QUALITY ANALYSIS FOR HEAVY METALS, NITRATE AND AMMONIA IN RIVER GASHUA YOBE STATE

Yusuf. I[1], Gambo. N[2], Sule G.Tabita[3], & Ibrahim B. Binta[4].
[1&2]*Department of Chemistry Umar Suleiman College of Education Gashua.*
[3&4]*Preliminary Department Umar Suleiman College of Education Gashua.*
Emails: ibrazuby@yahoo.com, ibratimah74@gmail.com.

ABSTRACT

This study was carried out with river water of Gashu'a, water and aqueous sediment samples were collected from different points of the river and analyzed for heavy metals. A total of 16 water and 8 aqueous sediments samples were collected from 4 different locations Abattoir, bridge, behind prison and zango (Takari). All the samples were analyzed for heavy metals, such as Cu, Cd, Pb and Fe etc. using standard procedures, while nitrate and the ammonia where tested by Palin test method. The results obtained were compared with international standards. All the samples results obtained were within the recommended limits set by WHO (2010), as well as New Zealand (1000 µg/L) and US EPA (100 µg/L) maximum acceptable limits. The results of the present study have shown that river Gashua is free from heavy metals contamination. This study, therefore, recommends the government and other responsible authorities to take appropriate measures to ensure that the water is not polluted in future.

Key words: Copper, Cadnuim, Lead, Iron, Nitrate and Ammonia.

INTRODUCTION

Water is the supreme natural resources that occurs in our world and is vital for survival but the growth of new technologies and fast industrial development are accountable for aquatic pollution as well industrial effluents disturbs the plants and animals (Fatima and Usmani., 2013).Water covers 70 percent of the globe's surface, but most is saltwater. Freshwater covers only 3 percent of the earth's surface and much of it lies frozen in the Antarctic and Greenland polar ice. Fresh water that is available for human consumption comes from rivers, lakes and subsurface aquifers. (WHO. 1998)Water bodies such as canals are used in many different ways which include leisure, as well as fishing and wildlife. Water quality is generally poor particularly in urban areas due to the direct effect of past and present input of polluted waste found in the water. (Yahaya et al., 2012).Rural rivers have been related to water quality problems since the nineteenth century this has become a traditional practice to release unprocessed domestic and industrial waste into water channels (Rand. 2009).The quality of any body of water is assessed by the extent of pollution of the water. Pollution may arise from domestic, industrial as well as agricultural wastes that eventually find their way into a body of water (WHO. 2010). Chemical pollution arising from inorganic and organic pollutants, physical pollution which includes coloration and temperature changes are the three basic classification of water pollution. Besides the shortage, drinking water may be contaminated by different contaminants which have an impact on the health and economic status of the consumers (Anonymous, 1992).Although there are no systematic and comprehensive water quality assessment programs in the country, there are increasing indications of water contamination problems in some parts of the country. The major causes of this contamination could be soil erosion, domestic waste from urban and rural areas and industrial wastes (Li-feng., 2011). Heavy metals normally occurring in nature are not harmful to our environment because they are only present in very small amounts (Yahaya et al., 2012). However, if the levels of these metals are higher than the recommended limits, their roles change to a negative dimension. Human beings can be exposed to heavy metal ions through direct and indirect sources like food, drinking water, exposure to industrial activities and traffic (Ghaedi et al., 2005). The main goal of this paper is to determine the levels/concentration of some of the Physicochemical parameters and heavy metals (Cu, Cd, Pb, and Fe) in river Gashua to compare with national and international organization like (WHO) recommended standards values (WHO., 2008)

DESCRIPTION OF STUDY AREA

Gashua is a community in Yobe State in northeastern Nigeria, on the Yobe River a few miles below the convergence of the Hadejia River and the Jama'are River. Average elevation is about 299 m. The population in 2006 was about 125,000. The hottest months are March and April with temperature ranges of 38-40o Celsius. In the rainy season, June-September, temperatures fall to 23-28o Celsius, with rainfall of 500 to 1000mm.Gashua is one of the largest and most developed towns in Yobe State. Since 1976 it has been headquarters of the Bade Local Government Area. The Bade language is spoken in Gashua and in an area fanning out east and south of Gashua. Bade is one of seven languages of the Chadic family indigenous to Yobe State. The town lies near the Nguru-Gashua Wetlands, an economically and ecologically important ecological system. The town is the location of the court of Mai Bade, the Emir of Bade.

MATERIALS AND METHOD

All the reagents used were of analytical grade (Analar) and all the glassware used, containers and tools were washed with liquid detergent first, rinsed with 20% (v/v) nitric acid and finally rinsed with deionised water. The containers and glassware were kept in an oven at 105 0C until needed. Deionised water was used throughout the work.

FIELD METHODS

The samples in this study were collected from the river Gashua in Yobe state. Thus water samples and aqueous sediments were collected at some average distance. The samples (water and sediments) were collected from the months of November, December and January.

SAMPLES COLLECTION AND PREPARATION

A total of 16 water samples and 8 sediments samples were collected from different sampling points in the month of November, December and January respectively. The containers were first rinsed three times with the sampled water before formal collection. For all the samples collected, the water sample was dipped well below the surface of the water to collect the water sample and labelled appropriately. The physicochemical parameters including temperature, oxygen and percentage of saturation were measured at the sampling collection sites by the use of the multi - meter model (METTLER TOLEDO). The aqueous sediment sample was collected in a cleaned sediment white bucket container. The plastic containers were rinsed three times with the sampled water before formal collection of the sediments. The sediment was collected by the use of sediments grab and scoop into the container and then labelled A, B, C and D respectively. All the water samples collected from the river were refrigerated immediately on arrival from field while the sediments samples were kept in oven at a moderate temperature. Both the water samples and the sediments samples were analyzed using atomic absorption spectroscopy (ASS).

TESTS FOR NITRATE

A nitrate tube was filled to the mark of 20 ml with water sample and one level spoonful of nitrate powder and one nitrate tablet was added, the added tablet is not crushed. The screw cap was replaced and shakes well for at least one minute. The tube was allowed to stand for about one minute and gently overturn three or four times to help flocculation, the tube was allowed to stand for two minutes or more to allow complete settle down to occur. The screw cap was then clean around the top of the tube with a clean tissue. The clear solution was pour into the test tube, filling to the 10 ml mark. One nitricol tablet was added and crushed and allowed to dissolve. The solution was then allowed to stand for ten minutes this will allowed full colour to develop, and finally the sample was put into that 23 photometer for result in mg/l N. If the sample concentration is greater than 1.0 the solution was diluted by adding deionized water and multiplies result by 4. This procedure was repeated for all the water samples.

TESTS FOR AMMONIA

An ammonia tube was filled with water sample to the mark of 10 ml, Ammonia No 1 tablet and one Ammonia No 2 tablet was added, the tablet was crushed and mixes and allowed to dissolve. The solution was allowed to stand for ten minutes to allow the color to develop. A phot 4 photometer reading was used to measure the ammonia mg/l N. If the temperature is low the rate of colour development will become slow or if the temperature is below 20OC, then allow the solution for 15 minute to allow colour to develop.

RESULTS AND DISCUSSION

Table 4:1 Water Sample Collected at Abattoir.

ELEMENTS	SAMPLE A Con. In ppm	SAMPLE B Con. In ppm	SAMPLE C Con. In ppm	SAMPLE D Con. In ppm
Copper (Cu)	0.037	0.038	0.036	0.030
Cadmium(Cd)	0.024	0.026	0.026	0.031
Lead (Pb)	0.059	0.126	0.0128	0.125
Iron (Fe)	0.124	0.101	0.022	0.091

Table 4:2 Water Sample Collected Under Bridge

ELEMENTS	SAMPLE A Conc. In ppm	SAMPLE B Conc. In ppm	SAMPLE C Conc. In ppm	SAMPLE D Conc. In ppm
Cupper (Cu)	0.039	0.031	0.040	0.045
Cadmium (Cd)	0.028	0.020	0.021	0.041
Lead (Pb)	0.061	0.061	0.064	0.061
Iron (Fe)	0.072	0.054	0.050	0.064

Table 4:3 Water Sample Collected Behind Prison

ELEMENTS	SAMPLE A Conc. In ppm	SAMPLE B Conc. In ppm	SAMPLE C Conc. In ppm	SAMPLE D Conc. In ppm
Cupper (Cu)	0.040	0.041	0.041	0.044
Cadmium(Cd)	0.022	0.024	0.026	0.023
Lead (Pb)	0.051	0.052	0.050	0.054
Iron (Fe)	0.070	0.050	0.051	0.060

Table 4:4 Water Sample Collected at Zango (Takari)

ELEMENTS	SAMPLE A Conc. In ppm	SAMPLE B Conc. In ppm	SAMPLE C Conc. In ppm	SAMPLE D Conc. In ppm
Cupper (Cu)	0.048	0.050	0.049	0.051
Cadmium (Cd)	0.033	0.036	0.035	0.031
Lead (Pb)	0.036	0.030	0.038	0.041
Iron (Fe)	0.090	0.081	0.084	0.090

Table 4:5 Sediment Sample Collected Behind Bridge

ELEMENTS	SAMPLE A Conc. In ppm	SAMPLE B Conc. In ppm	SAMPLE C Conc. In ppm	SAMPLE D Conc. In ppm
Cupper (Cu)	0.050	0.051	0.052	0.056
Cadmium (Cd)	0.041	0.044	0.046	0.050
Lead (Pb)	0.040	0.042	0.041	0.042
Iron (Fe)	0.096	0.091	0.094	0.091

Table 4:6 Sediment Sample Collected at Zango (Takari)

ELEMENTS	SAMPLE A Conc. In ppm	SAMPLE B Conc. In ppm	SAMPLE C Conc. In ppm	SAMPLE D Conc. In ppm
Cupper (Cu)	0.049	0.050	0.049	0.052
Cadmium (Cd)	0.039	0.042	0.046	0.041
Lead (Pb)	0.046	0.044	0.042	0.043
Iron (Fe)	0.094	0.092	0.090	0.086

Table 4:7 Concentration of Ammonia (Mg/L) in River Gashua Collected at Four Locations

MONTH	SAMPLE A	SAMPLE B	SAMPLE C	SAMPLE D
November	0.12 mg/l	0.09mg/l	0.10 mg/l	0.08 mg/l
December	0.11 mg/l	0.12 mg/l	0.09 mg/l	0.08 mg/l
January	0.13 mg/l	0.12 mg/l	0.13 mg/l	0.11 mg/l

Table 4:8 Concentration of Nitrate (Mg/L) in River Gashua Collected at Four Locations

MONTH	SAMPLE A	SAMPLE B	SAMPLE C	SAMPLE D
November	1.26 mg/l	1.24 mg/l	l.24 mg/l	1.22 mg/l
December	2.00 mg/l	1.98 mg/l	1.96 mg/l	1.92 mg/l
January	2.22 mg/l	1.99 mg/l	1.96 mg/l	1.89 mg/l

DISCUSSION

Table 4:1, 4:2, 4:3 and 4:4 present the values of Copper, Cadmium, Lead and Iron analyzed from the month of November, December and January in four different locations of river Gashua. Highest heavy metal concentration was found for iron (0.124 ppm) (see table 4:1) followed by (0.090 ppm) in water sample (see table 4:4). All the concentration of the elements determined in water samples and the sediments does not exceeded the recommended values set by WHO and EU. However, the presence of copper in river water may be due to fertilizer application by farmers, septic tank system, industrial waste as well as food processing waste. (Bundy et al.2013). High level of copper may lead to chronic anemia (Acharya et al., 2008). In this study, the concentration of copper was found to be very low this could be due to low copper related industrial and mining activities in the sampling areas. The concentration was found to be below the permissible standard limit set by WHO (2008). Cadmium occurs mostly in association with zinc and gets into water from corrosion of zinc coated ("galvanized") pipes and fittings (danamark.com 2008). At higher concentrations, it is known to have a toxic potential. The main sources of cadmium are industrial activities; the metal is widely used in electroplating, pigments, plastics, stabilizers and battery industries (Nassef et al., 2006). Cadmium is highly toxic and responsible for several cases of poisoning through food. Small quantities of cadmium cause adverse changes in the arteries of human kidney. Lead (Pb) was found to be moderate in the river water sample. The high concentration of lead in river water could be due to lead battery-based unit. Although investigation has showed that there is no battery-unit present in the study area. The shortage of iron causes disease called "anemia" and prolonged consumption of drinking water with high concentration of iron may lead to liver disease called as haermosiderosis (Rajappa et al., 2010; Bhaskar et al., 2010). Table 4:7 present the values for ammonia in river Gashu'a for a period of three months November, December and January respectively. Highest value of ammonia could be seen in sample A which is close to the abattoir (0.13mg/l) and the lowest value could be seen in sample D (0.08mg/l) (see table 4:7).The high amount of ammonia concentration in water may be due to increase in pH that favors unionized (NH_3) and low pH favors ionized (NH_4^{+}) form. Ammonia in sediments may be due to bacterial decay of natural and anthropogenic organic matter that accumulates in sediment. Ammonia is especially prevalent in anoxic sediments because nitrification (the oxidation of ammonia to nitrite [NO_2 and nitrate [NO_3) is inhibited (Lin et al., 2011). Table 4:8 present the values for nitrate in river

Gashua for a period of three months respectively. From the table it could be seen that highest value of nitrate is (2.22 mg/l in sample A), while the lowest values could be seen as (1.22 mg/l) in sample D. Higher nitrate in river water may be due to uses of fertilizers by farmers, runoff from animal feedlots, waste water lagoon, industrial waste and leaking from septic tanks (Le-feng et al., 2011). The river Gashua is surrounded by famers where farming is being practiced throughout the (raining and dry seasons).

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