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# Analysis of the Water Quality of Imonite Creek in Ndoni, Rivers State, Nigeria

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***Abstract:*** *The water quality of the Imonite Creek was investigated based on nine water quality parameters. These include fecal coliform count, BOD, DO, phosphate, pH, TDS, nitrate, turbidity and temperature. Though heavy metals such as Mn, Fe, Pb, Zn and Ca were analysed, they recorded insignificant and trace amounts. The creek water was investigated for a period of eight months using five stratified sampling stations of A, B, C, D and E. The use of recommended standard methods were employed for the analysis of the water quality parameters. The mean observations for the various water quality parameters in the sampled months of June, September, November and January respectively are BOD, mg/l (0.27, 0.28, 0.33, 0.33), DO mg/l (3.8, 3.78, 2.72, 2.73), pH units (7.43, 7.53, 7.03, 6.95), Temperature $^{O}C$ (26.70, 26.40, 26.08, 24.94), TDS mg/I (27.20, 26.40, 28.00, 28.00), Total phosphate mg/l, (0.28 0.37, 0.09, 0.05), nitrate mg/l, (0.88, 0.74, 1.28, 0.97), Turbidity units (134, 138, 334, 337). Though low pollution potentials due to the negligible values were recorded, the creek water is not potable due to the turbidity and aesthetics but suitable for other beneficial uses.*
***Keywords****: Water Quality Index, Imonite Creek, Rainy and Dry Season, Mgboroka, Abadiukwu.*

## I. Introduction

The Niger Delta was formed from sediments derived mainly and transported by rivers from the hinterland (1). No country can afford to ignore the sound management and resources which forms the basis for development (2). The pollution of the urban environment according to…… (3) results from man's determination to match his desire with production. This is through the establishment of various industries which have high pollution potentials. Agriculture increases crop and livestock production but also facilitates the discharge of pollutants within acceptable limits (4).

Due to the high flow velocity of the Imonite creek water, a high risk of bank failure results which also increases turbidity and colour. Many authors have reported that the Nigerian environment has deteriorated tremendously (5,6). The most adverse effects are concentrated within the Niger Delta to which Imonite creek belongs (7). According to (8), water quality is reduced by environmental pollution which is identified when the carrying capacity is exceeded. The water quality of the creek water is of great necessity because this is the source of drinking water. Similarly, no works on water quality has been carried out on this creek, which will serve as academic reference material.

**GEOGRAPHY OF THE IMONITE CREEK**

The Imonite creek is a tributary of the River Niger which empties into the Orashi River at the Obrikom terminal. The creek experiences two major characteristics during the rainy and the dry season. These include flooding that occurs during the months of May/June and dry lands experienced during the dry season of November through March. It is important to note that the creek leaves some pockets of ponds during the dry season and serves as fishing ponds to the natives and also as source of drinking ground water. The Imonite Creek has some minor tributaries which extend into the swamps. By its relief, the creek falls under that of the Niger Delta. Topographically, it is relatively flat falling gradually from the interior to the coast. The geology shows that of underlying sedimentary rocks. Due to the coastal alluvial deposits of deltaic origin, it falls into the quaternary geologic period.

Geomorphologically, the area is classified as part of the Sombreiro-Warri-Deltaic plane characterized by fresh water swamp forest and fresh water rain forest (9,10). The soil type is of the Sombreiro-Warri-Deltaic Sands (2,10). The water is moderately hot and humid due to the presence of surface water sources in and around the study area (11). The study area is dominated by the tropical rain forest vegetation (12). Very visible aquatic macrophytes are Bamboo, Water palms, Azola, Salvinia, Vicia species, Raphia hookeri and the popular Pandamus candelabrum. These plants secret two or more organics and hence play major roles in water quality determination (11).

## II. Materials And Methods

The study commenced in March with a reconnaissance survey of the study area. The survey helped in giving a proper description of the geographical environment and sketches of the study area. The work was done across two seasons (the rainy and dry).

Five sampling stations were selected A, B, C, D and E (Table 1). The sampling was repeated for both seasons. The water samples were collected between 1400—1800 hours local time on each sampling day. The depth of water sampling was 0.35m, corked and transported to the laboratory in cool ragolis bottles. Samples for the determination of nitrate, phosphate and cations were covered in dark polythene bags to avoid damage. Temperature and pH were measured in situ using Inolab pH meter and thermometer. The samples for the analysis of water bacteriology were aseptically collected in 25m1 sterilized bottle and well corked while the water chemistry parameter samples were collected in 1 litre polythene jerry cans and were well corked. The samples for DO and BOD were collected in a 20m1 bottle. The Winkler's titration method was used for determination of DO and BOD. The orthophosphate phosVer 3 (ascorbic acid) method using powdered pillows was used for phosphate determination as recommended (13,14). Similarly, sulphate, the sulfaVer method was employed. The cadmium reduction method using NitraVer 5 powder pillows and HACH DR/2010 spectrophotomerter procedures was employed to analyse nitrate. Fecal coliform count was also analysed using the standard most probable Number (MPN) method (15).

## III. Results And Discussion

The results of the physico-chemical parameters of the Imonite creek are given in Table 2. Most of the parameters were within tolerable standard limits except for fecal coliform count especially in stations B, C, D, and E. (These are the areas of human inhabitation). Station A had negligible fecal count probably due to the distance upstream from the Ndoni Community. The communities around the Imonite creek defecate into the river especially during the rainy season as no public toilet facilities and basic water systems are available. This agrees favourably with works of (16) that the presence of high level of fecal coliform count and nutrient parameters increases eutrophication. BOD levels in all the stations were relatively low and below the recommended standard limits for surface waters for safety according to (17,18). The DO recorded for all the stations showed that they were at the recommended standard limit for safety except at station C which was below the lower limit of the (17,18) recommended standard limit for safety. This may be due to the palm oil refining activity around the Abadiukwu axis flowing into the stream (station C). The low levels of BOD observed in this study may be inferred that there are no major anthropogenic activities or industries around the creek. This contradicts the works of other reporters in similar environments of the Niger Delta (19,20,21). Organic materials are broken down by aerobic bacteria, but absence means low levels of the gross organic pollution parameters. The low levels of the nutrient parameters i.e. $NO_3^-$ and $PO_4^{3-}$ are indicative of low levels of industrial effluents and human population. The levels of phosphate and Nitrate were found to be lower than those of permissible limits set by (17,18). They were within the acceptable limits except non conformity to those reported for similar Niger Delta waters (22,23,24). The higher relative values of nutrient parameters at station B indicates more human influence because this is the centre of the Ndoni community where refuse wastes are dumped indiscriminately into the creek. They also succumb to the argument of (25) that the concentration of nitrate and phosphate are low in surface waters. The values contradict results of studies on rivers and creeks in the Niger Delta (21). The low level of nitrate is an advantage because nitrate toxicity was reported by (26) to increase the risk of anemia in infants and pregnant women, including the formation of carcinogenic nitrosamines.

Heavy metals of Fe and Zn were not detected (ND). Though Mn and Ca were detected, their levels were below (17,18) limits of safety. The highest level of 0.256mg/l (Mn) was found in station C while for Ca, it was 0.76 mg/l in station A. The higher level of Ca in station A may be connected with the presence of limestone deposits at the mouth of the River Niger. Metal concentration shows the following order: Ca> Mn> Pb> Fe> Zn. The pH values were relatively lower than the permissible limits, they are higher than those reported by (21) for Woji Creek, (27) for the Okrika River, both in the Niger Delta. The temperature and pH were below and within the permissible limits recommended by (17,18). The temperature differences were as a result of exposed areas and those covered by large trees. High water temperatures at the beginning of rainy season and towards the end of the rainy season are due to high ambient temperatures in dry season as reported by Awachie (28) for typical West African Rivers. Alabaster and Lloyd (29) reported that the temperature of natural inland waters in the tropics varied between 25°C and 35°C which compares favourably with the works of (30,31) on a similar environment.

All the stations recorded TDS values below the (32,33) stipulated limits of 500mg/l. TDS can be introduced into surface water bodies from weathering rocks, municipal run-off water, from soil and other anthropogenic sources (though, small amounts can be added or derived from macrophytes and phytoplankton excretions, (34). The low level of TDS may be as a result of the self-purification mechanism of the creek from the high levels of sand and gravels aiding filtration and sedimentation.

## IV. Conclusion

The relatively lower concentrations of BOD, DO, $PO_4^-$, $S0_4^{2-}$, $N0_3^-$, pH, heavy metals and TDS indicates that the Imonite creek is not polluted by the organic and inorganic contaminants entering the water body of the Imonite creek around Ndoni in the Niger Delta of Nigeria. Though the high level of turbidity destroys the aesthetic value of the water, the trace amount of Mn is something to worry because of bioaccumulation and biomagnifications processes. The trace amount of Ca is welcomed for health reasons like strong bones and teeth maintenance. Though the heavy metals like Pb are within permissible limits set by (17,18,32,33), there is the need to locally control the discharge of waste into the creek waters especially during the dry season where pockets of water (ponds) are left due to the topography of some stations. To aid this checks, the local authorities should make provisions for task forces to ensure strict compliance by the natives. The analysis of the water quality of Imonite creek can be used as a baseline standard as no similar works have previously been done. Government can use this to solve most of the water problems of the large population of the local inhabitants, knowing the water quality measurements.

**Table 1: Description of Sampling Stations**

| S/NO | STATION | DISTANCE (INTERVAL) | ACTIVITY |
|---|---|---|---|
| 1. | A | 0.5km (from Niger River) | Confluence of River Niger and Imonite Creek |
| 2. | B | 4 km | The Mgboroka axis |
| 3. | C | 10km | Abadiukwu axis |
| 4. | D | 20km | Ase-Azaga axis |
| 5. | E | 30km | Confluence of Orashi River and Imonite creek at Obrikom axis |

**Table 2: Mean Values of Physico-Chemical Parameters of Water Samples from Imonite Creek.**

| S/NO | PARAMETER | FMENV/DPR (LIMIT) | WOJI CREEK | OKRIKA RIVERS | SAMPLING STATIONS | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | C | D | E |
| 1. | Fecal coliform count | <10 | - | - | 3.8 | 14.5 | 14.0 | 13.35 | 15.82 |
| 2. | $BOD_5$ (mg/L) | 10.00 | 12.80 | 3.77 | 0.24 | 0.26 | 0.39 | 0.36 | 0.37 |
| 3. | DO (mg/L) | 3 – 7 | - | - | 3.33 | 3.25 | 2.97 | 2.14 | 3.60 |
| 4. | $PO_4^{3-}$ (mg/L) | 0.5 | 15.96 | 0.33 | 0.27 | 0.34 | 0.07 | 0.26 | 0.06 |
| 5. | pH (Units) | 7.0-10 | 6.38 | 7.2 | 7.36 | 7.43 | 7.15 | 7.19 | 7.03 |
| 6. | TDS (mg/L) | 500 | - | - | 26.85 | 27.53 | 27.50 | 28.03 | 27.10 |
| 7. | $NO_3^-$ (mg/L) | 20 | 13.41 | 0.70 | 1.05 | 0.90 | 0.91 | 1.05 | 0.93 |
| 8. | Turbidity (NTU) | NS | - | - | 168 | 255 | 223 | 243 | 292 |
| 9. | Temperature ($^0$C) | 35 | 35 | 30 | 25.90 | 25.95 | 26.33 | 25.93 | 26.05 |
| 10. | Mn (mg/L) | 5 | - | - | 0.034 | 0.062 | 0.256 | 0.170 | 0.147 |
| 11. | Fe (mg/L) | 1.0 | - | - | ND | ND | ND | ND | ND |
| 12. | pb (mg/L) | 1.0 | - | - | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| 13. | Zn (mg/L) | 1.0 | - | - | ND | ND | ND | ND | ND |
| 14. | Ca (mg/L) | - | - | - | 0.76 | 0.61 | 0.64 | 0.71 | 0.73 |

NS=Not specified, ND= Not detected.

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