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Bacteriological Assessment Of Orle River From Different Sources In Etsako West Metropolis

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Abstract: ***The bacteriological assessment of Orle river from different sources in Etsako West metropolis was investigated. The microbial load of the river in the various communities was high and varied from one community to another. The values ranged from 2.32 x 10^4cfu/ml in points 2 to 2.91 x 10^6cfu/ml in Auc3.The least total coliform counts of 95MPN/100ml was observed in Auc 4 while the highest total coliform counts was 360MPN/100ml and it was recorded in Auc 3. Five bacterial genera were isolated from the water sample of Orle River and these included pathogens and opportunistic pathogens. Members of the Enterobacteriaceae predominated, and the genera are Escherichia, Staphylpcoccus, Enterococcus, Salmonella, Shigella and Enterobacter. The most prevalent bacterial isolates were Escherichia coli (44.1%), Enterococcus faecalis (42.9%) Salmonella species (35.7%) and Enterobacter species (35.3%). Auc 3 had the highest Escherichia (44.1%) while Auc 2 had the lowest with 8.8% Escherichia. Auc 3 recorded the highest total bacterial counts value, this point is believed to have received high human and animal activities. Escherichia coli, the main indicator of faecal pollution constituted about 44.1% of the identified bacterial isolates in the examined water, an indication that, the river water has received faecal pollution. The pH values recorded were observed to be within the WHO standard of 6.5 – 8.5. The results of some of the physico-chemical parameters were shown to be higher in Auc 3, which have direct effect of human activities. The total viable counts for all the water samples were generally high exceeding the WHO limit of 1.0X10^2cfu/ml which is the standard limit of total bacterial counts for drinking water.***

Keywords: Microbial assessment, Orle river and Etsako west.

I. INTRODUCTION

Water is life and without water there will not be human life. Humans need water for metabolic and other activities to carry on with life. It is an important constituent of human life (Mberekpe and Eze, 2014). Most developing countries experience water shortage and pollution of the readily accessible water (Muhammad *et al.*, 2017). This is to a large extent ascribed to low level of personal hygiene and insufficient treatment facilities for water and indiscriminate disposal of wastes that results in pollution (Kuta *et al.*, 2014). More pressure on the available water sources has been exerted due to increase in population. Microbial contamination of water is usually caused by the presence of living organisms, such as algae, bacteria, protozoan or viruses which results in disease and eventually death (Ashbolt 2004). Besides causing death, water-related diseases also prevent people from working and living active lives. Maduka *et al.* (2014) had reported that more than 1.2 billion people worldwide do not have access to safe water. Also Memon *et al.* (2011) had

reported that millions of people die yearly from diarrheal disease and a larger proportion are children aged below 5 years. Water has played a major role in the transmission of human disease. Typhoid fever, cholera, amoebic dysentery and many other gastrointestinal diseases can be transmitted by water. Contamination of water by sewage and human faecal material present the greatest danger to public health (Ekhaise and Omoigberale, 2011).

Trace metals in ground water have been attributed to human interference, proliferation of industries, and recent agricultural practice in urban areas where storm water flow recharges the aquifer. Effective retention of determinants depends upon soil types (Zubair and Farooq, 2008).

II. MATERIALS AND METHOD

MATERIALS

Materials used for these analyses were standard microbiological materials and were gotten from the microbiology laboratory in Food Technology Department, Auchi Polytechnic, Auchi, Edo State, Nigeria except samples.

SAMPLE COLLECTION

The sources of the river are from Auchi, Egono, Egbogio and Ejor communities in Etsako West Local Government Area of Edo State. The main tributary is Orle River. The Orle River watershed is the principal natural water network irrigating the communities (Auchi, Egono, Egbogio and Ejor). The River is used by the communities for multiple activities including: agriculture, laundry, drinking, commercial purpose, car washing, bathing, watering of crops for raw consumption and in certain areas swimming by youth. Therefore, an overview of the quality of the River is a major public health issue.

SAMPLING

The method of Ekhaise and Omoigberale (2011) was used. Samples were collected against the water current. A total of 18 samples were collected with each point sampled two times. The Sampling points were labelled point A (Edoke) Auchi, point B (Egono), point C (Egbogio) and point D (Ejor). Samples for bacteriological analysis were collected into sterile clean glass bottles by dipping and corking the bottle in the water. Bottles were labeled before sample collection. For physico-chemical analysis, sterile plastic bottles with hard plastic screw caps were used for sample collection. Collected samples were transported immediately to the laboratory for the bacteriological and physico-chemical examinations. The bacteriological parameters monitored included total viable counts, total coliform counts, total faecal coliform counts, according the methods of APHA, (1995) as reported by Ekhaise and Omoigberale (2011). The isolation and identification of bacterial isolates were carried out using Bergey manual of determinative bacteriology. The physico-chemical parameters studied were pH, water temperature, turbidity, conductivity, total dissolved solids, total suspended solids, colour, acidity, alkalinity. The physico-chemical analyses were determined according to Standard Methods for Water and Wastewater (APHA, 1998).

The physico-chemical parameters studied were pH, water temperature, turbidity, conductivity, total dissolved solids, total phosphorous, available phosphorous, nitrate, ammonia nitrogen, chromium, lead, chloride, colour, acidity, alkalinity, nitrite, iron, copper, zinc, sulphates, dissolved oxygen, biochemical oxygen demand and chemical oxygen demand were analysed.

STATISTICAL ANALYSIS

SPSS was used to carry out single factor analysis of variance (ANOVA) on the bacteriological counts to test for statistical significance and where significant differences were detected the Duncan's Multiple Range (DMR) test was further used to locate the significantly different means. Also correlation coefficient test was conducted between the total viable counts and physico-chemical parameters at 95% and 99% probability level.

III. RESULTS AND DISCUSSION

RESULT

The results of the total viable counts (TVC) (cfu/ml) of Orle River water samples from the different are presented in Table 1. Table 2 shows the total coliform counts (TCC) for the various sampling points. Table 3 shows the frequency of bacterial distribution from the different sources. The results of the physico-chemical assessment of the water sample of Orle River are presented in Table 4.

Sampling point	Total viable counts (cfu/ml)	WHO Standard
Auc1	2.6×10^5	1×10^2
Auc2	2.32×10^4	1×10^2
Auc3	2.91×10^6	1×10^2
Auc4	2.41×10^4	1×10^2

Key: Auc1= Auchi, Auc2=Egono, Auc3=Egbogio and Auc4=Ejor

Table 1: Total viable counts (cfu/ml) of Orle water sample from the four communities (Auchi,Egono, Egbogio and Ejor).

Sampling point	Total viable counts (cfu/ml)	WHO Standard
Auc 1	230	3 coliform/100ml
Auc 2	120	3 coliform/100ml
Auc 3	260	3 coliform/100ml
Auc 4	95	3 coliform/100ml

Key: Auc1= Auchi, Auc2=Egono, Auc3=Egbogio and Auc4=Ejor

Table 2: Total coliform counts (MPN/100ml) of Orle water sample from the four communities (Auchi, Egono, Egbogio and Ejor).

Bacterial Isolates	Auc1	Auc 2	Auc 3	Auc 4	Total
E.coli sp	11 (32.4%)	3 (8.8%)	15(44.1%)	5(14.7%)	34(100%)
Enterococcus faecalis sp	6(28.6%)	2(9.5%)	9(42.9%)	4(19.0%)	21(100%)
Enterobacter	4(23.5%)	4(23.5%)	6(35.3%)	3(17.6%)	17(100%)

sp *Salmonella* sp	8(%28.6)	6(21.4%)	10(35.7%)	4(14.3%)	28(100%)
Shigella sp	8(32.0%)	5(20.0%)	7(28.0%)	5(20.0%)	25(100%)

Table 3: Frequency of distribution of bacterial isolates from Orle River in Auchi, Egono, Egbogio and Ejor

	Lead (Mg/l)	pH (Mg/l)	Temp (Mg/l)	Colour (Mg/l)	Turbidity (Mg/l)	Chloride (Mg/l)	Iron (Mg/l)
Auc1	0.003	7.16	27.33	7.2	2.76	7.14	0.01
Auc2	0.002	7.15	27.33	7.4	2.78	7.14	0.01
Auc3	0.003	7.15	27.33	7.2	2.75	7.18	0.01
Auc4	0.003	7.18	27.33	7.2	2.76	7.14	0.01

Key: Auc1= Auchi, Auc2=Egono, Auc3=Egbogio and Auc4=Ejor

Table 4: Physico-chemical characteristics of Orle River in the various Communities

DISCUSSION

The microbial load of the river in the various communities was high and varied from one community to another. The values ranged from 2.32 x 10^4cfu/ml in Auc 2 to 2.91 x 10^6cfu/ml in Auc3.The least total coliform counts of 95MPN/100ml was observed in Auc 4 while the highest total coliform counts was 360MPN/100ml and it was recorded in Auc 3. Five bacterial genera were isolated from the water sample of Orle River and these included pathogens and opportunistic pathogens. Members of the Enterobacteriaceae predominated, and the genera are *Escherichia*, *Staphylpcoccus*, *Enterococcus*, *Salmonella*, *Shigella* and *Enterobacter*. The most prevalent bacterial isolates were *Escherichia coli* (44.1%), *Enterococcus faecalis* (42.9%) *Salmonella* species (35.7%) and *Enterobacter* species(35.3%). Auc 3 had the highest *Escherichia* (44.1%) while Auc 2 had the lowest with 8.8% *Escherichia*. Auc 3 recorded the highest total bacterial counts value, this point is believed to have received high human and animal activities.

Escherichia coli, the main indicator of faecal pollution constituted about 44.1% of the identified bacterial isolates in the examined water, an indication that, the river water has received faecal pollution.

The pH values recorded were observed to be within the WHO standard of 6.5 – 8.5 The results of some of the physico-chemical parameters were shown to be higher in Auc 3, which have direct effect of human activities. The total viable counts for all the water samples were generally high exceeding the WHO limit of 1.0X10^2cfu/ml which is the standard limit of total bacterial counts for drinking water (EU, 1998). The primary sources of these bacteria in water could be attributed to animal and human activities. These sources of bacterial contamination include surface runoff, pasture, and other land areas where animal wastes are deposited.

IV. CONCLUSION

The bacteriological assessment of Orle river from different sources in Etsako West metropolis which serves as the major source of water to the communities (Auchi, Egono, Egbogio and Ejor) shares significant importance in improving living standard and quality of life in the region. Therefore the periodic examination of water source for both domestic and commercial activities should be an important component for the protection strategy in this area. Understanding of pathogenic bacteria genera in river is important and useful to arrive at measures that may act as indicators of water quality and pollution. In this study, it was discovered that Orle river water which serves as water source is heavily contaminated with biological and physical agents of human and animal origin. The water source fell far below the WHO standard for surface water, which has more than 3 coliform per 100ml. For drinking purposes, according to WHO health reports, the water needs to receive appropriate treatment to make it fit for consumption. However, it could be used for other purpose like laundry.

V. RECOMMENDATIONS

From the above study, it is recommended to do the followings:

- ✓ Control of human activities to prevent faeces and refuse from entering water body is the major key to avoiding bacterial contamination of the river water.
- ✓ The government and other stakeholders should provide sanitary facilities especially in the rural areas to control river and water sources from pollution.

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