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RESEARCH ARTICLE

DETERMINATION OF MICROBIAL LEVEL OF ENVIRONMENTAL WATER USED FOR CONSUMPTION IN SELECTED AREAS OF EASTERN SENATORIAL DISTRICT OF KOGI STATE, NIGERIA

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ABSTRACT

The level of microbial activity in environment water used for consumption in Dekina, Anyigba and Ejule Districts in the Eastern Senatorial District of Kogi State were determined. Sample were taken from Agbano pond in Ejule, Kogi State University borehole, Anyigba, Oganaji River in Anyigba and Dekina River in Dekina. The physiochemical parameters such as particular matter, pH, Temperature and odour for each sample were taken. All samples were prepared using serial dilution. Colonies formation count was done using plate inoculation method at 37°c for 24 hours. The aerobic mesophilic for each sample was done using three media, (McConkey agar, M-endo agar and Eosin methylene blue agar). Sub-culturing were prepared for each sample and the Gram stain technique was used to determined the type of bacteria present in water. The catalase test were equally carried out. The results the rivers (Oganaji and Dekina) were highly polluted and contain more potent bacteria (Salmonella typhi) among others and hence pose a heavy health risk in the environment.

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INTRODUCTION

Water which is the most abundant and most important compound on the earth over the years. Access to portable water has become a key indicator for measuring life quality in nations across the world. The consumption of contaminated water had led to intake of certain microbial agents as well as toxic industrial and environmental pollutants. This situation had led to deadly water borne diseases such as cholera, typhoid fever, dysentery, diarrhoea, guinea worm, etc. Polluted water could also contain heavy metals, dirts, garbage, industrial waste etc, which make them unsafe to consume. The 2004 edition of Human Development Report indicates that 62% of Nigerian lack access to portable water. Microbial contamination were due to numerous factors such as dam storage containers, distribution system, soil erosion and other activities of man including refuge dump in marine areas, chemicals etc leading to diverse diseases (DC 1990; Nevando and Doete, 1999). However, the W.H.O. agreed on a minimum standard of portable water for all countries of the world. The problem of the study of this research work is to determine the level of pollution of environmental water and to identify the pathogenic microorganisms present that could be a risk factor to the consumption of the polluted water in our immediate environment.

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MATERIALS AND METHODS

Sample collection

Water sample collection sites were:

(i) Agbano pond in Ejule Village in Ofu LGA of Kogi State.
(ii) Oganaji River Located at Oganaji – Anyigba in Dekina LGA of Kogi State.
(iii)Borehole located at KSU Campus Anyigba in Dekina LGA of Kogi State.
(iv) Dekina River Located at Dekina town in Dekina LGA of Kogi State.

Samples were appropriately labeled, stored in sterile polythene plastic bag in the laboratory. They were ice – preserved for bacteriological analysis.

Methods

(i)Preparation of serial dilution

Ten test tubes containing 9.0ml of distilled water each were used and labeled. 1ml of the sample A was added to the first test tube. Mixed well and 1ml removed and added to the

second, and this was repeated until the tenth test tube. The same procedure was used for the second and third and fourth samples to obtain a serial dilution.

(ii)Plate inoculation

0.5ml of the prepared sample of each test tube was inoculated into a well labeled gelled nutrient, spread evenly and allowed to dry and incubated at 37°C for 24hrs in an invested position. The colony forming units in each Petri dish were counted and the result recorded, while necessary precautions were taken to avoid contamination.

agar, M-endo agar and the Eosin methylene blue agar. 0.5ml from the prepared water dilution were inoculated into each of the media and spread over the media. Inoculation was at 37°C for 24 hours after which the colonies count were taken and recorded.

(v)Sub-cuturing to obtain pure isolate

Portion of the sample were picked from each media after the mesophilic count and subjected to sub-cuturing using the same freshing prepared media for each at 37°c for 24 hours. To obtain a pure isolates which is now subjected to various characterization.

RESULTS

Table 1. Physicochemical properties of test water sample

S/No.	Samples/ code used	Place and date of collection	Physical appearance	pH	Tempe-rature (ºC)
1	Agbano pond (A)	Ejule in Kogi State 5/9/15	Particulate present odourless	7.60	34
2	KSU Borehole (B)	Kogi State University Campus 5/9/15	Clear, odourless and non-particulate	5.9	36
3	Ogananji River (O)	Anyigba town in Kogi State 5/9/15	Cloudy, turbid with odour particulate present	6.85	36
4	Dekina River (D)	Dekina town in Kogi State 5/9/15	Turbid with odour particulate present	7.30	38

Table II: Bacterial count using nutrient agar (Colony forming unit)

S/N	x10^{-4}				10^{-6}			
	a	B	C	Mean	a	b	C	Mean
1	245	229	237	237	216	220	212	216
2	139	153	143	145	119	140	122	127
3	219	260	247	242	122	118	129	123
4	242	246	232	240	221	243	208	224

Table III: Aerobic mesophilic count using differential media

S/N	Samples	EMB Agar				McConkey Agar				M-endo agar			
		a	b	c	Mean	a	b	c	Mean	a	B	c	Mean
1	Agbano pond (A)	18	19	20	19	189	193	191	191	138	132	135	135
2	KSU Borehole (B)	13	17	15	15	172	188	190	184	138	170	133	147
3	Oganaji River (O)	26	23	26	25	202	206	204	204	159	142	146	149
4	Dekina River (D)	27	22	30	23	204	209	202	205	148	160	146	151

Table IV: Biochemical characterization of pure isolates of test samples

S/N	Samples	Gram's stain reaction	Catalase Test	Inference
1	Agbano pond (A)	–	+	Pseudomonas
2	KSU Borehole (B)	+	–	E. coli
3	Oganaji River (O)	–	–	Salmollea spp
4	Dekina River (D)	–	–	Samollela spp

Table IV: Acceptable standard for consumable water

Category	Level of E. coli present	Remark
A	O E. coli count/100ml	Excellent
B	1 – 10 E. coli/100ml	Acceptable
C	10 – 50 E. coli/100ml count	Unacceptable
D	> 50 E. coli count/100ml (Cheesbrogh, 1984)	Grossly polluted

(iii) Determination of physical parameters

(a) Appearance: The appearance of the water were observed and the results recorded.
(b) Odour: The four samples were inhaled to note the odour and the colour if any.
(c) Temperature: This was measured using the thermometer for each sample and the results recorded.
(d) pH: This was achieved using the pH meter and the results were recorded.

(iv)Aerobic mesophilic count using differential media

Differential media were used to determined the total faecal or enteric bacteria count. Three media agar used were McConkey

(a)Gram – staining

Introduced by Christian Gram in 1884 and enable a clear division of bacteria into Gram negative and Gram positive. A drop of water was dropped on a clear slide and a colony was picked from the pure culture of each media using a wire loop, smeared and heat – fixed. It is flooded with crystal violet stain, allowed to stay between 10 – 60 second. Rinsed with distilled water gently and acetone was used to decolourize rapidly and washed with water. Safranire was used to cover the smear for 1 – 2 minutes and washed with water and air – dried and examined under the microscopic to check the staining at x10^{-4} and x10^{-6} respectively.

(b)Catalase Test

Colony were picked from each of the pure isolates using a wire loop on a slide. This was emulsified with hydrogen peroxide and examined for immediate formation of bubbles which indicate either a catalase positive or a catalase negative.

DISCUSSION

The physiochemical properties as shown on table I indicate that the Agbano pond has slightly alkaline (pH 7.4). It is a close environment along side the soil type while the Oganaji and Dekina River as slightly acidic (6.85 and 6.75); There are a lot of debris been packed by flowing river especially during the down pour of rain as well as erosion on the bank of the river. This situation also have effect on the temperature range as well as particulate matters that are predominantly present. The mean aerobic mesophilic count at $x10^{-4}$ is seen to be greater than the ones taken at $x10^{-6}$. The count seen at $x10^{-4}$ is relatively greater than that at $x10^{-6}$ for the four sample taken. The mean Aerobic mesophilic count at differential media was low for EMB – agar than that for McConkey agar and M-endo agar for the four samples. This been an indication of the ability for each of the agar to culture the bacteria cells. The present of Salmolla spp was established in the Oganaji and Dekina Rivers, a situation that is responsible for the high rate of typhoid fever, and other infection agents such as cholera, diarrhea, etc in the environment (Mackie and McCartney, 1991; Parry, 1992; Ogedeughe and Adeniyi, 1978). The activities of man, birds, animals in the river had immensely contributed to the pollution of these rivers with a consequent adverse effects on the health status of the consumers. The present study identifies water borne diseases prevalent in these areas. The present survey gives an insight into the problem, with a view that government will seen the need to provide portable water by building boreholes and dam in the environment to avoid an epidemic break out of a particular diseases that will claim many lives.

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