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Mycoflora and Water Quality index Assessment of Water Sources in Oproama, Niger Delta, Nigeria

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ABSTRACT: Mycoflora and Water quality index assessment studies of hand-dug wells and a river in Oproama Community, Niger Delta were studied. Water samples was taken from the ten sampling stations (7 wells and 3 river points) and water quality index using water quality index calculator given by National Sanitation Foundation (NSF) information system. The total heterotrophic fungal counts ranged from 1.58 x 10^2 ($\log_{10}$2.2000) to 3.22 x 10^2 ($\log_{10}$2.5091) cfu/ml and the identified mycoflora from the water sources include *Alternaria* sp., *Aspergillus niger, Aspergillus flavus, Fusarium* sp., *Mucor* sp., *Rhizopus* sp., *Penicillium* sp., *Rhodotorula* sp., *Saccharomyces* sp., and *Candida* sp. The water quality index of the water sources (31.96 - 47.31) falls within the classification "Bad" despite the slight increase during the dry season. The quality of water in the study area is poor and portends health risk; hence, effort must be made to complete the abandon water project in the community. © JASEM
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KEYWORDS: Water Quality Index, National Sanitation Foundation, Hand-dug well, River

INTRODUCTION

Water is essential to all known forms of life which supports life processes (Shiklomanov, 2000). Without water it would not have been possible to sustain life on this planet. We use water for various purposes and for each purpose we require water of appropriate quality. Consumption of water which has not met internationally acceptable standards could lead to an attack by water-borne such as cholera, typhoid fever and others (Udom et al., 2002). There is increasing awareness of the significance of fungi in drinking water (Hageskal et al., 2007). Fungi in drinking water are involved in the production of tastes and odours in water. Kelly et al. (2003) indicates that the fungal lipid, ergosterol can be responsible for the growth of fungi in water.

The water quality index (WQI) has been considered as one criteria for drinking water classification, based on the use of standard parameters for water characterisation. The objective of an index is to turn complex water quality data into information that is understandable and useable by the public (Kumar and Dua, 2009).

In Oproama Community, the only drinking water source is hand-dug wells of various depths; therefore it is noteworthy to establish the baseline status. The present study was therefore carried out to ascertain the mycoflora level and water quality index (WQI) of the water sources in Oproama Community.

MATERIALS AND METHODS

The study was carried out in Oproama Community in Asari-toru Local Government Area of River State. The community lies on latitudes 4° 47' and 4° 56' North and longitudes 6° 50' and 6° 41' East. The study area falls within the tropical equatorial zone dominated by dry season (November-March) and rainy seasons (April-October) and surrounded by Oproama River and tidal creeks and only accessible by sea. The Oproama River is salty, tidal and a tributary that originates from the New Calabar River

For the purpose of this study, ten (10) sampling stations were selected. Seven (7) hand-dug wells which are being used extensively for drinking and other domestic purposes and three (3) source points along the Oproama River were sampled monthly for twelve (12) months to cover both wet and dry seasons. The samples were collected in duplicate for mycoflora and physicochemical analysis. The mycoflora were isolated and identified according to Harrigan and McCance (1976) and Samson et al. (1981). The physicochemical parameters include temperature, pH, turbidity, total dissolved solids, nitrate, phosphate, dissolved oxygen and biological oxygen demand and were analysed according to APHA (1998). All the samples were then taken to the laboratory in a cold box for analysis within 24 hours.

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The National Sanitation Foundation WQI procedure according to Brown et al. (1970) was used to calculate the WQI. Eight parameters were analysed, namely, nitrate, pH, total dissolved oxygen, phosphate, biological oxygen demand, turbidity, total dissolved solid and temperature were considered for calculation of WQI proposed by NSF following the algorithm as given below:

Step 1: Calculate the water quality parameter value. Step 2: Calculate quality value (Q value) from the value function graph using a calculator (http://www.water-research.net/waterqualityindex/index.html) for each parameter. Step 3: Multiply the Q value by weight factor (Appendix 3) to get the parameter sub-index. The arithmetic mean of the data was used to calculate the WQI. Step 4: Compute the WQI from the sub-index and weight factor by dividing the sum of the sub-index of parameters by the sum of weight factors for these parameters. $Wi = \frac{(Wi)i}{\Sigma(W_t)i}$ as $\Sigma W_i = 1$,

For calculating WQI, the sub-index (SI) is first found out for each parameter which is $(SI)_{i} = q_i W_i$ and thus the formula which is $WQI = \frac{\Sigma(SI)_I}{\Sigma W_i}$

Therefore $WQI = \Sigma q_i W_i$ as $\Sigma W_i = 1$

RESULTS AND DISCUSSION

The results of the analysis of the hand-dug wells and river water samples in the study area are shown in Table 1.

The total heterotrophic fungal (mycoflora) count show a range of 1.47×10^2 cfu/ml (Station 10) to 2.93×10^2 cfu/ml (Station 6) indicating that river water samples (stations 8-10) recorded lower counts. The identified mycoflora from the water sources include *Alternaria* sp., *Aspergillus niger, Aspergillus flavus, Fusarium* sp., *Mucor* sp., *Rhizopus* sp., *Penicillium* sp., *Rhodotorula* sp., *Saccharomyces* sp., and *Candida* sp. The present investigation indicates that drinking water may be an important contributor to the transmission of wide variety of fungi to the water consumer. Several of the species have been reported to be active mycotoxin producers. The fact raises the question of potential mycotoxin production in water which need investigations into problem are merited.

Physicochemical characteristics are very vital water quality monitoring parameters due to their instability once water is extracted from its source (Horsfall et al., 2005). Significant variations in physico-chemical parameters affect the quality of a water resource.

The reading of temperature of the water samples revealed a range of 23.7°C to 26.3°C. Temperature is considered one of the most important environmental factors affecting growth and survival of microorganisms which ranged from 27-36.5°C.

The Dissolved Oxygen (DO) values of the water samples recorded the lowest value of 6.73mg/l (station 6) and the highest value of 8.53mg/l (station 1). The difference observed in DO may be due to solubility of oxygen in water; at high temperature the solubility of oxygen decreases, while at lower temperature it increases.

Table 1 shows the pH values of the water samples ranged from 5.32-7.23. Though pH has no direct effect on human health, nevertheless, high pH causes a bitter taste, makes pipes and appliances to become encrusted and depresses the effectiveness of chlorine disinfection.

The readings of nitrate concentration of the water samples ranged from 0.24-1.95mg/l are shown. Nitrates are strongly linked to the occurrence of blue baby syndrome otherwise known as infant methaemoglobinaemia (Powlson et al., 2008). WHO (2004) set an upper limit of 50 mg/l of nitrates for water meant for domestic consumption. In this study, low levels of nitrate were detected in all the samples.

The phosphate content of the water samples which ranged from 0.033-0.423mg/l. Generally, low values of phosphate concentration were recorded in the water sources (well and river). This may be because there are no prominent agricultural activities in the study area.

The results of the Biological Oxygen Demand (BOD) for the water samples ranged from 5.36-10.62mg/l. The overall quality of the water samples maybe considered doubtful.

Readings of Total Dissolved Solid revealed a range of 24.5-8545mg/l. The lower values observed during the study were found in well water samples which were within the stipulated value of 1000 mg/l by WHO (2004) for drinking water, hence, the water is not harmful in view of this.

Readings of turbidity as revealed in Table 1 which ranged from 4.97-40.12 NTU. Generally, the well water stations (1-7) are higher in turbidity than the river water stations (8-10) during the study period. The contributing factors of this high turbidity level are due to absence of well-casing, platform and runoff.

The water quality index of each station is shown in Table 2. The result reveals that the WQI values ranged from 39.76 (station 10) to 44.56 (station 8). Generally, the water from all the stations is classified as “Bad”. The seasonal water quality index (WQI) of each station is shown in Table 2. The wet season WQI values ranged from 31.96 (station 6) to 43.47 (station 8), while the dry season WQI values ranged from 36.97 (station 7) to 47.31(station 8). In this

study, the computed WQI values show that the overall water quality is classified as "Bad". The lower values of WQI show that the water is not very clear i.e., it is not free of any impurities all the sampling period. This means that the water needs some degree of treatment before consumption and it also needs to be protected from the peril of contamination.

Conclusion: The microbiological investigation indicates that identified mycoflora of the water sources included various potential pathogens which could be hazardous to health. The values of WQI in Oproama Community showed that water quality was "bad". Therefore, the abandon water project in the community should be urgently completed.

TABLE 1: Mycoflora and Physicochemical Parameters Analysis

Parameter	Station									
	1	2	3	4	5	6	7	8	9	10
Fungi (cfu/ml)	$2.13x10^2$	$2.36 x10^2$	$2.22x10^2$	$2.72 x10^2$	$2.19 x10^2$	$2.93 x10^2$	$2.20 x10^2$	$1.89 x10^2$	$1.54x10^2$	$1.47x10^2$
Temperature (°C)	23.7	25.1	25.1	24.9	24.7	24.9	25.1	25.9	26.2	26.3
DO (mg/l)	8.53	7.71	7.63	7.93	8.33	6.73	6.99	7.58	7.59	7.63
pH	5.40	5.88	5.32	5.40	5.62	6.16	5.43	7.09	7.17	7.23
Nitrate (mg/l)	1.95	0.60	0.42	0.29	0.36	0.37	0.67	0.38	0.26	0.24
Phosphate (mg/l)	0.033	0.078	0.111	0.08	0.113	0.145	0.133	0.126	0.296	0.423
BOD (mg/l)	10.08	7.42	6.28	9.01	10.62	10.52	10.50	5.36	8.68	8.11
TDS (mg/l)	130.67	55.67	55.92	36.0	24.58	155.92	125.0	8442.5	8545	5480.83
Turbidity (NTU)	4.97	35.94	18.69	15.18	15.31	25.83	40.12	12.58	19.26	20.78

TABLE 2: Water Quality Index (Wqi) of each Station

Station	WQI Value	Classification
1.	42.39	Bad
2.	41.8	Bad
3.	42.3	Bad
4.	41.69	Bad
5.	41.52	Bad
6.	41.5	Bad
7.	38.05	Bad
8	44.54	Bad
9.	41.61	Bad
10.	39.76	Bad

Water Quality Index Legend

Range	Quality
90-100	Excellent
70-90	Good
50-70	Medium
25-50	Bad
0-25	Very Bad

Source: http://www.water-research.net

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