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PHYSICO-CHEMICAL CHARACTERISTICS OF WATER FROM KHADKAWASALA RESERVOIR, PUNE, MAHARASHTRA STATE

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ABSTRACT

Water is essential in every stage of life for any living organism. Physico-chemical characteristics of Khadakwasla reservoir near Pune were monitored for physico-chemical parameters like temperature, pH, electric conductivity, sodium, potassium, calcium, magnesium, silica, iron, bicarbonate, chloride, sulphate, nitrate, phosphate, dissolved oxygen, biological oxygen demand and chemical oxygen demand. These parameters were analyzed by collecting water samples at four different locations of reservoir from July 2005- Jan 2006. From this study, it is observed that there is seasonal variation in concentration of physico-chemical parameters and some of parameters are beyond permissible limit, which shows degradation of water quality due to pollution.

Key words: Physico–chemical parameters, Khadakwasla reservoir.

INTRODUCTION

Water is the single most vital component of the earth that made possible for life to originate, evolve, flourish and reach the present form that we have today. The earth is called as a wet planet as two third of it is occupied by water. About 99.7 per cent of water found on earth is in the oceans and seas, while it is not available for human consumption. Rest of the 0.3 per cent is fresh water. A good proportion of this water (22.7%) is available in glaciers, ice caps, atmospheric moisture and ground water.[11] Water is the only naturally occurring inorganic fluid in the universe but most of the surface water sources have no more pure water due to pollution. The total man made reservoir area in India is about 1094960.616 hectares out of which 40% is covered small reservoir and tanks. Dams are constructed for different purposes like water needs for urban population, irrigation and

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industrial use. The Mutha river atributary of the Bhima originates from Deccan volcanic province, rises in a mass of hills on the edge of Sahyadri at Mutha village.

Mutha River is approximately at 10 km upstream of the Pune city. Khadakwasla dam was conceived, designed, and built by the famous engineer M. Visveshwaraiha in the year 1879. Water is natural resource, which has been used for different purposes such as drinking, domestic and irrigation and it depends on its intrinsic quality, quantity, and resources available in the region. Knowledge about the water quality of the reservoir would help to decide the treatment, which should be given to water for different purposes. This study is in continuation of our earlier work of monitoring of water quality, effluents and treatment to reduce TON[1-10].

EXPERIMENTAL

Water samples were collected from three different stations i.e. R.B.= Right bank, L.B. = Left bank, D/S = Down stream. E. R. = entire reservoir**.** Samples were collected monthly in plastic cans. All the cans used were double stopperd to avoid any spill during transit. Samples were collected from July 2005 to Jan 2006 in interval of two months.

The unstable parameters such as pH, temperature, electric conductivity, and dissolved oxygen were measured in situ using sensor of water quality monitor (WQM; In-Situ Inc; Multiparameter Toll 9000). Parameters analyzed in laboratory were sodium, calcium, magnesium, carbonate, bicarbonate, chloride, sulphate, biochemical oxygen demand, chemical oxygen demand, nitrate, phosphate, silica and iron according to the methods prescribed in literature [11-15].

RESULTS AND DISCUSSION

The temperature observed at right bank of reservoir was less than left bank. The surface water temperature of down stream was observed less, compared to up stream temperature of dam. This difference in temperature may be due to the fact that a down stream water was flowing and up stream water was stagnant. The right bank shows minimum pH value while left bank showed the maximum. The sampling location, Kudje situated on left bank, shows the maximum pH and it may be due to the discharges of domestic waste water of resort “Lakewood” to the reservoir. Down stream showed less pH values than up stream. The pumping station point on left bank showed high electric conductivity value than right bank. As the left bank is much steeper than right bank, more runoff, containing silt are mixed with reservoir and these may increase the electric

conductivity. The electric conductivity values of up stream of dam were reported more than down stream of dam. This may be due to the sedimentation of slit particle in the bottom of up stream of dam. From data, it was observed that at the left bank, electric conductivity values deviate less than the right bank during the study period.

Table 1 Average variation in water quality parameters (Physico-chemical) of Khadakawasala reservoir in different months

Parameter	Location	Jul. 05	Sep. 05	Nov. 05	Jan. 06	Min.	Max.
Temp (ºC)	R.B.	25.05	26.58	23.30	21.46	21.46	26.58
	L.B	25.73	27.70	23.69	23.16	23.16	27.70
	D/S	25.38	25.43	23.57	23.05	23.05	25.43
	E.R.	25.39	26.71	23.52	22.49	22.49	26.71
pH	R.B.	7.65	7.29	7.45	7.32	7.15	7.65
	L.B	7.72	7.76	8.22	8.41	7.42	8.41
	D/S	8.00	7.74	7.88	7.61	7.45	8.00
	E.R.	7.77	7.58	7.85	7.80	7.33	7.85
EC (μS/cm)	R.B.	143.84	93.95	84.10	77.12	77.12	143.84
	L.B	158.84	95.10	103.10	76.62	76.62	158.84
	D/S	160.21	83.61	123.15	73.53	73.53	160.21
	E.R.	153.36	91.80	100.99	76.03	76.03	153.56
Na^+ (μg/L)	R.B.	7.13	10.43	6.70	3.97	3.67	10.43
	L.B	6.53	10.10	7.23	4.00	4.00	10.10
	D/S	5.65	9.75	8.25	3.85	3.85	9.75
	E.R.	6.61	10.14	7.29	3.95	3.95	10.14
K^+ (μg/L)	R.B.	0.93	0.77	0.63	0.50	0.47	0.93
	L.B	0.70	0.50	0.57	0.43	0.43	0.70
	D/S	0.70	0.55	0.60	0.45	0.45	0.70
	E.R.	0.79	0.61	0.60	0.46	0.46	0.79

Parameter	Location	Jul. 05	Sep. 05	Nov. 05	Jan. 06	Min.	Max.
Ca^{2+} (mg/L)	R.B.	23.57	3.33	20.96	5.28	3.33	23.57
	L.B	22.42	2.32	17.12	4.90	2.22	22.42
	D/S	22.67	1.71	22.79	5.04	1.71	22.79
	E.R.	22.91	2.55	19.98	5.08	2.55	22.91
Mg^{2+} (mg/L)	R.B.	6.77	0.84	3.03	2.48	0.84	6.77
	L.B	8.81	0.25	4.20	2.40	0.25	8.81
	D/S	9.11	0.88	2.98	2.73	0.88	9.11
	E.R.	8.12	0.63	3.46	2.51	0.63	8.12
HCO_3^- (mg/L)	R.B.	75.51	7.65	71.22	33.42	6.43	75.51
	L.B	77.34	6.83	56.53	30.18	6.83	77.34
	D/S	80.08	5.62	59.35	28.71	5.62	8.08
	E.R.	77.34	6.83	67.74	31.02	6.81	77.34
Cl^- (mg/L)	R.B.	8.76	0.61	14.20	4.30	0.61	14.20
	L.B	9.50	0.51	13.43	4.53	0.51	13.43
	D/S	8.51	0.62	13.27	4.47	0.62	13.27
	E.R.	8.97	0.58	13.68	4.43	0.58	13.68
SO_4^{2-} (mg/L)	R.B.	3.39	1.78	5.28	0.45	0.45	5.28
	L.B	3.21	1.59	4.02	0.77	0.77	4.02
	D/S	3.58	1.57	3.02	0.45	0.45	3.58
	E.R.	3.37	1.66	4.24	0.57	0.57	4.24
DO (mg/L)	R.B.	7.48	6.87	11.16	8.17	6.87	11.16
	L.B	7.22	6.71	11.98	8.77	6.77	11.98
	D/S	8.00	7.25	10.65	8.05	6.67	10.65
	E.R.	7.70	6.93	11.34	8.37	6.93	11.34
BOD (mg/L)	R.B.	2.26	1.18	0.86	0.50	0.05	2.26

Parameter	Location	Jul. 05	Sep. 05	Nov. 05	Jan. 06	Min.	Max.
	L.B	1.07	0.94	0.34	1.00	0.34	1.07
	D/S	0.44	0.64	0.95	1.15	0.37	1.15
	E.R.	1.36	0.95	0.69	0.85	0.68	1.36
COD (mg/L)	R.B.	14.90	15.19	15.14	4.42	4.42	15.19
	L.B	15.70	12.43	12.21	3.90	3.90	15.70
	D/S	19.90	14.09	16.49	6.64	6.64	19.90
	E.R.	16.45	13.88	14.38	4.78	4.78	16.45
NO_3^--N (mg/L)	R.B.	0.29	1.73	0.52	0.31	0.29	1.73
	L.B	0.29	2.04	0.30	0.37	0.29	2.04
	D/S	0.15	2.06	0.64	0.34	0.15	2.06
	E.R.	0.25	1.93	0.46	0.34	0.25	1.93
PO_4^{3-}-P (mg/L)	R.B.	0.05	0.07	0.01	0.03	0.01	0.07
	L.B	0.01	0.06	0.00	0.03	0.00	0.31
	D/S	0.00	0.05	0.00	0.04	0.00	0.05
	E.R.	0.02	0.06	0.01	0.03	0.01	0.12
SiO_3 (mg/L)	R.B.	0.63	0.84	2.35	1.77	0.63	2.35
	L.B	0.74	0.79	2.52	1.80	0.74	2.52
	D/S	0.78	0.76	2.79	1.79	0.76	2.79
	E.R.	0.71	0.80	2.53	1.79	0.71	2.53
Fe (mg/L)	R.B.	0.39	0.61	0.48	0.82	0.37	0.82
	L.B	0.21	0.43	0.35	0.82	0.19	0.82
	D/S	0.04	0.47	0.30	15.00	0.04	0.47
	E.R.	0.23	0.51	0.39	0.65	0.23	0.65

R.B= Right bank, L.B. = Left bank, D/S = Down stream, E.R.= Entire reservoir

The sodium concentration was observed more at left bank than right bank and it may be due to steeper left bank than right bank when runoff was more. The canal water showed the minimum value. The value of sodium in up stream dam water were reported to be highest and down stream showed the lowest. This clearly indicated that runoff played an important role in deciding the sodium values. The right bank showed the maximum potassium ion concentration. In right bank, the anthropogenic activities were observed more because the villages were close to the bank. So domestic sewage may increase the potassium values. The up stream dam water has high values than the down stream.

Calcium contributes to hardness of water. When river water is impounded in storage as reservoir, changes may occur in calcium contents as a result of calcium carbonates. The right bank water contained a moderately high concentration of calcium where as left bank showed the less. In right bank, the anthropogenic activities and agricultural lands were observed. The down stream of dam and canal water showed less calcium contents than upstream during entire study period. The canal water showed the highest value of magnesium. The left and right bank gave the same results for magnesium. It showed that the values of magnesium concentration remain fluctuating within the entire period.

The right bank of reservoir showed, more concentration of bicarbonate than left bank. Up stream showed the higher values of bicarbonate while down stream showed the minimum value. The higher amount of bicarbonate may be due to the combination of excess amount of carbonate with monocarbonate forming bicabonate[16].The chloride value of right bank was observed to be more than left bank. The organic matters were influencing these values. On right bank, the anthropogenic activities were observed more. The amount of organic matters contributes to chloride value. Up stream water was observed to have high chloride value than down stream, as down stream water received less runoff of organic matters from near land. The right bank showed less value of sulphate in month of January but it was observed to be higher in month of September among the all values. Down stream water showed less value of sulphate than up stream. Sulphate is one of the components of fertilizers. Run off also carried domestic sewage, which contributes to the increased amount of sulphate in the water. The left bank showed more values of sulphate than on the right bank. The left bank is very steep. It is surround by agricultural lands, but the runoff from interior part of village flushed out loose containing nutrients and get mixed with reservoir near left bank. In reservoir, phosphorus enters in a lake from the catchments area or sediment. Right bank samples were observed to have less phosphate than left bank. Left bank showed the highest value of phosphates, as the left bank was sloppy. During the study period, silica value ranged between 0.58 mg/L to 2.81 mg/L. Right bank showed

minimum value than left bank. Iron is necessary for the growth and development of animals and plants. Its concentration varied between 0 mg/L to 1.53 mg/L. Left bank showed the minimum values of iron in month of December and January at sampling point.

Dissolved oxygen in water is the most fundamental parameter of lakes and reservoir. The lowest and highest values were observed at left bank in the beginning and off set of post monsoon, respectively. Down stream water also showed the higher value in month of December and January. Dissolved oxygen affect solubility and availability of many nutrients and therefore, productivity of aquatic system. The biochemical oxygen demand represents the amount of oxygen that microbes need to stabilize biologically oxidisable matter. The right bank has high biochemical oxygen demand values than left bank. Near the dam, wall it is a tourist place and remained always crowded. Right bank showed the high chemical oxygen demand than left bank as the anthropogenic activities were observed more at right bank. From the discussion, it may be concluded that the pollution of reservoir gets increased due to domestic activities around reservoir.

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REFERENCE

1. K. K. Karle, S. S. Bhusal, P. S. Gunjal and S. R. Kuchekar, Poll. Res., **11(2)**, 65 (1992).
2. P. S. Gunjal, D. G. Zinjad, S. R. Kuchekar and H. R. Aher, Poll. Res., **12(4)**, 219 (1993).
3. P. S. Gunjal, S. R. Kuchekar, D. G. Thorat and H. R. Aher, J. Aqua. Biol., **10 (1 and 2)**, 26 (1995).
4. D. S. Shinde, H. R. Aher, D. G. Thorat, P. S. Gunjal and S. R. Kuchekar, J. Aqua. Biol., **12(1 & 2)**, 85 (1997).
5. H. R. Aher, D. G. Zinjad, P. S. Gunjal and S. R. Kuchekar, J. Aqua. Biol., **14 (1 & 2)**, 51 (1999).
6. H. R. Aher, D. G. Zinjad, P. S. Gunjal and S. R. Kuchekar, J. Chem. Envi. Res., **9 (1 & 2)**, 158 (2000).

7. H. R. Aher, D. G. Zinjad, P. S. Gunjal and S. R. Kuchekar, J. Chem. Envi. Res., **11 (1&2)**, 101 (2002).

8. Vaishali Wagh, G.M.Pondhe and S.R.Kuchekar, Ind. J. Env. Ecoplan, **10(2)**, 419 (2005).

9. Manisha Dharam, S. C. Jagadale, H. R. Aher and S. R. Kuchekar, J. Aqua. Biol., **20(1)**, 39 (2005).

10. Ujawal Shetty, Kanchan Sonwane and S. R. Kuchekar, J. Annall. De Chem., **9**, 771 (2005).

11. G. Gitanjali and A. Kumarsen, Tamil Nadu, India Poll. Res., **25 (3)**, 583 (2006).

12. APHA (American Public Health Association) 17th Edition (1989).

13. D. B. Botkin and E. A. Keller, John Wiley and Sons, Inc. New York-Chichester, Brisbane, Tronto Singapur, In Environmental Science Earth as a Living Planet, (1995) pp. 398-420

14. R. K. Trivedy and P. K. Goel, Chemical and Biological Methods for Water Pollution Studies, Environmental Publication, Karad, India. (1984).

15. WHO. Guidelines for Drinking Water Quality, Vol.2. Health Criteria and Other Supporting Information, Geneva. Mcmillan/Eeuteric-8000 (1984).

16. P. S. Welch, in ILimnology, McGraw Hill Book Co. Inc., New York (1952).

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