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PHYSIOCHEMICAL ANALYSIS OF SOME PORTIONS OF LAKE ALAU, MAIDUGURI, BORNO STATE, NIGERIA

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ABSTRACT

Water samples from six (6) different locations (Lowojeri Man Cholmari Ngafate, Ngurmuri Awa Isari and Abbari) around Lake Alau were collected and analyzed for physical (temperature, conductivity, turbidity. Colour, pH and Alkalinity) and chemical (Lead, Cadmium, Manganese, Iron, Cobalt, Mercury, Nickel, Copper, Chromium, Zinc and Arsenic) respectively. Phosphate and sulphate levels were also determined.

Result showed varying values with respect to locations. The pH ranged between 7.6±0.3 to 8.45±0.50mg/l); Turbidity 6.0±0.80 to 12.3±6.NTU and Alkalinity 86.5±1.50 mg/1 to 95.3±1.50 mg/1 respectively. Similarly, results showed varying concentration values with location C (Nga fate) having the highest concentration of lead 0.60±0.30ppm, Arsenic 0.30±0.03ppm, Copper 0.54±0.32ppm. as against other locations. Also location B (Man Cholmari) showed high values 44.7±3.00mg/l and 804 98±1.40mg/l respectively thereby indicating high level of entrophication making the area not fit for aquatic. The results of other parameter examined tends to fall within the WHO recommended standard values.

INTRODUCTION

Water is probably one of the most important natural resources in the world and it plays a vital role in the development of communities, hence a reliable supply of water is an essential entity. Water is also a carrier fuel which serves to distribute nutrients and other essential of life (Nikoladge et al., 1994). Some metals are known to be essential to life, while others are toxic above certain levels in the environment. Notably, lead, chromium, nickel and Mercury represent potential or real public health hazard. However, even metals thought harmless, such as Iron, Chromium, Manganese, Cobalt and Zinc may prove to have subtle health effects not earlier recognized, (Henry, 1971). All water supply is essentially derived from precipitation and is said to be polluted if it is not of sufficiently high quality to be suitable for the highest uses people expect to make of it at present or in future (WHO, 1971; Wells, 1977; Sridhar et aL, 1980). Many causes of pollution resulting from heavy metals, strong acids, alkalis and organic compounds affect the environment and humans (Hammer, 1997; Howen, 1979; O'neil, 1983). Sewage and fertilizers containing nutrient such as Nitrate and Phosphorus in excess levels over stimulate the growth of aquatic plants and algae with resultant consequences to respiratory ability of fish and other invertebrate residing in the water. Similarly, in United Kingdom, Industrial effluents from referring, petrochemical, textile and paper mill companies reveal acute toxicity on the aquatic habitant. (Dalzell and Christofi, 1999). The complex interaction between water and life process is therefore fundamental to our need for suppliers of pure potable water, (Bartram and Ballaco, 1996).

METHODOLOGY

Sampling

Water samples were collected randomly at each of the six locations of the river. The samples were collected in already precleaned polythene containers with covers. Each sample container was properly labeled upon collection.

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Analysis

Physical analysis

(i) pH. The pH was determined on site by the use of an electrode pH meter.

(ii) Temperature: The temperature (°C) of all the sampled water was measured in situ by use of a graduated thermometer (0-360°C) range.,

(iii) Conductivity: The conductivity of the water was determined by the use of a standard conductivity meter (μs/cm)

(iv) Colour: Physical observation (vision) was employed in detecting the colour of the water samples.

(v) Alkalinity: This was determined by titrating a measured volume of sample with H_2SO_4. Since the pH was less than 8.3 a single titration was employed using methyl orange as the indicator. The methyl orange end point corresponds to the equivalent point of the following reaction

$2HC0_3^- + H_2S0_4 \rightarrow SO_4^{2-} + 2H_2C0_3$

This provided the total alkalinity of the water.

(vi) Turbidity: Turbidity was measured using the graduated turbidity meter (NTU) by use of a standard solution (Blank). The corresponding values of the instrument after sample was placed givens the actual turbidity of the water (NTU).

CHEMICAL ANALYSIS

(a) Elemental Analysis

Samples were subjected to atomic absorption spectrophotometric procedure (SOLAR 969 Model, Unicam) for the determination of the metals. The instrument was set at appropriate wavelengths current, flame types and then calibrated by the use of standard solutions for each metals (ASTM, 1980).

(b) Determination of some Ions:

Sulphates:

Sulphate values were determined by the precipitation method. The crucible precipitates was dried in an oven at 105°C to constant weight and the weight of the precipitation was obtained by subtracting the weight of the sintered glass crucible from the total weight.

$$S0_4^{2-} = \frac{MgBaS04 x 411.5}{Vs}$$

Where

mgBaS04 = Weight ofBaSC>4 in Milligram

Vs = Volume of sample taken for evaporation.

Phosphate

Calorimetric method was employed in the above'analysis. Mixture develops yellow colour on addition to ammonium molybdo - vanadate solution and absorbance recorded at 400 nm. Similar observations were recorded for blank and concentration of orthophosphate of the water was calculated. (ASTM, 1980).

P04 ' (mg/1) = A x calibration factor

Where A = absorbance.

Nitrates

Brucine method of analysis was employed. Standard solution were diluted and calibrated followed by the addition of 1 cm^3 of brucine -'sulphanilic acid reagent into each of the standard solution until colour develops. The absorbance was measured using cecil spectrophotometer at 410 nm. The resultant absorbance value were plotted against the corresponding concentration of NO'^3 and from calibration, via extrapolation, the concentration of NO' was deduced.

RESULTS

Table 1: Mean value of some physical characteristics of Lake Alau Water ofBorno State, Nigeria (March to April, 2005)

Location (X ± S.D)

Parameter	A	B	C	D	E	F	WHO Standard values
Ph	8.0±0.50	7.8±0.20	7.6±0.30	7.9±0.30	8.3±0.30	8.5±0.50	<8.0
Temp °C	28±1.50	26±2.5	27±2.0	25±0.8	28±1.5	27±1.3	25-28
Turbidity (NTU)	6.0±0.50	8.5±0.15	10.6±0.05	7.8±1.20	11.5±1.05	12.3±0.6	500
Conductivity ((is/cm)	180±0.50	160±1.5	170±2.5	180±1.5	160±2.5	180±3.5	500
Colour	Clear	Slightly Cloudy	Clear	Clear	Slightly Cloudy	Clear	Colouress
Total Alkalinity (mg/1)	93.5±0.50	92.3±1.36	90.6±2.05	95.3±1.50	86.5±1.50	94.3±1.30	250mg/l

Table 2: Mean Concentration of Heavy Trace Elements (ppm) in Water Samples of Lake Alau, Borno State, Nigeria (March to April, 2005)

Location X + S.D. (ppm)

Element	A	B	C	D	E	F	WHO Standard values
Zn	0.87±0.50	0.76±0.03	0.36±0.02	0.54±0.03	0.68±0.01	0.69±0.02	0.1-5.0
Mn	0.15±0.02	0.17±0.03	0.16±0.01	0.09±0.03	0.12±0.04	0.08±0.03	0.05
Cd	0.08±0.00	0.09±0.01	0.01±0.00	0.09±0.01	0.70±0.02	0.05±0.01	0.003
Hg	0.17±0.05	0.21±0.04	0.25±0.04	0.23±0.05	0.05±0.01	0.01±0.00	0.001
Pb	0.05±0.03	0.06±0.02	0.08±0.03	0.06±0.02	0.03±0.01	0.03±0.00	0.01
Fe	0.22±0.08	0.50±0.15	0.18±0.03	0.18±0.03	0.20±0.02	0.30±0.01	0.30
As	0.10±0.01	0.20±0.00	0.30±0.03	0.22±0.04	0.28±0.03	0.20±0.01	0.01
Cu	0.22±0.01	0.12±0.01	0.54±0.03	0.03±0.01	0.34±0.03	0,25±0.03	0.1-3.0
Cr	0.05±0.01	0.03±0.01	0.05±0.00	0.03±0.00	0.02±0.00	0.01±0.00	0.05
Co	0.01±0.00	0.01±0.00	0.02±0.01	0.02±0.01	0.03±0.00	0.02±0.00	0.01
Ni	ND	0.03±0.01	0.02±0.00	ND	ND	ND	0.001

Table 3: Mean Concentration of $SO4^{2-}$, $PO4^{3-}$ and $NO3^{-}$ (mg/1) of Lake Alau, Borno State, Nigeria. March to April, 2005).

Total Alkalinity (mg/1) 93.5±0.50 92.3±1.36 90.6±2.05 95.3±1.50 86.5±1.50 94.3±1.30 250mg/l

Location X + S.D (mg/l)

Ions	A	B	C	D	E	F	WHO Standard value (mg/1)
$SO4^{2-}$	88.5±1.15	98.5±1.40	86.5±1.50	93.8±1.50	88.5±2.30	96.5±2.05	250
N03-	30.5±1.60	30.5±2.18	22.4±1.90	32.3±3.0	28.6±2.5	30.5±1.90	45.00
POa^{3-}	22.7±1.00	44.7±3.00	20.3±0.80'	19.8±0.50	7.6±0.30	19.4±0.80	5.00

DISCUSSION

Results of analysis carried out showed varying values for both physical and chemical substances examined. Location A (Lowojeri) had highest concentration of Zinc (0.87±0.50), while location C (Ngafate) showed highest concentration of lead (0.80±0.03)ppm, Arsenic (0.30±0.03, 0.03), and Copper (0.54±0.03)ppm as against other locations. This could be due to high human activity at the areas. Also, location B (Man Cholmari) showed highest concentration of sulphates (98±1.40) [illegible] phosphate (44.7±3.00)ppm which suggest

Co 0.01±0.00 0.01±0.00 0.02±0.01 ... 0.01

high activity of algae in water resulting from washing (laundry) and other social activity in the areas. Thus, location B is not suitable for human use as well as aquatic life. But, all other locations examined showed results that conform to the WHO recommended standard value. This could hence be said to be suitable for aquatic and agricultural activities but needs further treatment for human consumption.

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