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Physico-Chemical Assessment On Quality Of Watari Dam Water, Kano State, Nigeria

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Abstract: ***This study evaluated the Physico-Chemical Composition of Watari Dam, Kano State. Monthly variation and composition of physico-chemical parameters of the river were studied for a period of ten months (May, 2012 – February, 2013). Physico-chemical parameters result showed monthly variations, where pH, temperature and Electrical conductivity means monthly values ranges between 6.1 – 8.0, 25 – 310C, and 61.0 – 77.0µohm/cm respectively. Dissolve oxygen (DO), dissolve solid (DS) and biological oxygen demand (BOD) mean monthly values ranged between 2.5 – 3.9, 33 - 49 and 2.0 – 4.1 respectively. While suspended solid (SS) and nitrate means values ranges between 2.2 – 5.8 and 20.4 – 27.0 respectively. Correlation matrix showed there was significant positive and negative correlation between physico-chemical parameters. The composition of DO, DS and BOD of in the river were affected by seasonal variations. Adequate monitoring of the water quality and regulation of anthropogenic activities in and around the basin are recommended in order to slow down the aging process of the dam and conserve it for a longer period.***

Keywords: Physico-chemical, Watari Dam, water quality

I. INTRODUCTION

Taking the planet earth as a whole, water is one of the most abundant commodities since it occupies about 70% of earth surface. Water is also essential for the well being of all living organism. Water is of vital importance to man for several reasons (Hulbert, 1999). Water is valuable as a carrier of man's domestic, agricultural and industrial wastes, impacting negatively on its physico – chemical qualities, affecting adversely the aquatic life and other communities making use of the water (Ogbonna *et al.,* 2006). Cheesbrough (2000) reported that the World Health Organization (WHO) estimated that up to 80% of ill health in developing countries are water and sanitation related. Olukosi *et al.,* (2008) reported that contamination remains a problem of global concern, contributing to high morbidity and mortality rates from water borne diseases. In Nigeria, some of the major sources of water are open and shallow wells, stream and even ponds (Garba *et al.,* 2009). Also livestock are reared within compounds and households and are allowed to roam freely in search of food. Hence, they serve as source of feacal contamination of water source (Tabakum *et al.,* 1996; Atiribo *et al.,* 2008).

The aim of this study is to investigate some Physico-Chemical water quality parameters of Watari dam water. The Dam was situated 1km from Bagwai and 8km south west of Bichi town in Kano state North Western Nigeria; with surface area 1,959 hectares, with active storage capacity of 92.74 million litres.

II. MATERIAL AND METHODS

The water samples from Watari dam were collected from two different stations in the morning hours between 9 to 11am, in a brown bottle for every month from May, 2012 to February 2013. The water samples were immediately brought into laboratory for the estimation of various physico-chemical parameter. Water temperature, pH and transparency were measured and recorded at the time of sample collection by using portable mercury in glass thermometer and pocket digital pH meter. Transparency was measured with the help of

sachi disc while other parameters such as Electrical Conductivity, Hardness, Dissolved Oxygen, Biochemical Oxygen Demand, Nitrate, Phosphate, Suspended Solids and Dissolved Solids were estimated in the laboratory by using standard methods as prescribed by Benett and David, 1974.

DATA ANALYSIS

Data collected were subjected to Pearson correlation coefficient and paired t-test to ascertain variation in physico-chemical parameters and the mean value of wet and dry season.

III. RESULTS

MONTHLY VARIATION IN PHYSICO-CHEMICAL PARAMETERS IN WATARI DAM

Table 1 shows that higher temperature (31°C) was observed in September and the temperature decreases (25° C) in December. The pH was high (8.0) in May and low (6.1) in December in site A. transparency had the highest value (0.99) in December and lower values (0.042 and 0.048) were recorded at site A and B in May. The Dam E.C was high (77.0) in site B in October and as low as 61.0 in November. Hardness value reached its peak (78.3) in July during the research period and reduced to 60.0 in December and January in site B and A respectively.

Month	Site	Temp	pH	Transparency	E.C	Hardness
May	A	28	8.0	0.042	66.2	61.0
	B	29	7.2	0.048	68.0	68.0
June	A	30	6.9	0.055	70.8	68.0
	B	30	7.4	0.049	69.0	65.0
July	A	28	7.9	0.067	65.4	78.3
	B	29	6.9	0.061	67.1	65.0
August	A	29	7.0	0.066	70.8	78.3
	B	30	7.5	0.054	63.0	64.0
September	A	31	7.6	0.09	64.6	68.0
	B	30	7.5	0.83	63.1	74.0
October	A	29	7.0	0.091	70.1	70.0
	B	30	7.0	0.096	77.0	70.0
November	A	28	6.6	0.96	65.0	62.0
	B	26	7.0	0.96	61.0	66.0
December	A	26	6.1	0.99	71.0	63.0
	B	25	6.8	0.94	69.0	60.0
January	A	27	7.0	0.92	73.0	60.0
	B	29	6.9	0.90	69.1	61.0
February	A	30	7.2	0.93	69.0	61.0
	B	31	7.0	0.91	71.0	61.0

Table 1: Physical Parameters of Watari dam at Bagwai Local Government Area Kano State

CHEMICAL PARAMETERS OF WATARI DAM WATER

Table 2 shows the highest to lowest values in mg/l in both sites (A and B) of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Nitrate, Phosphates, Suspended Solids (SS) and Dissolved Solids (DS); 4.1 in February to 2.5 in September, 4.1 in November to 2.0 in September, 30.4 in August to 23.0 in November, 2.8 in September to 1.6 in December, 5.8 in October to 2.2 in May and 49 in September to 33 in May respectively.

Month	Site	DO Mg/L	BOD Mg/L	Nitrate Mg/L	Phosphate Mg/L	SS Mg/L	DS Mg/L
May	A	3.1	3.0	24.3	1.7	2.6	33
	B	3.0	2.9	25.0	1.7	2.2	35
June	A	3.3	4.0	25.4	2.0	2.8	37
	B	3.2	3.0	24.0	1.9	2.4	39
July	A	3.7	4.0	27.0	2.6	2.4	39
	B	3.5	4.1	25.3	2.2	3.0	34
August	A	3.3	4.0	25.4	2.0	3.0	42
	B	2.9	2.4	30.4	1.9	2.2	44
September	A	3.1	2.0	20.4	2.6	2.6	49
	B	2.5	3.1	24.6	2.8	5.4	47
October	A	3.4	2.9	24.1	1.9	5.8	43
	B	3.1	3.0	25.0	1.6	2.9	43
November	A	3.3	4.1	23.0	2.6	2.3	47
	B	3.1	3.7	23.7	2.0	4.3	44
December	A	2.9	3.6	25.1	2.1	4.0	46
	B	3.0	4.0	24.7	1.6	4.5	40
January	A	3.2	3.3	23.0	2.0	4.7	39
	B	3.1	3.1	23.0	2.1	3.0	37
February	A	3.9	2.3	23.1	2.3	3.0	41
	B	4.1	2.9	23.0	2.0	4.1	39

Table 2: Chemical Parameters of Watari dam water at Bagwai Local Government Area Kano State

THE MEAN VALUE OF PHYSICO-CHEMICAL PARAMETERS OBTAINED DURING THE WET AND DRY SEASON AT THE SAMPLING SITE A AND B

Table 3 Shows the Mean values for all sites during the wet season (WS) and dry season (DS). Turbidity, EC, DO, BOD, SS and DS had the highest Mean value during the dry season. Temperature, pH, Hardness, Nitrite and Phosphates had the highest Mean value during the wet season.

S/N	Parameter	Site A		Site B		Mean for all sites	
		WS	DS	WS	DS	WS	DS
1.	pH	7.84	6.88	7.3	6.9	7.17	6.89
2.	Temp (^{0}C)	29.20	28.60	29.6	28.2	29.4	28.4
3.	Turbidity	0.24	0.78	0.21	0.76	0.23	0.77
4.	Hardness	69.24	61.4	68.2	62.0	68.72	61.7
5.	E. Conductivity	67.56	69.62	66.04	69.4	66.18	69.3
6.	DO (Mg/L)	3.30	3.34	3.02	3.28	3.16	3.31
7.	BOD (Mg/L)	3.40	3.24	3.10	3.34	3.25	3.29
8.	Nitrate (Mg/L)	24.5	23.66	25.86	23.88	25.18	23.7
9.	Phosphate (Mg/L)	2.18	2.18	2.10	1.86	2.14	2.02
10.	SS (Mg/L)	3.20	3.76	3.20	4.28	3.2	4.02
11.	DS (Mg/L)	40.0	43.2	39.80	4.06	39.9	41.9

Table 3: The mean value of physico-chemical Parameters obtained during the wet and dry season at the sampling site A and B

IV. DISCUSSION OF FINDING

TEMPERATURE AND pH

The temperature at the sites A and B showed a very close association from May to October and are stable from 28^{0}C to 30^{0}C. The period covered wet season. In December however,

the temperature at all the two sites dropped ranging from 26^0C in site A and 25^0C in site B. this was due to harmattan period in this part of the country where the weather condition becomes cold, windy and dusty. At site A the peak of the pH was recorded in May 8.0 while from June to October, the pH remain stable. At site B, the pH was at its peak in August and September 7.5, however, the pH fall to 6.8 in December. The pH value during the wet season was within the range of 6.9 – 7.9 in both site A and B. These corroborated with the findings of Maitland (1978) who reported that rain water dissolve atmospheric carbon (iv) oxide to form carbonate-bicarbonate-carbonic acid system which prevent change in pH of the aquatic environment.

ELECTRICAL CONDUCTIVITY TRANSPARENCY AND HARDNESS

This variation in electrical conductivity at site A and B was slightly similar. However, in October in Site B, the E.C was remarkably high (77.0). The rain brings volume of water and other material from many places noticeably inorganic fertilizer, pesticides and herbicide from farmlands into the dam, thus, increasing the concentration of dissolved substances in the water. Lowest value of transparency was recorded in wet season (May to September) due to water turbulence, accumulation of suspended solids and decomposition of waste from run offs as reported by Lin (1992). Kadem et al., also reported similar observation from Masoli reservoir Maharashtra district india. The highest value of hardness was recorded in August during the rainy season but dropped to 61.0 in October possibly due to dilution effect of rainfall. From November to January 2013 the values of hardness dropped again. Therefore, the readings recorded are within the limits of FEPA (1991) and WHO (2003) recommended limit of 350mg/L.

DISSOLVED OXYGEN (DO) AND BIOCHEMICAL OXYGEN DEMAND (BODS)

Dissolved oxygen concentration in all the two sites A and B appeared to be within the normal range. The reading showed little variation between July and February while September recorded lowest value of 2.5mg/L. December and January indicated greater similarity where they rise together due to mixing of surface water current and harmattan wind in the dry season. May and June had their BODs values close to one another between 2.9mg/L to 3.0mg/L. However, there was a sudden rise in Site A and B in July and August. This rise could be due to wash down of organic materials into the dam at the onset of rainy season. In September, the values fell again at all the sites, which correspond with the period of maximum rainfall during the year and hence, the highest dilution of the dam water.

NITRATE, PHOSPHATE AND SUSPENDED SOLIDS

The nitrate value across the two sites varied between 24.3mg/L in July at site A and 30.4mg/L at site B in August which could be due to inflow of agricultural waste into the dam during the rainy season. During the period of study the nitrate value obtain at two sites, does not exceed the FEPA (1991) and WHO (2003) guidelines of 50mg/L in water.

The values obtained in May for the two sites were 1.7mg/L. But there was an increase in the phosphate value from the month of June up to the month of September which may be as a result of fertilizer applied into agricultural lands, which are washed off into the dam water. The highest value was recorded in September in both sites (5.8mg/L) during the rainy season, but dropped to 2.3mg/L in October. The suspended solid values rose again in November up to February as a result of decomposed matter brought by rainfall and all the values exceed the WHO (2003) standard for drinking water throughout the study period (0.75mg/L).

DISSOLVED SOLIDS

The variation in dissolved solids at the two sites does not exceed the WHO standard. The final mean value at site A was 41.6mg/L and 39.2mg/L in site B. (WHO 2003 standard value is 500mg/L).

V. CONCLUSION AND RECOMMENDATION

CONCLUSION

The physico-chemical properties of Watari dam water were within the tolerable limit, no excessive value was recorded during the study period except for suspended solid which was found to be above the WHO (2003) guideline limit. The study also revealed some seasonal variations in the water quality parameters across the sampling station A and B.

RECOMMENDATIONS

- ✓ Adequate monitoring of the water quality and regulation of anthropogenic activities in and around the Dam are recommended in order to slow down the aging process of the river and conserve it for a longer period.
- ✓ There should be additional support for research in key areas of aquatic biology to expanding biological processes in aquatic ecosystem and their role in global change.
- ✓ The application of agro-climatic and limnological research to solve day-to-day problems like eutrophication should be encouraged.

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