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Der Chemica Sinica, 2011, 2 (4):229-234



Monitoring of Physico Chemical Parameters and Quality Assessment of Water from Bhandaradara Reservoir

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ABSTRACT

The present study deals with the assessment of physico chemical parameters of water samples from Bhandaradara reservoir during the period of September to December 2008. The observed values of various physico chemical parameters from water samples have been compared with standard values recommended by WHO. Statistical studies have been carried out by calculating mean, standard deviation, co-variance and correlation coefficient between different pairs of parameters. It is observed that the parameters studied have a positive and negative correlation with each other.

Key words: physico chemical parameters, reservoir water, statistical analysis.

INTRODUCTION

Water is the one of the basic indispensable source on the living planet the earth. This natural resource influences on almost every aspect of development. Water resources have been severely affected by rapid economical development and intensified human activities [Yin et al., 2011]. Human being depends on the natural resource of water for drinking, irrigation, washing and industrial purposes. Though water is abundant on earth, it is precious for living beings because, out of the total water resource of the world, about 97% is salty and only 3% is fresh water [Kamble et al., 2008a; Kamble et al., 2008b]. Even this small fraction of fresh water is not available as most of it is locked up in polar ice caps and just 0.003% is literally available in the form of ground water and surface water. The human activities like industrialization, urbanization and domestic activities, which been affecting water quality and leads to large scale water pollution. The industries like electroplating, tanneries and textiles release large quantities of heavy metals into the natural environment; as a result health problems will arise. The human activities like agriculture and domestic release large number of pollutants into the water bodies [Kocaoba & Akcin, 2005]. In India ponds, rivers and ground water is used for the domestic and agriculture purposes. The effective maintenance of water quality through appropriate control measures and continuous monitoring of large number of quality parameters is essential. Recently these things have become a difficult task for regular monitoring of all the parameters even if the adequate manpower and laboratory facilities are available. The present research aims to predicting the possible causes of water pollution. The statistical correlation has been used to develop mathematical relationship for comparison of physicochemical parameters [Bhandari & Nayal, 2008].

The Bhandaradara dam was designed by Wilson. This dam was built across the Pravara River near village Bhandaradara, in Akole Taluka of Ahmednagar district, Maharashtra. The construction of the dam was started in 1910 and completed in 1926. The maximum height of the dam is 82.30 meters and length of top is 598.33 meters. The capacity of dam is 11 TMC. The reservoir water has been used for drinking and irrigation purpose by the people of the Ahmednagar district.

MATERIALS AND METHODS

Ten different sites were selected for collection of samples. The samples were collected in sterilized polythene bottles of two liters capacity. Monitoring was done during September to December 2008. Samples were brought to the laboratory for analysis of physico chemical parameters. However unstable parameters like pH, temperature, electrical conductivity (EC) and dissolved oxygen (DO) was measured in-situ using sensor of water quality monitor [WQM; In-situ Inc; Multi parameter Toll 9000]. Parameters like sodium, potassium, total alkalinity, total hardness, calcium, magnesium, chlorides, sulphate, nitrate, phosphate, biochemical oxygen demand (BOD) and chemical oxygen demand (COD) were analyzed according to the standard methods described in the literature [APHA, 1989; WHO, 1984; Trivedy & Goyal, 1984; Goyal, 1996, Botkin & Keller, 1995]. Study area is shown in map.

RESULTS

The results of analysis were reported in Table 1. The temperature of water during study period was in a range between 19.00 °C to 21.57 °C. The maximum value of temperature was observed at site 10, while minimum was at site 1. The pH values varied from 6.9 to 7.7. The maximum pH value was observed at site 3 and that of minimum at site 6. The electrical conductivity (EC) varied between 0.039 mhos to 0.348 mhos. The maximum value was recorded at site 3 and minimum at site 1. The values of alkalinity were varied between 17.50 mg/L to 33.75 mg/L. The maximum value was recorded at site 6 and minimum at site 9. The values of chloride were between 17.97 mg/L to 28.50 mg/L. The maximum value was recorded at site 4 and the minimum at site 6. The values of total hardness were in a range between 27.74 mg/L to 45.83 mg/L. The maximum value was recorded at site 1 and minimum at site 2. The calcium values were in a range between 09.21 mg/L to 17.14 mg/L. The maximum value was at site 1 while minimum at site 9. The magnesium values were recorded between 16.20 mg/L to 28.78 mg/L. The maximum value was recorded at site 1 while minimum was at site 2. The DO values were ranges between 5.79 mg/L to 8.19 mg/L. The maximum value was recorded at site 1 and minimum at site 7. The BOD values were in a range between 01.63 mg/L to 03.17 mg/L. The maximum value was recorded at site 5 and minimum at site 1. The COD values were between 2.65 mg/L to 6.8 mg/L. The maximum value was observed at site 4 and minimum at site 1.

The sodium values were in a range between the 01.98 mg/L to 03.92 mg/L. The maximum value was shown at site 4 and minimum at site 7. The potassium values in a range between 01.33 mg/L to 02.4 mg/L. The maximum value was observed at site 8 and minimum were at site 7.

Parameters	Site1	Site2	Site3	Site-4	Site-5	Site-6	Site-7	Site-8	Site9	Site10	Min-	Max
Temp.	19.00	19.50	19.30	20.20	20.40	20.50	21.20	21.07	20.90	21.57	19.00	21.57
pH	06.90	07.30	07.70	07.60	07.50	07.70	07.30	07.60	07.40	07.50	06.90	07.70
EC	0.348	0.044	0.122	0.0622	0.0404	0.0396	0.0499	0.0412	0.061	0.0487	0.0396	0.348
ТА	23.75	28.75	21.75	20.50	24.50	33.75	24.25	21.25	17.50	23.50	17.50	33.75
Cl -	18.89	23.30	26.15	28.50	26.78	17.97	20.49	24.57	27.74	22.81	17.97	28.50
ТН	45.83	27.74	32.57	32.19	31.25	31.59	34.07	33.7	41.27	37.05	27.74	45.83
Ca+	17.14	13.09	14.2	13.03	12.19	12.28	12.02	9.58	9.21	12.48	9.21	17.14
Mg+	28.78	16.2	18.48	19.16	19.08	19.47	22.47	23.95	32.56	26.36	16.2	32.56
DO	08.19	07.66	06.61	07.12	07.95	07.38	05.79	06.35	06.35	06.49	05.79	08.19
BOD	01.63	02.31	02.91	02.69	03.17	02.28	02.29	02.67	02.49	02.14	01.63	03.17
COD	02.65	03.16	03.78	06.81	04.30	03.77	03.20	06.60	03.26	03.60	02.65	06.81
Na^+	02.70	02.20	02.00	03.92	02.31	02.36	01.98	02.66	02.03	02.25	01.98	03.92
\mathbf{K}^+	01.92	01.83	01.66	02.27	02.00	02.12	01.33	02.40	01.75	01.75	01.33	02.40
SO ₄	02.57	02.25	02.34	02.07	02.06	02.02	01.81	02.17	02.12	02.45	01.81	02.57
PO ₄ -	00.02	00.04	00.04	00.03	00.04	00.03	00.03	00.03	00.04	00.03	0.004	0.04
NO ₃	0.47	0.46	0.57	0.56	0.57	0.17	0.16	0.59	0.39	0.57	0.16	0.59
	All parameters are expressed in mg/l except pH and EC (mhos)											

Table No.1

The sulphate values were in a range between 01.81 mg/L to 02.57 mg/L. The maximum value was observed at site 1 and minimum at site 7. The phosphate values were in a range between 0.02 mg/L to 0.04 mg/L. The maximum values were observed at sites 2, 3 and 5 respectively and minimum at site 1. The nitrate values were in a range between 0.16 mg/L to 0.52 mg/L. The maximum value was observed at site 8 and minimum at site 7. All the parameters studied were within the permissible limit suggested by WHO 1984.

DISCUSSION

In order to study the relation between all parameters statistical analysis has been carried out. The statistical analysis was reported in table 2. The statistical analysis mean, standard deviation and coefficient of variance have been calculated. The coefficient of correlation has been reported in the table no. 3. The temperature has shown the significant positive correlation with pH, chloride, magnesium, BOD, COD and phosphate, while negative correlation shown with the electrical conductivity, alkalinity, hardness, calcium, DO, sodium, sulphate and nitrate. The pH had shown significant positive correlation was observed with electrical conductivity, hardness, calcium, DO, magnesium, phosphate and sulphate. The electrical conductivity showed significant positive correlation with hardness, calcium, magnesium, DO, sodium, sulphate and nitrate and negative correlation with alkalinity, chloride, BOD, BOD, potassium and phosphate. The alkalinity had shown the significant positive correlation with calcium, DO, potassium and phosphate, while negative correlation with chloride, hardness, magnesium, BOD, COD, sodium, sulphate, and nitrate.

Parameters	Mean	SD	CV				
Temp	19	± 0.86	4.55				
рН	6.9	± 0.24	3.50				
EC	0.040	± 0.10	240.79				
ТА	17.50	± 4.54	25.93				
Cl	17.97	± 3.69	20.56				
ТН	27.74	± 5.32	19.18				
Ca ⁺	9.21	± 2.23	24.22				
Mg ⁺	16.20	± 5.22	32.23				
DO	5.79	± 0.79	13.66				
BOD	1.63	± 0.43	26.50				
COD	2.65	± 1.44	54.24				
Na ⁺	1.98	± 0.58	29.14				
K ⁺	1.33	± 0.31	23.48				
SO ₄	1.81	± 0.23	12.55				
PO ₄	0.004	± 0.01	272.90				
NO ₃	0.2	± 0.16	102.38				
SD- standard deviation, CV- Coefficient of Variance							

Table 2 Statically analyses for mean, standard deviation and co-variance

Fig – 1 Map of Bhandaradara reservoir



Map- Bhandaradara Dam in Akola Tahsil.

The chloride had shown significant positive correlation with BOD, COD, sodium, potassium, phosphate and nitrate while negative correlation shown with hardness, calcium, magnesium, DO and sulphate. The hardness had shown positive correlation with calcium, magnesium, DO, sulphate and nitrate while negative correlation with the COD, COD, sodium, potassium and phosphate. The calcium shown positive correlation with the DO, sodium, potassium, sulphate and nitrate while negative correlation with the magnesium, BOD, COD and phosphate. The magnesium had shown positive correlation only with sulphate and phosphate and negative correlation with DO, BOD, COD, sodium, potassium and nitrate. The DO had shown significant positive correlation with sodium, potassium, sulphate, nitrate and phosphate. The BOD had shown positive correlation with the COD, sodium, potassium, phosphate and nitrate. The COD had shown the positive correlation with the sodium, potassium, phosphate and nitrate. The sodium had shown only positive correlation with the potassium, sulphate, phosphate and nitrate. The potassium had shown positive correlation with sulphate, phosphate and nitrate. The sulphate had shown the positive correlation only with nitrate. The phosphate had shown positive correlation with itself and nitrate. Nitrate and all other remaining parameters showed positive correlation with itself.

CONCLUSION

All the parameters studied have shown positive and negative correlation between each other. However water from Bhandaradara reservoir is suitable for drinking purpose. All parameters tested are within the permissible limit according to WHO (1984) guidelines. Continues monitoring of water quality is necessary to help local people and irrigation department for making water policy. However, human induced water pollution should be monitored in proper manner and its needs appropriate management to achieve sustainable development.

Acknowledgement

Authors would like to thank BCUD, University of Pune, for providing financial assistance and Prof. V. R. Gunale for advice on analysis of water. Authors are also thankful to Management, Pravara Rural Education Society and Principal, P. V. P. College, Pravaranagar for providing laboratory facilities.

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