayode , 2003).

Soil is important to everyone directly or indirectly.

Soil is a complex ecosystem where living organisms play a key role in the maintenance of its properties. Soil is a highly complex medium influence by environmental and physicochemical parameters, creating a varied habitat for a diverse range of soil microorganisms.

Soil quality can be assessed by analyzing different physiochemical parameters with the analysis of microbial diversity.

These are the various indicators which provide the actual condition, nature and quality of the soil.

2.2 Soil Colour

Soil colour does not affect the behavior and use of soil; however it can indicate the composition of the soil and give clues to the conditions that the soil is subjected to. Soil can exhibit a wide range of colour; gray, black, white, reds, browns, yellows and under the right conditions green colour and distribution pattern of soil results from both chemical and biological processes, especially redox reactions. As the soil contains various minerals, organic compounds so the combination lead in to new and colorful compounds.

Reducing environment produce disrupted colour pattern but aerobic environment result in uniform pattern of colour change. Yellow or red soil indicates the presence of iron oxides. Dark brown or black colour in soil indicates that the soil has high organic matter content.

Due to presence of water wet soil appears darker than dry soil.

Soil colour is get affected by oxidation rate which is dependent upon water content. High water content means less air in the soil, specifically less oxygen. (Gonazalo and Heike 2004; Gonzalo *et al,* 2003). In well drained (oxygen rich soils) red and brown colour caused by oxidation are more common, as opposed to in wet (low oxygen) soils where the soil usually appears grey. The presence of specific minerals can also affect soil color.

Manganese oxide causes a black colour, glauconite makes the soil green and calcite can make soil appearance white.

2.3 Soil types

Soil is basically of 5 types these are:

1. Sandy Soil:

This light and dry in nature. Approximately no moisture content and absorb heat quickly.This is good for the production of early crops.

It is fit for cultivation any time of the year but it need to be watered frequently.

2. Clay Soil: Clay soil is also called “late soil” The soil serves as an excellent retort for the dry season, as it has a high water retention quality.For improving texture, it is necessary to drain clay soil frequently. The soil becomes unmanageable during rainy season, as it becomes „sticky‟. On the other hand, during draught, it becomes “rock solid”

3. Loam Soil:

Loamy soil is a combination of all the three sandy soil, clay soil and silt soil, in the ratio of 40:40:20. It is suitable for any and every kind of crops. loam soil has best of the characteristic of all. It has high nutrients content, warms up quickly in summers and rarely dries out in the dry weather. It has become the ideal soil for cultivation.

4. Peaty Soil:

Peaty soils are acidic in content, which makes them sour. This is the most exceptional feature of Peaty soils. Usually found in low-lying areas, these soils require proper drainage, as the place is accustomed to a lot of water clogging. Though peaty soils have less nutrient content, they warm up quickly in the spring, making them excellent if right amount of fertilizers are added.

5. Chalky Soil:

Chalky soil is alkaline in nature and usually poor in nutrients. It requires nourishment, in the form of additional nutrients and soil improvers, for better quality. The soil becomes dry in summers, making it very hard, and would require too much of watering for the plants to grow. The only advantage which such a soil has is its lime content. When deep rooted, Chalky soil becomes excellent for plant growth and favors good growing conditions as well.

2.4 Physicochemical parameters of Soil

These parameters provide the physical and chemical status of the soil. (Rabah ,2010) assessed different physicochemical parameters of the soil contaminated with abattoir effluents.(Zaiad and Galal M *et al*, 2010) analyzed different physicochemical parameters Al-Khums city, Libya.

The parameters which were studied by different groups are summarized and represented in table 1.

Table 1: Different physicochemical parameters of soil

S/N	Physiochemical parameters	References
1	pH,Temperature,Nitrogen,Magnesium,Phosphorus,Potassium,Calcium,Sulphide organic matter, Cation exchange capacity	(Rabah , 2010).
2.	Moisture contents conductivity,TDS,pH, and chloride contents	(Zaiad and Galal M *et al*, 2010).
3	pH, Conductivity, Total alkalinity, Total chloride ,Sulphate, Bulk Density Moisture Content, Organic matter, Na, K	(Narkhede,2011). [12]
4	pH , Bulk density, Specific gravity, N,P,K,Carbon Nitrogen ratio	(Pal and Lalwani *et al*, 2011).
5	pH , EC, N,P,K,Cu,Fe,Mn,Zn,Ni,Cd	(Pujar, 2012). [12]

2.5 Physio-chemical parameters of Soil quality

pH

The most significant property of soil is its pH level, Its effects on all other parameters of soil. Therefore, pH is considered while analyzing any kind of soil. If the pH is less than 6 then it is said to be an acidic soil, the pH range from 6-8.5 it's a normal soil and greater than 8.5 then it is said to be alkaline soil.

Texture

Soil texture is a qualitative classification tool used in both the field and laboratory to determine the classes for agricultural soils based on their physical texture. Soil in different regions shows different texture, the texture of the soil is mostly depends upon the size of particles. Soil texture shows its effect on aeration and root penetration. It also effect on the nutritional status of soil. Soil texture can be expressed significantly by its electrical conductivity.

Moisture

Water content or moisture content is the quantity of water contained in a material, such as soil called soil moisture, Moisture is one of the most important properties of soil.

Absorption of the nutrient by soil is largely depends on moisture content of the soil moisture of soil also shows its effect on the texture of soil.

Soil temperature

Soil temperature depends on the ratio of the energy absorbed to that lost. Soil has a temperature range between -20 to 60 °C. The temperature of the soil is the most important property because it shows its effect on the chemical, physical and biological processes related to growth of plants. Soil temperature changes with season, time of day, and local conditions of climate.

Electrical conductivity

Electrical conductivity is also a very important property of the soil, it is used to check the quality of the soil. It is a measure of ions present in solution. The electrical conductivity of a soil solution increases with the increased concentration of ions. Electrical conductivity is a very quick, simple and inexpensive method to check health of soils. It is a measure of ions present in solution. The electrical conductivity of a soil solution increases with the increased concentration ions.

Nitrogen

Nitrogen is the most critical element obtained by plants from the soil and is a bottleneck in plant growth. About 80% of the atmosphere is nitrogen gas. Nitrogen gas diffuses into water where it can "fixed" (converted) by blue-green algae to ammonia for algal use. Nitrogen can also enter lakes and streams as inorganic nitrogen and ammonia. Because nitrogen can enter aquatic systems in many forms, there is an abundant supply of available nitrogen in these systems.

Phosphorus

Phosphorus is a most important element present in every living cell. It is one of the most important micronutrient essential for plant growth. Phosphorus most often limits nutrients remains present in plant nuclei and act as energy storage.

Potassium

Potassium plays an important role in different physiological processes of plants, it is one of the important elements for the development of the plant. It is involved in many plant metabolism reactions, ranging from lignin and cellulose used for the formation of cellular structural components, for regulation of photosynthesis and production of plant sugars that are used for various plant metabolic needs.

Soil organic matter

It is also a valuable property of soil. If the soil is poor in organic matter, then it enhances the process of soil erosion. If the soil organic matter is present in soil, then this soil is useful for the agricultural practices. Organic matter may be added in the soil in the form of animal manures, compost, etc. The presence of the higher content of organic matter in the soil can be another possible reason for lowering of the pH. Soil organic matter content has decreased from surface to subsoil due to leveling.

2.6 Water

Water is a chemical compound having two hydrogen and one oxygen atom linked by covalent bond. Its molecular formula is H_2O.Water is a liquid at standard ambient temperature and pressure. It is also found in solid (ice) and gaseous (vapour) state. 71% of the total Earth surface is covered by water. On Earth water is found as ocean, river, lake, groundwater and glacier etc. Water is a vital element of all the biological systems Water is needed for day to day activity. For various production processes at industries water is also essential. Water plays a pivot role in the field of agriculture.

Water is also a huge ecological system which houses various kinds of organisms. Safe drinking water is essential to humans and other life forms even though it provides no calories or organic nutrients.

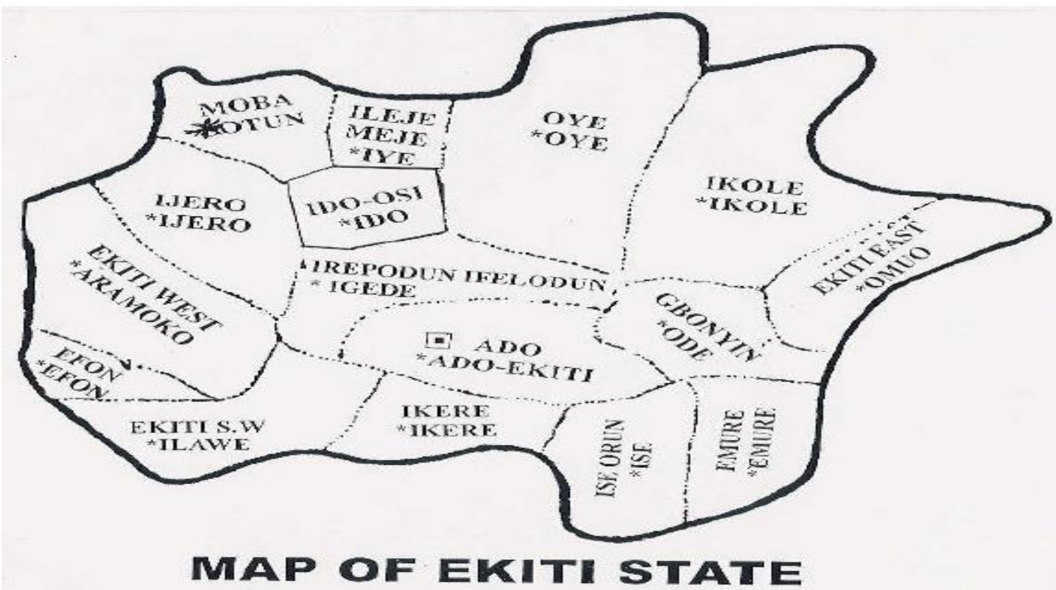
Water is highly essential for day to day activities of human. The physical and chemical parameters of water (e.g. pH, Dissolved Oxygen, TDS, alkalinity etc.) provide the quality of water and for which purpose it can be used.

CHAPTER THREE

3.0MATERIALS AND METHODS

3.1Study Area

The study area is Ijero-Ekiti and Oye-Ekiti while fig. 1 shows the geological map of the two location areas. Ijero-Ekiti is situated at 7.81° North latitude, 5.07° East longitude and 466 meters elevation above the sea level. Ijero-Ekiti is a big town in Nigeria, having about 167,632 inhabitants.



Source: researchgate.net

Date assessed: 08-01-2020

Figure 1: Map of Ekiti state

It is the third largest city in Ekiti State. Soil Sample A was gotten from an active mining site in Ijero-Ekiti, (plate 1)

Plate 1: Active mining site where soil A was obtained from Ijero-Ekiti

Soil sample B was gotten from Federal University Oye-Ekiti along the boy’s hostel pathway (Plate 2).

Plate 2: Control site for soil B

3.2 EXPERIMENTAL DESIGN

The soil sample A (Ijero-Ekiti) and soil sample B (Oye-Ekiti) were collected using soil auger and transferred into cellophane bags, tightly sealed with minimal air space and labelled with carbon free paper in which soil sample A serves as SS1 which is the mining soil gotten from Ijero-Ekiti while the soil B which serves as SSC is connoted has the reference gotten from taken from Federal University Oye-Ekiti along the boy's hostel pathway the two soils is stored outside in a cool place to prevent breaking down of organic matter. Samples were air dried for 48 hours, and then sieved with 2 mm mesh to remove debris, gravel and other materials prior to analysis

Determination of moisture content in soil using oven Drying method

Procedure

Weigh an aluminium dish that has been preheated (1mg) (W_1) accuracy for at least 10 minutes.

Transfer at least 2 – 5 g mineral soil sample (1mg) accuracy to the dish and weigh soil plus dish (W_2)

Place the dish sample in an oven at 105ºC for 2hours. Dry to constant weight.

Cool in desiccators for 30 minutes. Weigh to an accuracy of (1mg) (W_3).

Calculation

$$\text{Water content, (\% by weight)} = \frac{(W_2 - W_3)}{(W_2 - W_1)} \times 100$$

Soil pH in water (pHw) Determination

Procedure

- Weigh or scoop 10 g of sieved, air – dried soil into beaker.
- Add 10 ml distilled water to the sample.
- Stir vigorously for 15 seconds and let stand for 30 minutes.
- Stir the soil and water slurry.

- Place the electrode in the slurry, swirl carefully and read the pH immediately. Ensure that the electrode tips are in the slurry and not in the overlying solution.
- When a stable number is achieved on the pH meter, record the meter reading as pHw to the nearest 0.1 unit.

Calculation

The result is the direct reading from the pH meter and is reported as pHw.

Determination of Bulk Density in soil

Procedure

- Fill a pre – weighed 100 ml graduated cylinder with air – dry soil
- Compact the soil in the cylinder by tapping the cylinder firmly 15 times on the palm of the hand.
- Record the volume of the packed soil in the cylinder.
- Record the weight of the cylinder and the soil.
- Calculate the weight of the soil.
- On a separate sample, determine the moisture content of the soil sample and calculate the oven- dry weight of the soil in the cylinder.
- Calculate the bulk density.

Calculation

$$\%\ \text{equivalent oven – dry weight} = \frac{\text{Weight of air – dry soil (g)} \times 100}{100 + \%\ \text{residual water content of the air -dry soil}}$$

$$\text{BD (g/cm}^3\text{)} = \frac{\text{Weight of oven – dry soil (g)}}{\text{Volume of soil sample (cm}^3\text{)}}$$

Note: Bulk density is commonly calculated on oven – dry basis, but for certain uses it is calculated on a wet soil basis.

Determination of Particle Density in soil

Graduated Cylinder Method

Procedure

- Weigh 40 g of soil in a 100 ml graduated cylinder.
- Add 50 ml of water to the soil in the cylinder. Ensure no soil materials adhere on the inner walls of the cylinder.
- Stir thoroughly with a stirring rod to displace the air, and rinse the stirring rod and the inner walls of the cylinder with 10 ml water.
- Record the volume of the packed soil in the cylinder.
- Allow the mixture to stand for 5 minutes and record the volume of the soil plus 60 ml water.
- Determine separately the moisture content of the soil sample by the gravimetric method. The amount of moisture should be added to the amount of water added to obtain the total amount of water used.

Calculation

Volume of total solids = volume of (soil + water) – volume of added water

Volume of (soil + water) = as shown on graduated cylinder

Volume of added water = 60 ml + soil moisture (ml)

$$\text{PD (g/cm}^3) = \frac{\text{Weight of oven – dry soil (g)}}{\text{Volume of soil sample (cm}^3)}$$

Determination of Percent Pore Space/ Porosity

Porosity is not usually determined, but it can be calculated from the bulk density and the particle density.

$$\text{\% PS/ Porosity} = \frac{\text{PD} - \text{BD}}{\text{PD}} \times 100$$

Determination of soil texture / particle size distribution using mechanical analysis

Procedure

- Weigh out 20 g of soil and transfer to a shaker cup, add 50 ml of distilled water and 5 ml of Hexametaphosphate solution (5%).
- Stir for 5 - 10 minutes and pour contents in 500 ml graduating cylinder. Use a stream of water from a wash bottle to transfer remaining in cup. Bring volume to 500 ml.
- Put a palm of hand over top, grasp bottom of cylinder and invert several times to re-suspend soil.),
- Set on bench top, begin timing and take a 20 ml or 25 ml aliquot from the upper 10 cm of suspension at 48 seconds.
- Transfer aliquot to a weighed evaporating dish and put in oven at 105ºC. Higher temperature than boiling is needed due to the presence of solutes. Label evaporating dish “silt + clay’’.
- Take the second 20 or 25 ml aliquot only after 40 minutes but from upper 4cm of the suspension. Mark pipette 5cm above tip. Then transfer aliquot to weighed evaporating dish put in oven at 105ºC and dry top constant weight. After 40 minutes, all silt grater than 0.005mm diameter will have settled to below 5cm. thus, the second aliquot contains some silt (0.005mm to 0.002mm diameter) as well as clay.
- Dispose of suspension and soil into waste bucket, not down sink drain.
- Remove evaporating dishes from oven, cool and weigh. Record the net weight of the first evaporating dish as combined silt and clay in 1/20 of the soil – water suspension. The net weight of the second is assumed to be 1/20 of the clay.

Calculation

% Clay = (20 x mass of clay / total mass of soil) x 100

% Silt = (20 x mass of silt + clay / total mass of soil) x 100

% Sand = (20 x mass of clay / total mass of soil) x 100

Determination of bicarbonate and carbonate in soil

Procedure

- Weigh or scoop 10g of < 10 mesh soil into an extraction flask.
- Add 0.1 g of activated charcoal in order to obtain a clear filtrate.
- Add 25 ml of the extracting solution
- Shake the suspension for 15 minutes and filter through Whatman No. 42 filter paper (or equivalent filter paper.
- Transfer a 10 ml aliquot to a 50 ml conical flask
- Add 3 or 4 drops of Phenolphthalein indicator. The appearance of a pink colour indicates the presence of carbonate.
- Titrate the content in the flask with 0.01 M HCl solution until the pink colour disappears
- Record the volume of HCl titrant used (V).
- To the colourless solution, add 2 to3 drops of methyl orange indicator
- Continue the titration, without refilling the burette, to the pin end point.
- Record the total volume of HCl used (T)
- Run a reagent blank and record the titre value B.
- Run a standard in the same way as the sample is run.

Calculation

$$CO_3\ (\text{mg/L}) = \frac{(V - B) \times \text{Molarity of HCl} \times 60000}{\text{Volume of extractant}}$$

$$CO_3 \text{ in soil (mg/Kg)} = \frac{CO_3\ (\text{mg/L}) \times \text{Molarity of HCl} \times 60000}{\text{Mass of soil}}$$

$$HCO_3\ (\text{mg/L}) = \frac{(T - 2V - B) \times \text{Molarity of HCl} \times 61000}{\text{Volume of extractant}}$$

$$HCO_3 \text{ in soil (mg/Kg)} = \frac{HCO_3\ (\text{mg/L}) \times \text{Molarity of HCl} \times 61000}{\text{Mass of soil}}$$

Determination of cation exchange capacity in soil

Procedure

- Add 25g of soil to a 500 ml extraction flask.
- Add 125 ml of the 1M Ammonium acetate shake thoroughly and allow to stand 16 hours overnight.
- Filter the flask using a Buchner funnel (with filter paper). with suction
- Gently wash the soil four times with 25 ml additions of the Ammonium acetate, allowing each addition to filter but not allowing the soil to crack or dry. Apply suction only as needed to ensure slow filtering. Discard the leachate unless exchangeable cations are to be determined. **Note: exchangeable cations can be determined on the leachate after diluting into 250 ml.**
- Wash the soil with eight separate additions of 95% to remove excess saturating solution, only add enough to cover the soil surface, and allowing each addition to filter through before adding more. Discard the leachate and clean the receiving flask.
- Extract the adsorbed NH_4^+ by leaching the soil with eight separate additions of 1M KCl leaching slowly and completely above. Discard the soil and transfer the leachate into a 250 ml volumetric flask. Dilute the volume with additional KCl**.**
- Determine the concentration ofNH_4 - N in the KCl extract by distillation or colorimetry. Also determine the NH_4 -N in the original KCl extracting solution (blank) to adjust for possible NH_4-N in the contamination in this reagent.
- If determined by distillation, follow the SOP for nitrogen determination in water manual.

Calculation

$$\text{CEC (meq/100)} = \frac{NH_4 - N^+ \text{ (mg/L as N)}}{14}$$

$$NH_4 - N^+ = (NH_4 - N \text{ in extract -- } NH_4 - N \text{ in blank})$$

Determination of soil organic matter (Walkey black method)

Procedure

- About 0.10g dried soil was weighed and transferred into a 500 mL Erlenmeyer flask.
- Add 10mL of 0.167M $K_2Cr_2O_7$ by means of a pipette.
- Add 20mL of concentrated sulfuric acid by means of dispenser and swirled gently to mix, then allow to stand 20-30 minutes.
- Dilute the suspension with about 200mL of water to provide a clearer suspension for viewing the end point.
- Add 10mL of 85 of phosphoric acid and 0.2g of sodium fluoride are added to complex Fe^{3+} which would interfere with the titration endpoint.
- Add 10 drops of Ferroin indicator
- Titrated with 0.5M Fe^{2+} to a burgundy endpoint (a wine red). The colour of the solution at the beginning is yellow orange to dark green depending on the amount of unreacted$Cr_2O_7^{2-}$ remaining which shifts to a turbid gray before the endpoint and then changes sharply to a wine red endpoint.
- Run a reagent blank using the procedures without the soil. The blank is used to standardize the Fe^{2+} daily.

Calculations

The result was calculated as follows:

% Easily Oxidizable Organic Carbon

$$\%C = \frac{(\text{blank titre} - \text{sample titre}) \times 0.5M \times 12 \times 100}{\text{Weight of soil} \times 4000}$$

Total carbon = %C x 1.30

$$\%\ \text{Organic matter} = \frac{\text{Total carbon} \times 1.72}{0.58}$$

12/400 = milliequivalent weight of carbon in g.

To convert easily oxidizable carbon to total carbon divide by 0.77 or multiplies by 1.3

CHAPTER FOUR

4.0 RESULTS

Table 1 shows the particle size distribution and physical properties of soil samples collected at Ijero-Ekiti Mining site shows a concentration 89.15 of sand and for control shows 99.25, that of silt shows 10.6 and for control shows 0 that of clay shows 0.25 and for control shows 0.72.

Bulk density ranges from 1.43 to 1.58 g/cm3 at Ijero-Ekiti compared values of bulk density are below mean value of 2gcm-3reported by Onwermadu *et al.*, 2007*)* which means the Bulk density in Ijero-Ekiti has an high bulk density which reduces water filtration.

It shows the control site of the textural class at Oye-Ekiti was sandy while that of Ijero-Ekiti as sandy loam.

Table 2 shows the chemical properties of the mining site the pH values in Ijero-Ekiti and Oye-Ekiti ranges from 7.3 & 7.5 which means the pH value of Ijero-Ekiti is a normal soil which is very good, and it means the mining soil in Ijero-Ekiti is very useful for agricultural practices and it can help to improve the yield of crops.

Table 2: SOIL SAMPLE RESULT

S/N	PARAMETERS	SSC	SS1
1 1	Colour (Munsell Color chart)	Brown	White
2	pH (soil-water ratio,1:2)	7.30	7.50
3	Conductivity (µs/cm)	287.90	164.0
4	Porosity (%)	46.44	40.82
5	Salinity (ppt)	0.15	0.09
6	Bulk Density (g/cm3)	1.43	1.58
7	Texture	Sandy Loam	Sandy
8	Moisture Content (%)	0.87	0.43
9	TOC (%)	1.89	0.81
10	ParticleSize Distribution (%)		
	Sand	89.15	99.28
	Silt	10.60	0.0
	Clay	0.25	0.72

Table 3: Particle size distribution and physical properties of soil samples collected at mining site

Soil Particle	Concentrations (mg/kg)	Control (mg/kg)	Standard Limits
Sand	89.15	99.28	0.25- 0.1
Silt	10.6	0	0.05-0.002
Clay	0.25	0.72	Less than 0.002
Porosity (%)	46.44	40.82	0.01- 0.5%
Moisture Content (%)	0.87	0.43	0.2- 0.5
Bulk Density (g/cm3)	1.43	1.58	1.0- 1.8(g/cm3)

Table 4: Chemical properties of soil samples collected at mining site

Physiochemical parameters	Concentrations (mg/kg)	Control (mg/kg)	Standard Limits
Ph	7.3	7.56.5-8.5	
TOC (%)	1.89	0.81	1-10%
Conductivity (us/cm)	287.9	164	200 - 400(us/cm)
Salinity(ppt)	0.15	0.09<10(Excellent)	

CHAPTER FIVE

DISCUSSION

The results from this study the physiochemical parameters of the soil pH in the mining soil taken from Ijero-Ekiti is 7.3 which indicate that the pH level is a normal soil which also falls under WHO Standard Limit and it then shows that soil in that area is favourable for agricultural production which can also improve the yield of crops. The bulk density ranges from 1.43-1.58 for both the Control and Test Sample. The textural class of the mining site soil is Sandy Loam while the textural class of Oye-Ekiti is Sandy. This means that soil texture of Ijero mining site and Oye-Ekiti is good for the production of crops.

The technology adopted at Ijero-Ekiti mine also affected soil texture; sandy loam soil indicated the pulverization of soil into higher silt and clay fractions.

Soil colour does not affect the behaviour and use of soil; however, it can indicate the composition of the soil and give clues to the conditions that the soil is subjected to.

Soil can exhibit a wide range of colour; gray,black,white,reds,browns,yellows and under the right conditions green colour and distribution pattern of soil results from both chemical and biological processes, especially redox reactions. The soil colour of the Ijero mining soil is Brown which indicates that the soil has high organic matter content. Due to presence of water wet soil appears darker than dry soil. As the soil contains various minerals, organic compounds so the combination lead into new and colourful compounds.

The presence of specific minerals can also affect soil colour. Soil colour is get affected by oxidation rate which is dependent upon water content. Texture refers to particle proportions or to sand, silt, and clay fractions in the soil mass. It is closely related to water retention and transport, soil structure, nutrient content, and organic matter, besides its strong influence on soil erosion processes.

The textural class of the mining site soil is Sandy loam while the textural class of Oye-Ekiti is Sandy. This means that soil texture of Ijero mining site and Oye-Ekiti is good for the production of crops. It has high nutrients content,warms up quickly in summers and rarely dries out in the dry weather. Porosity is determined by porous space.

Water amount in the soil depends on climatic factors and on soil texture, structure, and porosity.

The technology adopted at Ijero-Ekiti mine also affected soil texture; sandy loam soil indicated the pulverization of soil into higher silt and clay fractions.

5.1 CONCLUSION

Conclusively, from this study, soil pH and other soil parameters analysed in Ijero mining soil indicate the increase in pH which can also affect the concentration of heavy metals in the soil. Maintenance or enhancement of soil quality is a more important criterion for analysis and sustainability of soil ecosystems. Contaminated soils have been largely monitored through physical-chemical analyses. According to Mandel and Shiftan (1981) water containing SAR 0 -10 is applicable on all agricultural soils.

Then we can deduce that the soil obtained from Ijero mining site can be utilized for agricultural practices and appeared to fall within the WHO standard limits.

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