EVALUATION OF SURFACE WATER AND GROUNDWATER SOURCES OF POTABLE WATER IN OWERRI MUNICIPAL

By
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INTRODUCTION

• Water is one of the basic elements of life only second to air.

• Problems associated with the lack of adequate and quality water resources in Nigeria have threatened to place the health of about 40 million people at risk (WHO/UNEP, 1996).

• UNICEF/WHO (2004) defines water quality as its fitness for the beneficial users, which is provided for drinking by man and animals for the support of marine life, irrigation, industry, recreation and anesthetic purposes.

• Quality of water can be completely defined and estimated by studying its physical, chemical and bacterial characteristics.

• The basic physiological requirement for drinking water has been estimated at about 20 litres per person per day. However, the daily supply of 140 litres per capita per day is considered adequate to meet the needs for all domestic purposes (WHO/UNEP, 1996).

• It is estimated that more than one billion people in developing countries lack access to safe drinking water (FEPA, 1991).

• The quality of water from Otamiri River, Nworie River and Groundwater (borehole) as sources of potable water supply in Owerrri Municipal using appropriate technology has been evaluated in this study.

OBJECTIVES OF STUDY

The objectives of the study are:

• To evaluate the quality of water from Otamiri River, Nworie River and selected borehole for drinking purposes.

• To evaluate the efficiency of the treatment unit operations of Otamiri Water works.

• To make recommendations on the Owerrri Municipal water supply system.

STUDY AREA

Owerrri is the capital of Imo State and is located 5° 29' 0" N and 7° 2' 0" E South-East Nigeria. Owerrri has a population of about 2.5 million people. The two main rivers in Owerrri are Otamiri and Nworie. Owerrri water treatment plant (Otamiri Water works) is located 2km from the water source (Otamiri River). It is situated at Egbo in Owerrri North Local Government Area of Imo State as shown in Plate 1.

MAP OF OWERRI SHOWING LOCATION OF WATER TREATMENT PLANT

SOURCE: Imo State Water Corporation
MATERIALS & METHODS

- Water samples were collected at the upstream, mainstream and downstream locations in Otamili River, Nworie River and selected boreholes.
- The following water parameters were analyzed: pH, temperature, colour, total dissolved solid, conductivity, magnesium, hardness, total hardness, nitrate, nitrite, phosphate, sulphate, free chlorine, iron, sodium, turbidity and ammonia.
- The results obtained were compared with World Health Organization (WHO) standards for drinking water.
- These parameters were also analyzed for samples collected before and after treatment units (aeration tank, sedimentation tank) of Otamili Water work treatment plant.
- The removal efficiency of the unit operation processes were carried out.

The treatment method adopted in Owerri Municipal water treatment units is an appropriate technology for provision of potable water in Owerri Municipal. The treatment method adopted includes the steps shown in Fig. 2.

![Diagram of water treatment process]

**Fig 1: Chart showing steps in treating raw water by the Imo State water cooperation**

RESULTS

Table 1: Average values of measured parameters of water samples from all water sources with comparison to World Health Organization (WHO) standard

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average values for Otamili River (1)</th>
<th>Average values for Nworie River (2)</th>
<th>Average Values for borehole water (3)</th>
<th>Average values for Treated water (4)</th>
<th>WHO Standard</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Iron (mg/l)</td>
<td>0.29</td>
<td>0.88</td>
<td>0.02</td>
<td>0.31</td>
<td>0.36</td>
<td>(1), (3) &amp; (4) pass, (2) fail</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>5.46</td>
<td>63.33</td>
<td>5.8</td>
<td>0.64</td>
<td>5.0</td>
<td>(1), (2) &amp; (3) fail, (4) pass</td>
</tr>
<tr>
<td>TDS (mg/l)</td>
<td>22.23</td>
<td>46.13</td>
<td>17.13</td>
<td>18.0</td>
<td>100</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>pH</td>
<td>7.56</td>
<td>7.20</td>
<td>5.82</td>
<td>5.29</td>
<td>6.5 – 8.5</td>
<td>Pass</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>28</td>
<td>28.3</td>
<td>29.5</td>
<td>26.8</td>
<td>27 – 28</td>
<td>(1), (3) &amp; (4) pass, (2) &amp; (3) fail</td>
</tr>
<tr>
<td>Hardness (mg/l)</td>
<td>12.23</td>
<td>1.72</td>
<td>29.0</td>
<td>14.48</td>
<td>500</td>
<td>Pass</td>
</tr>
<tr>
<td>Nitrate (mg/l)</td>
<td>1.18</td>
<td>17.4</td>
<td>2.29</td>
<td>0.91</td>
<td>10</td>
<td>(1), (3) &amp; (4) pass, (2) fail</td>
</tr>
<tr>
<td>Nitrite (mg/l)</td>
<td>0.61</td>
<td>3.9</td>
<td>0.00</td>
<td>0.47</td>
<td>3</td>
<td>(1), (3) &amp; (4) pass, (2) fail</td>
</tr>
<tr>
<td>Free Chlorine (mg/l)</td>
<td>1.40</td>
<td>1.00</td>
<td>0.00</td>
<td>1.15</td>
<td>250</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Sulphate (mg/l)</td>
<td>2.03</td>
<td>4.17</td>
<td>14.73</td>
<td>1.33</td>
<td>42</td>
<td>Pass</td>
</tr>
</tbody>
</table>
CONCLUSION

- The study showed that, Otamiri River as a source of potable water requires minimal treatment before use.
- Nworie River as a source of drinking water for Owerri Municipal water supply system may require a state of the art water treatment plant.
- The use of boreholes as sources of drinking water for Owerri Municipal water supply system will be the best in terms of quality.
- The lack of adequate funding has been identified as a problem by operators for the supply of potable water to consumers.
- The mean levels for free chlorine (Cl), sodium (Na), sulphate (SO₄), nitrate and nitrite (NO₂⁻) did not exceed the maximum tolerance limit required by WHO standard for drinking water.
- The pH was within standard limit required, the mean levels for turbidity, ammonia and iron of the treated water sample were within the permissible limits.
- There is the need for adequate funding to improve the quality of water supplied to consumers.
- The evaluation of removal efficiency shows that treatment plant is performing at 40.3% which can be upgraded for better performance as it has proved to be an appropriate technology for potable water supply in Owerri Municipal.

RECOMMENDATIONS

- Based on the study and site visit to the study area (Owerri Water Treatment Plant), it is recommended that:
  - Evaluation of plant performance should be carried out yearly.
  - Backwashing of the filter bed should be carried out every six months.
  - The Otamiri water treatment plant should be upgraded.
  - Weeds/ water hyacinth of the source of water and / or radial gate should be cleared monthly.
  - There should be proper funding by the government for the treatment plant.
  - Nworie River requires a state of the art water treatment plant.