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Physicochemical and Multivariate Analysis of Aveeluz and Alabukunfun Tributaries in Kuto Community, Ogun State, Nigeria

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Abstract

Tributaries which are smaller streams that feed into larger rivers play a crucial role in the river ecosystems. These water bodies carry water, sediments, and nutrients from surroundings into a main river influencing water quality. This study aimed to determine some physicochemical parameters and their association in Aveeluz and Alabukunfun tributaries in Kuto Community, Ogun State, Nigeria. Water samples were collected from five (5) stations each from both tributaries. pH and Temperature were tested on site then further analysis were carried out by standard procedures in the laboratory. The results revealed that Aveeluz tributary has the highest mean pH, electrical conductivity, salinity, and total dissolved solids in station E (6.15, 162.33 μS/cm, 80.33, 80 ppm) respectively while Alabukunfun tributary highest mean temperature, total alkalinity, total acidity in station D (27.90 °C, 63.00 and 15.00 mg/L) respectively. The physiochemical parameters except (pH) across the stations in each tributary were within the WHO standard. Multivariate statistic such as correlation showed a significantly moderate positive correlation between pH and EC (0.558), and salinity (0.546), $p<0.05$. Strong positively correlation between EC and TDS (0.859) and salinity (0.881), TDS and salinity (0.880) $p<0.01$ for Aveeluz Tributary. Furthermore, a significantly moderate correlation between TDS and salinity (0.569) $p<0.01$ was observed for Alabukunfun tributary, while principal component analysis (PCA) revealed three components for both tributaries with similar relationship pattern to the correlation. Additionally, this study revealed an unacceptable low pH level across the tributaries which could be linked to it lotic nature.

Keywords: Tributaries, Physicochemical, Aveeluz, Alabukunfun, Kuto

Introduction

One of the essential components for survival of life on earth, containing minerals, important for humans as well as for aquatic life is water [1]. Although approximately 70% of the earth's surface is covered with water, 97% of it is saline, rendering it unusable, especially in impoverished nations like India [2]. Only 3% of the earth's water is freshwater, with 2% of that being frozen in glaciers, 3% being surface water, and the remaining 0.6% being groundwater. Surface water can be found in rivers, lakes, ponds, and streams. Rivers, in particular, have been historically significant to human societies, with many civilizations emerging around their banks [2-5].

Globally, water pollution has become a cause for worry [6]. Water which is important and essential has been impaired by pollution from natural and anthropogenic sources. This has reduced the quality and the productivity of aquatic ecosystems [7]. The deteriorating condition of water quality has a profound effect on the environment as a whole, disturbing the very nature of the ecosystem and degradation of natural habitat is a significant factor resulting in a decrease in the diversity and abundance of the species [8]. Human activities like the discharge of sewage and runoff of agricultural pollutants are the main contributing factors to reduced water quality index [9-10]. Also, one of the most problematic issues facing the people is the availability of good quality freshwater for various domestic, agricultural and industrial purposes in most developing countries of the world, especially Nigeria [11-12].

Water contamination due to pathogenic agents, chemicals, heavy metals, pesticides water disinfectants, and thereby product as a consequence of industrial and agricultural activities leaching from soil, rocks, and atmospheric deposition and other human activities has become a hazard to human health in several regions of world. Physicochemical parameter of any water body plays a very important role in maintaining the fragile ecosystem that maintains various life forms. Present research paper deals with various water quality parameter, chlorides, dissolved oxygen, total iron, nitrate, water temperature, pH, total phosphorous, faecal coli form bacteria, and adverse effect of these parameters on human being [13]. And these physicochemical parameters like water temperature, pH, dissolved oxygen, dissolved carbon dioxide, electrical conductivity, suspended solids, nitrate, ammonium ions, orthophosphates, color, salinity and turbidity affect the quality of water [14].

Numerous factors are responsible for variations in the physicochemical properties of water and may exert a positive or negative influence on the survival of the species [15]. These factors are associated with one another and change in one factor may lead to change in another which may lead to serious consequences on the water quality as well as the organisms living in it. Dissolved oxygen is one of the most significant factors required for aquatic life, and low levels of dissolved oxygen lead to reduced quality of water which may increase mortality in prawns [16]. Laws and policies regulate the generation and treatment of solid and liquid waste, but their effectiveness is hindered by ignorance, lack of resources, and insufficient technical know-how.

Environmental regulations must be effectively used to manage surface water bodies in developing nations. The following studies support this imperative: [17-20]. The contamination of surface water bodies is a topic of discussion among scientific groups due to the impact of industry and urbanization on their survival. While most rivers are self-cleaning, they have a limited capacity to absorb solid, industrial, household, and agricultural waste. Due to the constant dumping of increasing volumes of waste, rivers have lost their ability to self-clean [21-23]. Therefore, it is crucial to regularly monitor surface water bodies. This study hereby focuses on the physicochemical parameters compared to the WHO permissible limit in Alabukunfun and Aveeluz tributaries in Kuto, Ogun State, Nigeria.

Materials and Methods

Description of Study Area

The study was carried out in two tributaries (Aveeluz: 7°13'94.0"N 3°35'56.7"E and Alabukunfun: 7°14'15.8"N 3°35'45.7"E) in the vicinity of Kuto communities of Abeokuta, Ogun State, Nigeria. Abeokuta is a city located between latitude 7°20" north of the equator and between longitude 3°20" east of the Greenwich Meridian. The city experiences the wet and dry seasons. The wet season runs from April through October while the dry season runs from November through March. The main rock type found in the study area is older granite rock which has undergone intense weathering into a reddish to dark brown medium-grained lateritic layer of considerable thickness. The streams in the city are used by some of its residents for domestic activities [24].

Sampling Procedure

Water samples were collected using a 1L plastic bottle pre-treated with 5% nitric acid (HNO_3) overnight each from five (5) stations (100 meters apart) in the tributary. During sampling, all necessary precautions were taken into consideration to avoid contamination. The temperature and pH of the samples were determined in situ, labelled appropriately and transported in an ice pack to the Chemical Science Research Unit, Pure Sciences, Abeokuta, Ogun State, Nigeria for further analysis.

Quality Control

All chemicals used in experimentation were of Analytical grade purity and reagent blanks were made following the specifications to evaluate the reagents' purity. To ensure the highest level of instrument accuracy, the water quality meter and laboratory equipment were checked and calibrated according to the manufacturer's specifications and instructions. [1, 11, 12, 25].

Physicochemical Quality

The physicochemical quality of the water samples collected were carried out using standard methods [11, 26, 27]. The pH of each sample was determined using a handheld pH meter. Temperature and pH were measured in situ. After standardizing the apparatus with standard buffer solutions of varying pH, the sample pH was immediately taken. Total dissolved solids, salinity and electrical conductivity were determined using a handheld digital water quality meter (Model: EZ-9909SP). Total acidity, total alkalinity was determined using Titrimetric Methods.

Total Acidity: This was carried out as follows, the titrant (0.025 M NaOH) was titrated against 100 cm³ of sample in a conical flask using two drops of phenolphthalein as indicator, then a pink coloration was obtained to indicate the endpoint.

$$Total\ Acidity = \frac{Titre\ value \times 0.025 \times 1000}{100} \quad (1)$$

Total alkalinity: This was carried out as follows, the titrant (0.025 M HCl) was titrated against 100 cm³ of sample in a conical flask using two drops of methyl orange as an indicator, then a peach colouration was obtained to indicate the endpoint

$$Total\ Alkalinity = \frac{Titre\ value \times 0.025 \times 1000}{100} \quad (2)$$

Dissolved Oxygen (DO): Determination of DO was carried out using Winkler's method [28, 29], 200 cm^3 of the water samples, was measured and cautiously transferred into a 300 cm^3 BOD bottle, followed by in situ fixation with Winkler A and B reagents. 2 cm^3 of concentrated sulphuric acid (H_2SO_4) was added to 100 cm^3 of the fixed sample, inverted several times to dissolve the flocs. Then titrated against standard sodium thiosulphate solution (0.1N $Na_2S_2O_3$) using 1 cm^3 starch solution as indicator. The reaction turns from blue-black to colorless. The values of dissolved oxygen were expressed in mg/L and content was expressed using the formula:

$$Dissolved\ Oxygen\ (DO) = \frac{Titre\ value \times 0.1N}{0.025} \quad (3)$$

Statistical Analysis

Data was subjected to Statistical package for social sciences (SPSS version 21) for descriptive statistics. Turkey Post hoc test was employed to determine the significance between the stations ($p<0.05$) while Pearson correlation and principal component analysis was employed to determine the association between parameters.

Results and Discussion

Results

Physicochemical Qualities

The result is showed below. It was recorded that pH ranged from (5.82 to 6.17) from station A-E in both tributaries. Alabukunfun lowest pH was recorded in station E (6.01) and Aveeluz in station B (5.82) while Alabukunfun highest pH was recorded in station A (6.16) and Aveeluz in station E (6.17). Both Alabukunfun and Aveeluz tributaries mean pH from all the station (A-E) are not in compliance with the WHO standard (6.5- 8.5). Both tributaries temperature ranged from (27.20 °C to 28.60 °C) from station A-E in both tributaries. Alabukunfun lowest temperature was recorded in station B (27.20 °C) and Aveeluz in station E (27.80 °C) while Alabukunfun highest was recorded in station D (27.90 °C) and in Aveeluz in station A (28.60 °C).

Both Alabukunfun and Aveeluz tributaries mean temperature from the station (A-E) all complies with the WHO standard (25 °C – 29 °C). Both tributaries EC ranged from 151.00 µS/cm to 197.00 µS/cm. Alabukunfun lowest EC was recorded in both station A and D (184.00 µS/cm) and in Aveeluz in station B (151 µS/cm) while Alabukunfun highest EC was recorded in station B (197.00 µS/cm) and in Aveeluz in station A (165 µS/cm). Both Alabukunfun and Aveeluz tributaries mean EC from all stations (A-E) recorded are in compliance with the WHO standard (1000 µS/cm). Both tributaries TDS ranged from 75.00 ppm to 94.00 ppm. Alabukunfun lowest TDS was recorded in station D (91.00 ppm) and in Aveeluz in station B (75.00 ppm) while Alabukunfun highest was recorded in Station A and E (94.00 ppm) and in Aveeluz in both station A and E.

Both Alabukunfun and Aveeluz tributaries mean TDS from all station (A-E) complies with the WHO standard (<600 ppm). Both tributaries salinity ranged from (76.00 ppm to 96.00 ppm). Alabukunfun lowest salinity was recorded station B and D (92.00 ppm) and in Aveeluz in station B (76 ppm) while Alabukunfun highest salinity was recorded in station A (96.00 ppm) and in Aveeluz in both station A and E (81 ppm). Both Alabukunfun and Aveeluz tributaries mean salinity from all station (A-E) are in accordance with the WHO standard (100 ppm).

Both tributaries total alkalinity ranged from (51.90 mg/L to 102.00 mg/L). Alabukunfun lowest total alkalinity was recorded in station B (51.90 mg/L) and in Aveeluz in station A (59 mg/L) while Alabukunfun highest total alkalinity was recorded in station D (68.00 mg/L) and in Aveeluz in station D (102 mg/L). Both Alabukunfun and Aveeluz tributaries mean total alkalinity from all the stations complies with WHO standard (200 mg/L).

Both tributaries total acidity ranged from (9.00 mg/L to 24.00 mg/L). Alabukunfun lowest total acidity was recorded in station A (9.00 mg/L) and in Aveeluz in station A (12.00 mg/L) while Alabukunfun highest total acidity was recorded in station E (19.00 mg/L) and in Aveeluz in station C (24.00 mg/L). Both tributaries DO range (7.75 mg/L to 22.50 mg/L). Alabukunfun lowest DO was recorded in station A (16.50 mg/L) and in Aveeluz in station D (7.75 mg/L) while Alabukunfun highest DO was recorded in both station C and E (22.50 mg/L) and in Aveeluz in station A (20.00 mg/L). Alabukunfun tributary mean DO was not in line while Aveeluz tributary mean DO from all the stations are not in compliance with WHO standard (13-14.0 mg/L).

Table 1: Aveeluz Tributary

Parameter		Stations				
		Station A	**Station B**	**Station C**	**Station D**	**Station E**
pH	Mean	5.93[a]	5.88[a]	5.91[a]	5.94[a]	6.15[b]
	Std. Deviation	0.02	0.05	0.02	0.01	0.02
	Minimum	5.91	5.82	5.89	5.93	6.14
	Maximum	5.95	5.92	5.93	5.95	6.17
	WHO (2011)	**6.5-8.5**				
Temperature (°C)	Mean	28.60[d]	28.30[c]	27.93[b]	28.30[c]	27.80[a]
	Std. Deviation	0.00	0.00	0.06	0.00	0.00
	Minimum	28.60	28.30	27.90	28.30	27.80
	Maximum	28.60	28.30	28.00	28.30	27.80
	WHO (2011)	**25-29**				
EC (µS/cm)	Mean	160.00[a]	153.33[a]	156.00[a]	156.33[a]	162.33[a]
	Std. Deviation	5.57	2.08	3.61	3.06	1.53
	Minimum	154.00	151.00	152.00	153.00	161.00
	Maximum	165.00	155.00	159.00	159.00	164.00
	WHO (2011)	**1000**				
TDS (ppm)	Mean	80.00[b]	76.33[a]	78.33[ab]	77.67[ab]	80.00[b]
	Std. Deviation	1.73	1.53	1.15	1.15	1.00
	Minimum	78.00	75.00	77.00	77.00	79.00
	Maximum	81.00	78.00	79.00	79.00	81.00
	WHO (2011)	**<600**				
Salinity (ppm)	Mean	80.00[b]	77.33[a]	78.33[ab]	79.00[ab]	80.33[b]
	Std. Deviation	1.00	1.15	1.15	0.00	0.58
	Minimum	79.00	76.00	77.00	79.00	80.00
	Maximum	81.00	78.00	79.00	79.00	81.00
	WHO (2011)	**100**				
T. Alkalinity (mg/L)	Mean	65.00[a]	68.67[a]	71.00[a]	95.00[b]	76.67[ab]
	Std. Deviation	6.00	6.81	1.73	8.19	11.68
	Minimum	59.00	61.00	69.00	86.00	64.00
	Maximum	71.00	74.00	72.00	102.00	87.00
	WHO (2011)	**200**				
T. Acidity (mg/L)	Mean	12.67[a]	15.33[ab]	21.67[c]	17.00[b]	19.33[bc]
	Std. Deviation	1.15	0.58	2.08	2.00	1.53
	Minimum	12.00	15.00	20.00	15.00	18.00
	Maximum	14.00	16.00	24.00	19.00	21.00

	WHO (2011)	**-**				
Dissolved Oxygen (mg/L)	Mean	19.75[b]	16.25[ab]	13.75[ab]	7.75[a]	12.00[ab]
	Std. Deviation	0.35	1.06	2.47	3.89	3.54
	Minimum	19.75	16.25	13.75	7.75	12.00
	Maximum	20.00	17.00	15.50	10.50	14.50
	WHO (2011)	**13-14**				

[abc]Mean with different superscript across the row are significant at $p<0.05$

Table 2: Alabukunfun Tributary

		Stations				
Parameter		**Station A**	**Station B**	**Station C**	**Station D**	**Station E**
pH	Mean	6.15^{b}	6.06^{a}	6.04^{a}	6.08^{a}	6.06^{a}
	Std. Deviation	0.02	0.01	0.02	0.01	0.04
	Minimum	6.13	6.05	6.03	6.07	6.01
	Maximum	6.16	6.07	6.06	6.09	6.09
	WHO (2011)	**6.5-8.5**				
Temperature (°C)	Mean	27.60^{c}	27.27^{a}	27.40^{b}	27.90^{d}	27.30^{a}
	Std. Deviation	0.00	0.06	0.00	0.00	0.00
	Minimum	27.60	27.20	27.40	27.90	27.30
	Maximum	27.60	27.30	27.40	27.90	27.30
	WHO (2011)	**25-29**				
EC(µS/cm)	Mean	186.00^{a}	189.67^{a}	185.33^{a}	184.00^{a}	187.00^{a}
	Std. Deviation	2.65	6.35	0.58	0.00	0.00
	Minimum	184.00	186.00	185.00	184.00	187.00
	Maximum	189.00	197.00	186.00	184.00	187.00
	WHO (2011)	**1000**				
TDS (ppm)	Mean	93.00^{ab}	93.00^{ab}	92.33^{ab}	91.67^{a}	93.67^{b}
	Std. Deviation	1.00	0.00	0.58	0.58	0.58
	Minimum	92.00	93.00	92.00	91.00	93.00
	Maximum	94.00	93.00	93.00	92.00	94.00
	WHO (2011)	**<600**				
Salinity (ppm)	Mean	94.00^{a}	92.00^{a}	93.00^{a}	92.00^{a}	93.33^{a}
	Std. Deviation	1.73	0.00	0.00	0.00	0.58
	Minimum	93.00	92.00	93.00	92.00	93.00
	Maximum	96.00	92.00	93.00	92.00	94.00
	WHO (2011)	**100**				
T. Alkalinity (mg/L)	Mean	56.67^{a}	54.97^{a}	55.67^{a}	63.00^{a}	59.67^{a}
	Std. Deviation	3.79	3.65	3.79	6.24	6.03
	Minimum	54.00	51.90	53.00	56.00	54.00
	Maximum	61.00	59.00	60.00	68.00	66.00
	WHO (2011)	**200**				
T. Acidity (mg/L)	Mean	10.67^{a}	14.00^{a}	10.67^{a}	15.00^{a}	13.67^{a}
	Std. Deviation	1.53	3.00	0.58	1.00	4.73
	Minimum	9.00	11.00	10.00	14.00	10.00
	Maximum	12.00	17.00	11.00	16.00	19.00
	WHO (2011)	**-**				
Dissolved Oxygen (mg/L)	Mean	16.50^{a}	18.50^{a}	21.00^{a}	20.75^{a}	20.75^{a}
	Std. Deviation	0.71	1.41	2.12	1.06	2.47

	Minimum	16.50	18.50	21.00	20.75	20.75
	Maximum	17.00	19.50	22.50	21.50	22.50
	WHO (2011)	**13-14**				

abcMean with different superscript across the row are significant at $p<0.05$

Correlation Matrix for Aveeluz Tributary and Alabukunfun Tributary

Pearson's correlation coefficient conducted between parameters is presented in Table 3 and 4. Table 3 showed a significantly moderate positive correlation between pH and EC (0.558), and salinity (0.546), p<0.05. A significantly strong positively correlation between EC and TDS (0.859) and salinity (0.881), TDS and salinity (0.880) p<0.01 for Aveeluz Tributary. Table 4 showed a significantly moderate correlation between TDS and salinity (0.569) p<0.01 for Alabukunfun Tributary

Table 3: Correlations matrix for Aveeluz Tributary

	pH	Temperature	EC	TDS	Salinity	Total Alkalinity	Total Acidity	Dissolved Oxygen
pH	1	-0.609*	*0.558**	0.471	*0.546**	0.180	0.309	-0.297
Temperature		1	-0.157	-0.092	-0.053	-0.130	-0.851**	0.425
EC			1	**0.859****	**0.881****	-0.044	0.047	0.111
TDS				1	**0.880****	-0.021	-0.016	0.168
Salinity					1	0.107	-0.090	-0.032
Total Alkalinity						1	0.160	-0.823**
Total Acidity							1	-0.311
Dissolved Oxygen								1

**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlations matrix for Alabukunfun Tributary

	pH	Temperature	EC	TDS	Salinity	Total Alkalinity	Total Acidity	Dissolved Oxygen
pH	1	0.389	-0.077	-0.035	0.346	0.176	-0.429	-0.454
Temperature		1	-0.544*	-0.607*	-0.114	0.443	0.129	0.000
EC			1	0.410	0.120	-0.269	0.107	-0.122
TDS				1	*0.569**	-0.300	0.033	-0.120
Salinity					1	0.054	-0.310	-0.199
Total Alkalinity						1	.071	0.092
Total Acidity							1	-0.130
DO								1

*Correlation is significant at the 0.05 level (2-tailed).

Principal component analysis (PCA) for Parameter in Aveeluz and Alabukunfun Tributaries

The principal component analysis of water parameters in Aveeluz and Alabukunfun tributaries is shown in table 5 and 6. Table 5 indicated three components making up 89.6% of the overall variance. The first component accounted for 43.3 % variance with a strong loading between EC, pH, Salinity and TDS. Furthermore, the second component accounted for 28.9 % variance with a strong loading with DO, and moderate loading with temperature while the third component accounted for 17.3 % variance and a moderate loading between total alkalinity and Temperature. Furthermore, table 6 indicated three components making up 75.3% of the overall variance. First component accounted for 35.4% of the variance and a strong loading between temperature and total alkalinity. The second component accounted for 24.7% of the variance and a strong loading between pH and salinity while the third component accounted for 15.2% of the variance and a moderate loading with total acidity

.

Table 5: Component Matrix for Aveeluz

	Component		
	1	2	3
Electrical Conductivity	**0.915**	0.334	
pH	**0.829**	-0.119	
Salinity	**0.816**	0.363	0.348
Total Dissolved Solid	**0.813**	0.428	0.165
Dissolved Oxygen	-0.197	**0.849**	-0.441
Temperature	-0.572	**0.618**	**0.522**
Total Acidity	0.494	-0.584	-0.536
Total Alkalinity		-0.660	**0.695**
Eigen values	***3.465***	***2.320***	***1.386***
% of Variance	***43.316***	***28.995***	***17.331***
Cumulative %	***43.316***	***72.311***	***89.641***

Table 6: Component Matrix for Alabukunfun

	Component		
	1	2	3
Temperature	**0.946**	0.133	
Total Alkalinity	**0.813**		0.247
Total Dissolved Solid	-0.773	0.319	0.107
Electrical Conductivity	-0.669	0.118	0.206
pH	0.394	**0.808**	0.139
Salinity	-0.235	**0.805**	-0.174
Total Acidity	-0.115	-0.517	**0.776**
Dissolved Oxygen		-0.520	-0.667
Eigen values	***2.83***	***1.97***	***1.22***
% of Variance	***35.39***	***24.68***	***15.20***
Cumulative %	***35.39***	***60.07***	***75.27***

Discussion

Physicochemical parameters

pH of a stream is the measure of the acidity and alkalinity of the stream, although pH has no significant hazardous implication on the health of humans its impact on the physiology cannot be neglected [11]. This is contrary to the previous result reported from the same areas [30], showing that all water is generally alkaline but similar to that of the upstream and downstream of River Iju, Ogun State (6.65 – 8.56) impacted by effluents [11]. The temperature of a stream is the degree of coldness and hotness of the stream, the report from the study was similar to the report of an abattoir impacted wells in Omu – Aran, Nigeria with 26.90 – 26.70 °C [31] except high temperature peak at the upstream of station D which can be attributed to exothermic reaction taking place between the ionic species discharged from the effluents discharged from soap and detergent and domestic wastes [32].

Electrical conductivity (EC) is a direct function of total dissolved salts in water constituents. This low EC value is very good as high conductivity may reduce the quality of the water by giving miner al taste to the water in line with [33]. TDS are water property used for evaluating the number of solid substances in a water sample [34]. The TDS from the study is exponentially higher to the report from KNUST campus, Ghana (51.96 mg/L) [35]. Potential health effects of high TDS include damage to the central nervous system, dizziness, and paralysis of the tongue [36]. This low level of TDS observed shows good quality. The salinity of the stream is a measure of dissolved salts in the stream [32], the high salinity of the streams was likely due to presence of soaps and detergents in the form of ions. Chemically, soap is a salt of fatty acids, or a combination of salts, composed of Na^+ or K^+, and a negative ion, usually the anions of long chained carboxylic acids [32]. The salinity recorded from this study is extremely higher than that reported from mini Whuo Stream (24.82±4.97mg/L), Port Harcourt, Rivers State, Nigeria [37].

Total alkalinity is the concentration of titratable bases in water [38]. The Total Alkalinity reported from this study are higher than the report from well in Kano (16.3 mg/L) by [39]. Water hardness occurs as a result of alkaline earth metallic cations (Ca^{2+} and Mg^{2+}) in water [34]. The total alkalinity in the water sample from the study was high in sample H and I. The water hardness report from this study is higher than the report from KNUST campus, Ghana (58.8 mg/l) [38]. Total acidity is primarily caused by naturally occurring, unpolluted waters is dissolved CO2. Weak acids like CH3COOH can make a major contribution to the overall acidity of contaminated waters [40]. The acidity recorded across the streams was similar to the report across sampling stations in the dry season in River Sokoto 05- 20 mg/L [41] and Asa River, but lower than Ilorin 26.3 - 50.23 mg/L [41].

The DO is a measure of the degree of pollution by organic matter, the destruction of organic substances as well as self-purification capacity of the water body [42]. The DO concentration across the station is higher than the report from industrial effluent 100 meters downstream of River Iju (7.56 mg/L) [11] and abattoir effluent in Omu – Aran, Nigeria (5.80 – 7.23 mg/L) [31].

Conclusion

This study assessed the physicochemical parameters of Aveeluz and Alabukunfun tributaries in Kuto, Ogun State, Nigeria. The study showed that most parameters were within the World Health Organization (WHO) standards, except for the pH levels across all stations which were below the acceptable limits. High water acidity in Aveeluz tributary indicated the influence of both natural processes and anthropogenic activities in the area. Furthermore, the relationship between the parameters confirmed the impact of human activities on the water quality. Therefore, continuous monitoring of Aveeluz and Alabukunfun tributaries is important while further studies should evaluate their metallic and biological status and also identify the source of pollution.

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