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Research Paper

Physio-chemical status of four streams in Gwagwalada area council, Abuja Nigeria

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ABSTRACT

Samples were collected and measurements taken and documented to analyse the physio-chemical status of University of Abuja (mini campus) stream, University of Abuja teaching hospital stream, Gwako and Dobi streams for the period from July to August, 2015. The respective physical parameters of the four streams fell within the same range. Temperature values for the streams were (28.8°C ± 0.37, 28.6°C ± 0.26, 28.5°C ± 0.72, 28.3°C ±0.43), pH (6.0 ± 0.16, 5.9 ± 0.59, 5.8 ± 0.55, 6.2 ±0.24), Turbidity (42.60 cm ± 0.50 , 50.60 cm ± 0.43, 28.50 cm± 1.00, 28.30 cm ± 0.75) Transparency (29.65 cm ± 0.30, 28.80 cm ± 0.19, 36.58 cm± 2.08, 126.50 cm ± 4.22). The chemical parameters of the four stream are as followed sulphate ion was not detected in the University of Abuja (mini campus) stream, but was detected in the University of Abuja teaching hospital stream due to the habit of drainage waste dump and other human activities around the stream and was not detected in Gwako and Dobi stream due to the absence of drainage waste dump around the stream. Nitrate ion was not detected in the University of Abuja (mini campus) stream and Dobi stream but was detected in the University of Abuja teaching hospital stream and Gwako stream due to the human activities carried out around the stream. Chloride ion was detected in the University of Abuja teaching hospital stream, Gwako and Dobi stream but was not detected University of Abuja (mini campus) stream because no human activities is carried out around the stream. Calcium ion was detected in Dobi and Gwako stream because of the presence of rocks around the stream, but was not detected in the University of Abuja (mini campus) stream and the University of Abuja teaching hospital because of the absence of rock around the stream. All the values for the physical parameters fell within the WHO standard. Thus recommended for drinking, cooking and for food beverage industries except for the pH.

Key word: pH, stream, Gwagwalada area council, Physio-chemical status

INTRODUCTION

Water is a liquid without colour, smell or tastes that falls as rain in lakes, rivers and seas and is used for drinking, cooking, washing, etc. It often appears blue in ice and clear lake, but green or brown in a river because it contains or reflects other matters (Adigun, 2005). Water is an important part of a healthy lifestyle and the drinking force of nature (Shukle and Gupta, 2001); it is the essential medium of biogeochemical cycles and of life itself. However, water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70% of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. It is difficult to understand the biological phenomenon fully because the chemistry of water reveals much about the metabolism of the ecosystem and explain the general hydro - biological relationship (Simpi *et al.,* 2011).

The critical problem today is the provision of adequate and safe water supply for human consumption. A spring board for the formation of National health care policy is the provision of good water, a problem that is becoming increasingly difficult to address as we forge ahead to industrialization, urbanization and economic self enhance (Umeham and Ogbonnaya , 2001).

The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Natural water contains different types of impurities which are introduced in to aquatic system through different ways such as weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including mining, processing and the use of metal based materials (Ipinmoroti and Oshodi, 2007; Adeyeye, 2005). The increased use of metal-based fertilizer in agricultural revolution of the government could result in continued rise in concentration of metal pollutions in fresh water reservoir due to the water run-off. Also faucal pollution of drinking water causes water born disease which has led to the death of millions of people (Adefemi and Awokunmi, 2010).

Industrial development (Either new or existing industry expansion) results in the generation of industrial effluents, and if untreated results in water, sediment and soil pollution (Fakayode and Onianwa, 2002; Fakayode, 2005).The aim of this study is determine the physio-chemical parameters in four stream in Gwagwalada area council, Abuja Nigeria.

Water quality

Water quality is defined as microbiological, physical, and chemical properties of water that determine its fitness for specific use. If one or these properties is out balance the water quality is affected ‘Water quality’ is a technical term that is based upon the characteristics of water in relation to guideline values of what is suitable for human consumption and for all usual domestic purpose including personal hygiene. The chemical, physical and biological aspect of water quality is interrelated and must be considered together. For example higher water temperature reduces the solubility of dissolved oxygen shortage that kills the more sensitive fish species. The rotting fish carcasses may contribute to a bacterial bloom that makes some human swimmer or boater’s ill. Water quality however, is highly variable overtime due to both natural and human factors. Water temperature, photosynthetic activity and flows vary with season.

Water clarity

The quality of our water contributes greatly to our economy, particularly through tourism. Water clarity is an indirect measurement of the amount of suspended solids in water. In Nigeria it is the preferred method for assessing water turbidity or ‘murkiness’. In other words, high water clarity means low turbidity and vice versa. As runoff occurs within a catchment, tiny particles of clays, silts or organic material are washed into waterways. Depending on water velocity these tiny particles can be supported in the water column and are termed suspended solids. The faster the water is flowing the better its ability to keep solids in suspension. Many Nigeria waterways have a low level of fine suspended ‘colloidal’ material even during low flow situations. This opalescent or ‘slightly milky’ appearance is a consequence of the predominantly clay soils in the Region. Our urban streams are mostly small with short flow paths and muddy rather than stony embankments and bases. In slow-flowing lowland streams, high levels of turbidity may persist for long periods. This is due to the low rate of flushing and the fact that very fine particles are held in suspension almost indefinitely.

Measuring the murkiness of a stream under a variety of flow conditions is one way of measuring catchment condition.

Causes of reduced water clarity

There are many possible sources of reduced water clarity. Storm water runoff from urban areas may carry heavy sediment loads where they drain areas of soil that has been disturbed due to earthworks from subdivision or redevelopment, Increases in impervious area due to urbanization results in greatly accelerated runoff during rainfall events. Higher stream flow lead to greater water velocity leading to stream bed and bank erosion. Wastewater discharges from residential and industrial processes have the potential to adversely affect water clarity, regardless of flow condition. Contaminants such as paint, concrete cutting wastes and equipment wash-water are all potential negative influences on water clarity. Microscopic algae also can contribute to turbidity when too much nutrient and sunlight increase their numbers (this is a minor contributor to most Auckland waterways due to their short length and therefore the time it takes to get from the top to the sea)."The World Fact Book", CIA noted that water covers 70.9% of the earth's surface and is vital for all known forms of life (WHO/EEC, 2007). On earth, it is found mostly in oceans and other large water bodies, with 1.6% of water below ground in aquifers and 0.001% in the air as vapour, clouds (Formed of solid and liquid water particles suspended in air), and precipitation. Oceans hold 97% of surface water, glaciers and polar ice caps 2.4%, and other land surface. Water such as rivers, lakes and ponds 0.6%, are very small amount of the earth is contained biological bodies and manufactured products. Clean drinking water is essential to humans and other life forms. Access to safe drinking water has improved steady and substantially over the last decades in almost every part of the world (Lomborg, 2001; MDG Report, 2008). There is clear correlation between access to safe water and GDP per capital. However, some observers have estimated that by 2025, more than half of the world's population would have faced water-based vulnerability (Kulshreshtha, 2006). A recent report, November, 2009, suggests that by 2030, in some developing regions of the World, water demand will exceed supply by 50% (Kulshreshtha, 2006). Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation. Approximately, 70% of fresh water is consumed by agriculture (Baroni *et al.,* 2007).

Nutrients

The Word "Nutrients" are chemical element critical to the development of plants and animal life. In healthy lakes and streams, nutrients are needed for the growth of algae that form the base of complex food web supporting the entire aquatic ecosystem (Arowolo, 2007).

The most nutrients in lakes and streams are nitrogen and phosphorus under the right conditions, including abundant nutrients, algae and aquatic plants will continue to grow and multiply well beyond the amount needed to support the food web. The excess then dies, and microorganisms break it down, consuming dissolve oxygen from the water in the process (Mathieu *et al.,* 2005). Dissolve oxygen which aquatic organisms need just as human needs oxygen from the air, can be completely used by the breakdown process. When this happens, aquatic organisms die from lack of oxygen. Extensive fish kills can result (Mueller and Helsel, 1996). Good water quality resources depend on a large number of physicochemical parameters and the magnitude and source of any pollution load, and to assess that, monitoring of these parameters is essential (Barquin and Scarsbrook, 2008). Assessment of water resources quality of any region is an important aspect of developmental activities of the region, because rivers, lakes and man-made reservoirs are used for water supply to domestics, industrial agricultural and fish culture (Jackher and Rawat, 2003). Chemical composition of water is a function of hydro-geochemical processes acting in a given environment, thus, monitoring of water quality parameters provide important information for water management (Mathieu *et al.,* 2005). Skilful management of water bodies is required if they are to be used for such diverse purposes as domestic and industrial supply crops irrigation, transport, recreation and fisheries (Abel, 2006).

Physical and chemical properties of water

Water is a chemical substance with formula H_2O; one molecule of water has two hydrogen atoms covalently bonded to a single oxygen atom. The nature of the atomic structure of water causes its molecules to have unique electrochemical properties. The hydrogen side of the water molecule has a slight positive charged and on the other side a negative charge. This molecular polarity causes water to be a powerful solvent and also to have a strong surface tension. As a case of pure water; it is in aqueous solutions; the product of hydrogen ion concentration $[H^+]$ and the hydroxyl ion concentration $[OH^+]$ is a constant which at ordinary laboratory temperature is 1.0 x 10¯¼ m.Therefore, $[H^+] \times [OH^-] = 1.0 \times 10^{-14}$m, (Akubugwo *et al.,* 2006). Water appears in nature in all the three states of matter and may take many different forms on earth. Water vapour and clouds in the sky, sea water and ice bergs in the polar oceans, glaciers and rivers in the mountain and the liquid in aquifers in the ground, besides the ones already hinted above, the major physical and chemical properties of water are:

(1) Water is a liquid at standard temperature and pressure. The intrinsic colour of water and ice is very slight blue, although both appear colourless in small quantity. Water vapour is essentially invisible as a gas (Braun *et al.,* 2011).
(2) Water is transparent in the visible electromagnetic spectrum. This aquatic planet can live in water because sun rays can reach them. Ultra-violet and infrared light is also strongly absorbed by water.
(3) Since the water molecule is not linear and the oxygen atom has a higher electro-negativity than hydrogen atoms, it carries a slightly negative charges, whereas the

hydrogen atoms are slightly positive. As a result, water is a polar molecule with an electrical dipole moment.
(4) Water also can form unusually large number of water molecular hydrogen bonds (four) for a molecule of its size. These factors lead to strong attractive force between molecules of water, giving rise to waters high surface tension (Campbell *et al.,* 2006) and capillary forces. The capillary action refers to the tendency of water to move up a narrow tube against the force of gravity. This property is relied upon by all vascular plants.
(5) Water is a good solvent and is often referred to as the universal solvent. Substances that dissolve in substances, while those that do not mix well with water are known as hydrophobic (Water- fearing) substances.
(6) All the major components of cells (protein, DNA and polysaccharides) are also dissolved in water.
(7) Pure water has a low electrical conductivity but this increases significantly with the dissolution of a small amount of ionic materials such as sodium chloride.
(8) The boiling point of water and all other liquid is dependent on the barometric pressure. For example, on the top of mount Everest, water boils at 68ºC (154ºF) compared to 100ºc (212ºF) at sea level. Conversely, water deep in the ocean near geothermal vents can reach temperatures of hundreds of degrees and remain liquid.
(9) Water has second highest molar specific heat capacity with 4181.3J/kg of any known substance, after ammonia, as well as a high heat of vaporisation (40.65kj.mol$^{o\,L}$), both of which are a result of the extensive hydrogen bonding between its molecules. These two unusual properties allow water to moderate earth's climate by buffering large fluctuations in temperature.
(10) The maximum density of water occurs at 3.98ºc (39.16ºf)). It has the anomalous property of becoming less dense, not more, when it is cooled down to its solid form ice. It expands to occupy 9% greater volume in its solid state, which accounts for the fact of ice floating on liquid water.
(11) According to US on-line conversion-density under "liquid", the density of water is 1000kg/cm^3 while liquid (4ºC) and weighs 62-41b/ft^3 (917kg/m^3, solid).
(12) Water is miscible with many liquids according to increasing density from the top. As a gas, water vapour is completely miscible with air.
(13) Water forms azoetrope with many other solvents.
(14) Water can be split by electrolysis into hydrogen and oxygen.
(15) Water can be dissolving many different substances giving varying tastes and odour. The spring water and mineral water, often advertised in marketing of consumer products, derives its taste from the minerals dissolved in it.
(16) However, pure water is tasteless and odourless.

The physical and chemical properties of a freshwater body characterised by the climatic, geochemical, geomorphologic and pollution conditions (largely) prevailing in the underlying aquifers, the biota in the surface water is governed entirely by various environmental conditions that determine the selection of species as the physiological performance of the individual organisms. The primary production of organic matter is more intense in lakes and reservoirs than in rivers and streams. In contrast to the chemical quality of water-bodies, which can be measured by suitable analytic methods, biological quality is a combination of both qualitative and quantitative characterisation.

USES OF WATER

Agriculture

The most important use of water in agriculture is for irrigation, which is a key component to produce enough food. Irrigation takes up to 90% of water withdrawn in some developing countries (Zalifah and Norrakiah, 2007) and significant proportions in more economically developed countries. In United States, 30% of freshwater usage is for irrigation. It takes around 3,000 litres of water, converted from liquid to vapour to produce enough food to satisfy one person's daily dietary need. This is a considerable amount, when compared to that required for drinking, which is between two and five litres. To produce food for the 6.5 billion, or 50 people, who inhabit this planet today requires the water that could fill a canal ten meters deep, 100meters wide and 7.1 million kilometres long that is enough to circle the globe 180 times.

Drinking

The human body contains anywhere from 55% to 78% water depending on body size (WHO, 2000). To function properly, the body requires between one and seven litres of water per day to avoids dehydration; the precise amount depends on the level of activity, temperature, humidity and other factors. Medical literature favours a lower consumption, typically one litre of water for an average male, excluding extra requirements due to fluid loss from exercise or warm weather.

An original recommendation for water intake by the food and Nutrition Board of the National Research council read "an ordinary standard for diverse person is 1 millimetre for each calorie of food. Most of this quantity is contained in prepared food.

Humans require water that does not contain too many impurities. Some common impurities are metal salts and oxides (including copper, iron, calcium and lead), and harmful bacteria, such as vibrio. Some solutes are acceptable and even desirable for taste enhancement and to provide needed electrolyte (Maton, *et al.,* 1993).

Washing

The propensity of water to form solute and emulsions is useful in various washing processes. Many industrial processes rely on reactions using chemicals dissolved in water, suspension of solids and extract substance. Washing is also an important component of several aspects of personal body hygiene.

Chemical uses

Water is widely used in chemical reactions as a solvent or reactant and less commonly as a solute or catalyst. In organic reactions, water is a common solvent, dissolving many ionic compounds. In organic reactions, it is not usually used as a reactants well and is amphoteric (acidic and basic) and nucleophilic. Nevertheless, these properties are sometimes desirable.

Heat Exchange

Water and stream are used transfer fluids in diverse heat exchange systems, due to its availability and high heat capacity, both as a coolant and heating. Condensing steam is a particularly efficient heating fluid because of the large heat of vaporisation. A disadvantage is that water and steam are somewhat corrosive. In almost all electric power stations water is the coolant which vaporises and drives steam turbines to drive generators. In the US, cooling power plants is the largest use of water. In the nuclear power industry, water can also be used as a neutron moderator. In most nuclear reaction down-however, other methods are favoured for stopping a reaction and it is referred to keep the nuclear core covered with water so as to ensure adequate cooling.

Recreation

Humans use water for many recreational purposes, as well as exercises and for sports. Some of these include: swimming, water-skiing, boating, surfing and diving. In addition, some sports like, ice hockey and ice skating are played on ice.

Water industry

The water industry provides drinking water and waste water services (including sewage treatment) to household and industries, Water supply facilities, water tanks, water pipes including old aqueducts. The distribution of drinking water is done through municipal water systems, tanker delivery or as bottled water. Governments in many countries have programmes to distribute water to the needy at no charge.

Food processing

Water plays a crucial role within the field of food science. It is important for a food scientist to understand the role that water plays within food processing to ensure the success of their products. Solutes such as salts and sugar found in water affect the physical properties of water. The boiling and freezing points of water are affected by solutes as well as air pressure, which is in turn affected by attitude (Umeham *et al.,* 2001).

SOURCES OF WATER CONTAMINATION

Basin contamination

This consists of poisonous chemicals, which are washed from fields and roads, as well as the salts which are washed from the soils during irrigation.

Channel contamination

This occurs through the discharge of organic and inorganic water from domestic, communal and industrial resources. Sewage constitutes a large percentage of waste from domestic and communal sources whereas toxic waste products of chemical derivation are the predominant contaminants from industrial concerns. Wastes dumped from ship also contributed substantially to channel contamination.

Hydro-biological contamination

Herbicides, insecticides, fungicides, fertilizers and other such chemicals are being used in ever increasing volumes on farms and these substances get washed off the plants and soil into streams and rivers.

Thermal contamination

Thermal contamination occurs when hot waste water from thermal power station and industry is discharged into a body of water. This leads to a reduction in oxygen content and fish stocks. It also promotes the growth of algae, which depletes oxygen content further (Shukle and Gupta, 2001).

Effects of water on life

From a biological stand point, water has many distinct properties that are critical for the proliferation of life that set it apart from other substances. It carries out this role by allowing organic compounds to react in ways that ultimately allow replication. All known forms of life depend on water. Water is vital both as a solvent in which many of the body's solutes dissolve and as an essential part of many metabolic processes within the body. Metabolism is the sum total of anabolism and catabolism. In anabolism, water is removed from molecules although energy requiring enzymatic chemical reactions, in other to grow larger molecules (e.g. starches, triglycerides and proteins for storage of fuels and information). In catabolism, water is used to break bonds in order to generate smaller molecules (e.g. glucose, fatty acids and amino acids to be used for fuels for energy use or other purpose). Without water, these particular metabolic processes could not exist.

METHODOLOGY

Description of the study area

The study was carried out in Gwagwalada Area Council of the Federal Capital Territory Abuja. Gwagwalada is one of the fast growing and influential town in the Federal Capital Territory (FCT) of Nigeria. Over the years the town is threatened by ground water pollution making the inhabitant vulnerable to health hazards associated with polluted ground water due to their high dependence on the ground water. Gwagwalada is one of the six Area Councils of the Federal Capital Territory Abuja; there are other Area Councils like Abaji, Kuje, Bwari and Kwali. Gwagwalada is also the name of the main town in the Area Council which has an area of 1,043km with a population of 157,770 at the 2006 census. (F.C.D.A 2014). Gwagwalada is located in the south- western part of the FCT Abuja and share common boundaries with kwali, kuje and Niger state. Gwagwada is located at the south-west, near the flood plain of river Gurara, which transverse the territory from North to south at an elevation of 70m above sea level. The area lies between latitude 7°57" N and longitude 7°7" E. The vegetation combines the best feature of the southern tropical rain forest and Guinea Savannah of the North. This reflects the full transitional nature of the area as between the southern forest and the northern grassland which have the wood and the shrub respectively. The average rainfall per annum is 163.3 mm. the original settlers are Gwari, koko, Bassa, Gada, and the Hausa Fulani as well as immigrant population of the other Nigeria and expatriates (David, 2010). The Map shows the sample location.

Collection of water samples

The water samples for the study were collected in 50 ml BOD bottle by immersing the bottle under water until overflowed and inverted before they were tightly corked while still below water surface to avoid air bubbles.

Stations and sampling

Water samples were collected weekly from four stations for four weeks between July 2015 and August, 2015.

Sample station 1

The sample station 1 (SS1) was at University of Abuja river, mini campus Gwagalada, Gwagwalada Area council.

Sample station 2

The sample station 2 (SS2) was at University of Abuja teaching hospital river, Gwagwalada, Gwagwalada Area council.

Sample station 3

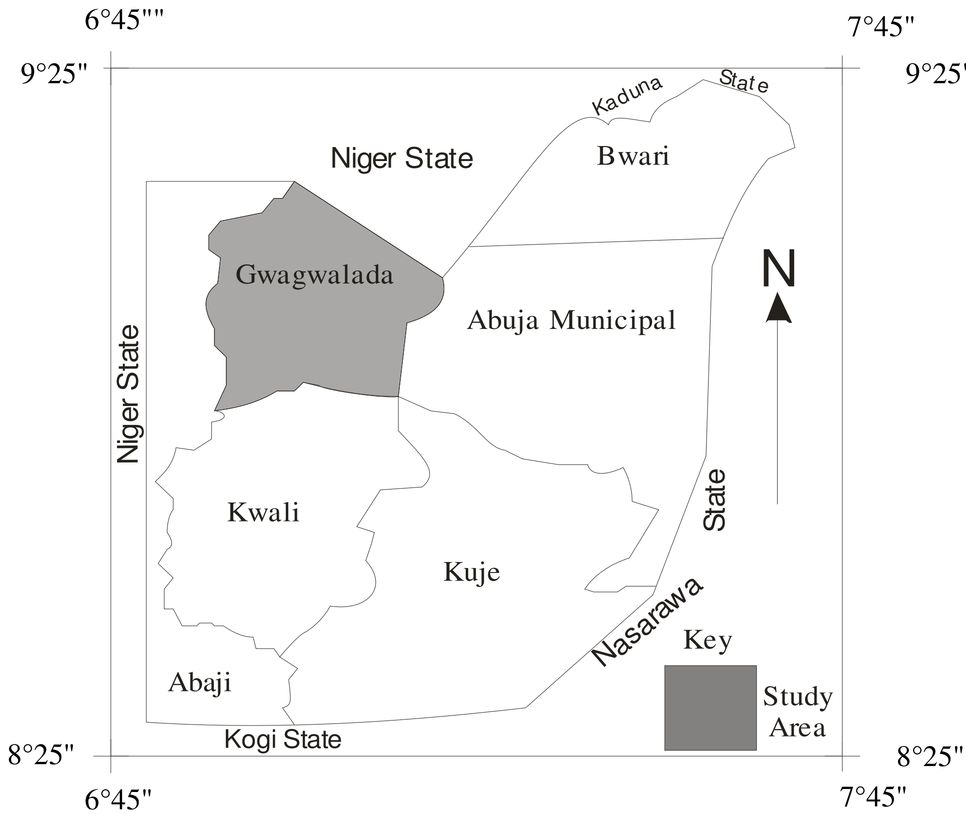
The sample station 3 (SS3) was at Gwako river, Gwagwalada.

Sample station 4

The sample station 4 (SS4) was at Dobi river, Dobi Gwagwalada Area council.

Physiochemical parameters measurement

The physiochemical parameters measured include pH,



Map of Abuja, Federal Capital Territory of Nigeria showing the study area. (F.C.D.A, 2014).

temperature, transparency and turbidity, sulphate, phosphate, calcium, chloride and nitrate.

Determination of temperature

Temperature is an important biologically significant factor, which plays an important role in the metabolic activities of the organism. Water temperatures were measured in the field using Celsius thermometer model 51- new Japan , by holding the thermometer 3cm below water body and allowing for 5 minutes equilibrium before taking the reading (Aguigwo, 1998).

Determination of pH

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. The pH was determined using pH meter model 51- new Japan, the pH electrode was rinsed with distilled water of pH 7 at 32^{0}C, and this served as reference. Then the pH meter was switched on and allowed to stabilize for about 3 to 5 minutes still in distilled water. 10mls of the sample was poured into clean, dry beaker and the pH electrode was immersed into it. The reading was taken after 5 minutes equilibrium (Aguigwo, 1998).

Determination of transparency

This was measured using a disc-shaped metallic object known as secchi disc which was alternative painted black and white on both halves. The transparency was estimated by immersing the disc into water to the point of clarity and the reading was taken.

Determination of turbidity

Turbidity in water is the degradation in the clarity or transparency in the water due to presence of particles such as silt, clay and other forms of living micro-organisms and non living materials found in water (Rputheti *et al*., 2008). This was determined using a secchi disc . This black and white disc is lowered into the water until can no longer be seen; the depth (secchi depth) is then recorded as a measure of transparency of the water.

Determination of Sulphate (SO_4)

Sulphate occurs naturally in water as a result of leaching for gypsum and other common minerals (Manivaskam, 2005). Discharge of industrial wastes and domestic sewage tends to increase its concentration.

Materials

Barium chloride, tetraoxosulphate VI acid, test tube.

Procedure

4ml of sample water is filled into a test tube and a small quantity of dilute tetraoxosulphate VI acid is added to the solution to acidify it. A few drops of barium chloride were added. A white precipitate was formed which dissolve in excess dilute acid indicate the presence of tetraoxosulphate VI

Determination of Phosphate (PO_4)

Materials

Ammonium molybate, stannous chloride, distilled water.

Procedure

2ml of water sample is poured into a test tube and ammonium molybate reagent was added. The test tube is then stoppered and vigorously shaken. 2ml of a dilute stannous chloride reagent, which was freshly prepared from a concentrated stannous chloride reagent, was then added with distilled water into the mixture in the tube. A blue colour precipitate, was formed, the depth of the blue colour indicates the presence of phosphate in the water sample.

Determination of nitrate (NO_3)

Materials

Freshly prepared ion II tetraoxosulphate VI solution,test tube ,test tube holder and a dilute tetraoxosulphate VI.

Procedure

Sample water is filled into a test tube to a depth of about 2cm. 2ml of a dilute tetraoxosulphate VI acid was added into it. 2ml of a freshly prepared ion II tetraoxosulphate VI then added and shake vigorously. The test tube is held in a slant position and carefully pours a stream of concentrated tetraoxosulphate VI acid down the side of the tube. A brown ring appears at a junction of the acid and an aqueous layer indicates the presence of nitrate ion.

Determination of Chloride (Cl)

Materials

Silver nitrate, ammonia

Procedure

A sample water is filled into a test tube and small quantity of dilute nitrate V is added. Then to the solution, a few drops of silver trioxonitrate V added and a white precipitate is formed which dissolve in aqueous ammonia indicates the presence of chloride.

Determination of Calcium (Ca)

Procedure and materials

NaOH, test tube, Pasteur pipette
A few drops of sodium hydroxide solution are added to the sample water. The formation of a white precipitate which is insoluble in excess of sodium hydroxide indicates the presence of calcium ion.

RESULTS AND DISCUSSION

The result of the physiochemical parameters of the University of Abuja (mini campus), University of Abuja teaching hospital, Gwako and Dobi stream is represented graphically as an aquatic profile of these parameters in (Figures 1-5). Temperature was measured in °C, transparency and turbidity in cm (Tables 1-6). Generally, the aquatic profile of physio-chemical parameters for the four streams (Figures 1-5) show that the levels of the different parameters measured fell within approximately the same range, this is because the streams are located within the same drainage basin and experiencing the same climatic conditions and allochtonous input which expressed in the stream channels (Nwadiaro et al., 1993) support this assertion.

The water temperature of the four streams University of Abuja stream (mini campus), University of Abuja teaching hospital stream, Gwako stream, and Dobi stream were within WHO limits. The pH of the streams also fell within

Table 1. The results of the physical parameter of sample station 1 (university of Abuja mini campus stream).

PARAMETERS	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Temperature (°C)	28.60	28.00	28.40	29.60
Turbidity (cm)	42.50	43.00	43.20	42.00
Transparency(cm)	29.00	30.00	30.10	29.50
pH	5.80	6.20	5.90	6.10

Table 2. The results of the physical parameters of sample station 2 (University of Abuja teaching hospital stream).

PARAMETERS	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Temperature (°C)	28.50	28.70	29.00	28.30
Transparency (cm)	28.90	29.00	28.80	28.50
Turbidity (cm)	50.50	50.00	50.80	51.10
pH	5.80	6.00	6.20	5.90

Table 3. The results of the physical parameters of sample station 3 (Gwako stream).

PARAMETERS	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Temperature (°C)	29.00	29.00	28.00	28.00
Transparency (cm)	35.50	37.20	34.00	39.60
Turbidity (cm)	80.70	83.00	80.50	80.90
pH	5.00	6.50	6.00	6.10

Table 4. The results of the physical parameters of sample station 4 (Dobi stream).

PARAMETERS	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Temperature (°C)	28.00	28.00	29.00	28.00
Transparency (cm)	59.30	59.90	61.10	63.50
Turbidity (cm)	120.00	125.50	129.30	131.00
pH	6.50	6.30	6.00	5.90

Table 5. The mean and deviation of the physical parameters of four streams in Gwagwalada area council.

PARAMETERS	STATION 1	STATION 2	STATION 3	STATION 4
Temperature(°C)	28.80 ± 0.37	28.6O ± 0.26	28.50 ± 0.72	28.30 ± 0.43
Turbidity (cm)	42.68 ± 0.50	50.60 ±0.43	81.27 ± 1.00	61.00 ± 0.75
Transparency (cm)	29.65 ± 0.30	28.80 ± 0.19	36.58 ± 2.08	126.50 ± 4.22
pH	6.00 ± 0.16	5.90 ± 0.57	5.80 ± 0.55	6.20 0.24

the pH of most natural water, (Umeham and Elekwa, 2005), it is below World Health Organisation stipulated standard but still suitable as a drinking water source. Low values in pH are indicative at high acidity, which can be caused by the deposition of acid forming substances in precipitation. A high organic content will tend to decrease the pH because of the carbonate chemistry. The pH generally fell on the acid side of the pH scale and agrees with the assertion that alkaline waters are not typically of Africa (Holden and Green, 2005).

The sulphate level which was not detected in university of Abuja (mini campus) stream could be attributed to the absence of any form of drainage waste dump around the stream. Mine drainage causes high sulphate level

Table 6: The results of the chemical parameters of four streams in Gwagwalada area council.

PARAMETERS	UNIVERSITY OF ABUJA STREAM (MINI CAMPUS)	UNIABUJA TEACHING HOSPITAL STREAM	GWAKO STREAM	DOBI STREAM
SO_4	-	+	-	+
NO_3	-	+	+	+
PO_4	-	+	+	-
Cl	-	+	+	+
Ca	-	-	+	+

- Means not detected
+ Means detected

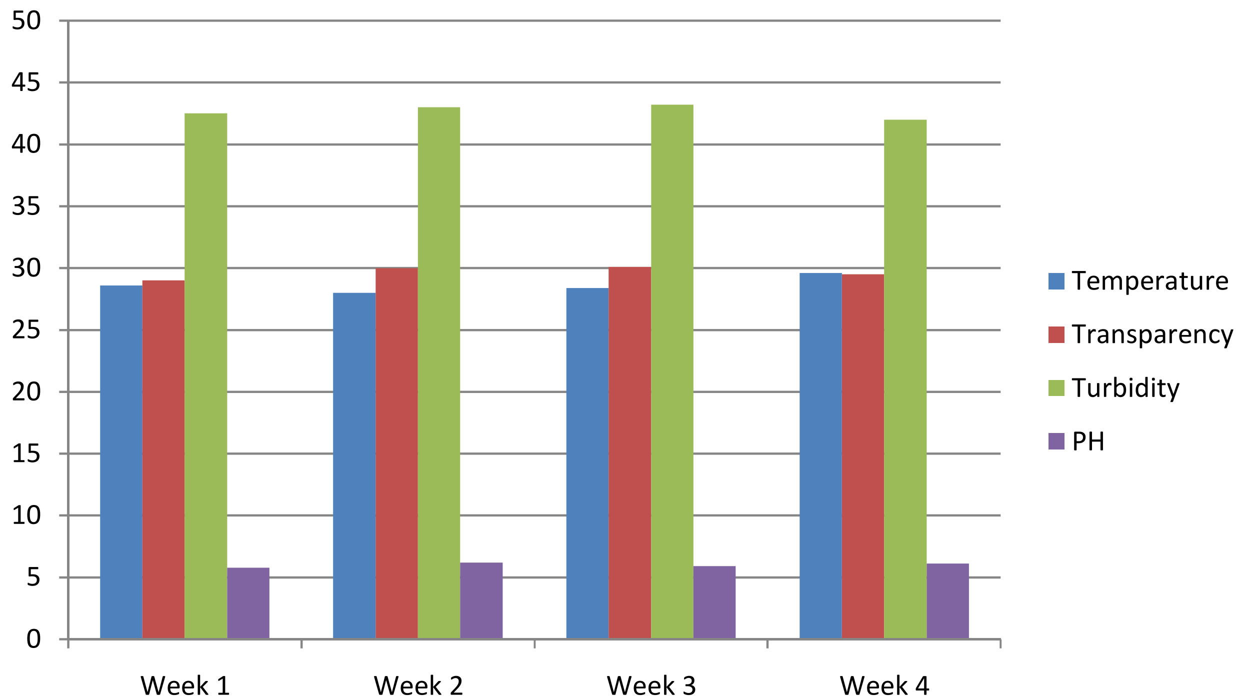


Figure 1. Result of the aquatic profile of the physical parameters of University of Abuja (mini campus) stream Gwagwalada.

(Sabaster *et al.,* 2007). The sulphate level was detected in University of Abuja teaching hospital stream because of the drainage waste dump around the stream, discharge of industrial wastes and domestic sewages which increased its concentration in the water.

The Nitrate level for university of Abuja (mini campus) and Dobi stream was not detected because common sources of excessive nitrogen sewages and agricultural run-off were not found around the stream. The Nitrate level was detected in university of Abuja teaching hospital and Gwako streams because of the sources of agricultural run-off, decayed plants and animal e.t.c found around the stream.The presence of chloride in University of Abuja teaching hospital stream, Gwako and Dobi streams is due to the waste water from industries eg block industries, agricultural run-off, water from laundry, washing of cars e.t.c found around the streams. Chlorine is formed when chloride gas dissolve in water, chlorine is also added to water during purification of water because of its sterile ability to kill and destroy microorganism. The calcium ion detected in Gwako and Dobi streams is due to the presence of rocks around the area of the stream.

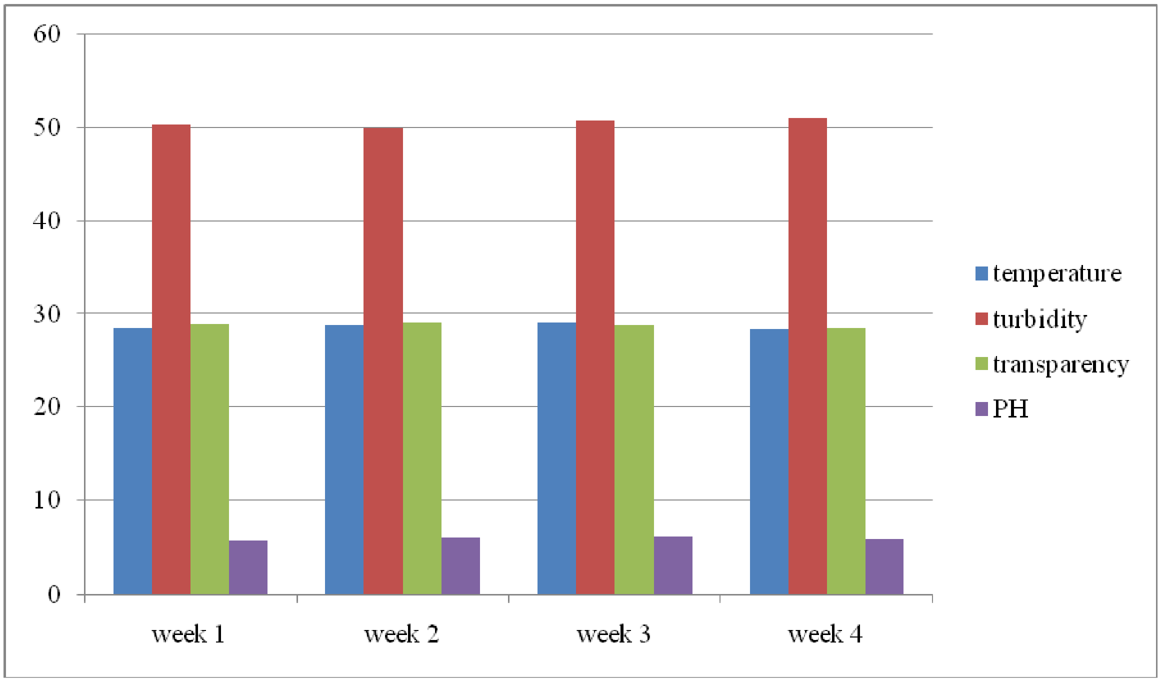


Figure 2. Result of the aquatic profile of the physical parameter of University of Abuja teaching hospital stream Gwagwalada.

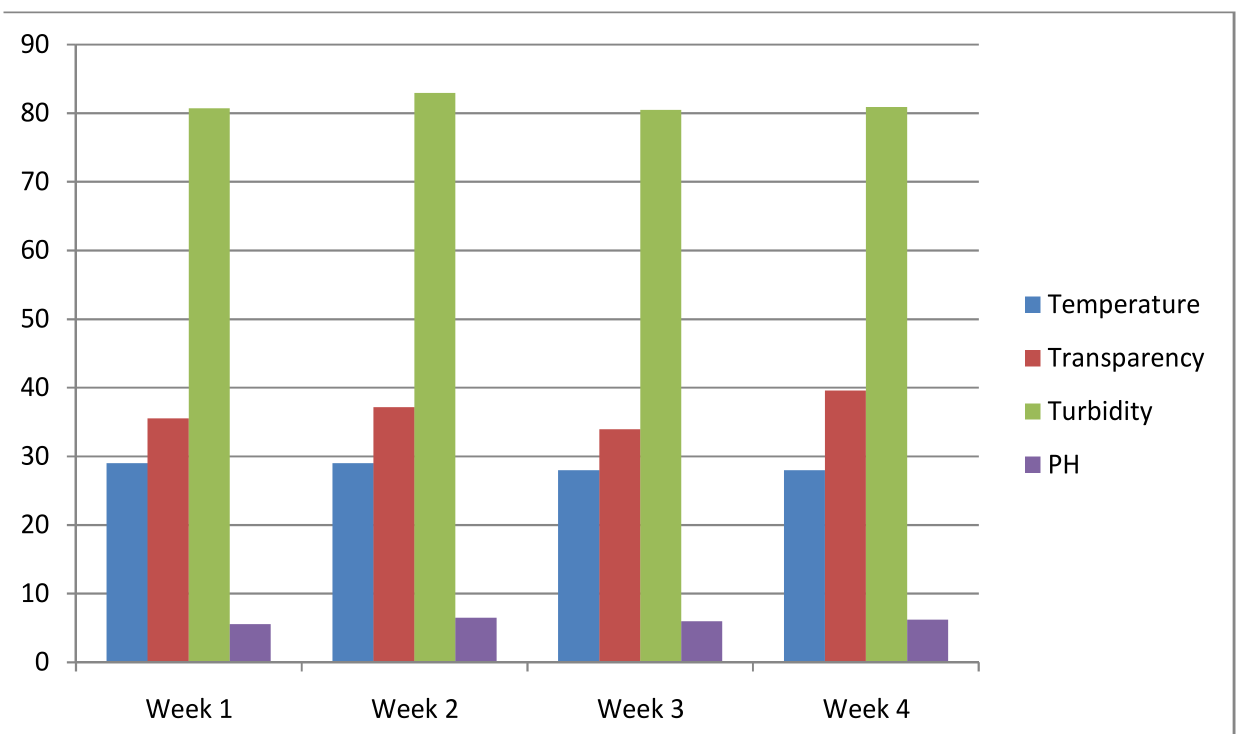


Figure 3. Result of the aquatic profile of the physical parameters of Gwako stream Gwagwalada.

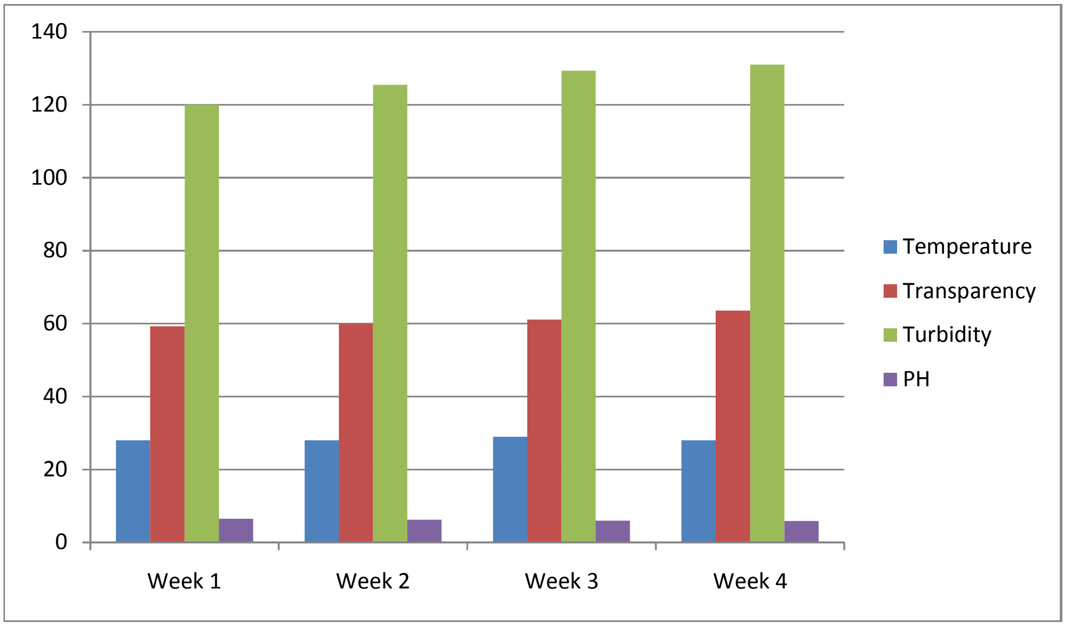


Figure 4. Result of the aquatic profile of physical parameters of Dobi stream Gwagwalada.

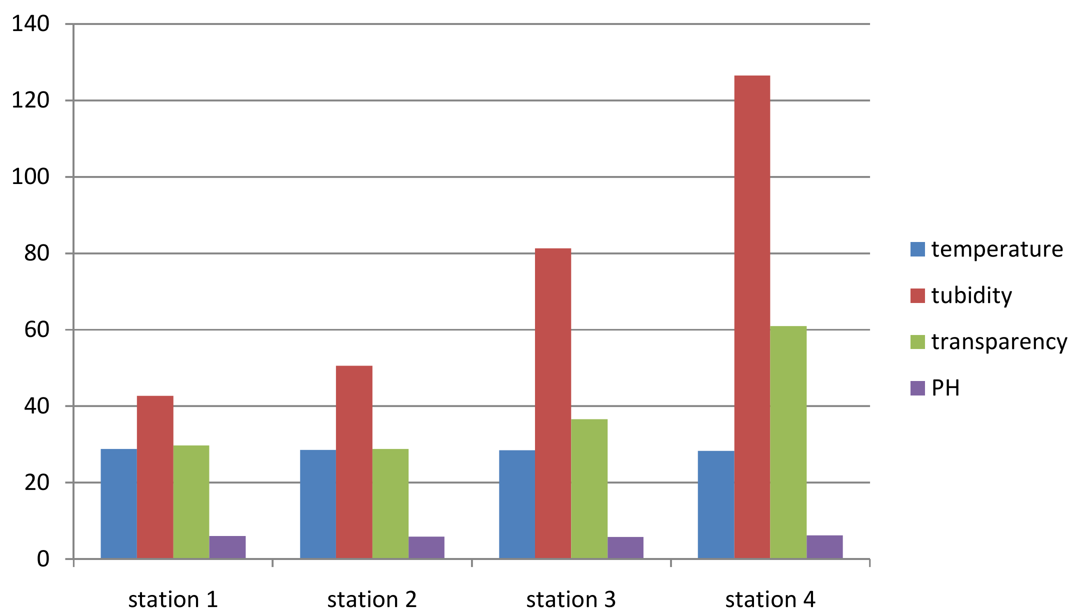


Figure 5. Aquatic profile of the physio-chemical status of University of Abuja (mini campus) stream, University of Abuja teaching hospital stream, Gwako stream and Dobi stream in Gwagwalada area council.

Conclusion

Due to the disposal of toxic waste product from industries sited around the water body, agricultural run-off water from laundry, road salting, produced water from gas and oil wells, drainage waste dump, defecating and other domestic activities going on around the stream lead to the pollution of the water body and endangering the organisms both phytoplankton and zooplankton living in the water body. It also renders the water unsafe for drinking according to the world health organisation standard.

RECOMMENDATION

Government should educate the public on the importance of utilizing water from safe sources, storing in clean containers and in some cases boiling water and cooling after treatment with alum and filtering before use, especially, drinking water. As the important cannot be overemphasis. The public should be enlightened on the dangers of water pollution and thus see the need to appreciate reserve, conserve and respect the environment in general and the stream in particular with a little treatment from the environmental agencies, the water will be ideal for the production of bottled water and for drinking.

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Appendix

Plate 1. University of Abuja (mini campus) stream Gwagalada.

Plate 2. University of Abuja Teaching hospital stream Gwagalada.

Plate 3. Gwako stream Gwagwalada**.**

Plate 4. Dobi stream Gwagwalada.