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Assessment of the Physico-Chemical Status of Water Samples from Major Dams in Ekiti State, Nigeria

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Abstract: The physico-chemical status of water samples from four major dams in Ekiti was assess for a period of three years (dry and wet seasons). Result showed that the physico-chemical parameters determined were higher in the dry season than wet season. The statistical analysis revealed that most of the physico-chemical parameters are significantly different except for temperature, conductivity and dissolved solid whose values are lower than the table value (0.4975 at P = 0.05). The value increased from one year to another. The result obtained fell within the maximum allowable limit set by United State Environmental Protection Agency and World Health Organization.

Key words: Water, dam, dry season, pH value

Introduction

The history of human civilization reveals that water supply and civilization are almost synonymous. Several towns, cities and communities have disappeared due to shortages originating from climatic changes. Millions of people all over the world, particularly in the developing countries are loosing their lives every year from water borne-disease (Dezuane, 1979). An understanding of water chemistry is the basis of the knowledge of the multidimensional aspect of aquatic environmental chemistry which involves the source, composition, reactions and transportation of water. The quality of water is of vital concern for mankind since it is directly linked with human welfare. It is a matter of history that faecal pollution of drinking water caused water-borne diseases which wiped out entire populations of cities. At present the menace of water-borne diseases and epidemics still looms large on the horizon of developing countries. Polluted water has been the culprit or cause in all such cases in which the major sources of pollution are domestic wastes from urban and industrial wastes (Asaolu, 1998).

Water quality characteristic of aquatic environment arise from a multitude of physical, chemical and biological interactions (Dezuane, 1979; Dee, 1989). The water bodies, rivers, lakes, dams and estuaries are continuously subject to a dynamic state of change with respect to the geological age and geochemical characteristics. This is demonstrated by continuous circulation, transformation and accumulation of energy and matter through the medium of living thing and their activities. The dynamic balance in the aquatic ecosystem is upset by human activities, resulting in pollution which is manifested dramatically as fish kill, offensive taste, odour, colour and unchecked aquatic weeds.

The over production of higher tropic levels biomass and the subsequent decay of dead plants could lead to oxygen depletion, death of aquatic organisms and development of anaerobic zone where bacteria action produce foul odours and bad tastes (EPA, 1976; Forstner and Wittman, 1979).

Ekiti State was created on 1st October, 1996 from the former Ondo State, with Ado-Ekiti as the state capital. The state inherited four major dams from the former Ondo State in quest to provide potable water for the teeming population of the state. Such dams are located in Ado-Ekiti (ureje), Gbonyin (Egbe), Moba (Ero) and Ikole (Itapaji) local government areas of the state. Water from these dams are being supplied to the public for domestic purposes. Since the establishment of the dams, there were no information concerning the physico-chemical status of water from these dams. This work is centered on the determination of the physico-chemical parameters in the water samples from the major dams in Ekiti State. The data generated would create environmental awareness for the state concerning the status of the dams.

Materials and Methods

Sampling: Representative water samples were taken below the water surface using one litre acid leached polythene bottles in all the dams (Ureje, Egbe, Ero and Itapaji) for the period of three years (dry and wet seasons). The samples were chemically preserved by the addition of 5 mL concentrated HNO_3 per litre of the sample.

Sample treatment: The temperature, pH, conductivity and dissolved solids of the water samples were determined on the spot using a thermometer, pH meter, conductimeter Hach model 4600 and TDS meter. Various standard methods (APHA-AWWA-WPCF, 1965; HMSO, 1986; USEPA, 1988) were used for the determination of other parameters.

Table 1: Physicochemical parameters of Water samples (Wet Season)

DAM	Year	pH	Temp. °C	Turbidity NTU	Cond-uctivity Ohm/cm	TDS mg/l	Chloride mg/l	Alkalinity mg/l	Dissolve oxygen mg/l	Free CO_2 mg/l	Acidity mg/l	Nitrate mg/l	Total Hardness mg/l
UREJE	2000	7.46	26.2	30	200	200	34	12.6	4.2	4.2	0.6	1.6	88
	2001	7.25	26.0	25	300	250	23	16.2	4.2	4.8	0.6	1.7	91
	2002	7.30	26.0	32	300	250	25	20.0	4.6	4.2	0.6	3.3	93
EGBE	2000	7.15	26.3	6.0	250	100	15.5	16.2	5.3	1.9	0.5	2.0	91
	2001	7.16	26.2	10.0	150	75	15.2	20.8	4.3	3.0	0.5	4.3	90
	2002	7.22	26.3	14.0	200	150	12.0	24.2	4.8	3.0	0.5	5.0	94
ERO	2000	7.14	26.6	12.0	200	150	15.0	13.8	4.4	3.6	0.5	3.2	90
	2001	7.45	26.2	13.0	200	83	18.0	15.5	4.3	2.9	0.6	3.0	84
	2002	7.35	26.1	28.0	200	150	17.2	20.2	4.4	2.9	0.6	4.6	85
ITAPAJI	2000	7.20	26.5	36.0	200	250	14.0	12.8	4.7	4.0	0.8	3.1	78
	2001	7.30	26.5	35.0	150	200	15.2	14.7	4.9	3.8	0.9	2.9	79
	2002	7.25	26.3	24.0	250	225	16.5	18.4	5.1	3.7	0.5	3.8	93
MEAN		7.3	26.3	22.1	216.7	173.6	18.8	17.1	4.6	3.5	0.6	3.2	88
SD		0.1	0.2	10.5	49.2	53.1	5.8	3.49	0.4	0.6	0.1	1.1	5.4
CV (%)		1.4	0.8	47.5	22.7	30.6	30.9	20.4	8.7	17.1	16.7	29.1	6.1

Table 2: Physicochemical parameters of the water sample (dry season)

DAMS	Year	pH	Temp °C	Turbidity NTU	Cond-uctivity Ohm/cm	TDS mg/l	Chloride mg/l	Alkalinity mg/l	Dissolved Oxygen mg/l	Free CO_2 mg/l	Acidity mg/l	Nitrate mg/l	Total hardness mg/l
UREJE	2000	7.86	27.0	25	150	175	33	15.4	6.8	2.3	0.8	1.4	91
	2001	7.80	27.0	24	200	200	26	16.2	4.5	3.0	0.7	1.5	96
	2002	7.88	27.0	26	215	200	28	19.7	5.0	3.6	0.8	1.5	96
EGBE	2000	7.70	26.8	6.0	200	100	15.5	18.2	5.3	1.9	0.5	2.0	91
	2001	7.50	26.5	8.0	200	100	14.3	18.7	4.7	2.4	0.6	3.2	93
	2002	7.72	26.9	11.0	250	175	16.3	22.2	5.3	2.8	0.7	4.3	97
ERO	2000	7.30	26.9	10.0	100	100	17.0	15.2	5.5	2.7	0.4	2.6	83
	2001	7.60	26.5	11.0	100	75	14.5	15.3	5.0	2.6	0.4	2.5	86
	2002	7.80	26.8	13.0	150	100	16.5	16.4	5.6	2.6	0.7	3.3	90
ITAPAJI	2000	7.60	26.7	30.0	100	200	16.5	15.2	6.0	3.2	0.9	2.8	81
	2001	7.40	27.0	31.0	100	150	17.6	15.0	5.2	3.0	1.0	2.4	83
	2002	7.60	27.0	20.0	175	150	18.2	16.0	5.8	3.1	0.6	3.3	89
MEAN		7.60	26.8	17.9	161.7	143.8	19.5	17.0	5.4	2.8	0.7	2.6	89.5
SD		0.7	0.2	9.0	52.8	41,7	6.0	2.3	0.6	0.5	0.2	0.7	4.7
CV (%)		10.0	0.8	50.3	32.7	29.0	30.8	13.5	11.1	17.9	28.6	26.9	5.3

Results and Discussion

The physico-chemical properties of water samples from Ureje, Egbe, Ero and Itapaji dams were presented in Tables 1 and 2 for dry and wet seasons respectively for the period of three years.

In all the dams, the pH values ranged between 7.14-7.46 with an average value of 7.3±0.1 for wet season and 7.30-7.88 with an average value of 7.6±0.7 for dry seasons. This implies that the samples collected during the wet seasons shows slight increase in acidity over the one of dry seasons. This might be due to the deposition of some organic matters into the water from run-off during wet seasons. Partial decomposition of organic matters by fungi and bacteria has been recognized to produced various organic acids that are capable of lowering the pH of aqueous solution (Bowen, 1979). The average seasonal pH of the water sample is favourable to aquatic life as pH 4.0-4.5 has been reported to be dangerous to aquatic life (ACS, 1969). The present results obtained for pH are similar to the results obtained by (Asaolu, 1999) in the water sample of Ondo State coastal water. Adeyeye and Abulude (2004) also have pH range between 5.90-7.60 when studying the assessment of some surface and ground water resources in Ile-Ife, Nigeria.

The temperature ranged between 26.0-26.5 with an average value of 26.3±0.2 for wet seasons while for dry seasons it ranged from 26.5-27.0 with an average value of 26.8±0.2. The temperature of the water samples during the dry seasons are slightly higher than those obtained fof the wet seasons (Tables 1 and 2), the result is similar to the one obtained by Asaolu (1999) when studying the physico-chemical parameters of the coastal water of Ondo state.

There is slight variation in most of the parameters from one season to another. In all the dams, it was observed that most values are higher in Ureje dam than the other dams. This might be due to the increase in the activities around the dam site due to population increase since the dam is situated within the state capital. Some physico-chemical parameters such as temperature and dissolved oxygen play vital roles in the rate of chemical reaction and the nature of biological activities, since these govern the assimilative capacity of aquatic system (EPA, 1976; Forstner and Wittman, 1979). Water hardness, alkalinity, pH, free CO_2 are some of the

Table 3: Statistical Summary of Table 1 and 2

	pH	Temp	Turbidity	Conduc-tivity	TDS	Chloride	Alkality Oxygen	Dissolve CO_2	Free	Acidity	Nitrate	Total hardness
Correlation	0.43	0.03	0.95	0.07	0.88	0.94	0.84	0.06	0.84	0.76	0.88	0.78
Regression	29.34	35.16	240.8	239.8	2071.0	211.3	267.0	6.4	56.6	4.55	34.2	875.6
C.A.	0.90	0.99	0.31	0.99	0.47	0.34	0.54	0.99	0.54	0.65	0.47	0.63
I.F.E (%)	10.0	1.0	69.0	1.0	53.0	66.0	46.0	1.0	46.0	35.0	53.0	37.0

I.F.E. Index of forecasting efficiency (%). C.A. Coefficient of alienation

important chemical characteristic that reflect the natural and quantity of waste in the different phases of a natural aquatic system (EPA, 1976). These chemical parameters because of their interrelationship enhance or depress the general physico-chemical conditions prevailing in the water system. This may play significant roles in the distribution of pollutants such as the heavy metals between the various components of the water body. A critical look at all the physico-chemical properties of the water samples from all the dams compared with the WHO (1999) standard indicates that the water samples fall within the stipulated range of acceptability'.

Table 3 presents the statistical analysis for the physico-chemical parameters for both dry and wet seasons for the four dams for a period of three years (2000-2002). The results show that most of the physico-chemical parameters are significantly different except for temperature, pH, conductivity and dissolved solid whose values are lower than the table values (0.03-0.07). The regression coefficient is between 6.4-875.6 which also indicates that the values were higher in the dry seasons than the wet seasons, the coefficient of alienation is between 0.31-0.99 with index of forecasting efficiency values between 1-100 which indicates that the reduction in the error of prediction between the seasons for most of the parameters are very high.

In conclusion, a critical look at the physico-chemical parameters of the water samples from all the dams and WHO standard indicate that the water samples still fall within the stipulated range of acceptability and hence the water can be treated for domestic purposes. There should be a constant monitoring of the physico-chemical parameters in future because of the increase in activities around the dams.

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