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A study of physico-chemical characterisation of Kanke Dam, Ranchi

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Abstract : The back water of river Potpoto is a prime source of water for Kanke Dam, located in Kanke of Ranchi district, have been studied to project the characteristics of water with respect to different pollution sensitive parameters i.e. organic pollutants- BOD, DO, COD, Inorganic pollutants - Electrical Conductivity, Turbidity, pH, total alkalinity, Chloride, Total hardness etc. The pH (7.68), total alkalinity (180.5 mg/l), Chloride (133.12 mg/l), Total hardness(139.83 mg/l), Calcium (60.26 mg/l) and Magnesium hardness (19.38 mg/l) were found well within the prescribed standard for drinking water (BIS10500:1991) during the study period i.e. December 2017- January 2020. The study inferred that the water quality of Kanke Dam is still free from the any kind of pollutants, must be due to its higher assimilative capacity. It also indicates the higher potential for pisciculture and drinking water sources (after disinfection) for the nearby villages which may ultimately improve the economic condition of the surrounding habitation.

Key words:Assimilative capacity, Kanke Dam, Dissolved oxygen, Physico-chemical characters, Water quality

INTRODUCTION

Kanke, is well known place of the capital of Jharkhand, Ranchi. It has a dense population. This area is facing severe water crisis in this year with underground water falling deeper than ever in the state with ponds and hand pump drying up in many areas, peoples are forced to depend the water tanks provided by Ranchi Municipal Corporation. Though in general the main causes of water scarcity are climate change accompanied with high temperature, low precipitation and loss of vegetation cover but every geographical area should have some inborn causes related to its origin, structure, geographical location and setup. Water is one of the most important natural resource available to mankind.

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For sustenance of life, the need for conservation of water bodies especially the fresh water bodies is being realized everywhere in the world. Lakes, rivers and reservoirs are most important water resources and used for several purposes. Physicochemical Analysis on Kanke Dam was aimed to assess the deterioration of water quality. A number of authors have studied the physical and chemical characteristics of some Indian water bodies.¹⁻¹⁸ The Characteristic feature of Ranchi Jharkhand is the presence of numerous lakes, ponds and reservoir which offer immense scope for fish culture practices. In the district Ranchi itself, there are three large lakes viz.; Getalsud Reservoir, Hatia Dam and Kanke Dam. Such a vast area water is presently in a state of deletion and neglect and warrants immediate attention of the fishermen if exploitation on scientific basis. Kanke Dam is formed at Potpoto River.

The lake, extending between the parallels 23°23'50" N latitude 85°18'15"E longitude cover an area of 182.10 hectares of perennial water. The objective of the study was to monitor the water quality of the lake with respect to its suitability for drinking water and pisciculture potential.

MATERIALS & METHODS

Monitoring of the Lake carried out twice in month during December 2017- January 2020 from 8 pre-identify locations following the standard sampling procedure.¹⁹ The samples were transported to the laboratory and analysis for the different parameters viz. Electrical conductivity, Turbidity, pH, BOD, DO, COD, total alkalinity, Chloride, Total hardness following standard procedure.²⁰

RESULTS & DISCUSSION

The physicochemical parameters of the Kanke Dam have been given in the table 1. The mechanism of controlling the chemistry of surface water has been discussed by Gibbs (1970)²¹. According to him there are three basic origins for chemical load of dissolved salts in surface water, atmospheric precipitation, rock weathering and crystallization. The temperature has greater role in the dynamic of aquatic ecosystem. In the present study both the atmospheric and water temperature fluctuated from 31.0°C to 34.6°C and 28.3°C to 30.0°C respectively at different studied sites. The variation in water temperature may be due to monitoring time and fluctuation in the weather conditions of the area.²² Temperature dictates the behavioral characteristics of organisms, solubility of gases and salts in water bodies. No other factor has so much influence as temperature.²³ The Electrical Conductivity (E.C.) ranged from 17.8 to 37.7 µmho/cm. The maximum values (37.7) were recorded in spring and minimum (17.8) in winter. The increase of E.C. is a indication of the enrichment of the ions in water bodies and may be due to natural sources or by the anthropogenic sources. Since no significant manmade contributor was noticed during the study which indicated that only natural sources imparting the variation that too not significant. Similar kind of observation has been recorded by Rajyalakshmi *et al.* (1988)²⁴ i.e. specific conductivity varied between 8.70 to 8.90 m mhos/cm in the ponds of Chilka fringe area indicating the high salt contents. The Turbidity of the lake water did not fluctuated significantly and remained under the prescribed limit i.e. 8.78 against the prescribed highest desirable of 5 NTU and maximum

permissible limit 25.0 NTU. The pH of the Kanke dam at most of the studied sites was more than 7.5 except at 2, 4 and 7 location. The pH and alkalinity goes hand to hand and are inversely proportional to water and air temperature. These are positively correlated to each other.²⁵ As per the water classification on the basis of pH water falls under the "A" class and is fit for drinking purpose provided all other parameters also fall under the class.²⁶ Rajyalakshmi *et al.* (1988)²⁴ recorded higher values of pH ranging from 8.3 to 8.9 in the ponds of Chilka fringe area. Wetzel (1975)²⁷ reported that the value of pH ranges from 8 to 9 in Indian waters. The pH of pond water was influenced by the monsoon, temperature and soil conditions. Dissolved oxygen (DO) concentration in the water bodies is a kind of indication of general health of lake. During this study the DO level was found more than 6 mg/l which showed a very good health of the lake i.e. under the "A" class of water as per the Water classification. DO level in the water bodies is temperature dependent. It also depletes as the organic load increases. Similar kind of study is also reported by Rajyalakshmi *et al.* (1988)²⁴ which indicated DO concentration ranging from 3.40 to 6.52 mg/l in the brackish water ponds of Chilka fringe area. Thampy *et al.* (1988)²⁸ observed that DO concentration fluctuated between 1.4 to 8.2 mg/l in the saline ponds at Cochin. Devaraj (1988)²⁹ noted concentration of DO from 3.7 to 8.2 mg/l. In the present study, the dissolved oxygen ranged from to 6.0 to 8.0 mg/l during the first year of study while during second year it ranged from 6.1 to 8.4 mg/l. Biochemical Oxygen Demand (BOD) is the key parameter which indicates the organic load of the water body or aquatic ecosystem. BOD in the study area varied from 1.16 to 2.1 mg/l during study period which indicates that the existing ecosystem do not have any significant source of organic pollution and existing system is capable of assimilating the organic load in case any pollution occurred. Similar finding has been projected by the Paramesher *et al.* (2012)¹⁵ at Kunigal lake in India. Chemical Oxygen Demand (COD) is a measure of oxygen equivalent to the requirement of oxidizing organic matter contents by a strong chemical oxidizing organic matter contents by a strong chemical agent. The COD test is helpful in assessing the toxic conditions and the presence of biologically resistant organic substances. The COD concentration fluctuated between 3.22 mg/l- 4.32 mg/l. The variation is not much. The COD data infer that no

chemically active substances are entering in the aquatic ecosystem which may alter the primary productivity of the system. The alkalinity of water is its capacity to neutralize acids; it ranged from the 153 mg/l to 200 mg/l which is well within the desirable level of alkalinity for drinking water assigned by BIS (1991)³⁰. Rajyalakshmi *et al.* (1988)²⁴, Gupta *et al.* (2008)³¹ and Parameswara *et al.* (2012)¹⁵ reported similar observation in the Kunigal Lake in Tumkur district, Karnataka of the India. The Chlorides occurs naturally in all types of water and waste water

forming a major inorganic anion. In the present study the values ranged from a minimum of 115 and maximum.164 mg/l. Similar findings are projected by the Singh *et al.*, (2011)³² for Kodaikanal Lake (Dindugal District), in India. Calcium and Magnesium were the dominant cations in the lotic aquatic ecosystem.³³ Calcium concentration was minimum of 52.5 mg/l to the maximum of 75.7 mg/l and the magnesium concentration of the present study is ranged from 13.1 mg/l to 26.8mg/l and present observation is in line with the reports of Kumar *et al.* (2006)³⁴.

Table 1. Physico-chemical parameter of water quality of Kanke Dam

Parameter	Unit	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII	Mean	SD
Atm.Temp.	°C	32.4	33.6	34.2	33.8	32.4	39.6	33.2	31	33.15	1.17
Water Temp.	°C	29	28.4	29.5	28.5	30	29.2	28.7	28.2	28.93	0.61
EC	µmhos/cm	32.3	37.7	30.8	17.8	24.5	18.8	28.2	33.2	27.91	7.055
Turbidity	NTU	6.4	7.4	6.74	8.78	7.24	8.6	6.5	8.23	7.49	7.055
pH		7.97	7.35	7.88	7.48	7.89	7.97	7.39	7.57	7.68	0.943
DO	mg/l	7.17	6	6.81	7.56	8.5	6.72	6.36	8.55	7.21	0.666
BOD	mg/l	1.58	1.16	1.74	1.78	1.43	2.1	1.71	1.28	1.59	0.302
COD	mg/l	4.32	3.67	3.32	4.12	3.34	3.86	4.1	3.22	3.74	0.42
Total Alkalinity	mg/l	165	186	155	205	187	193	153	200	180.5	20.2
Chloride	mg/l	120	115	117	145	164	134	142	128	133.12	16.74
Total Hardness	mg/l	75.0	70.4	77.5	79.3	78.0	100.0	89.0	76.0	80.65	9.42
Ca+ Hardness	mg/l	57.6	52.8	58.5	52.5	60	67.5	75.7	57.5	60.26	7.789
Mg+ Hardness	mg/l	17.4	17.2	19	26.8	18.3	24.4	13.1	18.5	19.38	4.291

CONCLUSION

The present study concluded that the characteristics of Kanke Dam is maintained with respect to the studied physico- chemical parameters and the water resources may be utilized for the propagation of the pisciculture at commercial scale which may uplift the economic status of the nearby habitation apart from the irrigation and drinking water source (after disinfection).

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