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Assessment Water Quality at the Kiri Dam, Adamawa State of Nigeria

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ABSTRACT
Kiri dam was constructed on the river Gongola to supply the much-needed water for the projected 12000ha of land for the sugarcane cultivation on the typical soil of Lower River Gongola. The water quality in the dam was investigated. Water sample where collected at inlet, main dam and the canal and were analysed for physical, chemical and biological contamination. Increased anions and cations were found at the canal although most valves were within acceptable levels. Total coli forms increased by 17.1% and Escherichia coli counts increased by 15.7% at the canal. Water quality computations shows that the water quality is water was moderate for irrigation but unsuitable for human consumption.

Key words: Land –uses, environment, waste management water quality index.

I. INTRODUCTION:

Good sanitation and hygiene are important for good health, human survival and development. However, human activities have affected water quality in many rivers worldwide. Heller Kihampa et al.(2013). Concluded that the pangani River, Tanzania, had the worst water quality in the Moshi, Arusha and Kilimanjaro region, with the highest levels of Na+,K+,Mg2+,Hco3- and F-,the presence of these contaminations being as a result of human activities. Industrial water pollution has also been reported in many countries in Africa such as Lesotho. (Pullanikkatal and Urama 2011).and Ghana (Attua el al. 2014).

Change in surface water quality associated with changes in land use (Arnold and Gibbons 1996). Characterising changes in land use, coupled with increase population growth, has revealed the vulnerability of water quality in various catchments. The cleaning of natural vegetation and the transformation of natural land use into urban developments are known to increase runoff and sediment loads, which also facilitate the transfer of pollutants from land to water bodies. (Arnold and Gibbons 1996). A positive correlation between population density and deterioration in water quality was found along the Bagmati River, Nepal. (Bhatt el al.2014). Therefore, combine pressure of human population growth, inadequate treatment of human wastes and ineffective management of industrial and agricultural waste make it imperative continuous monitoring of water quality is implemented for the provision of clean and safe water quality for both human and agricultural purposes at the dam.

II. MATERIALS AND METHOD

The water samples where collected in plastic containers at three different of the dam Upstream, main dam and downstream of the dam and were then take to the lab for testing and analysis.

WATER QUALITY ANALYSIS

The water quality index (WQI) developed by brown et al (1970) was used. The WQI is calculate from a standard formula:

Where Qi= sub index for i-the water quality parameter;

Wi= weight association with i-the water quality parameter,

N= number of water quality variable. The WQI is determined as the weighted average of all water quality variables of interest, where 91-100 is excellent, 71-90 is goal, 51-70 is medium, 20-50 is bad and 0-25 is very bad water quality (Brown et al.1970).

III. RESULTS AND DISCUSSION

Physical water pollution

Mean values of the physical quantities in table 1. were compared with the standards of the world health organization. (WHO 2005).

Human settlements made the water less turbid, while at the canal of the dam, the accumulated pollution loads of the dam and runoff

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the flows into the dam contributed to the increased turbidity at the canal. The pH was within WHO standards except of canal where standards and water was alkaline 9.22. Total alkalinity increased to 880.83 at the canal.

MAJOR CATION POLLUTION

The major cation of calcium, magnesium, sodium potassium and iron were analysed (Table 2). Calcium cation concentrations at all sampling points were within WHO standards. Calcium cation concentration was low at dam inlet (0.81) The highest concentration were recorded at the canal (27.71) . Where pollution loads accumulated. Magnesium cation concentration were within WHO at all sampling points and the values ranged from 0.11 to 11.06 over canal where was 9.22. Magnesium cation concentration was found to be 7.58 . Potassium concentration increased from 0.60 upstream to 3.02 canal. Higher concentration was recorded at the canal where potassium. Cation concentration was 41.36. The concentration increased from 3.62 upstream to 4.34. However, all values of potassium and sodium are within WHO standards

MAJOR ANION POLLUTION

The major anion of bicarbonate, chloride, sulphate, nitrate and phosphate were analysed tables 4. Bicarbonate concentration increased canal. Chloride concentration were within WHO standard at all sampling points except canal When the concentration was 689.59sulphate concentration increases was within the WHO standard while iron concentrations increased from 0.5 upstream to 4.05 at the canal of the dam. Nitrate concentrations were within WHO standards, except the canal where nitrate concentrations of 27.36 was recorded.

LEVELS OF FAECAL COLIFORM AND ESCHERICHIA COLI.

Faecal coliform and E. coli levels were above WHO standards at all sampling points table 5. The lowest value of total faecal coliforms was found at upstream. The faecal coliform count was 3cfμ per at all sampling point and 4000cμ per 100 high heterotrophic bacteria levels were detected with value 20,000cfμ per 100.

Table l mean values of physical parameters of Kiri dam WHO water hardness standards: 0-75=soft water, 75-150=moderately hard, 150-300hard,>300= very hard.

Sampling point	Turbidity	pH	EC μS	TDS	TH	TAL	SS
Upstream							
Sp1	0.57	7.43	40	20	59.69	39.99	23.50
Sp2	13.05	7.70	130	65	160.42	86.89	71.50
Main dam							
Sp3	6.39	8.05	140	70	136.13	80.22	55.50
Sp4	15.60	7.69	140	70	125.00	91.01	33.50
Canal							
Sp5	9.20	8.15	140	70	127.50	116.15	96.50
Sp6	16.25	7.16	170	85	131.25	108.28	133.00
WHO (2008)Standard	5	6.5-	N	N	N	N	1

Table2.Mean values (SD in Parentheses of major cation concentration at sampling point of Kiri dam.

Sampling point					Total
Upstream					
Sp1	0.81	0.44	5.35	0.60	0.50
Sp2	10.47	3.88	16.05	3.02	4.05
Main dam					
Sp3	10.74	4.94	14.55	3.43	1.50
Sp4	10.20	4.16	17.05	3.86	1.48
Canal					
Sp5	9.83	4.31	15.75	3.62	1.37
Sp6	13.03	5.82	15.55	4.34	2.05
WHO 2008 Standard	100 -	N	NA	N	N

Table 3 Mean values (SD in Parentheses) of anion concentration () at sampling point at Kiri dam.

Sampling point	Dry	Dry	Dry	Dry	Dry
Upstream					
Sp1	39.98	50.189	4.86	1.01	0.18
Sp2	86.89	58.93	17.92	1.58	0.23
Sp3	80.22	60.55	18.02	2.27	0.21
Sp4	91.01	53.85	20.02	2.62	(0.26)
Canal					
Sp5	116.15	60.47	19.86	2.77	0.21
Sp6	108.28	53.07	18.18	1.40	0.20
WHO Standard	N	NA	NA	N	N

Table 5 Physical properties. Water quality index values, physical properties and water quality ratings at sampling points at the Kiri dam. Cfµ= colony forming unit, NTµ nephelometric turbidity unit.

Sampling point	pH	Turbidity (NTU)	Total Phosphates	Nitrate	E,Coli Cfµ100	Water Quality Index(%)	Water quality rating
Upstream							
Sp1	7.165	1.46	0.87	1.045	500	53.95	Medium
Sp2	7.45	320.0	0.87	1.735	3150	42.4	Bad
Main dam							
Sp3	7.726	30.67	0.85	2.06	1585	50.93	Medium
Sp4	7.395	54.27	0.94	2.545	4650	46.4	Bad
Canal							
Sp5	7.775	56.85	0.93	1.91	1586	48.87	Bad
Sp6	7.18	78.88	0.82	1.1)	3515	50.41	Medium

IV. CONCLUSIONS

This study revealed correlations between systems of land use and water quality and therefore calls for a holistic approach to management of the Kiri dam. The use of the WQI is useful in identifying pollution hotspots. This is a simple method that could be used by authorities of upper Benue Development Authority to determine the health of water bodies and does not need extensive analysis or large resources. It is recommended that full land use mapping be done to get information on land use changes over the years, to help improve future catchment management.

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