Bacterioloigical Assesment of Water from Otamiri River in Owerri Imo State

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Abstract
The bacteriological assessment of water from Otamiri River was investigated in this study. Three sites of the Otamiri river: Akachi Road, Emmanuel college and mechanic village were selected for water collection points from the river based on effluent discharge. Analyzed water samples collected from the river showed that the river was highly contaminated. The temperature ranged from 29^0C to 30^0C while pH was 5.28 to 6.01 and the conductivity was 0.03-0.61. The total visible count ranged from $1.2x10^5$ to $9.0x10^5$ CFU/ml while the total coliform count was from $5.0x10^5$ to $9.0x10^5$ CFU/ml which revealed high level of contamination. The bacterial isolates were staphylococcus aureus, Escherichia Coli, Klebsiella Sp, Enterobacter. Sp, Bacillus Sp, Pseudomonas sp, Streptococcus sp, proteus SP, and Salmonella sp. The coliforms were dominant occurring in all the water samples and are indicators of faecal contamination. It is recommended that people using the water especially for drinking and other domestic activities should purify it properly to avoid possible health hazards associated with the identified microbes.

Keywords: *Bacteriological, Otamiri River, total visible count total colfiorm count, bacteria*

Introduction

Bacteriological water analysis is a method of analyzing water to estimate the amount of bacteria as well as the type of bacteria present. The bacteriological quality of water in most rural areas in sub-Saharan Africa is worrisome with water related diseases and illness such as typhoid fever, dysentery, cholera, meningitis and diarrhea amongst others being some of the outcomes (Cowan, 1974, Amadi et al, 2012). The lack of bacteriological analysis of water in rural area where basic amenities are lacking, have studies showing that faecal wastes and untreated effluents on rivers and streams are still rampant. (Amadi et al 2011). According to Adetuyi et al, (1997), poor sanitation and lack of safe water makes communities vulnerable to diseases such as shigellosis, amoebiosis, schstosomiasis, typhoid, leptospirosis infection, hepatitis, giardiasis etc. confirming the fact that the supply of clean and treated water remains a challenge in developing countries especially in the rural areas.

Bacteria can be described as either pathogenic which causes diseases. Pathogenic bacteria can overcome the body's natural defenses and invade healthy tissues. In addition, opportunistic or secondary pathogens are those that can cause an infection when an unusual opportunity, such

as an open wound or suppressed immune system, presents itself. In addition to air, water is essential for human beings, animals and plants. It is believed that man can survive without food but not without water for a long while. It is a group of microorganisms all of which lack a distinct nuclear membrane and hence are considered more primitive than animal and plant cells) and most of which have a cell wall of unique composition (many antibiotics act by destroying the bacterial cell wall). Most bacteria are unicellular. The cells may be spherical (coccus), rod-shaped (bacillus), spiral (spirillum), comma-shaped (vibrio) or corkscrew-shaped (spirochaete). Generally they range in size between 0.5 and 5µm. Motile species bear one or more fine hairs (flagella) arising from their surface. Many posses and outer slimy capsule and some have the ability to produce an encysted or resting form (endospore).

River water can be influenced directly and indirectly by microbial processes which can transform both organic and inorganic constituents. According to Matthew (2006), single and multi-celled organisms have become adapted to using the dissolved materials and suspended solid matter in the aquifer in their metabolism and then releasing the metabolic products back into the water. There is practically no geological environment at or near the earth's surface where P^H condition will not support some form of organic life (Chilton and West 1992).

Water polluted with human feaces may contain potentially pathogenic microorganisms that causes disease in the aquatic environment (Sobsey et al, 1989, Gerba et al 1996, Grabow 1996). The most commonly used faecal indicator micro-organisms which include the total coliform bacteria, thermotolerant coliform bacteria which are found in human faeces. However, water contaminated with human faeces is regarded as a greater risk to human health and aquatic organisms since it is more likely that it would contain human specific entric pathogens (Sinton et al, 1998).

The presence of faecal coliforms (over 99% of which are Escherichia coli) and a water body is an indication of possible human animal waste contamination and the possible presence of pathogenic bacteria. The detection of Escherichia provides definite evidence of faecal contamination. However, in practice, the detection of thermotolerant (faecal) coliform bacteria is an acceptable alternative. According to world health organization (WHO 1997, 2004), standard faecal coliforms should be absent (zero colony forming units per 100ml water) in portable water while total coliforms should be less than 10 colony forming units in 100ml water sample.

Materials and Methods

Description of Study Area

The Otamiri River is one of the main rivers in Imo State, Nigeria. The river takes its name from Otamiri a deity that owns all the waters called by its name and is often the dominating god of Mbari houses. The River runs south from Egbu past Owerri and through Nekede, Ihiagwa, Ezi-obodo, Ulakwo, Mgbirichi and Umuagwo to Ozuzu in Etche in Rivers State from where it flows to the Atlantic Ocean. The length of the River from its source to its confluence at Emeabian with the Uramrukwu River is 30km (19ml). The Otamiri watershed covers about 10,000 square kilometers (3,900 sqml) with annual rainfall of 2,250 to 2500 millimeters (89 to 98ml). The watershed is mostly covered by depleted rainforest vegetation with mean temperature of 27^0C (81^0f) throughout the year.

Sample Collection

Water samples were collected with carefully washed and sterile non reactive transparent glass bottles of 500ml capacity. Samples were taken from the river by holding the bottle near its base and plunging its neck downward below the water surface. This was done at three different stations based on proximity to points of effluent discharge. The stations were; Akchi road (station A), station B (Emmanuel College) and station C (Mechanic village) the sampling bottles were not filled up to the brim so as to give room for effective rocking (APHA, 1998). The bottles were then labeled appropriately according to the station and sent to the laboratory for bacteriological and physico-chemical analysis.

Serial Dilution

1ml of each sample was added into 9ml of distilled water contained in a test tube and homogenized thereafter, 1ml from the test tube was ascetically transferred into 9ml of second testtube containing 9ml of sterile water and homogenized. This process of transferring 1ml of the mixture of the samples from a previous test tube to 9ml of sterile water of the subsequent test tube was continued until the tenth test tube.

Grams Staining

The gram staining method of (Cheesbrough, 2005) was adopted for the determination of gram staining reactions of all bacterial isolates.

Biochemical Tests

Citrate Utilization Test

This was carried out using the method as described by Cheesborugh (2005).

Sugar Fermentation Test

This was determined according to Ochei and Kolhatkar, 2000.

Motility Tests

This was done according to Fawole and Oso, 2004 method

Catalase Test

This was carried out according to the method by Cheesbrough, 2005.

Indole Test

This was done according to the method adopted by Cheesbrough 2005

Oxidaze Test

The method of Cheesbrough 2005 was adopted

Results

Table 1: physicochemical parameters of Otamiri River

Parameters	Station A	Station B	Station C	Mean Station	WHO Standard (2004)
Temperature	29.2	29.5	30.0	29.5	25-32
P^H	5.60	5.28	6.01	5.63	6.5-9.0
Conductivity	0.03	0.61	0.03	0.67	
Turbidity	25.6	25.8	12.3	21.23	15-25
Colour	Pale Yellow	Grey	Grey		Clear
Appearance	Slightly Turbid	Very Turbid	Slightly Turbid		Clear
Odour	Odourless	Unpleasant	Unpleasant		Odourless

Table 2: Microbial Load of the Bacterial Isolates from Otamiri River

STATION	TVCC (CFU/ml)	TCC (CFU/ml)
A	$9.0X10^5$	$5.0X\ 10^5$
B	$1.2X10^5$	$7.0X10^5$
C	$1.5X10^5$	$9.0X10^5$

KEYS: Tvc = total viable count
Tcc = Total coliform count
CFU/ml = colony forming unit per ml

STATION A – Akachi road
STATION B – Emmanuel College
STATION C – Mechanic Village

Table 3: Cultural and Biochemical Characteristics of the Bacterial Isolates.

STATION A	CULTRUAL CHARACTERISTICS	GRAM reaction	Oxi	Cut	Mot	In	ci	C0	Sugar Fermentation SBGH^{2}S	Staphylococcus organisms
STATION A	golden yellow colonies	+ve Cocci in clusters	-	+	-	-	-	+	Ry^{+-}	Staphylococcus aureus
A,B,C	Blueish black muccoid colonia with greenish metallic sheen	- Ve rod	-	-	+	+	-	-	YY^{+-}	Escherichia coli
C	Mucoid pink colonies	-ve rod	-	-	-	-	+	-	YY^{+-}	Klebsiella spp
A,B	Large mucoid colonies	-ve rod	-	-	-	-	+	-	YY^{+-}	Enterobacter spp
B,C	Creamy dry flat colonies with rough edges	+ ve rod	-	+	-	-		+	Ry --	Bacillus spp
C	Blueish green colonies	+ve rod	+	-	+	-	-	-	Ry--	Pseudomonas sp
B	Small creamy non-mucoid colonies	Cocci in chain	-	-	-	-	-	-	Ry^{+-}	Streptococcus spp
A,C	Black colonies	-ve rod	-	-	+	-	-	-	Ry $^{-+}$	Salmonella spp

KEYS: += positive, - = negative, H_2S = Hydrogen sulphide,
Y = yellow (acidic), R = red (Alkaline), Oxi = Oxidase, Cat = catalase, Mot= Motility, in = indole, ci = citrate, co= coajulate, +ve = gram positive, -ve = gram negative, A = Akachi road, B= Emmanuel College C = mechanic village.

Table 4: Occurrence of the Bacteria Isolates form Otamiri River.

Organisms	STATION A (AKACHI ROAD	STATION B(EMMANUEL COLLEGE)	STATION C (MECHANIC VILLAGE)
Staphylococcus aureus	+	-	-
Escherichia coli	+	+	
Klebsiella	-	-	+
Enterobactes spp	+	+	-
Bacillus spp	-	+	+
Psecuchononous pp	+	-	-
Proteus spp	+	-	-
Salinonella spp	+	-	+

Key: + = Present, - = absent

Discussions

From table 1, temperature falls within the normal range while the pH ranged from 5.28-6.01. However, appearance and colour as well as odor were above the WHO standard. In table 2, the

total mean viable count ranged from $1.2x10^5$ to $9.0 x 10^5$ CFU/ml, while the total mean coliform count was from $5.0x10^5$ to $9.0x10^5$ CFU/ml. The microbial load of both the TVC and TCC were high which is a reflection of the input of microorganism from external sources and availability of growth supporting organic matter (Sayler et al, 1975). It also shows the level of water pollution as an indication of organic matter present. The mean total bacterial counts obtained in this study were very high but it is not surprising because Otamiri River serves the population within Owerri municipal and its environs for domestic purposes. The TCC of Otamiri River from station C (mechanic village) was very high; this may be as a result of so many activities going on there such as anthropogenic. Table 3 reveals the bacterial isolates from Otamiri River. Their presence in water indicates faecal contamination of the water. The coliform isolated is an indication of gross contamination of water. Staphylococcus aurues, bacillus sp. Pseudomonas sp. and proteus sp may have also come from current contamination of the river. Bacillus sp is a spore former and can survive in harsh environmental condition, staphylococcus aureus may have come from contamination before or during this study. Staphylococcus sp and bacillus sp are pathogenic and non-pathogenic bacteria respectively. In water, bacillus sp is harmless, their presence signifying waste materials decomposition in water body. (Ogubile, 1999). Salmonella sp and streptococci observed in this study is a health concern because their presence in Otamiri water has made it prone to diseases such as Typhiod fever, Salmonellosis, choleraete on consumption as confirmed by the study of Nwanebu et al (2011).

Table 4 reveals the occurrence of the bacterial isolates from Otamiri River. From the table the coliforms were dominant in this result which shows that Otamiri River was grossly contaminated with faecal materials.

Conclusion

From this study, it was found out that the Otamiri River is heavily contaminated with potential pathogenic bacteria that could predispose consumers of this water to numerous health problems

Recommendation

Based on this study; it is recommended that Government should enact regulations (monitoring agency) that will make sure people do not defecate in the river, do not dump refuse and waste materials from both domestic and industrial activities and this can be achieved through the organization of seminars/workshop from time to time to sanitize the populace on the need for personal hygiene the populace within Owerri municipal that make use of the water for domestic activities should endeavor to subject the water through purification processes before usage.

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