



Assessment of Freshwater Quality of Angoori Reservoir, District Datia, Madhya Pradesh

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ABSTRACT

Angoori reservoir is a small man-made reservoir located in District Datia, Madhya Pradesh. It was constructed on Angoori nalla in the tributary of Pahuj River. The reservoir is used for different purposes like irrigation, fisheries and drinking water supply to Datia city. The physico-chemical characteristics of Angoori reservoir water were analysed from January 2009 to December 2009. During this period, the monthly variation in water temperature, pH, total dissolved solids, DO, free carbon dioxide, alkalinity, total hardness, chloride, BOD, COD, sodium, potassium and electrical conductivity of the water samples were recorded from the four sampling stations.

INTRODUCTION

The importance of freshwater bodies for human habitation is well known. This is a prime natural resource, a basic human need and a precious national asset. It is very important that they are put to maximum use and are subjected to appropriate planning, development and management. Unfortunately, the water resources are not only decreasing in size but also getting more and more polluted, and thus, becoming less suitable for various uses. Development of industrialization, urbanization and developmental activities and population explosion have brought inevitable water crisis. The health of lakes and their biological diversity are directly related to health of almost every component of the ecosystem (Ramesh et al. 2007). Angoori reservoir is a small man-made reservoir situated in District Datia at longitude 78°28'E and latitude 25°38'N. The catchment area of the reservoir is 162 sq.km and has the capacity of 2.55 million cubic meters, while live capacity is 2.05 million cubic meters. Maximum water level is 235.60 sq.km. The reservoir has submerged area of 197 hectares. The gross command area is 57683 hectares. The reservoir is an important unit for irrigation, fisheries and drinking water supply in Datia district. About 246 villages are benefited from this reservoir. So far no physico-chemical study has been made on this reservoir, and the present study is aimed to find out the detailed characteristics of the reservoir

on the basis of the location, seasonal variation, and physico-chemical characteristics of the water.

MATERIALS AND METHODS

The surface water samples were collected in plastic bottles from Angoori reservoir from four sampling sites namely A, B, C, and D from January 2009 to December 2009. Samples were collected between 8:30 a.m. and 9:30 a.m. and were transported to the laboratory immediately for physico-chemical tests. Temperature, pH and electrical conductivity were measured at the sites.

The chemical parameters such as dissolved oxygen, total hardness, chloride, free carbon dioxide, alkalinity, TDS BOD and COD were estimated by the methods as outlined by APHA (1998), Trivedy & Goel (1986) and Adoni (1985). Values of various parameters were compared with BIS standards.

RESULTS AND DISCUSSION

Monthly variations in physico-chemical characteristics of reservoir water are given in Table 1, and the correlations between various parameters in Table 2.

Temperature of water is the an important physical parameter of any water reservoir which regulates the natural processes in environment. The present study showed

Table 1: Monthly physico-chemical characteristics of Angoori reservoir during 2009.

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	mean	range	BIS value Desirable Permissible
Temperature	19.50	20.15	22.65	28.20	29.65	27.90	27.38	27.95	25.60	21.23	20.18	17.85	24.02	17.85-29.65	
EC	234.3	231.1	214.6	245.7	229.0	225.9	230.9	224.1	246.2	226.7	223.0	239.2	230.9	214.6-246.2	1000
pH	7.50	7.35	7.45	7.45	7.80	7.75	7.35	7.48	7.58	7.55	7.65	7.55	7.54	7.35-7.80	6.5-8.5
DO	8.25	8.30	6.80	6.50	6.20	6.10	7.05	4.10	4.40	4.10	5.80	7.40	6.25	4.10-8.30	4.00-6.00
Alkalinity	123.0	128.0	111.8	147.0	152.0	170.0	142.0	121.0	116.0	123.0	115.0	126.0	131.23	111.8-170.0	200-600
T. Hardness	153.3	125.8	120.8	94.0	102.5	58.8	105.0	120.0	119.8	118.3	152.0	155.0	118.75	58.8-155.0	300-600
Chloride	25.3	25.0	26.0	33.0	40.5	50.5	19.6	20.5	24.0	25.5	30.5	23.5	28.68	19.6-50.5	250-1000
Free CO ₂	22.0	22.0	28.6	30.8	46.2	55.0	39.6	35.2	33.0	28.6	26.4	19.8	32.26	19.8-55.0	
TDS	133.0	132.6	151.0	156.8	163.1	172.4	130.0	141.7	152.7	145.6	135.0	131.8	145.5	130.0-172.4	500-1000
BOD	2.8	2.1	3.4	4.3	4.8	3.4	2.5	1.4	1.4	1.7	2.9	2.8	2.78	1.4-4.8	5.00-6.00
COD	15.9	13.5	21.1	27.2	26.6	34.7	15.9	15.0	12.0	20.9	15.8	13.8	19.34	12.0-34.7	
Na	13.2	14.0	14.1	14.6	14.4	15.4	13.6	9.9	14.4	14.0	15.6	13.4	13.86	9.9-15.6	
K	26.5	30.4	29.3	30.9	30.6	30.8	19.6	17.0	17.6	28.5	29.3	28.6	26.58	17.0-30.9	
Sulphate	14.5	11.2	7.7	7.2	6.5	5.8	9.1	9.2	10.7	11.7	11.4	12.7	9.80	5.8-14.5	200-400
Nitrate	0.4	0.4	1.1	1.2	1.4	1.2	1.0	0.8	0.7	0.6	0.5	0.4	0.81	0.4-1.4	45-45

All parameters are in mg/L except pH and EC (μmho); Temperature ($^{\circ}\text{C}$)

Table 2: Correlation matrix for water quality of angoori reservoir 2009.

	Temp	EC	pH	DO	Alk	TH	Cl	F CO ₂	TDS	BOD	COD	Na	K	SO ₄	NO ₃
Temp	1	~	~	~	~	~	~	~	~	~	~	~	~	~	~
EC	-0.099	1	~	~	~	~	~	~	~	~	~	~	~	~	~
pH	0.246	-0.099	1	~	~	~	~	~	~	~	~	~	~	~	~
DO	-0.382	0.074	-0.319	1	~	~	~	~	~	~	~	~	~	~	~
Alkalinity	0.614	0.132	0.399	0.144	1	~	~	~	~	~	~	~	~	~	~
T. Hardness	-0.795	0.037	-0.255	0.227	-0.802	1	~	~	~	~	~	~	~	~	~
Chloride	0.405	-0.107	0.760	0.003	0.765	-0.655	1	~	~	~	~	~	~	~	~
Free CO ₂	0.831	-0.179	0.545	-0.320	0.768	-0.862	0.688	1	~	~	~	~	~	~	~
TDS	0.658	-0.023	0.641	-0.356	0.602	-0.790	0.813	0.748	1	~	~	~	~	~	~
BOD	0.329	-0.027	0.415	0.381	0.571	-0.332	0.652	0.338	0.491	1	~	~	~	~	~
COD	0.541	-0.177	0.533	0.533	0.795	-0.798	0.882	0.712	0.839	0.689	1	~	~	~	~
Na	-0.090	0.101	0.394	0.202	0.298	-0.224	0.568	0.159	0.350	0.474	0.408	1	~	~	~
K	-0.262	-0.173	0.311	0.444	0.330	-0.101	0.594	-0.057	0.278	0.669	0.556	0.616	1	~	~
Sulphate	-0.826	0.224	-0.308	0.206	-0.648	0.857	-0.621	-0.801	-0.783	-0.553	-0.756	-0.190	-0.167	1	~
Nitrate	0.842	-0.131	0.357	-0.149	0.646	-0.776	0.584	0.781	0.770	0.691	0.764	0.196	0.150	-0.926	1

variation in the temperature from 17.85 $^{\circ}\text{C}$ to 29.65 $^{\circ}\text{C}$, the minimum temperature in the month of December and the maximum in the month of May.

Electrical conductivity measures the capacity of a substance or solution to conduct electrical current. By conductivity parameter, the variation in the natural concentration of ions present in water could be explained. The electrical conductivity in the present study fluctuated between 214.6 μmho to 246.2 μmho .

pH of water is an important environmental parameter that determines the suitability of water for several purposes. In the present study, the pH of water ranged from 7.35 to 7.80. The maximum pH value of 7.80 was recorded in the month of May, and minimum of 7.35 in February and July. The

water body was found to be slightly alkaline.

Dissolved oxygen is an important factor of water bodies. It regulates many metabolic activities of aquatic organisms. Dissolved oxygen concentration more than 5.00 mg/L favour growth of flora and fauna. Das (2000) found an increase in DO from 3.00 to 6.00 mg/L in Kandhar Dam (Surve et al. 2005). In the present investigation, however, the dissolved oxygen was recorded from 4.10 to 8.30mg/L. It was minimum in the month of August and October, and maximum in the month of February.

Alkalinity may be due to the minerals, which are dissolved in water from soil. Alkalinity in itself is not harmful to human being. In the present study, the alkalinity ranged from 111.8 mg/L to 170.0 mg/L, the highest value being

recorded in the month of June, and lowest in the month of March.

Total hardness fluctuated between 58.8 mg/L and 155 mg/L. Minimum value was in the month of June, and maximum in the month of December. Similar findings were recorded by Roy & Mahmood (1995).

Chloride is one of the important parameters to know quality of water. Chloride values varied in the present investigation from 19.6 mg/L to 50.5mg/L, the lowest in July, and highest in June.

The carbon dioxide content of water depends upon the water temperature, rate of respiration, decomposition of organic matter and geographical features of the water body (Sakhare & Jashi 2002). In Angoori reservoir it varied from 19.8 mg/L to 55.0 mg/L, minimum being in the month of December, and maximum in June.

The total dissolved solids were observed from 130.0 mg/L to 172.4 mg/L. Similar findings have been reported by Rao et al. (2003), Kirubavathy et al. (2005) and Garg et al. (2006) with regards to seasonal variations in TDS.

BOD is the amount of oxygen utilized by microorganisms in stabilizing the aquatic organic matter. BOD in Angoori reservoir was recorded to be 1.4 mg/L to 4.8 mg/L. The minimum value was in the month of August/September, and maximum in the month of May. Devarasu et al. (2005) made similar observations in Maddar Lake. Most of the Indian reservoirs have higher chemical oxygen demand with maximum values observed in summer season (Kaushik et al. 1989). The present study substantiates the above finding as in the present study COD ranged from 26.6 mg/L to 34.7mg/L in May and June. The overall values of COD ranged from 12.0 mg/L to 34.7 mg/L. Similar variations were also observed by many other workers including Ohakad & Chaudhary (2005).

Sodium is commonly present in water and its concentration in unpolluted water is less than that of calcium and magnesium. The concentration of sodium in the present study ranged from 9.9 mg/L to 15.6mg/L, with minimum value in the month of August, and maximum value in the month of November.

Potassium is a naturally occurring element. The concentration of potassium ranged from 17.0 mg/L to 30.9 mg/L in the present study. The sulphate concentration was recorded between 5.8 mg/L and 14.5mg/L. Similar variation was also recorded by Yalavarthi (2002) and Thilaga et al. (2005).

Nitrate is always present in greater amount in water bodies but it may be depleted in productivity lakes. In the present investigation, the values of nitrate in Angoori Reservoir were reported to be 0.4mg/L to 1.4mg/L, the minimum being in

the month of January, and maximum in the month of May.

Positive correlation was observed between pH and chloride, and free CO₂ and TDS and COD. Chloride has moderate positive correlation with free CO₂, TDS, BOD, COD, Na and potassium. Positive correlation was also recorded between sulphate and total hardness. Comparison of the parameters with BIS standards shows that the value of total alkalinity, total hardness, free CO₂, TDS, sulphate and nitrate are lower than the BIS values, however, dissolved oxygen showed slightly higher value than BIS from December to June.

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