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Investigation of Nitrate and Nitrite Contents in Well Water in Ozoro Town, Delta State

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Abstract**—** *Ten samples of well water were collected at random from Ozoro town, Delta state and sent to the laboratory. The concentration of nitrate (NO-3) and nitrite (NO-2) in mg/l of the well water were analyzed, using spectrophometer method. The result obtained showed that the nitrate values ranged from 0.12+ 0.01 to 3.01 + 0.02 while that of nitrite ranged from 0.00 + 0.01 to 0.08+ 0.05 and all values were within WHO maximum acceptable concentration. From the result obtained , the well water analyzed were in compliance with drinking water standard based on national/international guideline that provide assurance that such well water is safe for consumption.*

Keywords**—** *Nitrates, nitrite, well water*.

I. INTRODUCTION

Nitrate and nitrite are naturally occurring inorganic ions present in our environment. The decomposition of organic materials in soils release ammonia. This ammonia oxidizes to form nitrate and nitrate. Nitrites (NO^-_3) and NO^-_2) ions are hazardous materials that naturally occurs in ground water [1]

Nitrate and nitrite occurs naturally in plants foods as part of the nitrogen cycle between air, land and water environment (www.foodstandrads.gov.au/secondeducation). Nitrate and nitrite are two of the nitrogen components that are used by plants and animals and eventually return to the air as nitrogen gas. Nitrates and nitrite can also be produced in the body.

In nature, nitrate and nitrite can be found in igneous and volcanic rocks.

The human body naturally produces some nitrate and nitrite.

Well water is ground water, meaning that it comes from the water stored in the earth and rock below the ground. Even though groundwater is under the surface, substances on the surface, such as gas from lawnmower or animals waste, can seep down and pollute it. Some naturally substances stored in rocks and soil can also affect the smell, taste, colour and safety of well.

Water is a very good solvent, hence it dissolves some toxic and hazardous substances, producing water pollution problem posing many public parameters of interest for water quality assessment and nitrate and nitrite are out of them [2].

Nitrates and nitrites enters the ground water and make their way into well water through many sources such as, agricultural activities (including over-application of chemical fertilizers and animals manure), wastewater treatment through septic system or leaking sewages lines, industrial processes, improperly functioning septic systems motor vehicles and poor sanitary activities [3].

In nature (soil), nitrate and nitrites can be found in igneous and volcanic rocks.

To protect those at risk, the maximum contamination level (MCL) for nitrates in water is 50mg/l for nitrate. [4] while that of nitrate is 3.0mg/l

The primary health hazard from drinking water with nitrate-nitrogen occurs when nitrates is transformed to nitrites in the digestive system [5].

Nitrate and nitrite are two forms of Nitrogen that can cause health problem. Nitrogen is a chemical element present in nature and in our bodies. It is natural in groundwater but usually at low levels that do not cause health problems.

When drinking water contains high level of nitrate or nitrite, it can harm certain people, including babies, pregnant and nursing women and older adults.

Excessive levels of these nitrogen compound in drinking water have caused serious illness and sometimes death in infants less than six months of age [6]. This condition results when nitrate is converted to nitrite in the infant's body. The nitrite then interferes with the oxygen carrying capacity of the blood. This results to the "blue baby syndrome", (symptoms that include shortness of breath and blueness of skin (methemoglobenemia) [7]. The blood cannot bring enough oxygen to body cell and tissue. This can affect the babies in the womb and then later, if breast feeding. The Nitrates are fairly stable nitrogenous compound degradable into unstable nitrates that can combines readily with other compound in the digestive track to form carcinogenic nitrosamines. [8]

The World Health Organization (WHO) fixed limit of the contents of nitrates and nitrites in drinking water 50mg/l and 3.0mg/l respectively [9]. The present study focuses on the investigation of nitrate and nitrite concentration in well water consumed in ozoro town.

II. MATERIALS AND METHODS

Location of Research

The research study was conducted in Ozoro, Delta State. Ozoro is a semi-urban town that is fast developing probably because of the Delta State Polytechnic. Ozoro is the administrative headquarters of Isoko North Local Government Area and lies between $6^0$12' 58"E and latitude $5^0$32'18"N [11].

III. SAMPLE COLLECTION AND ANALYTICAL PROCEDURES

Ten samples of well water used for the analysis were collected randomly from ten different sites in Ozoro town. The samples were collected into a clean 1.5 litre plastic bottles. The bottles were thoroughly washed with well water before

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collection. The plastic bottles were partially filled with samples of well water and tightly covered.

The temperature of samples were measured and recorded. The samples were then labeled from 1 to 10 in triplicate and taken to the laboratory for the analysis of Nitrates (NO^-_3 and nitrites (NO^-_2) contents within six hours of sample collection.

Nitrate Determination

10ml of nitrate stock solution was pipette into a beaker. 5ml of HCL and 2ml of Zn/NaCl granular mixture were added and allowed top stand for 30 minutes, with occasionally stirring to form nitrite. Then the solution were filtered to 100ml standard flask using whatman No 1 fitter paper and diluted up to mark.

Aliquots of stock solution containing 0.26-10.7 µg/ml of reduced nitrate were transferred into series of 10ml standard flask. 1ml of 0.5% sulfanilic acid and 1 ml of 2mol/l HCl solution was added and shaken thoroughly for 5 minutes. (Diazotization). Then 1ml of 2 mol/l NaOH solution were added to for an azo dye. The content were diluted to 10ml with water and the absorbance of the red coloured dye was measured at 540nm against the corresponding reagent blank, using Jenway 754 UV-visible spectrophotometer.

Nitrite Determination

Aliquots of stock solution containing 0.2- 8.0µg/l of nitrite were transferred into a series of 10ml calibrated flask. To each flask 1ml of 0.5% sulfanic acid and 1ml of 2mol/l HCL solution were added and the solution was shaken thoroughly for 5 minutes. (Diazotization reaction). Then 1ml of 0.5% methyl anthranilate and 2ml of 2mol /l NaOH solution were added to from azo dye and the content were diluted with 10ml using water. Then absorbance of the red coloured dye was measured at 540nm against the corresponding reagent black, using Jenway –UV-visible spectrophotometer.

IV. Results and Discussion

TABLE I. Nitrate and nitrite contents of the well water sample.
Parameter: Nitrite and nitrate.

S/N	Samples	NO_2^- (mg/L)	NO_3^- (mg/L)
1	S1	0.04± 0.02	1.20 ± 0.01
2	S2	0.02 ± 0.01	0.160 ± 0.01
3	S3	0.05 ± 0.00	1.05 ± 0.02
4	S4	0.07 ± 0.02	0.14 ± 0.02
5	S5	0.08 ± 0.01	2.00 ± 0.01
6	S6	0.01± 0.05	1.12± 0.01
7	S7	0.00 ± 0.01	0.12 ± 0.01
8	S8	0.01 ± 0.01	0.11 ± 0.01
9	S9	0.06 ± 0.02	2.00 ± 0.00
10	S10	0.07 ± 0.03	3.01 ± 0.02

Results are expressed in mean ± SD test were carried out in triplicate

The nitrate values obtained ranged from 0.12± 0.001 to 3.01 ± 0.02

The highest content of nitrate was 3.01 + 0.02mg/l for sample S10 while the lowest level was 0.12 ± 0.001 mg/l for sample S7, and all were within the maximum acceptable concentration (50mg/l).

The nitrite level ranged from 0.00 ± 01 to 0.08 ± 0.05. for sample S5 contains the highest nitrite value of 0.08± 0.01 mg/l while that of S7 has the lowest level value of 0.00 ± 01mg/l and all were within the WHO maximum acceptable concentration (3.0) mg/l.

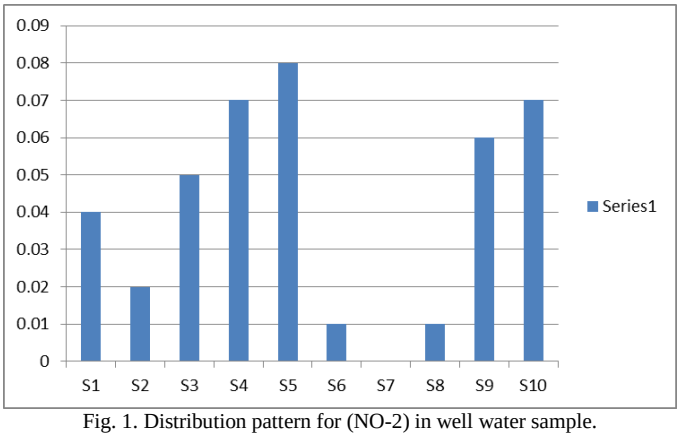

Fig. 1. Distribution pattern for (NO-2) in well water sample.

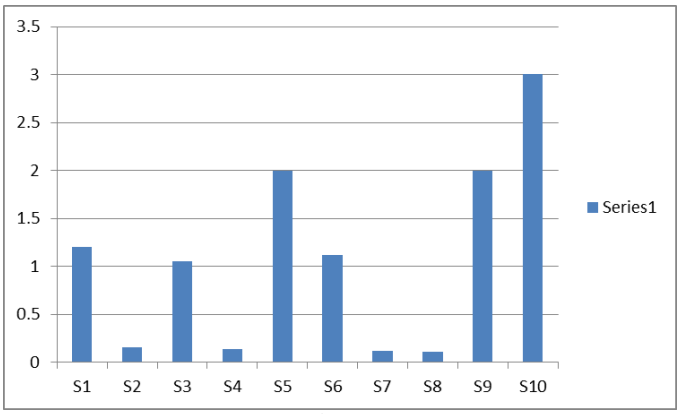

Fig. 2. Distribution pattern for (NO-3) in well water sample.

The nitrate and nitrite value recorded were low compared with the standard recommended limit.

The low content recorded must be due to the location of most wells been far from septic systems or leaking sewage line. However, most of the well are sunk in front of the houses. The few low nitrate and nitrite contents recorded might have been form during thunderstorm and lightening [10] and from motor vehicle or due to heavy rainfall.

Nitrate and nitrite are two different forms of Nitrogen. When drinking water contains high level of nitrate or nitrite, it can harm certain people, including babies, pregnant and nursing woman, and older adult [11].

Some nitrate and nitrite are colourless, odorless and tasteless you cannot tell if you have nitrates and nitrites in your well water unless you test for it.

Nevertheless, unpolluted well water usually contain only small amount of nitrate and nitrite [12].

V. Conclusion and Recommendation

The concentration of the nitrate (NO^-_3) and Nitrite (NO^-_2) from this research work were below thread hold limit set by WHO/SON.

It is especially important, if you are pregnant, have a baby under six months of age or have a health condition that puts

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you in risk, you are to use one of the following water sources for your drinking water: water from a nearby well that has been tested safe for nitrate and nitrite or commercially bottled water or exchange or reverse osmosis treatment system specifically designed to remove nitrate and nitrites.

There should also be continuous monitoring of our well water for nitrate and nitrites at regular intervals to make sure that it is safe. This should be done in addition to other parameters such as free ammonia or total chlorides.

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