SURFACE, GROUND AND HARVESTED WATER QUALITY ASSESMENT IN IGBANKE AND ENVIRONS, SOUTHERN NIGERIA

BY

Sandy Esegboria ISIDAHOME

PSC1506370

DEPARTMENT OF GEOLOGY

FACULTY OF PHYSICAL SCIENCES

UNIVERSITY OF BENIN

BENIN CITY

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CERTIFICATION

This is to certify that this project was carried out by **SANDY ESEGBORIA ISIDAHOME,** A project submitted to Department of Geology, Faculty of Science, University of Benin, in fulfillment of the requirement for the award of the degree of Bachelor of Science (Honor) in Geology.

PROFESSOR C. N. AKUJIEZE **DATE**

PROJECT SUPERVISOR

PROFESSOR C. N. AKUJIEZE

HEAD OF DEPARTMENT **DATE**

DEDICATION

To the glory of God Almighty who through His infinite mercy saw me through the completion of this programme. To my father, brother, sisters and friends for all their supports financially and spiritually, Love you all.

ACKNOWLEDGEMENT

I am greatly indebted to a number of persons who's contribution in one way or the other to the success of the research.

Firstly, I am grateful to Almighty God who made all things possible for me.

This project could have not been completed without the support of my project supervisor Prof. C. N. Akujieze for whom this project would not have been possible thank you sir and God bless.

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ABSTRACT

This study was undertaken to determine the quality of surface, harvested and ground water of IGBANKE in Orihionmwan area of Edo State, southern Nigeria. Five water samples were collected from harvested water (well), four from surface water (river), and one from bore hole. The result of the analysis showed that appearance (clear), Calcium (0.185-0.445), Manganese (<0.05), Magnesium (0.106-0.124), Nitrate (0.004-0.011), Iron (0.008-0.109), Phosphate (0.000-0.006), Zinc (0.006-0.0015), Cu (<0.05), Cr (0<0.05) , Ammonium-N (0.003-0.008), Sulphate (0.006-0.026), Electric conduction (28-88) and pH (5.42-5.87). The results gotten were compared with the World Health Organization standard (W.H.O) 1995, to determine quality of the water. From the result, all the parameter falls within the permissible limit for drinking water set by World Health Organization (W.H.O.).

CHAPTER ONE: INTRODUCTION

The quality of surface, ground and harvested water involves adequate evaluation of its physiochemical and biological constituents. Despite the scientific and economics importance of water, many who are otherwise well informed about water still poorly understand its chemistry. Ground, surface and harvested water are important sources of water for domestics, Agricultural, municipal, industrial and miscellaneous uses. D.K. Todd (1980) it has been observed that ground water is more abundant than surface and harvested water.

For the purpose of this the project work, I will be concerned with the physical and chemical properties of water because according to Walton (1970), pathogenic bacteria, viruses and other micro-organisms are rarely found in ground water since they do not multiply and eventually die in the subsurface environment except in poorly constructed wells that let in biological contaminants.

It should be clear in mind that the quality of water should be related to its use, human consumption, livestock, irrigation and industrial water supply will each pose different requirement to the use of water e.g It should be noted that water which is quite suitable for livestock, may be totally unfit for the human consumption is put into use as guide line for the purpose of this project work. In this way, account is taken for the public supply. A number of parameters of the ground, surface and harvested water quality will be looked into, restriction is made only to the physical and chemical properties of water and parameters which will determine the properties will be correlated with well established (FEPA and WHO) standard of portable water.

1.1 WATER

Water is a chemical compound (H_20) on which animals and plants depend for survival, it is also very useful for both domestic and industrial activities. In fact, life as known on earth is non-existence without water. Water can occur in the three states of matter, that is liquid, solid (ice or glacier) and gaseous (steam or water vapor). More than 60% of water available on earth is locked up as ice in the polar regions of the world.

1.1.1 WATER OCCURENCE

Geologically, water occurs on the earth's surface in the forms of rivers, ponds, lakes, streams and in larger bodies such as seas and oceans. Water occurring in this form is generally referred to as surface water whereas in situations where the water occurs in the sub surface in porous and preamble geological formation like aquifers, fractures, joints and faults, it is described as ground water. The third occurrence of water is the rain water, and this is the main source of replenishment for groundwater and surface water. Rain water is more abundant during the raining season in the tropics and it is the usual practice in localities that are in short supply of ground and surface water to collect or channel rain water into underground reservoir for use during the dry season.

The Encyclopaedia Britanica (19820 and sthelar (1973), have defined ground water as that which occurs below the earth's surface where it occupies all or part of the void in a geological layer or layers. Waltz (1971) attempts to distinguish between ground and others types of subsurface water (capillary’s and soil water) by defining ground water as any water occurring within the saturation zone (s) where the hydrostatic pressure is greater than or is equal to the atmospheric pressure.

Davis and de west (1966), classified groundwater into different types on the basis of depth of occurrence; the classification generally described all forms of water occurring above the water table as either being soil, gravitational or capillary water while water occurring below the water table as either ground or internal water as shown below.

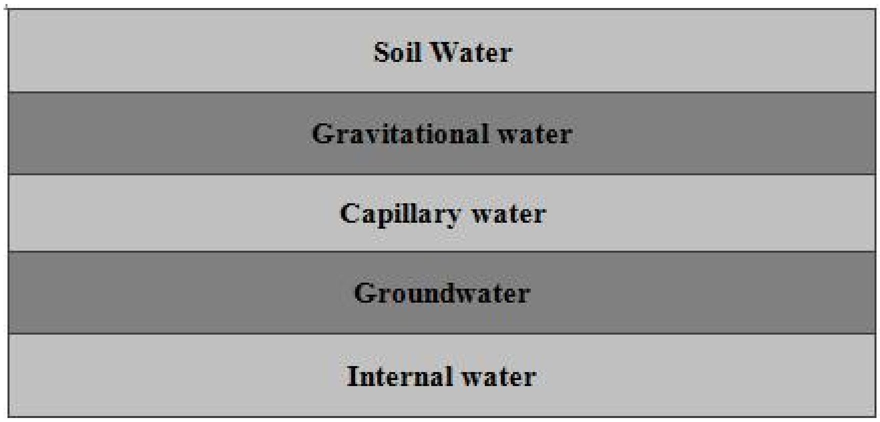

Figure 1: Classification of subsurface water (After Davis & Dewies 1966)

The study of the major hydrological systems (underground and hydrological systems) is referred to as Hydrogeology which incorporates geology, hydrology and fluid mechanics (also see offodile, 1992).

Water can also be described geochemically as heavy water if all or some of the hydrogen atoms have been replaced by deuterium to form deuterium oxide (D_2O) which has a specific gravity 1.1 freezing point of 8.84°s and a boiling point of 1010c as compared to the corresponding value of 1.0, 4°c and 100^0c respectively in natural water (Chapman, 1964).

Water is described as hard if it contains appreciable amounts of dissolved Ca and Mg bicarbonates and sulphates. Hard water is characterized by non-formation of lather (foam) with soap due to the production of a scum of insoluble sails. It also forms fury in kettles and in pipes. When water hardness is caused by the presence of the bicarbonates of the metals, this types of hardness is referred to as temporary hardness and it can be removed by mere boiling, but in situations where the hardness is caused by the presence of sulphates of the metal which cannot be removed by boiling and this is the described as permanent hardness.

1.1.2 USES OF WATER AND THE PROPERTIES

The uses of water are too numerous to be listed here and it will only suffice to say that without water, there cannot be life, because practically, all biological and chemical process that sustain life are dependent on water.

Water is an inevitable ingredient of life not only to man and animal but also to plants. All industrial process utilizes water. In the agricultural industry, a lot of water is used for irrigation and planting. In the chemical industry, in maintaining fluidity of enzymes in the body, water forms as perfumes, lotions paste etc. in the electrical industries, water is used also for the generation of hydro-electric power in the transportation industry water is used as a medium for conveying heavy duty cargo.

Furthermore, in all homes, water is consumed daily as food and used for domestic purpose such as cleaning, washing, cooking, bathing etc., water is the home of fishes and breeding place for amphibians.

The properties of water can be categorized into three namely;

1. Physical properties

2. Chemical properties

3. Biological and/or bacteriological properties.

The physical properties of water include:

i). its ability to exist in three physical state which are solid, liquid and gas

ii). its ability to melt at 0^0C and boil at 100^0C atmosphere pressure.

iii). its ability to expand about 100c on freezing

iv). its ability to exist as a polar liquid with high electric Constance 81 and 170 c, thus account for its high solvents power. And having maximum density at 40c

The chemical properties are:

i. Oxides of metal react with H_2O to form hydroxide

$K_2O + H_2O$ ----- 2KOH (potassium hydroxide)

ii. Water can act as an oxide when it reacts with metal

$Z_n + H_2O$ ----- $Z_nO + H$

iii. Water react with oxide of non-metal to form oxides

$CO_2 + H_2O$ ----- H_2CO_3 (carbonic acid)

$SO_2 + H_2O$ ----- H_2SO_4 (sulfuric acid)

Water hydrolyses common salt into hydrogen chloride gas (hydrolyze acid) and sodium hydroxide (base).

The Biological and bacteriological properties of water have led to the decrease in water quality for domestic use in the area. Potable water should be free from any form of life such as algae, bacteria etc. these are organisms of the obligate aerobes and obligate anaerobes. Their presence renders water unfits for domestic use. These organisms can be seen when water is cultured. Bacteria also differ with regards to the temperature needed for growth.

1.2 AIMS AND OBJECTIVES

This work geared towards emphasizing the need for pure and qualitative water using ground, surface and harvested water in assessing the degree to which the chemistry of the water has been affected by its interaction with the environment, the pollution sources and its attendant effect on ground, surface and harvested water, control and regulatory measure by standard organization (W.H.O).

It is also to adequately inform the lay man that purity of water does not depend only on its physical qualities like tasteless, odorless and colorless nature but mainly on its chemical properties such as: K, CL, Pb, Fe, Ca, Co2- acidity e.t.c.

To determine the rate of contamination of ground water, surface and harvested water in IGBANKE township of Edo state.

1.3 STUDY AREA

1.3.1 Location of Study Area

The study area covers Igbanke in Orhionmwon local government area in the South Western part of Nigeria. The area lies between longitude $6^{0}11'0''$ and $6^{0}13'30''$ E and between latitude $6^{0}19'0''$ and $6^{0}22'0''$ N covering an area of about $180km^{2}$.

The area falls within the humid subequatorial belt of southern Nigeria and it is characterized by two different climate season, wet and dry. In terms of the environmental and land use setting Igbanke is a semi urban environment dominated by moderate commercial activities as a divisional headquarters and with very few industries. Generally, the household in this moderately populated township are not connected to any central Sewage system, but rather most of the houses rely on pit latrines and soak away septic tanks within the households. The implications of this for the shallow ground water wells in such households are better imagined.

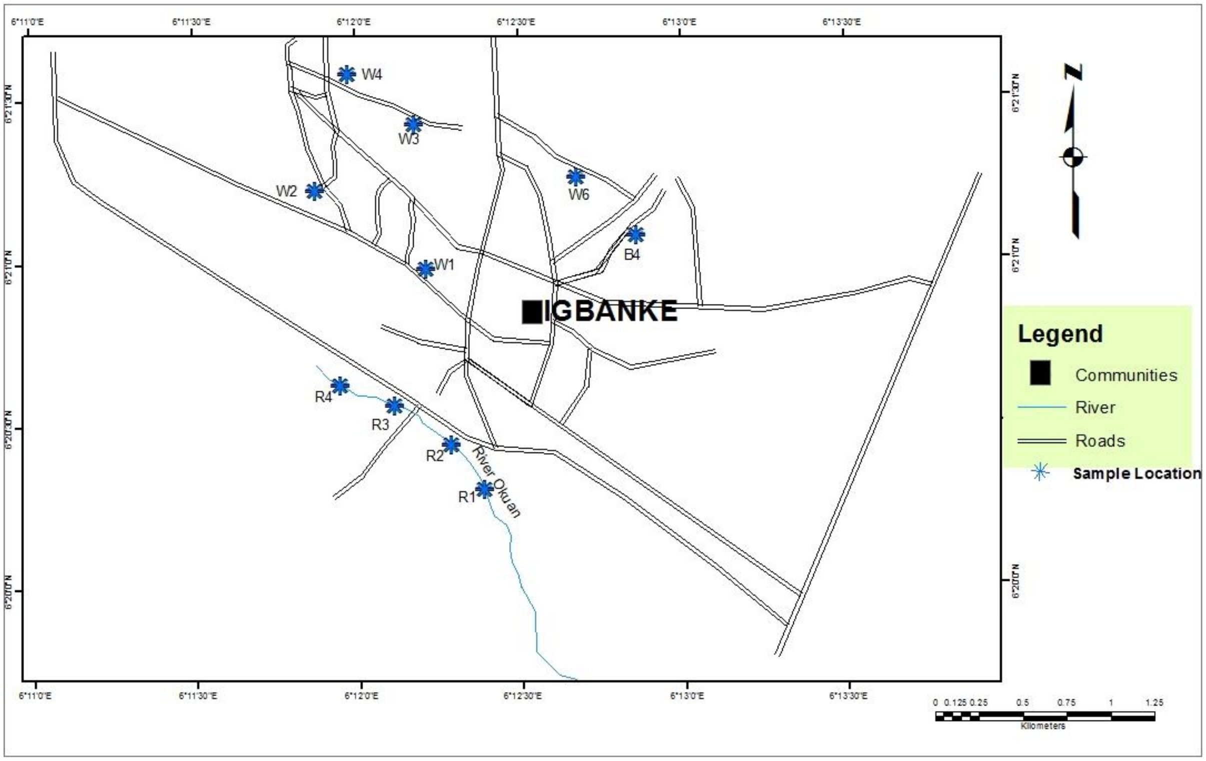

Figure 2: Map of study area showing sample locations

SCOPE OF WORK

1. Site investigation and evaluation
2. Collection of harvested, surface and ground water sample to investigate possible contaminant
3. Consideration, assessment and waste interpretation of overall effect of operational waste on ground water, harvested and surface water quality system. This will involve potential hazardous contamination present, their levels and distribution patterns.

1.4 CLIMATE AND VEGETATION

The dry and wet seasons are quite recognizable in this area. The dry season is between October and April in which the period December to February is marked by the dry wind. This is the time or periods where the sun is always high and temperature very sour.

The wet season is between April and September. The rainfall is of frequent occurrence being relatively heavy in later part of June and July. The vegetation is typically that of the mangrove swamp and marsh land.

1.5 PREVIOUS WORK

The geochemical characteristics and nature of harvested water, groundwater, and surface water in parts of the basement complex of South western Nigeria have been studied by some previous investigators.

Oyewole (or example, measured the river extents around Ile-ife and observed values ranging from 4.5 - 6.5ppm in ground water. The calcium content was observed to vary from 0.9ppm - 1.9ppm and 2.I ppm - 4.Ippm in surface water and ground water respectively. His result did not show any significant difference between the elemental concentration in the sample collected during the dry and rainy seasons but there was a marked increase in ground water table during the dry season.

1.6 GENERAL GEOLOGY AND HYDROGEOLOGY

The Benin formation as a coastal plain sand, it extends from the west across the whole Niger Delta area and southward beyond the coastline. It is dominantly sand beyond the shale intercalation. Color varies from dirty white to light gray to reddish brown ferrogenized sand. It is highly porous fresh water bearing loose pebbly sand and sandstones. The coastal plain sand is made of local thin clay and shale inter-beds which are considered to be of braided stream origin.

Sands, sandstones and clay vary in color from reddish brown to pinkish yellow un-weathered surface to white in the deeper fresh surfaces. Limonitic coating is responsible for the brown reddish yellow color. The formation is covered with loose brownish sand varying in thickness and is about the 800km thick, almost all of which water bearing with water level ranging from 20-50cm. generally, the direction of ground water flow is toward the lowland areas and can result in continuous discharge of streams. The aquifer is generally believed to be highly permeable, porous and prolific in waters.

Bore holes depth range between 60ft to 200ft. the aquifer yield range from 28.4m^3/hr at Iyanomo (South of the city). 125m^3hr^{-1} at Uselu (central part) to 208m^3h^{-1} at Ogba (Northern part) with a draw down ranging from 4.8m at Iyanomo, 1.8m at Uselu and 6.7m at Ogba.

The description of the formation is characteristics of transgressive and regressive sequences in the late quaternary Niger-Delta while the sands and sandstones may represent point bars, channels fills. It ranges from Miocene to recent.

CHAPTER TWO: LITERATURE REVIEW AND GEOLOGICAL SETTING

2.1 REGIONAL GEOLOGY OF THE AREA

The study area is underlain by the Benin formation. This is however covered by recent alluvial deposits along river channel, and in built up areas. They vary in color from dirty white to light gray of grayish brown.

The Niger Delta Basin was formed by a failed rift junction during the separation of the South American plate and the African plate, as the South Atlantic began to open. Rifting in this basin started in the late Jurassic and ended in the mid Cretaceous. As rifting continued, several faults formed many of them thrust faults. Also, at this time syn-rift sands and then shales were deposited in the late Cretaceous. This indicates that the shoreline regressed during this time. Concurrently, the basin had been undergoing extension resulting in high angle normal faults and fault block rotation. At the beginning of the Paleocene there was a significant shoreline transgression. During the Paleocene, the Akata Formation was deposited, followed by the Agbada Formation during the Eocene.

This loading caused the underlying shale Akata Formation to be squeezed into shale diapirs. Then in the Oligocene the Benin formation was deposited, which is still being deposited today. The overall basin is divided into a few different zones due to its tectonic structure. There is an extensional zone, which lies on the continental shelf, caused by the thickened crust. Moving basin ward is a transition zone, and a contraction zone, which lies in the deep-sea part of the basin.

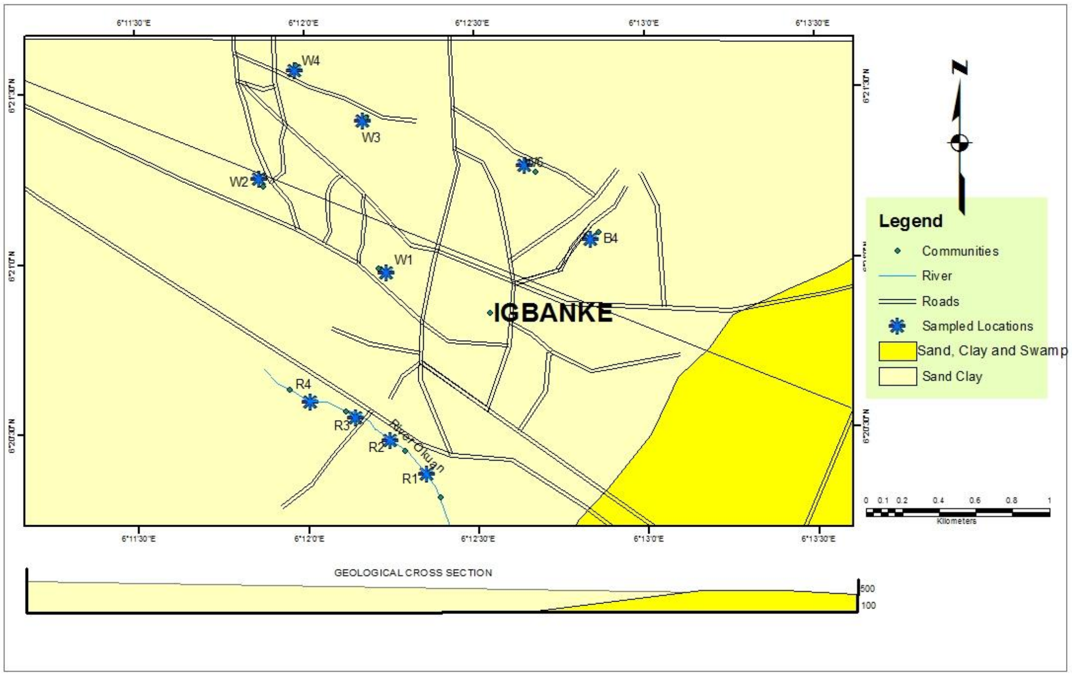

Figure 3: Map showing the geological map and cross section of the area

2.2 CHEMICAL CONSTUTUENTS IN SURFACE WATER

The most important substance for humans in their surrounding material world is natural water. It is one of the most wonderful, not yet completely understood, combinations on the Earth. It possesses a complex of anomalous properties distinguishing it from all other substances, (e.g. anomalously high values for the temperature of melting, boiling, and evaporation, and heavy dissolving capacity).

Chemically pure water should be considered an extremely complex substance consisting of atoms of various isotopes of hydrogen and oxygen, which can form up to 18 isotope varieties of water. Under natural conditions, water corresponding to the known H_2O formula is not found in a chemically pure form. In the processes of the hydrological cycle on the Earth, connecting hydrosphere with atmosphere, lithosphere and biosphere, the chemical composition of water is formed.

Interacting with all the components of the natural landscape and being influenced by natural and man-made factors, water, a universal solvent, is enriched by a wide gamut of various substances in gaseous, solid and liquid states that create an enormous variability of natural water types from the perspective of their chemical composition. Natural water is a dynamic chemical system containing in its composition a complex group of gases, mineral and organic substances in the form of true solutions, and suspended and colloidal matters as well.

2.3 MAIN IONS

Mineral substances contained in natural waters in the dissolved state (in the form of ions, complex ions, undissociated compounds and colloids) are conventionally subdivided into macro components and micro components. The macro components comprise the so-called main ions that determine water chemical type and account for the bulk of natural water mineral content (up to 95% for fresh water and up 99% for highly mineralized waters). The micro components comprise substances occurring only under certain conditions and in very small concentrations (µg·l-1 and < 1 mg·l-1). An intermediate position is occupied by ions of hydrogen, compounds of nitrogen, phosphorus, and silicon dissolved in water. The concentrations of all minerals are related to two main factors—the abundance of chemical elements in the Earth's crust and the solubility of their compounds.

The main anions contained in natural water are Cl^-**,** $SO_4^{2-,}$ HCO^{3-}, and CO_3^{2-} and the main cations are $Ca^{2+,}$ Na^+, Mg^{2+} and K^+. Chloride ions (Cl-) have a large migratory ability in connection with the very high solubility of chloride salts of sodium, magnesium and calcium. Their presence in water is naturally associated with the processes of leaching from minerals (e.g. gallite, sylvite, carnallite, bischofite), from rocks (e.g. nephelines), and from saline deposits.

It is also present in atmospheric precipitation, and today it is particularly associated with industrial and municipal wastes. Chloride ions occur in all types of water in concentrations from parts of mg·l-1 to hundreds of g·kg-1 (in brines). Sulfate ions (SO42-) are contained in all surface waters, and their content is limited by the presence of calcium ions together with which they form a slightly soluble CaSO4.

The main source of sulphate in water is various sedimentary rocks which include gypsum and anhydride. Water enrichment by sulphates takes place both by the process of oxidation of sulfide, which is abundant in the Earth's crust, and oxidation of hydrogen sulfide which is created during volcanic eruption and is present in atmospheric precipitation. The processes of decompositions and oxidat ion of substances of vegetable and organic origin containing sulfur, and also human economic activity, have an effect on sulfur content in water bodies. The sulfate content of waters of rivers and freshwater lakes reaches several tens of mg·l-1.

Hydro carbonate and carbonate ions (HCO^{3-} and CO_3^{2-}) occur in natural waters in dynamic equilibrium with carbonic acid in certain quantitative proportions and form a carbonate system of chemical equilibrium connected with the pH of water. When the pH of a water system is 7 to 8.5 the predominant ion is hydro carbonate. When pH is less than 5, the content of hydro carbonate ions is close to zero. Carbonate ions dominate when $pH>8$. The sources of HCO^{3-} and CO_3^{2-} are various carbonate rocks (limestones, dolomites, magnesites), from which dissolution takes place with the participation of carbon dioxide.

The sources of Na+ in waters are deposits of various salts (rock-salt), weathering products of limestone rocks, and its displacement from the absorbed complex of rocks and soils by calcium and magnesium.

Ions of potassium (K+). Potassium, in terms of the magnitude of its content in the Earth’s crust and the solubility of its compounds, is very similar to sodium. However, it occurs in lower concentrations in surface waters as it has weak migratory ability. This is due to its active participation in biological processes, e.g. absorption by living plants and micro-organisms.

2.4 CHEMICAL CONSTITUENTS IN GROUND WATER

Ground waters are not pure because they usually contain dissolved mineral ions whose types and concentration can affect the potability and usefulness of water for various purpose. This is due to its interaction with the environment, water, soil and rock system. This is influenced by the biochemical characteristic of the soil layer and of unsaturated zone. Substances that constitute impurities in groundwater are sourced from natural environment or waste products from mains activities e.g. hazardous, corrosive and toxic water especially when they react with substances like motor oil, household cleaners, chemicals, municipal waste and also house garbage that results in dumps and landfills, agricultural impact by the use of fertilizers is inclusive.

The major cations found in groundwater include K+, Na+, Ca+, Mg+, $Cu^{2+,}$ $Al^{3+,}$ and anions are $SO_4^{2-,}$ Cl, HCO_3, $NO^{3-,}$ NO. Also the non-ionic constituent in groundwater like dissolved gases e.g. (O_2) and carbondioxide (CO_2) and oxides have equally been noted. Their presence in ground water shows good quality when they are present in optimum concentration, but area of bad quality when they occur in excess concentration in water. The salts found in nearly all water are sodium chloride, sulphate, borate, magnesium and bicarbonate. Salts which are less frequently found are sodium nitrate, sulphate, magnesium nitrate and chloride, iron in ferric carbonate and sometimes ferric sulphate.

The most abundant dissolve gasses in ground water are oxygen, nitrogen, carbondioxide, hydrogen, sulphide, and methane. The first three occur in the earth's atmosphere and it is therefore not surprising that they occur in groundwater. While the remaining three often exist in ground water in significant concentration because they are products of biogeochemical processes that occur in the non-aerated subsurface zone.

The presence of these gases in groundwater may have effect on the quality of the water in recent years, the society has become aware of ground water and state of its chemical quality and this has led to a new method of measuring contamination in extremely small contamination e.g. part per million and equivalent per million etc.

CHAPTER THREE: MATERIALS / METHOD

METHODOLOGY

The work was carried out by collecting water samples from rivers, harvest water and ground water at various locations in the study area.

Sampling is very essential if accurate and reliable data are expected. This is achieved through the representative collection of water samples from the area under study. However, this involves careful planning and execution of appropriate sampling storage analytical process.

3.1 SAMPLE COLLECTION AND RESERVATIONS

A total of 10 samples were collected from the study area. Water samples are collected in very clean container just before analysis and the quantity collected at any given time depend} on the number of parameters being investigated. In most cases a 250 ml bottles or liter maybe sufficient. The mode of collection of water sample for analysis should be in accordance with the purpose for which the result of the analysis is intended hence as changes occurs frequently in water sample, it is desirable to commence analysis soon after collection, but in cases where analysis cannot be commenced immediately, Preservatives are added and or kept in a refrigerator present at 140C.

Based on the scope of the analytical techniques all the water samples used in this project were collected from harvest water, ground water and surface in Igbake environs.

3.2 METHOD

For the physical analysis of conductivity, it was analyzed pattenthiometrically with glass electrode and conductor and turbidity was measured by vigorously stricken water into the cell of the HACH spectrometer, mode DR/2010 was used for the analysis of such parameters $N0^3$ and FE^{2+} while the titration method was used for the analysis of Cl and HCO. However, potassium concentrations were determined through ionic balancing.

For this project work a bulk model 200A flanc system was used. Air / Acythelene were used for the metals. The result was recorded and displayed in tables in chapter three of this work.

3.3 CHEMICAL PARAMETER DETERMINATION

Atomic absorption analysis, for atomization, the water sample was sprayed into a spray chamber and then passed in the form of a fine aerosol into the flame.

Firstly, dissolution takes place i.e. the water (Solvent) evaporates. The rate of dissolution depends on the chemical species that makes up the solvent. The solid particles formed undergo various changes depending on the flame temperature. Organic matter present burns out, inorganic component reacts with each or with the flame gases.

The metal containing compounds are vitalized and dissociated into ground state atomic. The ground state atom absorbs the radiation from the hollow cathode lamp and is excited to higher energy levels. Some atoms are also thermally excited to higher levels. Some atones are also terminally excited but their fracture is so small that it causes no error's in the analysis. The source of reduction is a hollow cathode lamp, which contain a constructed off the same metal as that being analyzed.

3.4 pH DETERMINATION

pH was determined using a PH meter. The probe of the water was placed in the sample and the reading taken from a digital display on the meter.

3.5 DETERMINATION OF SULPHATE

10m of the filtrate was pipette into a small flats and water added to bring the volume to about 20ml. 1ml of the Gelatine-Bode reagent was added. This was shaken properly to mix and allowed to stand for 30 minutes for white turbidity to develop. This was read at 420nm in a spectrophotometer and the reading was expressed in mg/L.

3.6 DETERMINATION OF NITRATE

5ml of the filtrate was pipette into a 5 ml flask 2ml of Brucine and then rapidly 5ml of conc H2s04 were added. This was shaken to mix and allow standing for 1 minute; it was read spectrophostomctrically at 470mm.

3.7 PHOSPHATE DETERMINATION

25ml of the sample was placed in glass water and Phosuer (s) phosphate reagent powder pillow was added. This was properly shaken to mix and allowed 10 stands for at least 6 minutes for color to develop to blue before it was read in the instrument at 400nms.

3.7.1 BACTERIOLOGICAL METHOD OF ANALYSIS

The membrane filtration method was used to enumerate the total coliform in the sample.

100ml of each of the water samples was filtered through sterile, white grid marked, 47mm diameter, Millipore, HA-type cellulose filter with pore size 0.45mm. Each sample was filtered using a vacuum/pressure pump Alteration were placed with grid side upward on plates of M-endo agar and incubated at 37°C for 24hrs the bacteria trapped on the membrane grew on it using the nutrient that diffused from the medium on the plates. The coliform which grew on the plates as dark red colonies with a green metallic-gold sheen were counted and used to estimate the total coliform count of the water sample expressed as colony forming unit per 100ml (cfu/100ml) Production of acid in brilliant green lactose broth (BGLB) was used to confirm coliform while production of green metallic sheen on Eosin methylene blue agar (EMBA) was used to conform Escherichia cold.

3.8 METHOD FOR DETERMINATION OF E.COLI BACTERIA COUNT LEVEL

This was carried out using a multiple tube fermentation- All apparatus was sterilized, sample test was poured inside and covered with Patri-dish.

The mixture was gently and evenly rocked and allowed to gel (solidify) and was incubated for 3 days and was transferred into the refrigerator. The water samples were single and double strength MacConkey broth in the tube showing positive result. Colonies of green metallic sheen or Eosin methylene blue confirmed the presence of Ecoli in the water sample.

3.8.1 SOME ANALYTICAL WAVELENGTH FOR METALS DETERMINATION USING A.A.S

The determination of these metals in water samples was carried out using Atomic absorption spectrophotometer. A.A.S. 200 model. Samples were determined for heavy metal analysis in raw form and then boiled at 1000, after which filtrate of the boiled samples were also analyzed too.

Table 1: some analytical wavelength for metals determination using A.A.S

METALS	**WAVELENGTH (NM)**
Iron (Fe)	248.33
Magnesium (Mg)	285.2
Sodium (Na)	589
Zinc (Zn)	214
Calcium (Cl)	422
Lead (pb)	283

The determination of these metals in water samples was carried out using Atomic absorption spectrophotometer. A.A.S. 200 model. Samples were determined for heavy metal analysis in raw form and then boiled at 1000C, after which filtrate of the boiled sample were also analyzed too.

3.9 EXPERIMENTAL SET-UP

A total of 10 samples were obtained from Igbanke area of Edo State. The 10 samples were taken to the laboratory for geochemical analysis for various physio-chemical parameters, using appropriate analytical techniques. The result of the various water samples was analyzed for various parameters which are presented in the table below.

Table 2: presentation of results from the experiment carried out to determine the pH Ec and sulphate levels

NO	CODE NAME	APPERANCE	pH	Ec	SULPHATE
1	W1	Clear	5.4	77	0.036
2	W2	Clear	5.55	63	0.027
3	W3	Clear	5.42	71	0.033
4	W4	Clear	5.52	59	0.026
5	W5	Clear	0.53	68	0.033
6	R1	Clear	5.54	87	0.076
7	R2	Clear	5.55	88	0.063
8	R3	Clear	5.54	83	0.058
9	R4	Clear	5.55	85	0.046
10	BH	Clear	5.57	28	0.006
	W.H.O. standard		6.5-9.5	900-1200	250-500

The table above shows the result of pH, (EC), electrical conductivity and sulphate in the surface water, ground water and harvested water from the various locations.

Table 3: the result of the result of calcium nitrate, phosphate, calcium, magnesium, iron, zinc and magnesium from the various locations.

NITRATE	**PHOSPHATE**	**MAGNESIUM**	**IRON**	**ZNIC**	**MANGANESE**
0.005	0.006	0.126	0.035	0.011	0.126
0.004	0.003	0.107	0.026	0.16	0.107
0.007	0.005	0.211	0.027	0.009	0.211
0.000	0.003	0.123	0.041	0.016	0.123
0.003	0.004	0.142	0.026	0.008	0.142
0.011	0.008	0.231	0.109	0.013	0.231
0.013	0.007	0.199	0.113	0.015	0.199
0.009	0.006	0.204	0.093	0.014	0.204
0.010	0.060	0.227	0.044	0.015	0.227
0.004	0.000	0.106	0.008	0.006	0.106
W.H.O 10-50	3	50	0.3	3.0	0.44

Table 4: the result of CU and Cr for the various locations in the area.

NO	CODE NAME	CU	CR
1	W1	<0.05	<0.05
2	W2	<0.05	<0.05
3	W3	<0.05	<0.05
4	W4	<0.05	<0.05
5	W5	<0.05	<0.05
6	R1	0.004	<0.05
7	R2	0.006	<0.05
8	R3	<0.05	<0.05
9	R4	<0.05	<0.05
10	BH	<0.05	<0.05
W.H.O.		2	0.05

3.9.1 SAMPLING AND SAMPLE CODING

The present study is the physiochemical quality and causes of pollution in harvested water, surface water and ground water in Igbanke. The samples were collected from different location as shown in the codes below.

Table 5: code names of all samples collected.

NO	CODE NAME	INTERPRETATION OF CODE NAME
1	W1	Well 1
2	W2	Well 2
3	W3	Well 3
4	W4	Well 4
5	W5	Well 5
6	R1	River Okuan along Abudu Road (upstream)
7	R2	River Okuan along Abudu Road (downstream)
8	R3	River Okuan after the bridge (upstream)
9	R4	River Okuan after the bridge (downstream)
10	BH	Borehole

These water samples were collected with clean plastic bottles with light fitting plastic covers, the containers were well labeled so that each sample can be identified and easily differentiated from others. Accessibility to the river was by means of a boat in the ease well, samples were collected using a bucket attached with a rope, the bucket was allowed to sink down the well without the turbulence and then a clear and settled representative of the water fetched.

CHAPTER FOUR: RESULTS AND DISCUSSION

To a very large extent the chemical character of groundwater is a function of the quality of the source water, means of harvesting the water, meteoritic water and more importantly the chemical processes that take place in the ground between the percolating water and its host rocks.

Zinc contamination result from corrosion of galvanized pipes and roofing sheet by soft acidic water which tend to be more concentrated in early morning because the water stands all night in the pipes. Meteoritic water result when water penetrates a rock from above through precipitation and infiltration. The chemistry of meteoritic groundwater changes during its passage through rocks and because of this slow movement, it has a relatively long contact with the minerals that make up the host rocks.

These minerals are soluble, however to greater or lesser degree. When they dissolve in the groundwater, they alter the original chemistry and quality of the water.

Nevertheless, groundwater could be abstracted for drinking and other domestic, agricultural and industrial uses without treatment provided the water quality parameter do not exceed the highest permissible levels or limits. It follows that the level of these parameters determines the suitability of the groundwater for different purpose. This parameter can broadly be classified into physical, chemical and biological parameters.

It is interesting to note that the values of all the properties occur within the permissible international standards. (W.H.O) These parameters analyses are listed below:

Appearance, pH, magnesium, manganese, zinc, nitrate, phosphate, ammonium-N, sulphate, electrical conductivity, calcium, iron, cu and cr.

4.1.1 Appearance

Irrespective of the source, pure water is colorless. The appearance of harvested water is clear, borehole water is clear while surface water (River Okuan) is clear depending on the foreign substances in the solution.

4.1.2 Magnesium

High concentration of magnesium is usually associated with dolomitic or magnesium rich evaporate bodies mostly for surface and ground waters such that magnesium becomes the dominant cations in the water. From the result of analysis, the concentration of magnesium for surface, ground and harvested water range from 0.185 to 0.495mg/L which are within the limit of 50mg/l set by WHO in 1963.

4.1.3 Calcium

Very often, calcium in ground water and surface water is sourced from sedimentary rocks containing calcites, aragonites, gypsum and dolomite in contact with water. From the result the concentration of calcium in the surface, ground and harvested water ranges from 0.185- 0.445mg/l which are within the permissible limits of the 75mg/l set up by WHO (1963) for drinking water.

4.1.4 Nitrate

Nitrates find their way into ground water abstracted from outcropped geological formations. These nitrates are formed in the soil by oxidation of ammonium and by certain micro-organism fixing nitrogen from aerated soils. Water containing a high percentage of nitrates has been identified to cause methaemoly lobinamia (blue baby effect) in infant sand cancer in adult.

From the study area the nitrate contends is below 0.011 which is below the WHO permissible limit for nitrate which is 1 Oppm.

4.1.5 Manganese

The manganese content of the study area is < 0.05 which is in accordance with the WHO permissible limit of 0. Img/l.

4.1.6 PHOSPHATE

Phosphates may be leached into surface and harvested water from detergents or phosphates fertilizers in soils. From the table phosphate content in the water sample in the study areas shows that they only in significantly present.

4.1.7 Zinc

Zinc is very rarely present in natural water, but not so rare in water when it is drawn at consumers taps or roofing made up of zinc because of the use of galvanized piping, roofing and the zinc in solution in such water, as supplied for bacteriological action, continuity in the sample bottles, being toxic to many low form of life but relatively harmless to human beings. According to the result of the analysis, zinc ranges from 0.009 to 0.015mg/l.

4.1.8 Cu and Cr

The concentration of cu and Cr in the water samples is <0.05

4.1.9 Iron

The iron (fe). Concentrations in the water samples in the study area is between 0.008 to 0.041 which is within the permissible limit set by W.H.O which is 0.3mg/l. which is good for drinking, domestic and industrial uses.

4.2.O Ammonium-Nitrate

The ammonium-nitrate concentrations in the water samples in the study area are between 0.003 to 0.008mg/l which is within the permissible limit of W.H.O standard of 0.3mg/l.

pH is a measure of the acidity or alkalinity of a solution. It ranges from 1- 7 for acidity and from 7-14 for alkalinity with 7 serving as a neutral point.

From the study the results ranged from 5.43 to 5.87 which is lower than the W.H.O standard. The pH is inline with the W.H.O standard.

CHAPTER FIVE: CONCLUSION AND RECOMMENDTIONS

It is the need to ensure high quality ground water, surface water and harvested water in the area of the study that has necessitated this work. The quality of water is not merely by its physical characteristic like color, odor and taste but also by the amount and concentration of chemical constituent (cations and anions) like, nitrates, phosphates, lead, nickel, potassium, calcium, magnesium, manganese, zinc and pH. The water quality also controls its various uses. Since its main uses are domestic, municipal, agricultural and industrial. The concentration of both chemical and physical parameters for drinkable water will definitely be different from that of irrigation and manufacturing, and so on. That is why the international standards and permissible limits in the hydro industry put in place guidelines to ensure qualitative water especially for drinking and domestic usage by notable and internationally recognized organization like WORLD HEALTH ORGANIZATION (W.H.O). It was to this standard that all the results of the sample were compared with.

From the study, all the parameters concentration in the river samples, surface samples and harvested samples are within the permissible limit of the world health organization (W.H.O) international standard. There for the surface water (river), harvested water and groundwater are fit for drinking, domestic, agricultural and miscellaneous uses. However, Water treatment measures and methods should be vigorously pursued for contaminated water and efforts should be made to reduce water contamination to its barest minimum, activities and habit that tend to enhance water pollution, in order to safeguard the health of the community.

5.1 RECOMMENDATION

As have been observed from the result of geochemical analysis carried out on samples of ground water, surface water and harvested water during the course of the work, all the physiological parameters in ground, surface and harvested water were within World Health Organization (W.H.O). Hence water from these three sources are fit for both domestic activities and drinking purposes, also adequate information and enlightenment campaign should be given to the indigenes on health matters and use of water should be embarked on by both government and non-governmental agencies.

Individual efforts geared toward prevention /reduction of water contamination can be achieved in this area if the following precautions are adhered to:

Locating mechanic workshop by river side should be discouraged. Indiscriminate disposal of refuse, sewage and waste in surface water and unguided location should be discontinued as this will led to increased content of BOD, COD, etc. and increased leaching rate.

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