ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 5 No. 1a June 2019*

Physicochemical Properties of Some Hadejia-Nguru Wetland Tributaries Along Jigawa-Yobe Axes, Nigeria

[*1]S. E. Mohammed, [2]M. D. Saeed

Department of Chemistry,
Federal University Dutse Jigawa State, Nigeria
Email: saadatueri@gmail.com

Department of Pure and Industrial Chemistry,
Bayero University Kano, Nigeria

Abstract
The physicochemical properties of selected Hadejia-Nguru wetland tributaries were investigated using analytical test kits. The pH of water samples analysed gave a range of 6.9 to 9.0, conductivity 0.096-0.258mS/cm, alkalinity 38-232ppm, DO 0.2-9ppm, nitrates 0-1.8ppm, phosphates 0-2.2 ppm respectively. Most of the values showed compliance with USEPA (2002) and FAO/WHO (1985) with the exception of the water from Hadiyau (HA) and Marke which gave pH values of 9.0 and 6.9. The highest conductivity value recorded was 0.258mS/cm at Makintari (MR) which is higher than the USEPA 2002 but within the FAO 1985. DO has a highest value of 9.0 which is within USEPA (2002) limit; Nitrates were generally within the USEPA (2002) limits with phosphates having some values higher than the USEPA (2002) limit especially in the nearest sampling points of Ringim and Malamawar Yandutse. Pearson product moment correlation shows strong, positive correlation between temperature and conductivity, nitrate and phosphate, nitrate and dissolved oxygen, phosphate and dissolved oxygen with high r values of 0.968, 0.941, 0.763 and 0.723 respectively. There is also a strong but negative correlation between temperature and nitrate, temperature and phosphate, temperature and dissolved oxygen and nitrate and conductivity at r = -0.679, -0.620, -0.689, -0.640 respectively.

Keywords: Physicochemical properties, Hadejia- Nguru wetlands, ANOVA, Pearsons Product Moment Correlation

INTRODUCTION
Wetland is an area of land where the soil is saturated with moisture either permanently or seasonally and such areas may also be covered partially or completely by shallow pools of water. Water quality varies from place to place, with the seasons, and with various kinds of rock and soil which it moves through. Analysis of quality for some physicochemical parameters of water such as color, odor, pH, chloride, fluoride, nitrate, iron and presence of coliform bacteria etc. were conducted and many of the samples analyzed were found to have varying pH levels ranging from 4 to 7 (Deena, 2014). Some other parameters analyzed like turbidity, suspended solids etc. were also found to vary from sample to sample (Deena, 2014). Little or no attention has been paid to the physicochemical characteristic of

**Author for Correspondence*

the wetlands' water considering their use in agricultural and few domestic activities. Rural communities around wetlands use the water for domestic purposes including potable water, while large numbers of livestock are watered at the site, especially during the dry season (Adams, 1993). Heavy metals may also be introduced into the waters from decomposing vegetation and animal matter.

The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life (Oluduro and Aderiye, 2007). Waters from wetlands which are a form of natural water may contain impurities such as metals, faeces and chemicals (organic and inorganic) which could be introduced into the water by anthropogenic activities such as mining, farming and industrial processes (Ipinmoroti and Oshodi, 1993; Adeyeye, 1994).

In general, the quality of water is very important in addition to its quantity and availability. Its quality is of importance because in natural water bodies the quality of water determines and supports its biological composition and physico-chemicals parameters (Versari *et al.,* 2002). In addition, water quality plays a major role in structuring a community as it influences each stage of the life cycle of the individuals. (Ezra and Nwankwo, 2001). The quality of water is a function of its source and there are different sources of water. Natural sources of water include rain, spring, well, river, lake and sea. Rain water can accumulate in eroded soils (ditches) and low lands through flooding forming wetlands which play an important role in man's economic and traditional struggle for sustenance.

The common indicators for assessing water quality in Nigeria are temperature, pH, biological oxygen demand, turbidity, dissolved oxygen, ammonia, nitrogen and coliform counts as reported by Oluwande *et al.,* (1983). This paper assesses some physicochemical properties of selected tributaries of Hadejia-Nguru wetlands spanning between Jigawa and Yobe States which are basically used for irrigation purposes.

MATERIALS AND METHODS

Sampling frame and size

The sampling frame for this study comprised nine (9) local government areas (Ringim, Taura, Kaugama, Auyo, Hadejia, Kirikasamma, Birniwa, Guri and Nguru) which lie along the Hadejia-Nguru wetland axis. Owing to similarities in the edaphic and topographic conditions, agricultural practices and proximity of the sampling points to one another especially within each local government area, one (1) wetland was selected from each of the local government areas and the last two from Yobe state (Nguru) thus, giving a total of nine local government areas but ten (10) sampling points (Ringim, Malamawar 'Yan Dutse, Marke, Hadiyau, Hadejia, Makintari, Matara uku, Tukuikuyi, Dabar aro and Gadar goruba).

Sampling and sample analysis

Duplicate samples for physico-chemical analysis were also collected in dark colored 2- litre plastic containers and analysed as collected within 24 hours (Ademoroti, 1996; W. H. O., 2004).

The listed parameters: Alkalinity, dissolved oxygen (DO), NO_3^- and PO_4^{3-} were determined within 24 hours of sampling. pH, conductivity and temperature were measured on the spot for all the samples using portable field instruments: Elamotte smart 3 colorimeter and Hanna HI 9813-6.

The results obtained have been have been further analysed using descriptive and inferential statistics for better interpretation.

RESULT

fig 1: Descriptive statistics for physicochemical parameters of the water samples

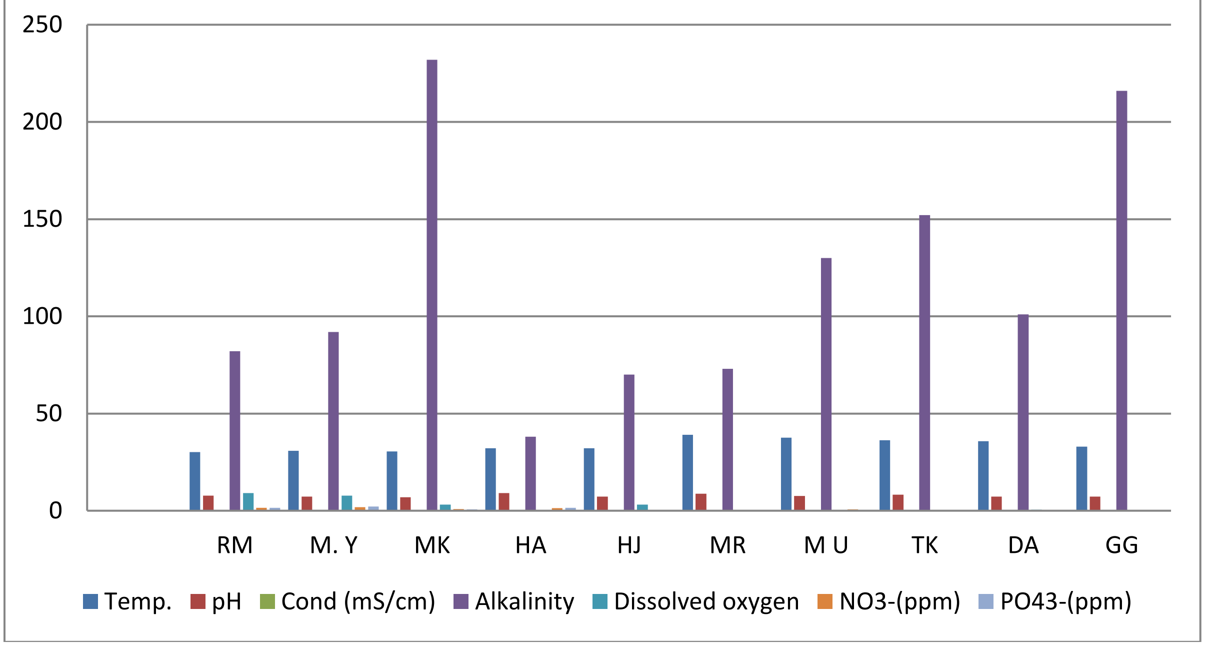

Table 1: Physicochemical parameters of the water samples

Sample ID	Temp. (^{0}C)	pH	Cond (mS/cm)	Alkalinity (ppm)	Dissolved oxygen (ppm)	NO_3^- (ppm)	PO_4^{3-}(ppm)
RM	30.1	7.7	0.096	132	9	1.5	1.5
M. Y	30.9	7.2	0.130	120	7.8	1.8	2.2
MK	30.5	6.9	0.126	232	3.1	0.8	0.6
HA	32.1	9	0.144	38	0.3	1.3	1.5
HJ	32.2	7.3	0.138	70	3.2	0.3	0
MR	39	8.8	0.258	73	0.4	0	0.3
M U	37.5	7.6	0.245	130	0.4	0.6	0
TK	36.2	8.2	0.240	152	0.3	0.1	0
DA	35.7	7.3	0.239	101	0.5	0.1	0
GG	33	7.3	0.140	216	0.2	0	0
WHO 1999	-	5-5.9		-	6.2-7	45	0.1
USEPA 2002 (Washington)	16-22	6.5-8.5	0-1mS/cm	-	9.5	-	-
FAO 1985	-	6.5-8.4	0-3(mS/cm)				

Table 2: Descriptive statistics for physicochemical analysis of the water samples

SAMPLE ID	Temp. (^0C)	pH	Cond (mS/cm)	Alkalinity (ppm)	Dissolved oxygen (ppm)	NO_3^-(ppm)	PO_4^{3-} (ppm)
RM	30.1	7.7	0.096	132	9	1.5	1.5
M. Y	30.9	7.2	0.130	120	7.8	1.8	2.2
MK	30.5	6.9	0.126	232	3.1	0.8	0.6
HA	32.1	9	0.144	38	0.3	1.3	1.5
HJ	32.2	7.3	0.138	70	3.2	0.3	0
MR	39	8.8	0.258	73	0.4	0	0.3
M U	37.5	7.6	0.245	130	0.4	0.6	0
TK	36.2	8.2	0.240	152	0.3	0.1	0
DA	35.7	7.3	0.239	101	0.5	0.1	0
GG	33	7.3	0.140	216	0.2	0	0
N	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Mean	**33.72**	**7.73**	**0.176**	**118.6**	**2.52**	**0.65**	**0.61**
S. D.	**3.147**	**0.709**	**0.062**	**64.019**	**3.316**	**0.672**	**0.821**
CV	**9.332**	**9.169**	**35.171**	**53.979**	**131.596**	**103.394**	**134.619**

Table 3: Analysis of variance (ANOVA) for physicochemical parameters of the water samples

Source of variation	Sum of Square	Number of groups	Df	Mean Square	F	F,critical	p value
Between groups	114273.79	7	6	19045.63	32.351	2.246	0.0001
Within groups	37089.181		63	588.717			
Total	151362.971		69				
Bartlett test			6		337.181	12.592	0.0001

Table 4: Pearsons product moment correlation for the physicochemical properties of the water samples

	pH	Temp	Alkalinity	DO	Nitrate	Phosphate	Cond
pH	-	.431	-.561	-.367	-.050	.099	.358
Temp		-	-.095	-.689	-.679	-.620	.968
Alkalinity			-	-.187	-.318	-.380	-.071
DO				-	.763	.723	-.679
Nitrate					-	.941	-.640
Phosphate						-	-.596
Cond							-

DISCUSSION

Descriptive statistics for the physicochemical parameters analysed in the water samples have shown a good summary of mean, standard deviation and coefficient of variation with most of the parameters giving high value of coefficient of variation and low values for standard deviation (Table 1). Analysis of variance ANOVA for the physicochemical parameters of the water samples show that the results obtained for the parameters analysed are significantly different at F (6, 63) = 32.351, p =0.0001 (Table 3). Pearson Product Moment Correlation for the physicochemical parameters of the water samples shows strong positive correlation between temperature and conductivity, nitrate and phosphate, nitrate and dissolved oxygen, phosphate and dissolved oxygen with high r values of 0.968, 0.941, 0.763 and 0.723 respectively. There is also a strong but negative correlation between temperature and nitrate, temperature and phosphate, temperature and dissolved oxygen and nitrate and conductivity at r = -0.679, -0.620, -0.689, -0.640 respectively (Table 4).

The pH of the water samples analysed gave a range of 6.9 to 9.0 (Table 1). These values showed compliance with USEPA (2002) and FAO/WHO (1985) permissible limits and also the findings of Suratman *et al*. (2014) with the exception of the water from Hadiyau (HA) which gave a pH value of 9.0. The general pH values of the waters showed neutrality and slight alkalinity. This is in agreement with the studies of Muwanga and Barifaijo (2006). The water from Marke (MK) is the most acidic with pH value falling slightly below the neutral cut off of 7.0 at 6.9. The fluctuations observed in the pH values may be due to slight changes in dissolved carbondioxide from the atmosphere or as a result of run offs from land which may have altered the pH, or decreased photosynthetic activity in the water (Table 1). W.H.O (2010) recommends a pH of 6.5-8.5 for fresh water and this shows that most of the water samples studied indicate good quality (Table 1). This is also the range for most drainage basins of the world (UNEP/GEM, 2007). These pH values are also in agreement with the findings of Oyem *et al*., (2014) and Afshin and Farid (2007) where inductively coupled plasma optical emission spectroscopy (ICP-OES) was used to estimate the levels of heavy metals.

Conductivity values obtained for the water samples at Matara Uku (MU) and Gadar Goruba (GG) were (0.245 and 0.140) mS/cm respectively. These values are in agreement with findings of Oyem *et al*. (2014) and than those obtained by Afshin and Farid, (2007). High fluctuations in temperature, dissolved oxygen and electrical conductivity were reported by Shib (2014) which corroborates the observations recorded in this research. Varying levels of dissolved oxygen, nitrates and phosphates were recorded by Mwegoha and Kihampa (2010) and these were found to be high at some sampling points.

Notable alkalinity values were recorded at RM (132ppm) and MY (120ppm). Alkalinity being the buffering strength of a water body against fluctuations in pH, the values obtained throughout the sampling sites has shown good buffering strength with only a few sites from HA, HJ and MR recording slightly lower values compared to those obtained at other sampling sites. The values obtained for alkalinity in this study are mostly within the UNECE (1994) standard of 20 to >200ppm (Table 1). Similar findings were reported by Shashikanth (2014) where total alkalinity was highest in Mogali wetland and lowest in Nelamachenhalli wetland.

The relationship among the physicochemical parameters of the samples throughout the study area has been pictorially represented. Alkalinity value for Marke (MK) is seen to be the highest followed by Gadar goruba (GG) as clearly shown in figure 1.

CONCLUSION

Based on findings of the research, the tributaries of Hadejia- Nguru wetlands studied show good physicochemical quality which makes the water suitable for most agricultural practices.

REFERENCES

Adams, W. M. (1993). Indigenous use of wetlands and sustainable development in West Africa. *The Geographical Journal*, 159:209.

Ademoroti, C. M .A. (1996). Standard Methods for Water and Effluent Analysis. Foludex Press Ltd., Ibadan.

Adeyeye, E. I. (1994). Determinations of Heavy Metals in Illisha Africana Associated with Water, Soil and Sediments from some Fish Ponds. *International Journal of Environmental Studies*, **45**: 231-240. http://dx.doi.org/10.1080/00207239408710898.

Afshin, Q. And Farid, M. (2007). Statistical analysis of accumulation and souces of heavy metals occurrence in Agricultural soilsof Khoshk river banks, Shiraz, Iran, American-Eurasian Journal of Agriculture and Environmental Sciences, 2 (5): 565-573.

Deena, M. J. (2014). Water Quality of Wetland Ecosystems - A sample study from Kozhikode District, Kerala, *Indian Journal of Applied Research*, **4** (10): 259-262. .

Ezra, A . G. and Nwankwo, D. I. (2001). Composition of phytoplankton algae in Gubi Reservoir, Bauchi, Nigeria. *J. Aquatic Sci*., **16** (2): 115-118.

FAO/WHO (1985). Food composition table for use in Africa, FAO and US Department of Education and Welfare, Bethseda, Maryland.

Ipinmoroti, K. O. and Oshodi, A. A. (1993). Determination of trace metals in fish, associated water and soil sediments from fish ponds, Discovery innovat., **5**: 135-138.

Muwanga, A. and Barifaijo, E. (2006). Impact of industrial activities on heavy metal loading and their physicochemical effects on wetlands of Lake Victoria basin Uganda, Afr. J. Sci. Tech. Sci. Eng.,7 (1), 51-63.

Mwegoha, W. and Kihampa, C. (2010) Heavy metal contamination in agricultural soils and water in Dar es Salaam city, Tanzania. African Journal of Environmental Science and Technology 4(11):763–769.

Oluduro, A. O. and Aderiye, J. (2007). impact of Moringa seed extract on the physicochemical properties of surface and underground water, *Int'l. Journal of Biological Chemistry*, 1: 244-249.

Oluwande, P. A., Sridhar, M . C., Bammeke, A.O. and Olubadejo, A.O. (1983) Pollution levels in some Nigerian Rivers. *Water Research*, **17**: 947-963.

Oyem, H. H., Oyem, I. M. And Ezeweali, D. (2014). Temperature, pH, Electrical conductivity, Total dissolved solids and Chemical Oxygen Demandof groundwater in Boji- BojiAgbor/Owa area and immediate suburbs, *research journal of environmental sciences*, 8 (8): 444-450.

Shashikanth, M. (2014). Status of Wetlands in Chikkbalapur distict.

Shib, A. (2014). Seasonal variations in physicochemical characteristics of Rudrasagar wetland- A Ramsar site, Tripura, North East India, *Journal of Chemical Sciences*, 4 (1): 31-40.

Suratman, Suhaimi and Hussein, N. A. R., A and Latif, Talib, M and Weston, Piawai and K., Dan and Kriteria, Kualiti and Air, Marin, Malaysia (2014). Reassessement of physicochemical water quality in Setiu Wetland, Malaysia Sains Malaysiana, 43:1127-1131.

UNECE (1994). Standard statistical classification of surface fresh water quality for the maintenance of aquatic life. In: readings in international environment statistics, United Nations Economic Commission for Europe, Unted Nations, New York and Geneva.

UNEP-GEMS/ water quality programme (2007): water quality data, GEMStat and open web services

U.S. EPA (2002) Methods for evaluating wetland condition: developing an invertebrate index of biological integrity for wetlands. Office of Water, U.S. Environmental Protection Agency, Washington, DC. EPA-822-R-02-019.

Versari, A., Parpinello, G.P., and Galassi, S. (2002). Chemometric survey of Italian bottled mineral waters by means of their labelled physicochemical and chemical composition, *Journal of food compo. Anal.*, 15:251-64.

World Health Organisation (2004). Guidelines for Drinking water Quality. 3rd Edition.

WHO, 2010. Guideline for drinking water quality, 3rd edition, World Health Organization, Geneva, Switzerland.