PRINT ISSN 1119-8362
Electronic ISSN 2659-1502

Full-text Available Online at
https://www.ajol.info/index.php/jasem
http://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 26 (8) 1457-1461 August 2022

Evaluation of the Water Quality Parameters in Surface Water of Iyesi Stream, Ogun State, Nigeria

ODUNMBAKU, A; *EKUTE, BO

Department of Chemistry, National Open University of Nigeria, Jabi-Abuja, Nigeria.
**Corresponding Author Email: bekute@noun.edu.ng; Tel: 07056909001*
Other Author Email: aodunmbaku@noun.edu.ng

ABSTRACT: The quality of surface water could have positive or negative impact on its consumption and use. This study is aimed at examining the quality of surface water of Iyesi Stream. In achieving this, sixteen (16) samples were taken at four different periods (four samples per batch) from October, 2017 to May, 2018 and analyzed for selected water quality parameters namely pH, alkalinity, BOD, COD, TDS, some anions (PO_4^{3-}, NO_3^-, SO_4^{2-}) and trace cations (Fe, Cr and Ni) according to APHA (1992) methods of analysis. The trace metals were analyzed using UNICAM AAS after sample digestion. An average pH range of 5.90±0.86 to 6.85±0.19 was recorded for the samples. SWR-2 had highest average levels of alkalinity, TH, BOD, COD, TDS, SO_4^{2-}, Fe, Cr and Ni. The higher values at SWR-2 could be attributable to the fact that it is in close proximity to the effluent discharge point of the industrial estate in its environ. It was observed from this study that SWR-3 had higher nitrate and phosphate levels of 4.01±1.95mg\L and 0.19±0.04mg\L respectively. Overall, the water source is grossly organically polluted and could require suitable treatment options like coagulation with Alum or Ferric chloride.

DOI: **https://dx.doi.org/10.4314/jasem.v26i8.20**

Cite this paper as: ODUNMBAKU, A; EKUTE, B. O (2022). Evaluation of the Water Quality Parameters in Surface Water of Iyesi Stream, Ogun State, Nigeria. *J. Appl. Sci. Environ. Manage.* 26 (8) 1457-1461

Dates: Received: 10 August 2022; Revised: 28 August 2022; Accepted: 31 August 2022

Keywords: Chemical oxygen demand; total dissolved solids; water quality; Biochemical oxygen demand

Water is often likened to life itself. This statement is true as good quality water is essential for overall well-being of humans and the environment as well. Good quality water is vital for supply of safe drinking water, maintaining aquatic life and supply of water for crops and livestock. One source of quality water is surface water. Unfortunately, surface waters in recent times have become recipients of wastewaters from homes, industries and agricultural run-offs, thus leading to the pollution of the water body. A case in hand is the surface water of Iyesi stream in Odo-ota Local Government Area of Ogun state. Iyesi town is becoming more populated as more industries are located in proximal locations to it in Ota. Though most of its populace are farmers, an increase in population could mean increase in generation of wastes coupled with the discharge of industrial wastewaters from neighboring industries into the town's source of fresh water. This could have significant negative impact on the surface water quality and pose a health risk to its consumers. For instance, alkalinity in large amounts imparts bitter taste to water and may cause eye irritation (Ekute, 2021). Water containing nitrate concentration above the recommended value of 10mg\L (USEPA, 1999) is dangerous to pregnant women and could cause blue baby diseases to infants (Ekute, 2021). Taiwo, (2010) stated that oxygen depletion in water bodies could cause fish death. This depletion is signified by high BOD levels which gives an indication of high amount of organic matter in the water source. The decomposition of organic matter in surface water produces inorganic nutrients such as ammonia, nitrate and phosphorus which in turn results in eutrophication and other serious ecological problems in the water body (Ogunfowokan *et al.* 2005). Considering these factors, an evaluation of the quality of this fresh water source is therefore necessitated to ascertain the probable use of the surface water by the residents of Iyesi town. Hence, the objective of this research work was to evaluate the

**Corresponding Author Email: bekute@noun.edu.ng*

water quality parameters in surface water of Iyesi Stream, Iyesi, Ogun State, Nigeria.

MATERIALS AND METHODS

Sample collection and Preparation: Sixteen (16) surface water samples were collected as grab samples at four different locations and four consecutive periods. The samples at each of the locations were labelled SWR-1 to SWR-4. SWR-1 is the originating point of the water body, SWR-2 is the industrial waste water entry point to the water body, SWR-3 and SWR-4 are sampling points that are 1.40km and 2.80km from the industrial wastewater entry point.

Samples for selected physicochemical and trace metal analysis were collected in pre-cleaned polyethylene bottles while those for BOD determination were collected in pre-cleaned BOD bottles. An ERMA pH-030 glass electrode pH meter was used to measure the pH of the water samples onsite. The concentration of Total dissolved solids (TDS) was determined using TDS meter. All other physicochemical parameters were determined according to methods of analysis stipulated by APHA (1992). Metal analysis was carried out using UNICAM AAS.

RESULTS AND DISCUSSION

The results obtained in this study are presented in figure 1-3. The average pH values for the water samples ranged from 5.90±0.86 to 6.85±0.19. SWR-2 had the highest average pH value while SWR-1 (the surface water origin) had the least average pH value. Similar results were reported by Udousoro and Umoren (2014) for surface water of Uruan (5.50 to 6.80), Akhigbe *et al.* (2018) for surface water within a slaughter area (6.30 to 7.10) and Egun and Oboh (2021) for Ikpoba Reservoir (5.8). the water source is slightly acidic at SWR-1 and this could be attributed to the presence of organic acids from decaying vegetation and dissolved carbon dioxide in the water (Paschke *et al.,* 2001; Verplanck *et al*. 2006). It could also be attributed to run-off wastewater from the industries in neighboring estates and carbonates from domestic wastewaters. This factors could also have impact on the alkalinity of the water source. A reduction in pH at SWR-4 is indicative of the self-cleaning power of the water source owing to the fact that there is limited access to this sampling point by Iyesi residents. The pH levels of the water samples were within WHO (2011) and NSDWQ (2007) limits except for SWR-1. Mean Alkalinity levels of 19.31±9.08mg\L to 27.66±11.95mg\L were recorded for the water samples. The values obtained in this study is in conformity with the values (20-36mg\L) documented by Akhigbe *et al.* (2018) though, Uruan surface water had lower alkalinity levels (Udousoro and Umoren, 2014) and are below WHO (2011) limit of 200mg\L. A knowledge of the alkalinity levels of a water source influences the choice of cleaning process of the water. Higher alkalinity levels in surface water helps in preserving aquatic life as it buffers acid rain and other acid wastes that could ordinarily harm aquatic life.

Hardness is the concentration of metal ions (primarily calcium and magnesium) and it's the property that decreases the lathering potential of soap, leads to an increase in scale formation in hot water heaters. Total hardness (TH) is mainly due to Calcium and Magnesium salts. TH mean values of 10.62±1.97mg$CaCO_3$\L to 15.07±5.24mg$CaCO_3$\L were reported for the water samples in this study with SWR-2 being the highest. Similar results were documented by Udousoro and Umoren (2014); Ekute and Etim (2021); Ekute (2021) for Mopin groundwater. A comparison of these data with WHO recommended limit (500mg$CaCO_3$\L) and NIS limit (150mg$CaCO_3$\L) shows that all values were below limits. According to Miroslav and Vladimir (1998), the water source is classified to be soft as hardness less than 50mg$CaCO_3$mg\L is considered soft. Based on this observation, the water source can be used for laundry and bathing purposes. As shown in figure 2, TDS mean value was highest in SWR-2 (221±46.31mg\L) and lowest in SWR-4 (172±26.29mg\L). The high TDS values at SWR-2 and SWR-3 is evidence of the impact of both industrial and domestic wastewaters. However, these values are within WHO permissible limits of 500mg\L. The TDS values recorded in this study is lower than those of Otamiri River (55.40mg\L) by Eze *et al.* (2021) and some points of Uruan surface water (12.60mg\L, 72.50mg\L) by Udousoro and Umoren (2014). BOD, COD and DO are water quality parameters that indicate the level of organic pollution of a water source (Ekute, 2021). BOD represents the amount of oxygen consumed by microorganisms to break down the organic matter present in the water whereas COD measures the amount of oxygen required to oxidize all soluble and insoluble organic compounds present in a volume of water. The mean BOD values were higher at SWR-2 (6.27±0.11mg\L) and SWR-3 (6.21±0.02mg\L) and least at SWR-4. The values are above NSDWQ (2007) limit for drinking water. However, the water source at SWR-1 and SWR-4 fell within FMEnv (2007) limit of surface water while SWR-2 and SWR-3 are above the permissible limit for surface water. Similarly, the mean COD levels of all the samples were far higher than permissible limits for the discharge of effluents or wastewater (125mg\L; WHO (1996)). The mean COD levels ranged from

307.01±9.73 to 369.85±8.99mg\L. Waters with high COD values typically contains high levels of decaying plant matter, human waste and/or industrial effluents. The surface water under study is surrounded by lots of trees and of course decaying plants, some residents excrete in and around the water body, some bath and wash in the river and wastewater from homes and industries also flows into this water body. The poor drainage system of Iyesi could also be a factor for the high organic pollution recorded as it makes way for leaching of anions like phosphates, nitrates from domestic wastes, sewage, industrial wastes and agricultural run-offs. The level of organic pollution thus renders the water source unsafe for human consumption and could also harm aquatic life. Of the anions considered, sulphate was the highest followed by nitrate and phosphate. Nitrate mean levels ranged from 0.28±0.26 to 4.01±1.95mg\L with SWR-3 being the highest (4.01±1.95mg\L). Phosphate was also higher at SWR-3 and least at SWR-4.

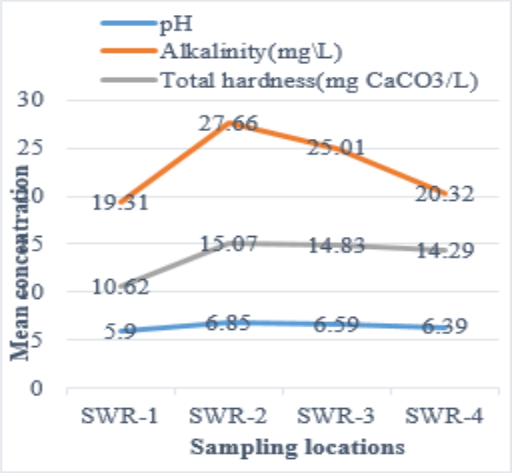

Fig 1: Mean Levels of Selected Water Quality Indicators in Surface Water Of Iyesi Stream

However, for sulphate, SWR-2 had the highest as shown in figure 3 while SWR-had the least mean value of 9.97±8.15mg\L. The higher sulphate content at SWR-2 could be due to the fact that it is closer to industrial wastewater discharge point and also a major entry point of sewage from residential buildings. Some of the data is in agreement with those recorded by Edeogu (2007); Jaji *et al.* (2007) for Ogun River and Eze *et al.*, (2021) for Otamiri River. The mean Iron levels at SWR-1 (0.20±0.03mg\L) was below permissible limit of 0.30mg\L, whereas at other points, the mean levels were above limits and of the order SWR-2>SWR-3>SWR-4. The very high Fe content gives an indication of the presence of Fe ion in the effluent discharged by the steel manufacturing industries in the neighboring industrial estate. The Fe level at SWR-4 is in agreement with that reported by Numbere (2017). The total ion concentration in Iyesi surface water was below the ambient water quality of 1.0mg\L which means that the water source is safe for aquatic life but not for drinking water supply.

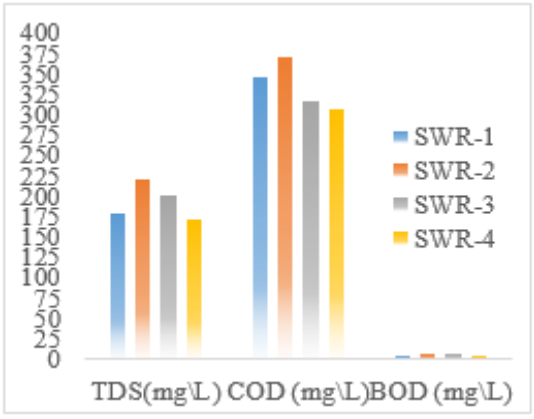

Fig 2: Mean levels of measures of Gross Organic pollution in surface water of Iyesi Stream

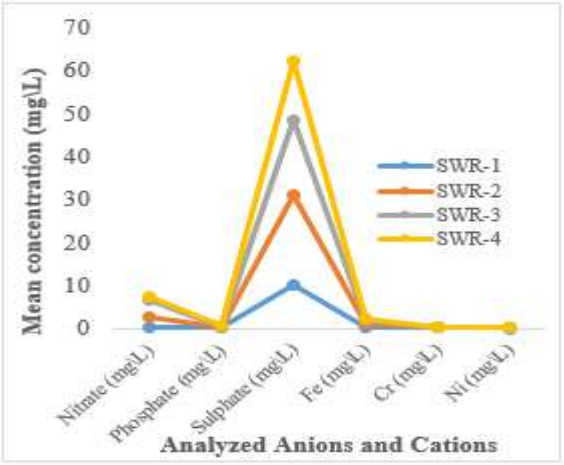

Fig 3: Mean levels of selected anions and cations in surface water of Iyesi Stream

Nickel and Chromium are added in the manufacture of alloy steel to enhance its properties. Both trace metals are considered carcinogenic to humans at high concentrations. The values recorded in this work are higher than WHO (2011) and BIS (2012) limits of 0.05mg\L for Cr and Ni (0.07mg\L; WHO (2011). This therefore means that the industrial wastewaters are not treated reasonably before discharge and there is also possibility of leaching from waste disposal dump sites thus affecting the values. Similar results were obtained by Chennaiah *et al.* (2014).

Conclusion: This study revealed that the surface water of Iyesi Stream is soft, slightly acidic and organically polluted. The water source, thus could be considered viable for laundry and irrigation purposes but not safe

for drinking unless it undergoes proper treatment like coagulation with alum.

REFERENCES

Akhigbe, S; Udom, GJ; Nwankwoala, HO (2018). Impact of Domestic and Industrial Waste on Surface and Ground Water Quality Within Slaughter Area, Trans-Amadi Industrial Layout, Port Harcourt, Nigeria. *Int. J. Waste Res.* 8 (1): 1-8.

APHA (1992). Standard methods for the examination of Water and Wastewater, 16th ed. Washington, D. C.

BIS IS: 10500 Indian Standard (2012). Drinking Water-Specification, first revision 2012 Bureau of Indian Standards New Delhi, India, 2012.

Chennaiah, JB; Rasheed, MA; Patil, DJ (2014). Concentration of Heavy Metals in Drinking water with emphasis on Human Health. *Int. J. Pl. Ani. Environ. Sci.* 4 (2): 205-214.

Edeogu, CO (2007). Nitrate, Sulphate, Phosphate and Chloride Status of Staple Food Crops, soils and water as Indicator of Environmental Base Anion Pollution load in Ebonyi State, Nigeria. *J. Bio. Sci.* 7(5): 745-751.

Egun, NK; Oboh, IP (2021). Surface water quality evaluation of Ikpoba reservoir, Edo State. *Int. J. Energy. Water. Res.* https://doi.org/10.1007/s42108-021-00139-z

Ekute, BO (2021). Physicochemical analysis of groundwater in the vicinity of an Industrial Area: A case study of Mopin Community, Ota, South-western Nigeria. *Sci. World. J.* 16(4): 433-435.

Ekute, BO; Etim, EU (2021). Evaluation of the impact of Ota industrial estate effluents on surface water quality of Oruku River, Ota, South Western Nigeria. *J. Appl. Sci. Environ. Manage.* 25 (9): 1671 – 1675.

Eze, CC; Ekekwe, EN; Ezenwata, IS; Frank-Ogu, N; Okorie, IU; Anaebonam, E; Nweze, KE; Onyemeka, RM (2021). Municipal Waste: Effect on the Physico-Chemical and Microbiological Parameters of Otamiri River in Owerri, Nigeria. *Asi. J. Basic Sci. Research*. 3(3): 98-109.

Gopalkrushna, MH (2011a). Assessment of physico-chemical status of ground water samples in Akot city. *Research J. Chem. Sci.* 1(4): 117-124.

Gopalkrushna, MH (2011b). Determination of Physico-chemical parameters of surface water samples in and around Akot City. *Int. J. Research Chem. Environ.* 1(2); 183-187.

Jaji, MO; Bamgbose, O; Odukoya, OO; Arowolo, TA (2007). Water quality assessment of Ogun River, South West Nigeria. *Environ. Monitor. Assess.* 33 (1-3): 473-482.

Mahananda, M; Mohanty, B; Behera, N (2010). Physico-chemical analysis of surface water and ground water of Bargarh District, Orissa, Indis. *Int. J. Research Rev. Appl. Sci. 2(3):*284-295.

Miroslav, R; Vladimir, NB (1998). *Practical Environmental Analysis.* Cambridge: The Royal Society of Chemistry.

Numbere, AO (2017). Concentration of Fe and other physico-chemical parameters in ground and surface water in some Mangrove Forest in the Niger Delta, Nigeria. *Afri. J. Appl. Zoo. Environ. Bio.* Vol. 19: 1-12.

Ogunfowokan, AO; Okoh, EK; Adenuga, AA; Asubiojo, OI (2005). An assessment of the impact of point source pollution from a university sewage treatment oxidation pond on a receiving stream – a preliminary study. *J. Appl. Sci.* 5 (1): 36 – 43.

Paschke, SS; Harrison, WJ; Walton-Day, K (2001). Effects of acidic, recharge on groundwater at the St. Kelvin Gulch site, Leadville, Colorado. *Geochem.: Explor. Environ. Anal.* 1(1): 3-14.

Standard Organization of Nigeria (SON), (2007). *Nigerian Standard for Drinking Water Quality (NSDWQ)* (pp. 15-17). Nigerian Industrial Standard NIS 554, Standard Organization of Nigeria.

Taiwo, AM (2010). Environmental impact of poultry farm operations on Alakata Stream at Isolu in Abeokuta, Nigeria. Unpublished Master's Thesis. University of Agriculture, Abeokuta. 108p.

Udousoro, I; Umoren, I (2014). Assessment of Surface and Ground Water Quality of Uruan in Akwa Ibom State of Nigeria. *J. Natural Sci. Res.* 4 (6): 11-27.

United State Environmental Protection Agency, (1999). *National Recommendation Water Quality Criteria-Correction* EPA 822/Z-99-001. USEPA, Washington, DC.

Verplanck, PI; Nordstrom, DK; Plumlee, GS; Wanty, RB; Bove, DJ; Caine, JS (2006). Hydrochemical controls on surface and groundwater chemistry in natural acidic porphyry-related mineralized areas, southern Rocky Mountains. *Chi. J. Geochem.* 25: 231-241.

World Health Organization (2011). *Guidelines for drinking water quality* ,4th ed. WHO, Geneva, Switzerland.

World Health Organization, (1996). *Guidelines for Drinking Water Quality Recommendations* 2. World Health Organization, Geneva.