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# ASSESSMENT OF NUTRIENT LOAD IN UNWANA RIVER

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## Abstract

Water samples from different locations of Unwana River were drawn. The parameters analyzed were $NH_3$-N, $NO_3^-$, $NO_2^-$ and $PO_4^{-3}$ and these were done using uv-spectrophotometric method. The results of the samples showed that $NH_3$-N concentrations in the five locations ranged $0.80\pm0.24$ - $1.63\pm0.17$ mg/L, $NO_3^-$, $0.44\pm0.19$ - $1.80\pm0.33$ mg/L, $NO_2^-$ $0.06\pm0.04$ - $0.20\pm0.09$ mg/L and $PO_4^{-3}$. $11.15\pm0.72$ - $26.20\pm0.24$ mg/L. The results showed that only $NO_3^-$ were below the WHO (2012) maximum permissible drinking water standard and while $NH_4$-N, $NO_2^-$ and $PO_4^{-3}$ were above the WHO drinking water standard and do pose dangers to the users of the water. High concentrations of $NO_2^-$ pose serious threat as it can cause methemoglobinemia (blue baby syndrome) in children using the water. Due to high concentrations of $NO_2^-$, the water should be given adequate treatment before usage.

**Keywords:** Nutrient, phosphate, UV-Spectrophotometric, danger, methemoglobinemia

## Introduction

Nutrient load also known as "Eutrophication" is an enrichment of water body by nutrient salts that cause structural changes to the ecosystem such as: increased production of algae and aquatic plants, depletion of fish species, general deterioration of water quality and other effects that reduce and preclude use (Eni, 2016).

Nutrient load is a serious environmental problem since it results in a deterioration of water quality and is one of the major impediments of achieving the quality objectives established by the water frame work directive at the European level. According to the survey of the state of the world's lakes, a project promoted by International Lake Environment Committee, nutrient load affects 54% of Asian Lakes, 53% of those in Europe, 48% of those in North America, 41% of those in South America and 28% of those in Africa (www.lescienze .it(http:www.lescienze.it). all water bodies are subject to a natural and slow nutrient lead process, which I recent decades has undergone a very rapid progression due to the presence of man activities (so called cultural nutrient load). The cultural nutrient load process consist of a continuous increase in the contribution of nutrients, mainly nitrogen and phosphorus (organic load) until it exceed the capacity of the water body (i.e. the capacity of lake river or sea to purify itself) triggering structural changes in waters.

Nutrient load most commonly arises from the oversupply of nutrients, most commonly as nitrogen and phosphorus, which lead to overgrowth of plant and algae in aquatic ecosystem. According to Ullman's Encyclopedia. "The primary limiting factors for nutrient load is phosphate". The availability of phosphorus generally promotes excessive plant growth and decay, favouring simple algae and plankton over other more complicated plants, and causes a severe reduction in water quality. Phosphorus is a necessary nutrient for plant ot live, and is the limiting factor for plant growth n many fresh water ecosystems. Phosphate adheres tightly to soil, so it is mainly transported by erosion. Once translocate dot lakes, the extraction of phosphate into water is slow, hence the difficulty of reversing the effects of nutrient load (Khan and Mhamad2014). However, numerous literatures report that nitrogen is the primary limiting nutrient for accumulation of alga biomass (Khan and Ansari, 2005). The sources of this excess phosphate are phosphates in detergent, with the phasing out of phosphate-containing detergent, industrial, domestic runoff and agriculture have emerged as the dominant contributors ot nutrient load (Werner, 2002). The aim of the study is to assess the nutrient load in Unwana River.

Materials and Methods

Sampling procedure

The containers and glass wares were soaked in 0.1M HNO3 for 24hours. Thereafter, the containers were thoroughly washed with detergent, rinsed with deionized water to remove any contaminant which may remain in the containers. Water samples were collected in 1-litre plastic containers and prior to collection as part of our quality control measures all the bottles were rinsed three times with the sampling water at the point of collection. Each location is sampled with three containers labeled a, b, c for triplicate analysis. The containers were capped and preserved at 4℃ pending analysis. The containers were labeled using masking tape and a permanent marker. The locations were indicated on the tapes using sample codes for easy identification.

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tape and a permanent marker. The locations were indicated on the tapes using sample codes for easy identification.

**Sample Analysis**

The ammonia of the water sample was determined using UV-Spectrophotometer model HACH DR 2400 (Phenate method) at a wavelength of 636 nm according to the method described by (SAP, 1999).

The nitrate of the water samples was determined using UV Spectrophotometric method according to the method described by (SAP, 1999).

The nitrite of the water samples was determined using UV-Spectrophotometric method according to the method described by (SAP, 1999).

The phosphorus of the water samples was determine using UV spectrophotometer (Ascorbic Acid method) according to the method described by (Balance, 1996).

**Results**

Table 1 showed the standard error of mean of $NH_3$-N, $NO_3^-$, $NO_2^-$ and $PO_4^{3-}$, while Figure 1 is the bar chart conveying the levels of each parameter in the three locations in Unwana River.

**Table 1: Standard Error of Mean of $NH_3$-N, $NO_3^-$, $NO_2^-$ and $PO_4^{3-}$.**

| Sample Location | $NH_3$-N, mg/l | $NO_3^-$, mg/l | $NO_2^-$, mg/l | $PO_4^{3-}$, mg/l |
|---|---|---|---|---|
| A | 1.63±0.17 | 0.73±0.039 | 0.17±0.017 | 12.10±0.39 |
| B | 0.95±0.73 | 0.73±0.19 | 0.17±0.017 | 11.15±0.72 |
| C | 1.20±0.44 | 0.44±0.19 | 0.20±0.09 | 11.43±0.092 |
| D | 1.00±0.30 | 1.80±0.33 | 0.10±0.00 | 26.20±0.24 |
| E | 0.80±0.24 | 1.60±0.46 | 0.06±0.04 | 18.20±0.14 |
| WHO STD(2012) | 0.50 | 50 | 0.003 | 5 |

**Discussion**

Table 1 showed that the mean concentration of $NH_3$-N in all the locations ranged 0.80±0.24 - 1.63±0.17 mg/L, with Location E showing the lowest concentration while Location A showed the highest concentration. The results when compared with WHO (2012) drinking water standard were higher than the permissible limit and hence pose serious health challenge. Also in Figure 1, Location A showed the highest concentration of $NH_3$-N in the water. The high concentration of

$NH_3$-N leads to formation of harmful substances such as nitrosamine which is mutagenic in nature.

The results were compared with WHO (2012) drinking water standard and were found to be lower than the permissible limit. The result obtained was in agreement to the result obtained (Katarzyna *et al*, 2022)

The mean concentrations of $NO_3^-$ in the five locations ranged 0.44±0.19 - 1.80±0.33 mg/L with Location C having the lowest concentration while location D have the highest concentration. The results were compared with WHO (2012) drinking water standard and were found to be lower than the permissible limit. The result obtained was in lower than the result obtained (Katarzyna *et al*, 2022)

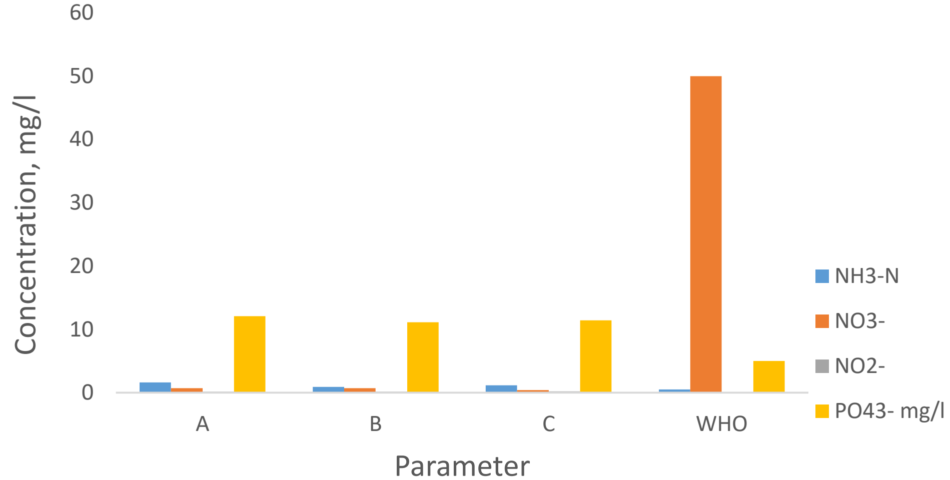


Fig. 1: Mean concentration of nutrient load parameter

Concentration of $NO_3^-$ below the WHO (2012) drinking standard does not have any hazard health implications to the user of the water. The mean concentration of $NO_2^-$ in all the locations ranged 0.06±0.04 - 0.20±0.09 mg/L with location E having the lowest concentration while Location C have the highest concentration. The results of the analysis showed concentrations of $NO_2^-$ higher than WHO (2012) drinking water standard. Nitrite when found in higher concentration in water pose serious danger in water as it is the cause of methglobenmia otherwise known as blue baby syndrome in children. The result of the analysis was in higher than the finding (Maria *et al*, 2020).

The mean concentration of $PO_4^{3-}$ in all the locations ranged 11.15±0.72 - 26.20±0.24 mg/L with Location B showing the lowest mean concentration while Location C showed the highest concentration. The results when compared with WHO (2012) drinking water standard were higher than the permissible limit. The highest concentration of $PO_4^{3-}$ was highest in Location A as conveyed in Figure 1. High concentration of phosphate in water leads to eutrophication which in turn leads to algae bloom and large aquatic plant growth in water. Water Research Center (2020) submitted that digestive problems could occur from extremely high levels of phosphate in water.

## Conclusion

From the findings, the three locations contained different levels of ammonia, nitrate, nitrite and phosphate and it was found out that only nitrate was lower than the WHO drinking water guideline.

## Recommendations

Since the results of the analysis showed that the ammonia, nitrite and phosphate were higher than the WHO permissible limit, then comprehensive treatment involving the combination of reverse osmosis and ultra and hyper filtration techniques should be used in the purification of the water before used.

Public enlightenment should frequently be carried out in order to educate the people against the danger of dumping refuse in the body of the water.

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