ISSN: 1119-1104

PHYSICOCHEMICAL AND MICROBIAL ANALYSIS OF WATER FROM MIMYAK RIVER IN KANKE LGA OF PLATEAU STATE, NIGERIA

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(Received 24th June 2011; Accepted 1st September 2011)

ABSTRACT
The physico-chemical and microbial analysis of surface water from Mimyak river were carried out to determine its suitability for domestic consumption. Analysis was done using standard methods. The average results of physicochemical parameters are: pH (7.03 ± 0.17, 5.23 ± 0.17), turbidity (3.75 ± 0.79, 11.64 ± 5.75 NTU), TDS (0.17 ± 0.07, 0.57 ± 0.03mg/l), conductivity (94.50 ± 8.23, 142.75 ± 53.82µs/cm), Total alkalinity (44.50 ± 6.23, 106.75 ± 27.81mg/l), Total hardness (55.75 ± 6.87, 60.50 ± 21.90mg/l), sulphate (18.52 ± 4.60, 18.38 ± 4.53mg/l), phosphate (37.00 ± 9.23, 2.64 ± 0.90 mg/l), and chloride (7.090 ± 0.00, 7.090 ± 0.00mg/l) during rainy and dry seasons respectively. All the metallic elements analyzed are within the WHO standard limits with the exception of trace metals such as Pb (0.014 ± 0.001, 0.010 ± 0.005mg/l), As (0.010 ± 0.005, 0.020 ± 0.007mg/l), Cd (0.01 ± 0.005, 0.04± 0.011mg/l), Cr (0.06 ± 0.022, 0.030 ± 0.010mg/l) which are high. Also, the microbial analysis revealed the presence of *Salmonella and Shigella, staphylococcoci aureus* and *proteus* with E. *coli*, and *pseudomonas* species found only in some of the samples and thus, the water cannot be used as potable source of water.

INTRODUCTION
Water is very essential to the survival of all organisms. Human body is composed of approximately 70% water by mass (Enger and Smith,2004). Moreover, human metabolic activities take place in water solution(Whitney and Hamilton, 1984). This most important and life sustaining human drink is hardly found 100% pure in nature due to human activities and other natural factors (Nsi, 2007). Many diseases in developing countries are caused by drinking contaminated water (Tar et al, 2009). This is because dead vegetation, metal leachates from solid waste dump, leaching of rocks, sewage, industrial wastes and agricultural chemicals return eventually to the river by runoffs (Ademola, 2008).

Many diseases in the world today are caused by drinking polluted water and approximately 4 billion cases of diarrhea were reported in 2000 in developing countries (Wright et al, 2004). All this happens because of the inability of the government to provide good drinking water to people particularly the rural dwellers. It was also reported that over one billion people in the world lack access to safe drinking water and 2.5 billion people do not have access to adequate sanitation services(Tar *et al*, 2009). Hence the need for water quality studies to determine its potability for human use. Uzairu et al (2007) investigated the concentration of trace metals in water in Kaduna State, Nigeria. while Manilla and Njoku (2009) carried out physicochemical analysis of Nworrie river water in Owerri, Imo State, Nigeria. This research work aimed at examining the water quality parameters and microbial characteristics of this river as the only source of potable water for the inhabitants of the area.

MATERIAL AND METHODS
Materials
The samples container (one litre plastic container with a screw cap) were washed with detergent, leached with concentrated HNO_3, rinsed with distilled water until acid free and finally with the water source. Water samples were collected from eight different locations singly (at one kilometer interval) into the prepared containers manually. The containers were labeled with masking tape containing samples number, date and time and were kept in the laboratory refrigerator at 4°C prior the analysis.Samples for heavy metal analysis were preserved by adding 3 drops of concentrated Nitric acid (Manilla and Frank, 2009) The water samples for bacteriological analysis were collected in sterilized neutral glass bottles of 120ml capacity with stoppers and kept in the refrigerator pending the analysis.

Methods
Colour determination was done using Lovibond comparator while pH was obtained using digital pH meter. Temperature was measured with mercury in glass thermometer and turbidity was determined by Nephelometric method. Conductivity was measured with conductivity meter. Alkalinity, total hardness and chloride were determined by titrimetric method. Total solids, total dissolved solids were measured by Gravimetric technique (Wright et al, 2004). Sulphates were done by turbidimetric while metallic elements including heavy metals were analysed using AAS model VGB 210 system. Microbial analysis was carried out by pour plating method using serial dilution technique (manila and Frank 2009; Egboh and Emeshili, 2007).

RESULTS AND DISCUSSION

Tables 1, 2, 3 and 4, show the results for the physico-chemical, metallic content and microbial analysis of water collected from Mimyak River, to assess the quality of the water for domestic consumption.

DISCUSSION

The results for physiochemical analysis (Table 1) of the water show that the water is odourless and tasteless. This makes the water aesthetically acceptable (Egboh and Emeshili, 2007). pH of rainy season samples fall within the WHO (2006) tolerance limit of (6.5-8.5) while that of dry season is slightly acidic. Low pH value causes corrosion and this can lead to leaching of house hold common metals, affect aquatic life and increase the release of toxic and fowl smelling hydrogen sulphite (Adekunle and Mojisola, 2007). The turbidity value is high during the dry season (11.64±5.75NTU) when compared with the WHO tolerance limit (5.0 NTU). The conductivity value shows 94.50 ± 8.23µs/l during rainy season and 142.75 ± 53.82 µs/l at dry season. Phosphate values are high during rainy season (Table 2), this could be due to the use of phosphate based synthetic detergents or from agricultural effluents from farmland.

The water is fairly soft with sulphate and alkalinity being within WHO limit of (400 and 500). The concentrations of chloride (7.09 ± 0.00 mg/l) remain constant. This is due to the fact that chloride are the most stable component in water and are hardly affected by chemical or microbial activities in water. Table 3 shows low level of K, Na, Mg, Ca, Fe, Cu, Zn and Mn in the water. Pb [0.014 ± 0.001, 0.01 V 0.005], As [0.01 ± 0.005, 0.02 ± 0.01], Cd [0.01 ± 0.005, 0.04 ± 0.01] and Cr [0.06 ± 0.02, 0.03 ± 0.01] were observed to be above the recommended standard.

The microbial analysis (Table 4) revealed the presence of staphylococcus aureus, *samonella* species, *proteu, shigella* species, E.*coli* and *pseudomonas*. These organisms cause diarrhea, hemorrhagic diarrhea, typhoid fever and bacillary dysentery. Also,the table shows the presence of *Giardia lambia* in some few samples, a parasite known to cause Giardiasis.

All the water quality parameters examined for Mimyak river revealed that the water is fairly soft and contain moderately high amount of phosphate, lead, arsenic and Cadmium which are detrimental to the lives of both human and animals. Also some microorganisms were detected in the same samples. These harmful substances and microorganisms makes the water unsuitable for consumption

Table 1: Mean values of the physicochemical parameters of Mimyak River water

	Parameters						
Samples	Temp(°C)	Colour(Hz)	Odour	Taste	TS(mg/l)	Turb(NTU)	TDS(mg/l)
Rainy season	27.25±0.83	1.00 ±0.00	Unobj	Unobj	1.03±0.08	3.76 ±0.79	0.11± 0.07
Dry season	25.50 ±0.87	1.00 ±0.00	Unobj	Unobj	0.31±0.15	11.64 ± 5.75	0.57± 0.13

Unobj = unobjectionable, TS= Total solid, Turb= turbidity, TDS= Total dissolved solid

Table 2. Chemical parameters of Mimyak river water

	Parameters						
Samples	Conductivity (µs/cm)	Alkalinity (mg/l)	Chloride (mg/l)	Total hardness (mg/l)	pH	Sulphate (mg/l)	Phosphate (mg/l)
Rainy season	94.50	44.50	7.09	55.75	7.30	18.5	37.00
	±8.23	±6.23	± 0.00	± 6.87	±0.17	±4.60	±9.23
Dry season	142.75	106.75	7.09	60.50	5.23	18.38 ±	2.64
	±53.82	±27.81	± 0.00	±21.90	±0.17	4.53	±0.90

Table 3. Mean metal contents (mg/l) of the river water

	Elements											
Samples	K	Na	Mg	C a	Fe	Cu	Zn	Pb	As	Cd	Cr	Mn
Rainy season	0.02 ±0.01	0.18 ±0.04	0.01 ±0.06	0.05 ±0.02	0.34 ±0.12	0.30 ±0.17	0.02 ±0.01	0.014 ±0.01	0.01 ±0.05	0.01 ±0.05	0.06 ±0.02	0.13 ±0.03
Dry season	0.03 ±0.01	0.003 ±0.04	0.17 ±0.01	0.06 ±0.02	0.34 ±0.02	0.29 ±0.10	0.02 ±0.16	0.01 ±0.05	0.02 ±0.01	0.04 ±0.01	0.03 ±0.01	0.23 ±0.04

Table 4: Organisms identified in Mimyak River Water

Organism	Sample numbers Frequency	(%) occurence
Staphylocuccus aureus	4	26.67
Shigella species	3	20.00
Salmonella Species	2	13.33
Proteus species	2	13.33
Escherichia coli	1	6.67
Pseudomonas aeruginosa	1	6.67
Girdia lamblia	2	13.33

REFERENCE

Adekunle A.I. and Mojisola A.A. (2007). Physicochemical of well water in Minna and its environs, Niger state, Nigeria J of chem soc of Nigeria .32[2] pp 122.

Ameh E.G and Momoh A. (2006). Ground water quality assessment of parts of Benin city, J of of Enviroment studies volume 2 pp 7-10.

Ademola F.A. (2008). Base line heavy metals concentration in river sediment within Okitipopo southt east belt of the Nigeria bituminous sand field.J of chemical society of nigeria.33[2] PP29

Chessbrough M. (2000).Pseudomonas aerugunosa in district laboratory practices in Tropical countries. Part II. Published by Cambridge University press UK. Low price edition pp 193-194

Chessbrough M. (1985). Medical laboratory manual in tropical countries vol. II Microbiology, low price edition. Published by Butterworth and Co Ltd. PP253

Egesier, U.G, Egesier O. J and.Kolawole, J.A (2005). Studies on chemical quality of water from a community borehole in Nigeria. African J. of Nat. Sc. 8:61

Enger, E. D, and Smith B. F (2004). Environmental science. A study of interrelationship 9th ed. Mc Graw hill higher education pp355

Egboh E. H. O and Emeshih E.M (2007). Physiochemical characteristic of river Ethiope source in Umuaja, Delta state, Nigeria. J. chemical Soc. of Nigeria. 32 (2), 72.

Egbere O. J. (2008). Enumeration and isolation of microrganism; principles and practice of food microbiology pp 38-39.

Evan S. (2009). The tropical tank. www.thetropicaltank.co.uk

Manila P.N and Njoko J.O (2009). Chemical analysis of water and sediment of Nigeria river in Owerrii, Imo state, Nigeria. J. Chem. Soc. Nigeria 32 (2), 95.

Manilla P.N. and Frank O.M (2009). Lakes of the Niger Delta Flood plain I. Chemical Characteristics of five lakes (Akipe, Egbedidi, Esiribi, Aboh, and Egbinya) in Bayelsa State, Nigeria. Journ. Chem Soc. Nig., 34 (2), 44.

Nsi E.N (2007). Basic environmental chemistry. Return press limited pp126.

Tar A. I, Eneji I. S,. Ande S.O, Oketunden F.O and Ande R.S,Oketunde F.O and Shaaton R. (2009). Assessment of Arssenic in drinking water in Markurdi metropolis of Benue State, Nigeria. Journal of Chemistry Society of Nigeria, 34 (2), 56-52.

Uzairu I., Harrison G.F, Balaraba M.L and Nnaji J.C (2007). Concentration level of trace metals in the fish, sediment and water from Kubanni river, Northern Nigeria. 30th Annual International Conference of Chemical Society, Book Abstracts pp168 - 11.

Wright et al (2004). Household drinking water in developing countries. A systemic review of microbial contamination between source and point of use. Tropical Medicine and International Health 9, 106-107.

Whitney E.N. and Hamilton E.M. (1984). Understanding Nutrition. 3rd edition. Published by West Publishing Company, St Paul, New York. pp106-107.

WHO standard (2006). Guidelines for drinking water quality. S16.

The Readers digest great encyclopedia dictionary (1980). vol 1. 3rd edition. Published readers digest association Ltd. London.