# Environmental Assessment of Stream Water Quality in Ago-Iwoye, Ijebu North Local Government, Ogun State

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Accessing clean and safe water in developing regions is critical for public health. Most regions remain exposed to domestic and industrial activities contaminating clean water. Stream and tap water are mostly used in the world today, but there are limited assessments on their physicochemical and heavy metal contamination. This study assesses the quality of stream water compared to tap water. Parameters like Cu, Fe, Pb, Zn, Ni), pH, total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and Dissolved Oxygen (DO) were analysed using the mean contamination factor (MCF) and water quality index (WQI) for comprehensive evaluation. The results show that Pb concentration in both tap and stream water is alarming because they are above the permissible limit. The pH of the stream water is slightly acidic, while the tap water is more acidic, both falling below the permissible limit. Both samples' BOD and COD levels exceed WHO standards, suggesting significant organic pollution, and TDS concentrations remain within safe limits. Dissolved oxygen (DO) levels are above the minimum requirement for aquatic life. MCF values range from moderate (W8, MCF = 2.37) to severe contamination (W6, MCF = 18.57), with heavy metal pollution primarily attributed to industrial discharge. Locations W3, W5, W6, and W9 exhibit extremely high concentrations of Zn, Ni, Fe, and Cu, emphasizing toxic contamination. The WQI results classify both tap and stream water as hazardous for human use. In conclusion, the study confirms that both water sources are significantly polluted, particularly with heavy metals, and are unsuitable for direct consumption without treatment. It is recommended that there is need for immediate intervention and water treatment to ensure safety for consumption and environmental sustainability.

**Keywords**: Contamination, Ijebu North, physicochemical parameters, stream water, water quality index

## Introduction

In Nigeria, 66.3 million people lack access to safe and clean water (Ighalo & Adeniyi, 2020). Clean water is important to sustainable development and public health. Mostly in low and middle-income countries, water that are contaminated water contributes to the burden of disease. In today's world, water is the most important source of life for plants and humans (Sankhla & Kumar, 2019) as it aids in transporting nutrients, regulating body temperature, digestion, and flushing wastes from the body. Talabi *et al.* (2020), however, discussed the importance of water to man but raised alarm of the heavy metals that have dissolved in the water for a long period, which pose health risks if not treated appropriately. Water pollution occurs in many areas of Nigeria because most companies are located near riverbanks, where they channel their sewage. Bokare and Choi (2011) noted that chromium, arsenic, and lead are toxic and not consumable in small or large quantities. Usman *et al.* (2020) reported the toxicity of the ionic form by metal because of the reactions of toxic compounds with other ions. Researchers detected that humans are exposed to metals that cannot be avoided, and the toxicity varies based on gender (Cefalu & Hu, 2004). The long-term harmful effects of toxic metals in the human body damage several human organs (Usman *et al*., 2023), like kidney dysfunction, cancer, vascular damage, immune system malfunction, birth defects, nervous system diseases, and skin lesions. Providing quality drinking water to people in developing countries, particularly in Africa, is crucial for poverty alleviation (Odunaike *et al*., 2022). A significant portion of national budgets in these regions is spent on treating preventable waterborne diseases. EPA (2023) discussed heavy metals as natural constituents in the earth's crust, with density is five times greater than water density and also with higher atomic density. World Health Organization (2024) creates international guidelines used worldwide to regulate water quality. The guidelines for drinking water quality (GDWQ) should be enforced to protect public health by encouraging the development of local standards and regulations, adopting preventive risk management from catchment to consumer (Water Safety Plans), and conducting independent surveillance to ensure these plans are effective and national standards are met. Also, airborne diseases carried by water-resistant bacteria may find their way into the water in the selected area for the study thereby adding to the contamination level of the water. People face unnecessary health risks when water and sanitation services are absent, inadequate, or poorly managed. The study area is close to the University clinic, where students and staff have been treated for more than fifteen years. Any medical waste not properly disposed, may find its way into the water collection near the clinic during the rainy season. This may contribute to the concentration of heavy metals in the stream. Odunmbaku and Ekute (2022) discussed the Iyesi stream and reveal organic pollution with high chemical oxygen demand (COD), biochemical oxygen demand (BOD), heavy metals like Nickel (Ni), chromium (Cr) and iron (Fe). Also, Egberongbe *et al.* (2012) reported high microbial loads, including pathogenic bacteria like Escherichia coli and Salmonella species, in stream waters used for domestic purposes, this indicates the harmful effects of water in Ijebu North area. Contaminated water and inadequate sanitation contribute to the spread of diseases like cholera, diarrhoea, dysentery, hepatitis A, typhoid, and polio. Gorde *et al*. (2013) reported that the values of the parameters (COD, DO, BOD. and TDS) of the lake water under investigation were many times greater than the world average and BIS standard. This study therefore aims to evaluate the level of heavy metals in the stream water usually utilized by the farmers and used for domestic purposes in farmlands located at Ijebu North Local Government Area by analysing its physicochemical parameters, calculating the heavy metal pollution index, and the risk level attached to the utilization. This is because public health has not adequately addressed the needs of the urban poor living in vulnerable slum areas.

**Materials and Methods**

Ago-Iwoye has been identified as one of the 15 key communities that have benefited from the state's Urban Water Resuscitation projects. The town experiences a tropical climate with distinct wet and dry seasons. In rural areas such as Ago-Iwoye, people often rely on surface water sources such as rivers, streams, and ponds for their water needs; thus, the need to assess the water quality of surface water sources in such locations. The study was conducted on a stream water body flowing through the University farmland behind the University health centre, Olabisi Onabanjo University, Ago-Iwoye, Ogun State. The location is reserved for local farming and is known for growing crops like maize, cassava, plantain and vegetables, which is sold to staff and students of the University. Water samples were collected on a sunny afternoon at an average temperature of 27.5°C during the rainy season. Samples were obtained from the stream along the water body flow within Latitude 6.9463°N and Longitude 3.9173°E at multiple spots. Standard and quality materials were used for the analysis in the laboratory, like the Buck Scientific Model PG 990 Flame Atomic Absorption Spectrophotometer.


**Figure 1: Map of Ago-Iwoye**
Source: Google maps

**Figure 2: Atomic absorption spectrometer**

**Data collection and analysis**

Ten (10) water samples were obtained from the stream water at Ago-Iwoye, Ijebu north local government of Ogun State using sterile plastic bottles to avoid contamination (Shawai *et al.,* 2018) and 2 water samples were from tap around the study area. The stream water samples were collected at a depth of 15cm below the water surface using an improvised calibrated setup. The tap water samples were designated as C1 and C2, while the stream water samples were labelled W1 to W10. The samples were labelled with paper tape and properly sealed in sterile plastic bottles. The samples were taken to Bowen University Central Laboratory for both physicochemical and elemental analysis.

The pH, temperature and conductivity were determined *in situ*, in order to prevent microbial growth, the samples were stored at a temperature below 4°C, as reported by Saeed and Mahmoud (2014). The samples were analysed in two different categories, namely, chemical and physical analysis (Ademoroti, 1996). The Acid digestion method was applied for the analysis using an atomic absorption spectrometer (Atolaiye *et al*., 2006). 5.0cm$^3$ of nitric acid was added to 250cm$^3$ of water in a beaker to reduce the pH to below 2.0. This acidification was done to stabilize the metal ions and prevent microbial activities or precipitation. Using the digestion process, the mixture was heated at about 95-100$^0$C in a fume cupboard for about 1-2 hours. The quantities were reduced to about 25cm$^3$ to ensure metals were released into the solution with a colour that showed complete digestion. The cleared digest was allowed to cool and was filtered using Whatman filter paper into a 50cm$^3$ volumetric flask that had been washed with acid and rinsed properly with deionized water. After thorough mixing, a proportion of the solution was used for heavy metal determination of five heavy metals, including iron, lead, copper, nickel, and zinc. The digested samples were analysed using the Buck Scientific Model PG 990 Flame Atomic Absorption Spectrophotometer (Figure 2) by USEPA (1996).

**Statistical analysis**

Evaluating the heavy metals and physicochemical parameters of the water samples, the authors adopted Horton's method of computation (Aliyu *et al*., 2019), along with the use of IBM SPSS Statistics 25.0 was used in analysing the mean values and standard deviations Matlab R2013 was used to draw the bar chart while Microsoft Excel software was used in analysing the water quality index and contamination factors. The standards used in comparing the permissible limits with the analysis are the World Health Organization (WHO, 2024) and the Nigeria Industrial Standard (NIS, 2015). The mean contamination factor (MCF), standard deviation (SD), contamination factor (CF), quality rating (Qn), unit weight (Wn), constant of proportionality (K), sub-index (Si), Water quality index (WQI) were considered in the analysis to check the contaminant level and its suitability for drinking and domestic use.

**Water quality index (WQI) calculation**

Horton (1965) stated that WQI is a method used evaluating and detecting water pollution.

The formula to calculate WQI is

$$WQI = \frac{\sum Q_n W_n}{\sum W_n} \quad (1)$$

*where,*

$Q_n$ = quality rating of the n$^{th}$ water quality parameter

$W_n$ = unit weight of n$^{th}$ water quality parameter

$$W_n = \frac{K}{V_s} \quad (2)$$

$$K = \frac{1}{\sum 1/V_s} \quad (3)$$

*where,*

K = constant of proportionality

$$Q_n = 100\left[\frac{(V_n - V_i)}{(V_S - V_i)}\right] \quad (4)$$

*where,*

$V_n$ = actual value of the parameter observed

$V_i$ = ideal value of that parameter

$V_s$ = standard permissible value for the n$^{th}$ water quality parameter

**Table 1: Interpretation of the WQI based on typical WQI scales**

| Range | Status | Descriptions |
|---|---|---|
| 0 – 25 | Outstanding | Safe for drinking without any health implications and do not pose a health hazard to the surroundings. |
| 26 - 50 | Good | Suitable for most uses e.g. for irrigation, industrial and domestic. |
| 51 - 75 | Fair | It requires treatment to make it drinkable but can be used for industrial purposes, bathing and irrigation. |
| 76 – 100 | Poor | Treatment is essential for drinking, and maybe be polluted. |
| 101-150 | Very poor | It is not safe for drinking, and not fit for direct contact. |
| 151-200 | Unsuitable for drinking | Needs special treatment to be fit for usefulness but not drinkable. |
| > 200 | Hazardous | Its usage is limited and can damage organs in the body. |

**Source: Horton (1965); Mohebbi *et al.* (2013)**

**Contamination factor (CF) and mean contamination factor (MCF)**

Provides cumulative effects of different parameters that are harmful to water (Sabo *et al.*, 2013).

$$\mathrm{CF} = \frac{C_x}{M_x} \quad (5)$$

$$\mathrm{MCF} = {(CF + CF_2 + \cdots + CF_n)}/{N} \quad (6)$$

$where$:
$C_x$ =concentration of the parameter
$M_x$ = Background concentration of the parameter

The Background concentration of the parameter is a measure used to differentiate between the concentration of the naturally occurring parameters and the concentration with an anthropogenic influence in the sample (Nasir *et al*., 2023).

**Table 2: Interpreting contamination Factor (CF) values**

| Range | Status |
|---|---|
| CF<1 | The contamination factor is low |
| 1 ≤ CF < 3 | The contamination factor is moderate |
| 3 ≤ CF < 6 | The contamination factor is considerable |
| CF ≥ 6 | The contamination factor is very high |

**Source: Hakanson (1980)**

**Results**

Table 3 depicts the water permissible limit properties by WHO (2024), EPA (2023), and NIS (2015) while Tables 4 and 5 show the results of the statistical analysis of the water parameters taken from the streams and the tap water. Table 6 interprets the mean contamination factor (MCF) values whilst Table 2 and 3 are the interpretations of the WQI based on typical WQI scales (Horton, 1965; Mohebbi *et al*., 2013) and the contamination Factor (CF) values of water quality.

**Table 3: Water permissible limit properties**

| Parameters | WHO (2024) Levels (mg/L) | EPA (2023) Levels (mg/L) | NIS (2015) Levels (mg/L) |
|---|---|---|---|
| Cu | 2.000 | 1.300 | 1.000 |
| Fe | 0.300 | 0.300 | 0.300 |
| Pb | 0.010 | 0.015 | 0.010 |
| Zn | 3.000 | 5.000 | 3.000 |
| Ni | 0.070 | 0.100 | 0.070 |
| Ph (no unit) | 6.500 | 6.5-8.5 | 8.000 |
| TDS | 600.000 | <500.000 | 1000.000 |
| BOD | 3.000 | NA | 5.000 |
| COD | NA | 10.000 | 5.000 |
| DO | 5.000 | NA | 5.000 |

**Table 4: Analysis of the parameters taken from the stream water**

| Parameters (mg/L) | Maximum | Minimum | Mean measured value (Vn) | SD | W=K/S | Qn | WQI | WQI Status |
|---|---|---|---|---|---|---|---|---|
| **Cu** | 1.104 | 0.012 | 0.1791 | 0.33571 | 0.00581 | 8.955 | 0.05206 | **Outstanding** |
| **Fe** | 1.544 | 0.046 | 0.426 | 0.58324 | 0.03876 | 142 | 5.50333 | **Outstanding** |
| **Pb** | 1.134 | 0.018 | 0.2703 | 0.42798 | 0.77512 | 1802 | 1396.7602 | **Hazardous** |
| **Zn** | 1.77 | 0.033 | 0.4674 | 0.66434 | 0.00388 | 15.58 | 0.06038 | **Outstanding** |
| **Ni** | 1.408 | 0.039 | 0.3629 | 0.53068 | 0.1661 | 518.4286 | 86.10913 | **Very poor** |
| **Ph** | 6.11 | 6.03 | 6.083 | 0.04923 | 0.00179 | 183.4 | 0.32805 | **Outstanding** |
| **TDS** | 71.4 | 67.2 | 69.09 | 2.21359 | 0.00002 | 11.515 | 0.00022 | **Outstanding** |
| **BOD** | 26.2 | 8.05 | 15.02 | 1.54952 | 0.00388 | 500.6667 | 1.94038 | **Outstanding** |
| **COD** | 88 | 16 | 52.8 | 7.49056 | 0.00233 | 1056 | 2.45557 | **Outstanding** |
| **DO** | 8.47 | 3.23 | 5.445 | 21.31666 | 0.00233 | 95.36458 | 0.22176 | **Outstanding** |

**Table 5: Analysis of the parameters taken from the tap water**

| **Tap water** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Para meters** | **MAX** | **MIN** | **Mean measured value (Vn)** | **SD** | **W=K/S** | **Qn** | **WQI** | **WQI STATUS** |
| Cu | 0.01100 | 0.00800 | 0.00950 | 0.00212 | 0.00581 | 0.47500 | 0.00276 | **Outstanding** |
| Fe | 0.02300 | 0.01900 | 0.02100 | 0.00283 | 0.03876 | 7.00000 | 0.27129 | **Outstanding** |
| Pb | 0.04100 | 0.00900 | 0.02500 | 0.02263 | 0.77512 | 166.66667 | 129.18711 | **Hazardous** |
| Zn | 0.02400 | 0.01700 | 0.02050 | 0.00495 | 0.00388 | 0.68333 | 0.00265 | **Outstanding** |
| Ni | 0.06000 | 0.00500 | 0.03250 | 0.03889 | 0.16610 | 46.42857 | 7.71168 | **Outstanding** |
| Ph | 5.78000 | 5.77000 | 5.77500 | 0.00707 | 0.00179 | 245.00000 | 0.43824 | **Outstanding** |
| TDS | 107.80000 | 107.80000 | 107.80000 | 0.00000 | 0.00002 | 17.96667 | 0.00035 | **Outstanding** |
| BOD | 9.05000 | 26.20000 | 17.62500 | 12.12688 | 0.00388 | 587.50000 | 2.27692 | **Outstanding** |
| COD | 28.00000 | 24.00000 | 26.00000 | 2.82843 | 0.00233 | 520.00000 | 1.20919 | **Outstanding** |
| DO | 8.47000 | 2.62000 | 5.54500 | 4.13657 | 0.00233 | 94.32292 | 0.21934 | **Outstanding** |

According to Nasir *et al.* (2023), for the contamination factor formula, the mean contamination factor (MCF) of W1 (5.91) and W2 (5.61) is considerably contaminated but the high Pb (40.92mg/L) is a concern in W2, there is a need for filtration. W3 is high in Zn (86.34mg/L) and Ni (43.32mg/L), which might be due to industrial discharge, it is high in Pb due to pollution. The MCF is 14.88 which is severely contaminated. W4 is high in Pb (45.36mg/L), which is a concern, the MCF is 6.34 and is highly contaminated. W5 is extremely high in Fe (47.86mg/L), the water may be iron-rich or rusting pipes, and Ni (40.25mg/L) indicates industrial influence. W5 (MCF=10.23mg/L) is highly contaminated. W6 (MCF=18.57) is highly contaminated, it is extremely high in Cu (116,21mg/L) and Zn (55.41mg/L), which indicates a toxic heavy metal pollution. CF highness in COD (2.00mg/L) indicates organic pollution. W7 (MCF=8.01) is highly concentrated in Zn (63.56 mg/L). W8 (MCF=2.37) the status indicates moderation; this is the lowest contamination level among all the samples. W9 (MCI = 9.61) and W10 (MCF = 7.73) are highly contaminated. W9 has the highest Fe (73,52mg/L) which is dangerous.

**Table 6: Mean contamination factor of the parameters taken from the stream water**

| | Contamination Factor | | | | | | | | | | Mean contamination factor | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample/ Trace metal** | **Cu** | **Fe** | **Pb** | **Zn** | **Ni** | **pH** | **TDS** | **BOD** | **COD** | **DO** | **MCF** | **STATUS** |
| **W1** | 31.895 | 3.000 | 3.800 | 4.976 | 7.539 | 1.053 | 0.656 | 1.487 | 3.385 | 1.381 | 5.917 | Considerable |
| **W2** | 2.947 | 4.952 | 40.920 | 1.610 | 2.400 | 0.009 | 0.623 | 0.457 | 1.385 | 0.802 | 5.610 | Considerable |
| **W3** | 9.790 | 2.191 | 3.560 | 86.341 | 43.323 | 1.044 | 0.630 | 0.460 | 0.615 | 0.801 | 14.875 | Very high |
| **W4** | 5.263 | 2.857 | 45.360 | 2.195 | 1.723 | 1.058 | 0.623 | 1.260 | 2.000 | 1.091 | 6.343 | Very high |
| **W5** | 1.263 | 47.857 | 3.760 | 3.122 | 40.246 | 1.001 | 0.630 | 0.570 | 2.923 | 0.945 | 10.232 | Very high |
| **W6** | 116.21 | 4.429 | 2.400 | 55.415 | 2.092 | 0.999 | 0.643 | 0.630 | 2.000 | 0.873 | 18.569 | Very high |
| **W7** | 4.947 | 4.095 | 2.000 | 63.561 | 1.200 | 1.000 | 0.656 | 0.687 | 1.385 | 0.583 | 8.011 | Very high |
| **W8** | 3.263 | 2.762 | 4.720 | 4.342 | 4.000 | 0.001 | 0.649 | 0.457 | 2.769 | 0.727 | 2.369 | Moderate |
| **W9** | 9.474 | 73.524 | 0.720 | 4.487 | 1.354 | 0.999 | 0.662 | 1.487 | 1.846 | 1.528 | 9.608 | Very high |
| **W10** | 3.474 | 57.191 | 0.880 | 1.951 | 7.785 | 1.001 | 0.636 | 1.030 | 2.000 | 1.309 | 7.726 | Very high |

**Discussion**

The results of the stream water parameters which included the concentrations of heavy metals such as copper (Cu), iron (Fe), lead (Pb) and, zinc (Zn), and physicochemical properties such as pH, total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and dissolved oxygen (DO) were analysed to establish the water quality of the water samples obtained from the study site. The results show different water quality levels in both the stream water and the tap water. The mean concentration of Cu in stream water is 0.17910 mg/L with SD of 0.33570 mg/L. For the tap water, the concentration is 0.00950 mg/L and the SD is 0.00212 mg/L. The concentration of both the stream water and the tap water are lower than the WHO permissible limits of 2.0000 mg/L. The concentration of Cu in the tap water was much lower than stream water.

The WHO permissible limit for iron (Fe) concentration in water is 0.30000 mg/L. The mean measured iron concentration in the stream water is 0.426 mg/L with SD as high as 0.58324 mg/L showing the variability at different spots. The tap water has Fe concentration at 0.02100 mg/L and SD as low as 0.00283 mg/L. The result showed that the iron content in stream water exceeds the permissible limit (Njoku *et al*., 2022). The high iron concentration can cause staining, sediment in the water, and discolouration. While the WHO standard limit for Pb is 0.010 mg/L, both stream water and tap water show hazardous lead levels. The tap water has lower lead levels at 0.02500 mg/L compared to 0.27030 mg/L in stream water; nonetheless both exceed the safe threshold for drinking water (0.010 mg/L). The toxic concentration of Pb in the stream water suggests that the environments are not safe, and immediate action is required (Hakanson, 1980). The Pb contamination of the water body could arise from disposed wastes from the University Health Centre. Adewuyi *et al.* (2021) reported the high concentrations in stream and tap water may be attributed to anthropogenic sources like the improper disposal of battery waste**,** industrial effluents, lead-based paints**.** The side effects of exposure to lead (WHO, 2017) through drinking water can cause kidney damage**,** neurotoxicity in children**,** and hypertension in adults. The WHO's acceptable zinc (Zn) concentration limit in stream water is 3.00000 mg/L. The stream water Zn concentration is 0.46740 mg/L, indicating that the Zn level is below the permissible limit, while the tap water Zn concentration is 0.0205 mg/L, which is also beneath the allowable limit. The SD of the stream water Zn concentration is 0.66434 mg/L, reflecting variability in Zn levels and confirming that the Zn is within a safe range. In contrast, the SD for the tap water concentration is 0.00495 mg/L, which is significantly lower than that of the stream water Zn concentration SD, suggesting that the tap water Zn, SD is nearly zero.

The acceptable limit for nickel (Ni) concentration in stream water set by the WHO is 0.07000 mg/L. The detected Ni concentration is 0.36290 mg/L, which exceeds the WHO acceptable limit. The tap water Ni concentration measures at 0.03250 mg/L, which is below the permissible limit. The measured Ni concentration's standard deviation (SD) is 0.53068 mg/L, while the tap water SD is 0.0388909 mg/L. This indicates that the measured Ni parameter is higher than the tap water's, which remains within the acceptable range, is closer to zero, and exhibits greater stability.

The WHO recommends a pH range of 6.5 to 8.5 for drinking water. The mean measured pH for the stream (6.08300) and tap water (5.77500) were below the WHO pH range suggesting that the samples are slightly acidic. The tap water is surprisingly lower at 5.77500 showing it is more acidic that the stream water. This may cause corrosion of the water pipes and shows that the water source is chemically polluted (Dirisu *et al*., 2016). The Total dissolved solids (TDS) in both the stream water (69.09000 mg/L) and tap water (107.80000 mg/L) are below the WHO permissible limit of 600 mg/L. As suggested by Adekitan *et al*. (2023), water samples with TDS level between 50 and 150mg/L are ideal for drinking and domestic uses.

In drinking water, the biochemical oxygen demand (BOD) concentration and chemical oxygen demand (COD) should be very low, ideally near 0mg/L. In stream water, the WHO sets the limit of 3.00000 mg/L. The mean measured BOD concentration in both stream (15.02000 mg/L) and tap water (17.62500 mg/L) exceeds the WHO acceptable limit. Like-wise, the mean measured COD in both the stream water (52.80000 mg/L) and tap water (26.0000 mg/L) exceeds the recommended limit suggesting a high presence of both biodegradable and non-biodegradable organic pollutants. The high BOD and COD values across both samples indicate significant contamination, likely from clinical or organic waste sources. The mean measured DO for the stream water samples and tap water is 5.44500 mg/L and 5.54500 mg/L respectively. High DO in water supply is good because it makes drinking water taste better. However, high DO levels speed up the corrosion in metallic water pipes. From the results, there is slight variance between the physico-chemical parameters of the stream water and the tap water at the study site as depicted in Figure 5. The result suggests a common source of contamination that requires urgent remediation actions.

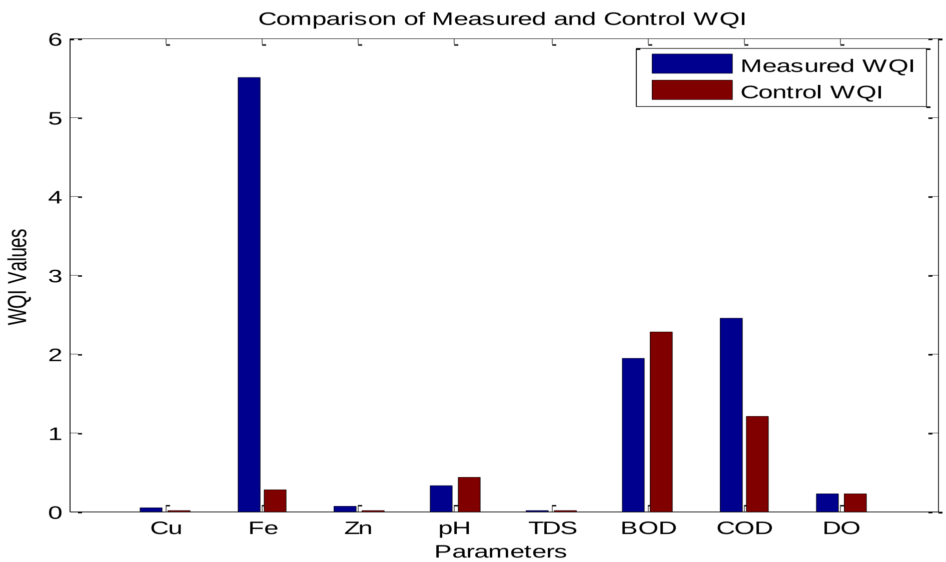


**Figure 5: Comparison of stream water and tap water quality index (WQI)**

**Table 7: Stream and tap water concentrations of WQI**

| Stream Water Concentration | | | | Tap Water Concentration | | |
|---|---|---|---|---|---|---|
| **Parameters (mg/L)** | **WQI** | **WQI Status** | **Observation** | **WQI** | **WQI Status** | **Observation** |
| **Cu** | 0.05206 | Outstanding | Well-controlled. | 0.00276 | Outstanding | low and stable. |
| **Fe** | 5.50333 | Outstanding | Acceptable but more variable. | 0.27129 | Outstanding | Slightly higher than Cu but still within limits. |
| **Pb** | 1396.76 | Hazardous | Contamination is extreme and the major contributor to the hazardous status. | 129.1871 | Hazardous | Lead is significantly above acceptable levels, contributing most to the hazardous WQI. |
| **Zn** | 0.06038 | Outstanding | Controlled and stable. | 0.00265 | Outstanding | Low and stable. |
| **Ni** | 86.10913 | Very poor | Has elevated WQI and contributes to poor quality. | 7.71168 | Outstanding | Slightly variable but well within safe limits. |
| **pH** | 0.32805 | Outstanding | Slightly acidic but within acceptable limits. | 0.43824 | Outstanding | Stable but slightly acidic; monitor closely. |
| **TDS** | 0.00022 | Outstanding | Slightly acidic but within acceptable limits. | 0.00035 | Outstanding | Exceptionally stable. |
| **BOD** | 1.94038 | Outstanding | Acceptable. | 2.27692 | Outstanding | Fluctuates but is acceptable. |
| **COD** | 2.45557 | Outstanding | Well-managed. | 1.20919 | Outstanding | Remains controlled. |
| **DO** | 0.22176 | Outstanding | Variability is high but levels are sufficient. | 0.21934 | Outstanding | Variable but sufficient. |
| ***SUM*** | 1493.431 | Hazardous | The WQI is heavily influenced by Pb and Ni contamination. | 140.1103 | Hazardous | The WQI is heavily influenced by Pb contamination. |

## Conclusion

The study shows that the water quality index (WQI) is hazardous due to extremely high lead concentration in both the tap and the stream water in Ago-Iwoye, Ogun State while nickel is very poor in stream water. Most of the parameters like Cu, Fe, Zn, TDS, BOD, COD, and DO were within the WHO permissible limits. The MCF is considerable in W1 and W2 locations, moderate in the W8 location but very high in the remaining location. Heavy metals are primary concern in stream water due to severe contamination in many locations. The findings use model from theoretical perspective like water quality index (WQI) and contaminant factor (CF) which supports the theory that localized anthropogenic inputs. In practical terms, the tap and the stream water need urgent intervention to ensure public health safety. There is a need for regulatory measures should be taken to address industrial pollution in the stream and to avoid serious health implications.

In conclusion, the study was based on small number of sampling locations, it focused on some heavy metals and physicochemical parameters alone, despite these limitations, the study offers critical insights that can inform both environmental policy and future research. Ongoing surveillance, broader parameter inclusion, and seasonal analyses are recommended to deepen understanding and support effective water management in Ago-Iwoye and similar urbanizing regions.

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