AN EVALUATION OF THE PHYSICO –CHEMICAL AND BACTERIOLOGICAL PARAMETERS OF "OGENE " (POND) WATER FOUND IN IGBO-EZE SOUTH AND NORTH LOCAL GOVERNMENT AREAS OF ENUGU STATE, SOUTH EAST NIGERIA

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Abstract

Physico- chemical and bacteriological assessment were carried out on "Ogene" (pond) water – a man made flood and runoff catch pit commonly found in towns and villages around Igboeze north and south Local government areas of Enugu state. This man made water body is used as an alternative source of water supply during the dry season. The results obtained were compared with World Health Organization (WHO), Environmental Protection Agency (EPA), Federal ministry of Environment (FME) standards for drinking and recreational water. Total Dissolved solids (TDS), Total solid (TS) and pH values obtained were within the recommended limits set by these bodies while Turbidity and conductivity were well above the prescribed limits .

The results also show that the water samples contain *E.coli, Staphylococcus aures, micrococcus spp, klebsiella spp, Bacillus spp, Actinomycess and Enterobacter spp*. The presence of these pathogens cast serious doubt about the suitability of Ogene water for human consumption.

Key words: Physico-chemical, Bacteriological, Pathogens, Contamination and water supply.

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1.0 INTRODUCTION

The continuous increase in the world population necessitates corresponding demand in potable water supply. Although water is very abundant on the earth surface, potable water is a very scarce commodity (Payment, P et al, 2003). As a result, people seek for alternative ways to ensure constant water supply. One of such ways is the construction of artificial ponds "ogene" commonly found in villages and towns in Igboeze North and South local government areas of Enugu state where portable water is very scarce.

Ogene is a very large body of water contained in a large man-made catch pit of about 45 meters long, 42 meters wide and usually not less than 4.6 meters deep. The pit is usually dug during the dry season. The walls and the floor are polished with palm oil or residue from its extraction, in order to make the setup retain water. Water flows into the pond from surrounding farms, pathways and bushes. The water is allowed to settle and used during the dry season. In most areas where the ogene is located, people living there have no toilet facilities and resort to defecating in open grassland and nearby bushes. These improperly discharged excreters gain entrance into the ogene through runoff water. Solid wastes, which include biodegradable and non biodegradable materials being generated every day, also find their way into the pond since most of these materials are carelessly disposed off thereby contaminating the water.

The world health organization (WHO) estimates that more than 20% of the world population has no safe drinking water while more than 40% of all the population lack adequate sanitation (Oastridge and Trent, 1999). Poor water quality limits their use and causes harm to humans as well as aquatic organism (Forum and Entwickling, 2001). Water is polluted by substances that dissolve in it which can either be solids or liquids (Plant et al, 2001). Polluted water can be potential source of microorganism, some of which are pathogens (Grabow, 1996; Fenwick, 2006; Seas et al, 2000; Medema et al, 2003). The pathogens may include intestinal pathogens which cause diseases ranging from mild gastro enteritis to the serious and probably fatal dysentery, cholera and typhoid fever depending on the prevalence of the diseases in the community (Schwart et al, 2000). The caustative organisms of these diseases are present in feaces and urine of infected persons which eventually gain entrance into the ogene through runoff water (Arvanitidou et al, 2005). Ogene water is used for house hold chores and are sometimes used as drinking water during extreme water scarcity. This study was undertaken to determine the safety

of Ogene water for human consumption by estimating the faecal contamination as well as the physico- chemical parameters of the water.

2.0 Materials and Method

The ogene water used for this study is located at Amaja-Ovoko in Igbo-Eze South and Amachalla Enugu-Ezike, Igboeze North local government areas of Enugu state.

The sampling was carried out in December 2011, when the runn off water inflow into the ogene has ceased. Three sampling points were chosen with the aim of collecting water samples at a place that truly represents the entire water body (Wide et al, 1999). Sterile 250cm^3 conical flask was tied to a long stick with a rope, so that samples could be collected while standing at about 1meter away from the bank of the Ogene. The flask was not filled to the brim to allow for thermal expansion. The sampling points are the entrance, the centre and the interior.

2.1 Physico-Chemical Analysis

Ogene water from Amaja-Ovoko and Amachalla Enugu-Ezike were analyzed for pH, conductivity and turbidity at the point of collection using Hanah pH meter, conductivity and turbidity meter respectively. While the total dissolved solid and dissolved solids were estimated by evaporation method at 180 ^{o}c.

2.2 Bacteriological Analysis

The bacteriological analysis were determined by the method described by Bezuidenhout et al (2002). The most probable number –mutiple tube technique was used for coliform count while Nutrient Agar (NA), Macconkey Agar , citrate bile salt sucrose agar were used to determine heterotrophic bacterial count. The plates were incubated at 37^{o}c for 48 hours. The presumptive colonies were confirmed by gram and spore staining and biochemical reactions. The plates were then given a positive or negative score. The isolates were latter confirmed by subjecting it to biochemical tests using Bergey's manual of systematic bacteriology (second edition, 2004) as reference.

3.0 Results and Discussion

Details of the results of the Physico-chemical parameters determined in Ogene water from Amaja and Amachalla are presented in tables 1 and 2.

Table 1: Results of the Physico-chemical parameters determined in Ogene water from Amaja

Amaja Ovoko	pH	EC (ms/m)	Turbidity(NTU)	TS (mg/l)	TDS (mg/l)	Temp ^{o}C
Point 1	8.23	20.8	1.43	217	128	30
Point 2	8.00	23.4	1.26	215	188	29
Point 3	8.20	21.9	1.60	227	176	30
Mean Value	8.14	21.77	1.43	219.67	164	29.67

Table 2: Results of the Physico-chemical parameters determined in Ogene water from Amachalla

Amachalla-Enugu Ezike	pH	EC(ms/m)	Turbidity(NTU)	TS(mg/l)	TDS(mg/l)	Temp ^{o}C
Point 1	6.44	21.4	1.26	222	185	30
Point 2	6.42	20.8	1.53	225	200	30
Point 3	6.57	22.6	1.60	196	174	31
Mean Value	6.47	21.6	1.46	214.33	186.33	30.3

The pH of Ogene Amaja ranged from 8.00 - 8.23 while that of Amachalla ranged from 6.42 – 6.57. The Federal Environmental Protection Agency / Federal Ministry of Environment FEPA/FMENV effluent limit for pH in water for domestic use is 6.0 – 9.0 (FEPA/FME, 1991), while the world health organization maximum permissible limit for drinking water is 6.5 – 8.5 (WHO, 1993 in NEMA 2003). Based on this guide line, the pH of the entire sampling points on the Ogene would not adversely affect its use for domestic purposes.

The turbidity level ranged from 1.26 – 1.60 NTU for Amaja Ovoko and 1.26 -1.60 NTU for Amachalla Enugu-Ezike. These values exceeded limit of 0 to 1.0 NTU for domestic use. This may be associated with microbial contamination as turbidity is viewed as supporting factor for microbial contamination (EPA 2002; Schwartz et al 2000).

The conductivity in ms/m ranges from 20.8 – 21.9 and 20.8 – 22.6. The limit given FEPA/FEMEV, 1991 ; NEMA 2003 , (20ms/m) was exceeded. This could be attributed to weathering of the rock as the runoff water move down the catchment area of the Ogene ponds. The high conductivity level renders the water unsuitable for domestic use.

The total solid ranged from 215 – 227 for Amaja and 196 -222 for Amachalla while the range for total dissolved solid is 128 – 176 for Amaja and 174 – 200 for Amachalla. These values are not significant when compaired to FEPA/FME (1991) and WHO (1993) standards and limits for Total Solids and Total dissolved Solid which is 500mg/l and 2000mg/l respectively for Total Solids and 1000mg/l for total dissolved solids.

Bacteriological analysis and Microbial isolates from the "ogene" samples are presented in the tables 3 and 4 below:

Table 3: Bacteriological Analysis of Ogene Samples.

Ogene samples	Total Heterotrophic content	Total coliform count
Amaja	5.0×10^6	1600
Amachalla	2.10×10^6	>1,800

Table 4: microbial isolates from Ogene samples

Microbial isolate	Amaja	Amachalla
E-Coli	+	+
Staphylococcus aureus	+	+
Micrococcus spp	+	+

Klebsella spp	+	+
Bacillus spp	+	+
Actnomycess	+	+
Enterobacter spp	+	+
Salmonella typhosa	_	+

The organisms are commonly found on decaying plants, in the soil, in human and animal faeces and could have entered the Ogene through Flood and runoff. It is also possible that it could have entered the ogene through unhygienic water collection habits of the villagers. The main occupation of the villagers is farming and it was observed during sampling that most of their hands were soiled. The containers used for water collection were very dirty and were also placed on the ground prior to being dipped into the Ogene pond for Water collection. Although there was no serological test to determine whether the E-coli found in the water were of animal or human origin, their presence in the water cast suspicion on the suitability of ogene water for drinking purposes. The World Health Organisation (WHO), United States Environmental Protection Agency,(USEPA) dictates that drinking water should be E – coli free (WHO 1986, USEPA,2001) as it impacts negatively on human health and is used as index for faecal contamination.

4.0 Conclusion

The level of physico –chemical parameters and estimated faecal coliform number observed in the study has shown that ogene water is polluted. It is not potable as potable water is water that is free from diseases producing microorganism and chemical substances that are dangerous to health (Lamikanra, 1999). This is probably because ogene is a collection of runoff water and flood from farmlands, foot path and roads. It is recommended that Ogene water should be treated further before it becomes fit for human consumption.

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