Sediment and Water Quality Characteristics of Ubelle Stream, Ogugu, Olamaboro, Kogi State, Nigeria

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ABSTRACT

Sedimentation is a process that erods and transports soil particles into water bodies. Sediment reduces storage capacity, lifespan of stream basins, water quality.The Ubelle stream was 465m length, 25 to 45m width and 60m depth. The stream basin served the people of the community as a multipurpose stream for fishing, swimming, laundry and sources of water for domestic uses. Soil analysis showed, excess sediment has been transported into the stream basin within a period of 15 years. Siltation occupied 57.07m, out of the 60m, leaving 1.00 to 2.93m in depth.This reduced the water storage and water quality. Soil samples analysis was dominated by very fine sand, ranging between 84.08 to 85.57 %. These indicate silty-clay soils silted the stream basin. Porosity ranged from 6 to 14%. This is low, indicating the soil is dense with low volume of voids relative to the volume of solids; meaning, it is more porous, less cohesive; and prone to erosive forces. Bulk density ranged from 2.27-2.50g/cm^3. This is high compared to average standard values of 1.33g/cm^3. High bulk density reduces infiltration of water into the soil and increases overland flow resulting in erosion. Therefore the stream basin was silted by silty-clay soils. Being a multipurpose stream; the physico-chemical parametres of the stream water was not suitable for drinking, but suitable for aquaculture. Erosion control measures like vegetative covers, afforestation along the river bed will avoid more soil loss. The stream water should be treated before use for drinking and other domestic uses.

KEY WORDS: *Sediment, Soil erosion, Stream basin, Characteristics, Ubelle stream, Water quality*

1. INTRODUCTION

Streams are one of the most important sources of water for all living things in addition to lakes, seas, water catchments and underground water. Streams are very important to humans and other organisms as they are essential resources for living. A number of processes influence the sedimentary content and quality of stream water(Shu-Qing, 2005). These include erosion, transport and deposition. These processes mutually interact along the stream, from the ridges up to the mouth of the stream. One of the characteristics of a stream is its unidirectional flow. Streams exhibit different water levels, rates of flow and rates of erosion during different seasons (raining seasons and droughts) and influenced by the frequency and intensity of rainfall in the area(Jovita *et al*.,2019).

Sediment is the nonpoint source pollutants that come from a number of sources and washed soils into waterways by surface runoff. When land disturbing activities occur, soil particles are transported by surface water movement. Soil particles transported by water are often deposited in streams, lakes, and wetlands. Land disturbing activities such as road construction and maintenance, timber harvesting, mining, agriculture, residential and commercial development, all contribute to this problem(Davies, & Abowei, 2009).

Sediment comprises of many shapes and sizes such as sand, small pebbles and silt, or large sizes such as boulders, which are normally found within uprivers. Sediments found in estuaries are mostly fine-grained, such as sand and silt. The speed at which water flows in rivers plays an important part in determining its capacity to carry away sediments. Slower moving rivers do have a lower rate of sediment movement. The process of sediment deposition is also dependent on river discharge and speed of river flow, as such; a higher discharge values and water velocity could result in higher amounts of sediment. In addition, time is a factor whereby the longer the sediment deposition process, the higher the sediment loads (Alex et al., **2022)**.

Erosion and sedimentation are linked to each other and embody the processes of erosion, transportation and deposition mechanism of sediments **(**Marc,2020). In nature, there are two major types of erosion, example by water and wind. In Nigeria environment, water is the most significant erosion due to high mean of annual rainfall, storm frequency and density (DID,2011). Sediments which reach streams or watercourses can accelerate bank erosion, clog drainage ditches and stream channels, reduce the depth and capacity of the channels and silt reservoirs. This may cause hydrological deterioration and can lead to severe flooding.

Erosion and sedimentation problems are becoming major threats and hazards for the lifespan of man-made surface water reservoirs as well as for the natural water bodies. Rapid urbanization and agricultural necessity, land clearing activities and human intervention to natural ecosystem are unavoidable. These land clearing activities may accelerate erosion processes and thus introduce water derived sediment to adjacent water bodies and may subsequently affect water quality (DID,2011). The fact that soil erosion and sedimentation continue to be an environmental problem of significant proportions in countries suggests that additional and more definitive guidelines, and more stringent monitoring and enforcement are required. In addition, proper mitigation measures need to be in place and maintained from time to time (Liliana, *et al.*, 2011).
Soils that contain minerals in large quantities produce strong chemical bonds in the soil and are highly stable on soils which cover crops or vegetation grow and where soil conservation such as mulching and contour terraces are practiced, also help prevent erosion as they reduce run-offs and provide a damping effect to the kinetic energy of rainfall on soil surfaces(Alex *et al*., 2022). Nevertheless, Any increase in velocity and volume of surface run-offs also increases the rate of erosion because large quantities of soil are swept down the slopes. This increases the amount of suspended sediments and water turbidity in stream channels, which reduces water quality(Lawson, 2011).

Stream quality is assured when it is sufficiently maintained, but may be adversely affected by sudden severe flooding or drought. Therefore the characteristics of the stream discharge are important in terms of its geomorphology, hydraulics, flood control, navigation, stabilization or development, depending on the purpose of the water resource for aquatic organisms, domestic use, etc.(Samesh & Tetsuya, 2021).

Rapid urbanization in Ogugu town has accelerated impact on the catchment around Ubelle stream. This rapid development which takes place around the stream catchment results in higher sediment yield and affects the stream stability. Changes to the land use can decrease permeability, increase fine sediment inputs, impact on water quality and increase runoff. These changes create an unbalance in the natural processes and lead to increased flood events, reduce base flows, decrease habitat diversity and channel erosion. Several major floods occurred in the last few decades in Ogugu, not only causing extensive damage and inconvenience to the community or the economic, but also the stream morphology itself. Over a period of time, high amount of sediment settled and the accumulated sediment filled up the river bed (Plate 1). The sediment also reduces the function of the stream and causes flooding and brings along the sediments from upstream to downstream of the stream when heavy rains occur during raining seasons. This study determined the sediment Characteristics in Ubelle Stream, assessed the sediment depth within the stream basin and analyzed the physico-chemical characteristics of the stream water.

2. MATERIALS AND METHOD

2.1 Study Site

The Ubelle stream is located at Ogugu central in Olamaboro LGA in the southeast of Kogi State, Nigeria. It is about 23,701m^2 in size, and lies within longitude 7º27'18.9E - 7º29'9.8E and latitude 7º7'58.9N -7º10'11.6N (Figure 1) (RAP, 2018). The stream catchment area is about 2.2004 km^2, while the Ubelle stream within the study area is 465m in length and has width ranging from 25 to 45m with a depth of 60 m (RAP, 2018). The sedimentation within the stream basin has been occurring for over fifteen years and came about as a result of uncontrolled water falls from the surrounding hills and the poor drainage along the stream. In 2014, flood from the stream led to the collapsing of a bridge and cut off a road linking many communities in the area to the rest of the Kogi state towns.

The sediment characteristics of the Ubelle Stream were studied with the aid of field and laboratory materials and their uses as shown in Table1.

Plate 1: Sediment Transported into the Ubelle Stream during Rainfall.

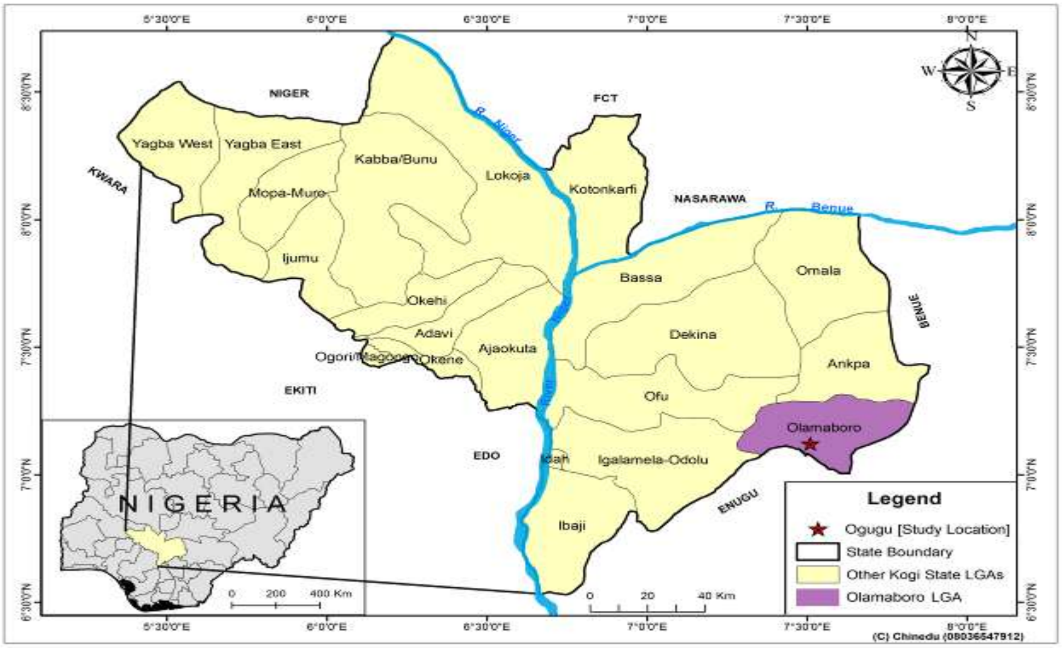


Figure 1: Map of Kogi State showing Project Location

Table 1: Field Materials and their Uses

S/N	Materials used	Uses
1.	Metallic depth metre	This equipment was used in taking sediment level measurement in the stream at different sampling points (The equipment was constructed and marked in engineering standard).
2.	Measuring tape	This tape was used to measure the depth of each sample point.
3.	Auger	This was used to dig out the samples at specific site in the stream basin.
4.	Peg	This was used to mark points of sediment sampling .
5.	Electronic balance	This was used to weigh the wet and dry samples.
6.	Oven dryer	This was used to dry the wet soil samples.
7.	Sampling containers(bottles, bags, cooler.)	Samples collected were packaged bottles, bags, and cooler and taken to the laboratory.
8.	Record book/pen	This was used to record the values of the data measured.
9.	Trowel	This was used to collect the samples from the auger.
10.	Manual sieve shaker	This was used to characterize the dry soil samples.
11.	Drying pans	The samples were placed in pans before putting in the oven.

2.1.1 Sampling points

Four sampling points were established along a spatial grid of Ubelle stream basin covering a distance of about 80 m. The sampling points were established based on ecological settings, vegetation and human activities in the area. Four sampling points were established, 20m apart from each other.

2.1.2 Sample collection

The samples were collected from the study area on sampling points starting from the top soil ; (depth 0.00 - 15cm,15 – 30cm, 30- 45cm) for three different points , for three months, making 36 samples all together. The sediment depths (SD) measured at various points (Plate 2) within the stream basin are as shown in Figure 2.

2.1.3 Particle density, bulk density and percentage (%) pore space Determination

Particle density, bulk density and percentage (%) pore space were determined by using the formulas below (S.B.D.,2019):

$$\text{Particle density} = \frac{Mass\ of\ dry\ soil}{Volume\ of\ particles\ only} \qquad 1$$

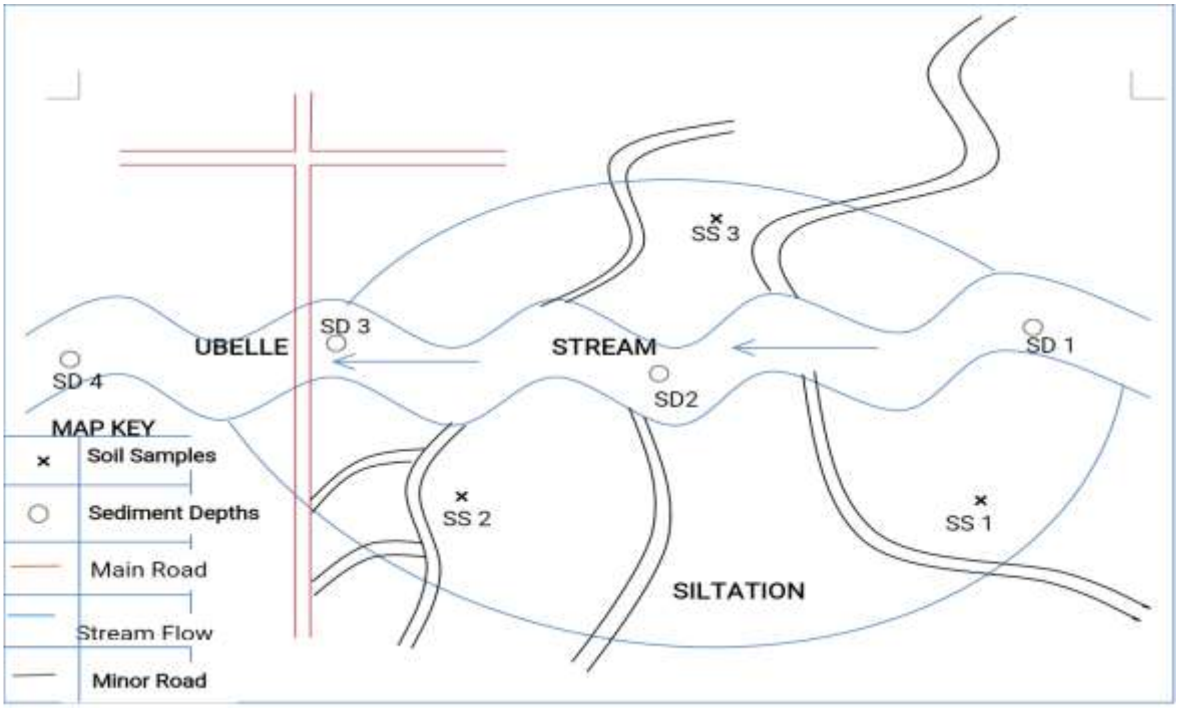
$$\text{Bulk density} = \frac{Mass\ of\ dry\ soil}{Total\ soil\ volume} \qquad 2$$

Particle density represents the average density of all the minerals composition of the soil. For most soils, this value is very near 2.65 g/cm3 because quartz has a density of 2.65 g/cm3 and quartz is usually the dominant mineral soils in river water flow sedimentation. Particle density varies little between minerals and has little practical significance except in the calculation of pore spaces which are obtained using the formula below (S.B.D.,2019).


(a)Getting Sediments with an Auger at the Stream Bank. (b) Measuring the Depth of Sediments in the Stream

Plate 2: Sediment Measurements in the Stream

Figure 2: Sketch Map showing the Sampling Points within the Stream Basin



Porosity or (%) Pore space = $\frac{100-bulkdensity\ \ x}{particle\ density}\ \frac{100}{1}$ 3

Soil (%) retained = $\frac{weight\ of\ soil\ retained\ \ x\ 100\%}{Total\ soil\ weight}\ x\ 100\%$ 4

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Sediment Analysis

The monthly amount of sediment depths measured from (SD1 – SD4) are recorded as shown in Table 2. The monthly sediment collected were oven dried at the temperatures of 105^{o}C for 24 hours. The characteristics of the sediment were determined using sieve analysis and the monthly results are tabulated as shown in Tables (3- 5) and the particle size characteristics are shown in Table 6.

Table 2. Sediment Depths (SD) within the Stream Basin

S/N	Sampling Points	Depths (m)
1	SD1	1.50
2	SD2	1.00
3	SD3	2.93
4	SD4	2.00

Table 3: Monthly Sieve Analysis of Soil Samples for April

Sieve no (BSS)	Sieve size (mm)	Soil retained (g)	Soil(%) retained	Cumulative (%) passing	% Finer
6	5	15.6	3.12	3.12	96.88
14	1.18	17	3.4	6.52	93.48
20	0.85	41.4	8.28	14.8	85.2
80	0.075	362	72.4	87.2	12.8
Tray		64	12.8	100	0

Table 4: Monthly Sieve Analysis of Soil Samples for May

Sieve no (BSS)	Sieve size (mm)	Soil retained (g)	Soil(%) retained	Cumulative (%) passing	% Finer
6	5	13.4	2.68	2.68	97.32
14	1.18	18	3.6	6.28	93.72
20	0.85	42.2	8.44	14.72	85.28
80	0.075	366	73.2	87.92	12.08
Tray		60.4	12.08	100	0

Table 5: Monthly Sieve Analysis of Soil Samples for June

Sieve no (BSS)	Sieve size (mm)	Soil retained (g)	Soil(%) retained	cumulative (%) passing	% Finer
6	5	11.15	2.23	2.23	97.77
14	1.18	17.2	3.44	5.67	94.33
20	0.85	40.4	8.09	13.76	86.24
80	0.075	370.2	74.04	87.8	12.2
Tray		61.05	12.21	100	0

Table 6: Particle Size Percentages

Parameters	April	May	June	Mean value
Particle Density (gcm^{-3})	2.65	2.65	2.65	**2.65**
Bulk Density (gcm^{-3})	2.5	2.27	2.3	**2.36**
Porosity (%)	6	14	13	**11**
Sand (%)	3.12	2.68	2.23	**2.77**
Silt (%)	84.08	85.24	85.57	**84.98**
Clay (%)	12.8	12.08	12.21	**12.36**
Textural class	Silty clay	Silty clay	Silty clay	**Silty clay**

3.1.2 Stream water analysis

The analytical result of physico-chemical characteristics of water from the stream basin are as shown in Table 7 and 8.

3.2 Discussion

3.2.1 Sedimentation in Ubelle stream basin

The analysis of sedimentation in Ubelle stream formed from river Ogugu 2.2004 km^2 from catchment area showed that, the depth of the siltation within the Stream basin was found to have filled the basin up and reduced the depth from the 60m (RAP, 2018), to a range between 1.00 to 2.93m (Table 2) as the deepest point in the stream. This means excess sediment has been transported into the stream basin and sedimentation occupied 57.07m, out of the 60m original depth of the stream within a period of fifteen (17) years (from 2004 - 2021).

The siltation also reduced stream basin's large body of water that served the people of the community as a multipurpose stream for fishing, swimming laundry and as sources of water for domestic uses from the width range of 25 to 45 m to between 5 to 15 m wide. This has resulted in impairing aquatic ecosystem in the stream because aquatic life is almost extinct.

Table 7: Monthly Mean Concentration of Physical Parameters

	April				May				June			
Parameter (unit)	**S1**	**S2**	**S3**	**Mean**	**S1**	**S2**	**S3**	**Mean**	**S1**	**S2**	**S3**	**Mean**
Colour(Pt co)	170	169	175	**171.3**	176	175	177	**176**	178	180	198	**185.3**
Temperature (0^c)	26.7	26.5	26.8	**26.7**	26.6	24.7	23.3	**24.9**	22.5	23.6	21.6	**22.6**
Turbidity(NTU)	32.2	33.5	34.6	**33.4**	33.7	35.8	36.8	**35.4**	37.8	36.7	37.7	**37.4**
T S S(mg/l)	65	62	67	**64.6**	68	69	70	**69**	70	72	71	**71**
T D S (mg/l)	80	84	82	**82**	84	86	84	**84.6**	87	88	90	**88.3**

Table 8: Monthly Mean Concentration of Chemical Parameters

Parameter (unit)	April S1	S2	S3	Mean	May S1	S2	S3	Mean	June S1	S2	S3	Mean
pH	6.6	6.7	6.5	**6.6**	7.9	8.3	8.8	**8.3**	9.2	9.1	9.7	**9.3**
Sulphate (mg/l)	8.3	8.6	8.4	**8.4**	8.7	8.8	8.6	**8.7**	8.9	8.7	8.9	**8.8**
Calcium (mg/l)	312	310	311	**311**	314	318	320	**317**	315	317	319	**317**
Magnesium (mg/l)	150	148	148.5	**148.8**	153	151	154	**153**	154	152	152	**153**
Iron (mg/l)	0.5	0.32	0.29	**0.37**	0.5	0.4	0.6	**0.5**	0.4	0.8	0.7	**0.6**
Phosphate (mg/l)	3.2	3.1	2.9	**3.1**	3.4	3.3	3.5	**3.4**	3.6	3.7	3.4	**3.6**
Nitrate (mg/l)	6.4	6.7	6.5	**6.5**	6.7	6.5	6.8	**6.7**	6.8	6.9	6.7	**6.8**
E.conductivity (µS/cm)	120	118	117	**118.3**	123	121	124	**120.8**	122	124	123	**123**

The sieve analysis of the soil samples was dominated by very fine sand with silt particles which range between 84.08 to 85.57 %, with a mean of 84.98% (Table 6). These falls within the soil textural of silty-clay, hence silty-clay soils silted the stream basin (Figure 3). This agrees with earlier findings (Kamaludin *et al.*,2013), that silty-clay soils gives rise to higher soil erodibility in an area. Satellite image (Figure 4), showed the villages in the central to southern parts of the study area are under threat by erosion (RAP, 2018). The image clearly reveals evidence of bare and eroded surfaces, as well as major access roads and streets which are both untarred and exposed to the erosion menace. Field observations also reveal that the entire slopes of the stream valley, trending in the Southeastern directions are easily prone to erosion, especially as increased surface runoff is generated by urbanization.

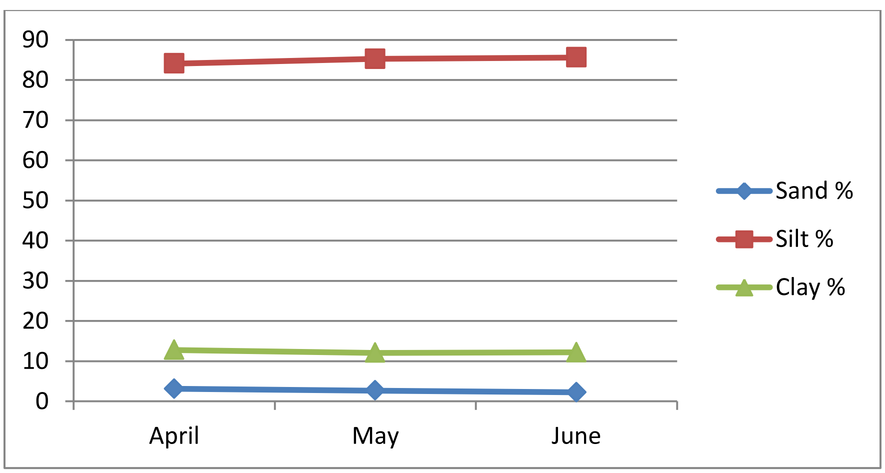


Figure 3: Textural class of Sediment in the stream

3.2.2 Sedimentation Characteristics of the stream basin

Soil particle sizes: The size of soil particles determines to a large extent the threshold forces required for detachment and entailment. The bigger the particle the more the force needed for transport. the size particle mostly eroded is about 0.1mm(Bryan, 2010). Results from the particles size analysis indicate that most of the particles obtained from the study area (Table 3 - 6) belong to the category of silty-clay (0.002 -0.02 mm). The inter-particle bonding forces between this particles is low, hence they are loose and thus very little force is required to detach and transport the soil particles therefore making then susceptible to erosion.
The porosity of soils from the study area ranged from 6% to 14%.The highest porosity (14%) is observed in the month of May (14%) and the lowest (6%) in the month of June (Table 6) (Figure 3and 4). This low porosity is an indication that the soil is dense and contains low volume of voids relative to the volume of solids The low porosity of these soils from study area are more porous and less cohesive due to their more finely divided individual soil particles. This lack of cohesion within the soil particles makes the soils prone to the effect of erosive forces(Esu, 2009).

Figure 4: Satellite Imagery over Ubelle Stream, Ogugu Erosion Areas

Bulk density: Bulk density is a property that determines to some extent the hydrological functions of the soil. It determines the porosity and hence the rate at which rainfall is absorbed. The infiltration of water into the soil is also affected by soil bulk density. Higher bulk density encourages erosion as this gives indications of poor environmental soil aeration, and undesirable changes in hydrologic functions such as reduced water infiltration. Soil analysis of the study area showed that values of the bulk density ranged from 2.27 - 2.50g/cm^3 (Table 6) (Figure 4). This is high compared to the average standards values of 1.33g/cm^3 (Esu, 2009), and agrees with Wyle & Ray (2009), that where the bulk density is high, infiltration reduces and increases overland flow that results to erosion. The high bulk density experienced at the study area can be attributed to the long intense tillage of soils in the area which destroys soil organic matter and weakens soil structure thereby making it vulnerable to the forces of erosion that causes sedimentation.

3.2.3 Physico-chemical Parameters of water from the stream

The stream water being a multipurpose one - the water is equally used for drinking and domestic uses do have water quality challenges because excess pollutants including nutrients and bacteria are transported to the stream basin. Some basic physico-chemical Parameters for drinking water were investigated and found to be as follows:

Temperature (°C) of the Stream water: The mean temperature of water samples from the stream was ranged between 22.6 –26.7°C and tends to decrease into the rainy season, possibly due to drop in environmental temperature. Temperature in this study was found within permissible limit of 30 °C (WHO, 2011; Ezeribe,2012).

Turbidity: The turbidity of water depends on the quantity of solid materials present in the suspended state. It is a measure of light emitting properties of water and the test is used to indicate the quality of waste discharge with respect to colloidal matter. The mean turbidity value obtained for Ubelle stream ranged from 33.4 - 37.4 NTU). This is higher than the recommended standard value of 5.00 NTU (WHO,2015).

From the research the mean turbidity of the three months was in accordance with studies in lower River Ogun in which high turbidity was found to have been caused by sediment deposits throughout the bed flows of water from the catchment area,(Yakub & Ugwumba,2009).

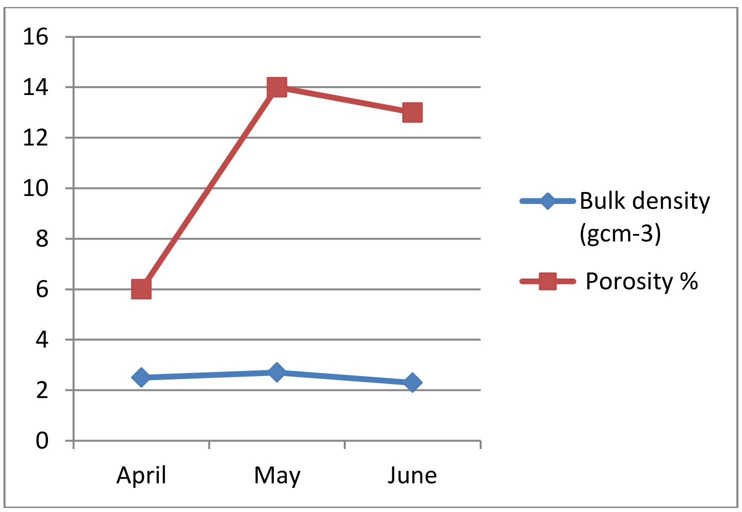


Figure 4: Bulk density Variations of the soils of the stream

Total Dissolved Solids (TDS): Water has the ability to dissolve a wide range of inorganic and some organic minerals or salts such as potassium, calcium, sodium, bicarbonates, chlorides, magnesium, and sulphates. These minerals produced un-wanted taste and dilute water to give its colour appearance. The water with high TDS value indicates that the water is highly mineralized. Desirable limit for TDS is 500 mg/l and maximum limit is 1000 mg/l which is prescribed for drinking purpose. The concentration of TDS from the stream water for the three months ranged between 80 and 90 mg/l(Table VII). The mean TDS concentration was found to be 82 - 88.3 mg/l, and it is within the limit of WHO standards. Similar value was reported for drinking water in Turkey (Soylak, 2001). TDS are generally not harmful to human beings, but high concentration may affect persons who are suffering from kidney and heart diseases and may cause laxative or constipation effects,(Sasikaran, 2012).

pH of the Stream Water: pH is an important parameter in evaluating acid–base balance of water because its indicates acidity or alkaline condition of water status. Recommended maximum permissible limit of pH for drinking water is from 6.5 to 8.5(WHO,2011). Findings from the stream water showed pH current ranged between 6.6 - 9.7, indicating that the water is slightly acidic and other points alkaline by WHO standards (Edimeh, 2011; Aremu, 2011).

Calcium (Ca): Results show that the concentration of calcium ranges from 310 to 320mg/l, these results did not meet the WHO standards and may become diseases associated excess calcium. Calcium is very important for human cell physiology and bones. About 95 % of calcium in human body are stored in bones and teeth, the high deficiency of calcium in humans may cause rickets, poor blood clotting, bones fracture, cardiovascular diseases. It is essential to fish for metabolic reactions such as bone and scale formation[(Anita & Pooja 2013). Permissible standard range in drinking water is 75 mg/l (WHO,2015), while that of aquaculture ranges between 10 – 180mg/l for different species of fish (Anita & Pooja 2013).

Magnesium (Mg): Magnesium was found to range from 148 to 154 mg/l. Similar value was reported to have been found in drinking water Turkey, (Soylak, 2001). It is an essential for proper functioning of living organisms (60 % in bones and 40 % in muscles and tissues) and a major dietary requirement for humans(EPA,2001). Standards, permissible range of magnesium in water should be 50 mg/l. For aquatic life; an acceptable standard ranges from 10 - 180 mg/l as $CaCO_3$ for fish species(WHO,2011). The concentration of magnesium in Ubelle stream water was higher than the standard limit for drinking water and for some species of aquatic fishes.

Iron (Fe): Results show that the concentration of Iron ranges from 0.29 to 0.8mg/l. The monthly mean concentration increase with advance into the peak of rainy season (July- September), possibly due to more dissolutions of Iron into the water body. The values exceeds WHO recommendation of 0.3mg/l and may have contributed to the colouring and the taste, which makes the samples not to be potable(Ajibade *et al.*, 2008).

Sulphate(SO_4) concentration ranged from 8.3 to 8.9.mg/l. Sulphate exists in nearly all natural waters from the sulphides of heavy metals, the concentrations varying according to the nature of the terrain through which they flow. Sulphate is found in fertilizers and can lead to water pollution due to increased sulphate concentration in water body that is washed from farms (Shinde *et al.*,2011). Sulphate is a source of nutrient that facilitates the growth of planktons that support the fish population in surface waters. But the finding from this stream appears higher than recommended standard (Anita & Pooja 2013). The excess might be from fertilizers applied in farm which are leach into the water courses.

Phosphate(PO_4): The monthly variation of phosphate ranged from 2.9 to 3.7 mg /l. The phosphate concentration of the stream was high compared to the standard guidelines (USEPA, 2008); NESREA, 2015). Phosphates are modified forms of Phosphorus in natural waters and wastewaters. Phosphates are not toxic to people or animals, unless they are present in very high levels. Digestive problems could occur from extremely high levels of phosphates (PHILMINAQ, 2012).

Nitrate(NO_3): Nitrate is the primary form of nitrogen used by plants as a vital nutrient to stimulate growth reproduction, and the survival of organisms. Nitrates variation from this study ranged between 6.4 to 6.9mg/l. This is within the 45mg/l limit standard for drinking water(WHO,2011). Excessive amounts of nitrogen may result in phytoplankton or macrophyte proliferations. High nitrate levels (>100 mg/l) are not good for domestic uses (WHO,2015) Excess nitrate in drinking water sources causes Cyanosis, and asphyxia diseases (blue baby syndrome) in infants under 3 months (Onoja *et al.*, 2017).

Electrical conductivity (EC): Conductivity is the measurement of the ability of water to conduct an electric current - the greater the content of dissolved ionic salts in the water, the more current the water can carry and the higher the conductivity. Generally, the amount of dissolved solids in water determines the electrical conductivity. Electrical conductivity (EC) increase in ions concentration enhances the electrical conductivity of water and enables it to transmit current.
The EC values from this study were 117 to124 μS/cm, with a mean value of 118.3-123 μS/cm. WHO standards stated that, EC values for drinking water should not exceed 400 μS/cm. Conductivity of freshwater varies between 50 to 1500 μS/cm, polluted waters 10,000 and seawater conductivity around 35,000 μS/cm and above; depending on its ionic concentration (Ca^{2+},Mg^{2+}, $HCO3^-$,$CO3^-$,$NO3^-$ and $PO4^-$), temperature and on variations of dissolved solids - used as indicator of primary production (chemical richness) for fish production. (Davies & Abowei, 2010; Anita and Pooja, 2013). The result obtained in this study clearly indicate that water was not minimally ionized and has the lower level of ionic concentration activity due to small dissolve solids (Table 8).

4. CONCLUSION

The sedimentation research carried out in Ubelle stream showed that the depth of the siltation within the Stream basin was found to have occupied up to 57.07 m out of the original depth of 60m leaving just 2.93m depth. The stream basin was silted by silty clay soil which had a higher porosity; this contributed to the erosion from the water courses.
The physico-chemical parameters fluctuated with variation towards rainy season. The water was alkaline with high turbidity above the recommended standards. Some of the chemical parameters equally had values above set standards for drinking water but are within limits for other domestic uses and aquaculture.
The sedimentation in the stream basin was due to soil erosion being transported by rain water and deposited into the basin. To prevent future occurrence, Erosion control measures along the water courses like vetiver grass and vegetative shrub cover plants like *Ipomoe Abyssinica*, (Choisy Plant) which grow very fast, mat spread and cover soils against stream bank erosion on riverbeds, as most of the soils in the catchment areas are silty clay. Naturally deep-rooted grasses that establish quickly such as turf-type tall fascue grasses and perennial ryegrasses should be planted near the stream. The stream water needs to be treated before use as drinking water and other domestic uses.

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