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ASSESSMENT OF WATER QUALITY USING PHYSICO-CHEMICAL PARAMETERS OF KOTMARA RESERVOIR SANGAMNER TAHSIL, MAHARASHTRA, INDIA

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ABSTRACT

In the present investigation the physico-chemical parameters of three locations of Kotmara Reservoir Tahsil in Sangamner district Ahmadnagar of Maharashtra during winter, summer, monsoon and post-monsoon period in 2018 and 2019. The water quality of different parameters temperature (T), pH, turbidity(NTU), total hardness (TH) , free CO_2 (FCO_2), dissolved oxygen (DO), total dissolved solids (TDS), biological oxygen demand (BOD), total alkalinity (TA), chloride (Cl), carbonates (TC), bicarbonates (TBC), nitrate(NO_3), calcium (Ca), magnesium (Mg), potassium (K) and sulphates (SO_4) were analyzed. The result shows that the seasonal variation in their concentration of the selected locations for all seasons. However, maximum physico-chemical parameters concentrations were observed period P2 (Summer) as compared to other periods during 2018 and 2019. Minimum physico-chemical parameters concentration was found in P3 (Monsoon) during 2018 and 2019. Overall investigation, we observed that the water quality of Kotmara reservoir is very good for drinking and irrigation. But, huge environmental variation will be observed in the future, therefore, I suggested that the proper management of the reservoir is essential for the quality of water.

Keywords **:** Physico-chemical Parameters, Water quality and Seasonal variations

INTRODUCTION

Water is one of the most essential items needed by living being for their survival, growth and maintains an ecological balance between various groups of living organisms and their environment (Santosh Kumar, 1984). All living organism is depending on the water, and water exists in nature in many forms like clouds, rains, snow, ice and fog. However, chemically pure water does not exist for more time in nature. Even while falling, rainwater picks up small amount of gases, ions, dust particles and particulate matter from the atmosphere. Then, as it flows over the surface of earth, it dissolves and carries some of it. These chemical and physical impurities get mix with water. Water also mixes with industrial solvents, metals, acids, salts, sediments, pesticides, herbicides, plant nutrients, decaying animals, vegetable material and living microorganisms such as algae, bacteria and viruses.

Therefore, it is necessary that the quality of drinking water should be checked at regular time of interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. Hence, Smitha and Shivashankar (2013) reported that, water quality assessment involves analysis of physico-chemical, biological and microbiological parameters. Similarly, many researches are work studies in the physico-chemical characteristics water with different region (Dhanaji, *et al*., 2016, Umerfaruq and Solanki, 2015 and Qureshimatva *et al.,*2015).

The Kotmara dam (Ambidumala Project) is a small fresh water reservoir and minor irrigation project. This reservoir is situated, on Kas river, near Ambidumala and Kurkutwadi villages, west of Bota village. This area is hilly with moderate rainfall. The reservoir is mainly used for agriculture and drinking water purpose. Therefore, it is an urgent need to assessment of physico-chemical properties of water. Hence, in the present investigation to analysis physico-chemical parameters of water is determined which revealed in the Kotmara reservoir, Sangamner, Ahmedangar, Maharashtra, India.

MATERIAL AND METHODS

Study area

Kotmara reservoir is a fresh water reservoir of Sangamner taluka, Ahmedangar, Maharashtra, India. The dam was constructed on Kus river in 1989-1992 and It is handed over to Ahmednagar irrigation department in November 1993. The total catchment area is 30.50 sq. miles and total command area is 1010 hectors.

Selection of Sampling Locations:-

The water quality assessment was carried out from water Kotmara reservoirs. The water samples were collected from three different locations (K1, K2 and K3) of the reservoirs (Fig.1). The three locations of Kotmara reservoirs are classified in below.

1. Sampling location - K1

It is situated near the Kurkutwadi village, towards the origin of Kus river. (Fig. 1).

2. Sampling location - K2

It is located towards southwest near the end of west weir. (Fig. 1).

3. Sampling location - K3

This region is near the wall of the reservoirs. (Fig.1).

Collection of Water Samples

Water samples from the reservoir were collected periodically in the morning at 9.00 a.m. The clean plastic water container was rinsed with water from sampling location. Then, sample was drawn with the help of bucket. One liter of sample was collected. Water container was labeled properly. The samples collected in three replicates from three different selected points were mixed together to prepare an integrated sample.

Experimental Methodology

The three sampling locations were selected for all season P1, P2, P3 and P4 (Winter, Summer, Monson, Post-Monsoon) and water samples were collected from the reservoir in a clean plastic container for the period of 2018 and 2019. The physico-chemical parameters were analyzed as per the selected locations in the seasons of Winter, Summer, Monsoon and Post-Monsoon, respectively. Then, parameters including temperature (T), pH, turbidity(NTU), total hardness (TH) , free CO_2 (FCO_2), dissolved oxygen (DO), total dissolved solids (TDS), biological oxygen demand (BOD), total alkalinity (TA), chloride (Cl), carbonates (TC), bicarbonates(TBC), nitrate (NO_3), calcium (Ca), magnesium (Mg), potassium (K) and sulphates (SO_4) were analyzed. The physic-chemical analysis of water samples were performed as per the procedures described by APHA (1995) and Trivedi and Goyal (1986). The results obtained are averaged out for different seasons and are presented in table 1 and 2.

RESULT AND DISCUSSION

Analysis of water samples from various sampling locations and period of Kotmara reservoirs was carried out. In the present investigation total 17 physicochemical parameters of Kotmara reservoirs were analyzed different locations with different period during 2018 and 2019. The values of each physico-chemical parameter recorded during the study period are presented in Tables 1 and 2.

Temperature

Temperature of Kotmara water reservoir was significantly influenced by period during both the year of experimentation. The highest water temperature was observed in P2 period during 2018 (25.79^0C) and 2019 (24.61^0C). It was significantly superior over the other periods except with the P3 Period during 2019. The increased water temperature of Kotmara reservoir at P2 Period might be due to climatic condition. Water temperature of Kotmara reservoir was non-significant due to interaction effects between period and sampling location. Thus, water temperature of Kotamara reservoir was influenced by the period and locations.

pH of Kotmara reservoir

It was found that the highest pH (7.55) in P2 period during 2019 and lowest was P3 (7.23) period at also 2019. Effect of period and location of sampling were non-significant for pH of Kotmara water reservoir. Mean of water pH of Kotmara reservoir was found significant for period and location. However, all periods and locations were at par with each other for water pH.

Turbidity

The effect of period and location of sampling are found to be non significant for water turbidity of Kotmara reservoir. The interaction effect are also non significant for water turbidity. The effect of period and location of sampling are significant in mean turbidity. Whereas, numerically, P2 period of sampling (20.4) and K2 location in the 2019 recorded the highest value of turbidity followed by P3 period and K2 location (18.80). Thus, period of the highest temperature; location, intermediate to end of reservoir and wall of reservoir recorded the higher value of turbidity. This might be ascertained that evaporation and accumulation of some colloidal particles in stagnated water.

Hardness

The hardness of water from Kotmara reservoir are significantly influenced by the period and sampling location. Period-2 and location K3 recorded the maximum value (118.25) of hardness of Kotmara reservoir in the year of 2019. The higher values of hardness of water in Kotmara reservoir during P2 and P1 might be due to an increased concentration of cations viz. calcium and magnesium in water. The rate of evaporation of water was also more during this period. Sampling during, P3 and P4 were recorded the lowest values of hardness.

Free Carbon dioxide

The free carbon dioxide content of water of Kotmara reservoir was significantly influenced by period of sampling. It was higher during 2018 and 2019 (9.98 and 21.66 respectively), at period of sampling-P2. Location of sampling was not effective for carbon dioxide content of Kotmara reservoir. Whereas, location-K1 and K2 recorded the higher values of free carbon dioxide content. Results indicate that sampling period played significant role in free carbon dioxide content of water reservoir.

Dissolved oxygen

The period of sampling, significantly influence the dissolved oxygen content of Kotmara water reservoir. It is maximum P4 sampling period during 2018 and 2019 as compared to other sampling period. This might be due to sampling period, during October-December, which is comparatively cooler, than rest of sampling periods. Cooler period reduces the activities of aquatic creatures. Therefore, utilization of oxygen by them is decreased. It is resulted in increased oxygen content.

Total dissolved solids

The period, sampling location and their interactions on total dissolved solids of Kotmara reservoir are significant. Sampling period (P2) recorded higher content of total dissolved solids during 2018 and 2019 than the rest of periods. This ascertains that during April-June, most of water

evaporates. Therefore, there increases total dissolved solids of water reservoir.

Biological oxygen demand

Biological oxygen demand of Kotmara reservoir was not affected by period, location of sampling and their interactions. This result revealed that oxygen requirement for biological activity is not dependent on location or period of sampling. This might be independent on biological population and their activity in the reservoir. Interaction between period and sampling location, were non significant for biological oxygen demand of Kotmara reservoir.

Alkalinity

Alkalinity of Kotmara water reservoir as affected by period, sampling location and their interactions is significant. Sampling period P1 recorded higher values of alkalinity during the both years. Results revealed that alkalinity was more at place where water flow entering and less, near the wall of reservoir.

Chloride

The chloride content of Kotmara reservoir was significantly influenced by the sampling period. Highest chloride content of Kotmara reservoir was observed at P4 sampling period as compared to other sampling period during 2018 and 2019. Chloride content of Kotmara reservoir was influenced by periodical change in climatic conditions.

Carbonate

The carbonate content of Kotmara reservoir was significantly influenced by the period. The highest amount of carbonate observed in P4 sampling period as compared to other period. This might be due to deposition of chloride by the incoming water. Carbonate content was found non-significant by the sampling location.

Bicarbonate

The sampling period P2 was found significantly higher for bicarbonate content of reservoir. This might be ascertained that high temperature during (P2) April-June leads to evaporate the water from reservoir and concentrating the salt content in the water. Similarly, release of carbon dioxide in water may be due to the biological activity. Interaction effect of period and sampling location were non-significant for bicarbonate content of Kotmara reservoir.

Nitrates

Nitrate content of Kotmara reservoir as influenced by sampling location and their interactions with period were non significant. The nitrate content of Kotmara water reservoir was higher during P3 period whereas, lowest values were recorded during P1 and P4 period. However, it was not showed consistent relationship with other period

Calcium

It was significantly higher in P2 sampling period as compared to other sampling period. Sampling location did not influenced, calcium content of Kotmara water reservoir. However, location number K2 recorded higher amount of calcium. This may be due to seasonal variation.

Magnesium

The sampling period P2 was significantly higher for magnesium content of Kotmara water reservoir. Thus, results indicated that the location of sampling and their interaction with sampling period did not influence the magnesium content of reservoir.

Potassium

Potassium content of Kotmara reservoir was significantly influenced by the period of sampling. It was higher in P2 period of sampling. The location number three, near to wall of reservoir showed higher amount of potassium. Variation in potassium content of water reservoir might be associated with change in climatic conditions viz. temperature, humidity wind velocity. Location of sampling did not influence the potassium content of Kotmara reservoir.

Sulphates

Period of sampling was influenced the sulphate content of Kotmara reservoir. Sampling period, P2 recorded high amount of sulphate and followed by P1 sampling period. Increased sulphate content of Kotmara reservoir during P2 and P1 period might be due to water reduction. The location of sampling did not showed definite relationship for sulphate content of Kotmara water reservoir.

As per above result, it is clear that variation in parameter of water in summer session are not remain constant for all location during 2018 and 2019. In overall observation, it is clear that the both years almost all parameter have higher concentration in the summer period (P2) and K2 location have maximum amount of concentration as compared to other location. In summer period shows increased concentration of T, pH, NTU, TH, FCO_3, TDS, BOD, TBC, Ca, Mg, K and SO_4, but DO, Cl, TC, TA, SO_4 and NO_3 shows decrease in concentration. Because water utilization in agriculture field with discharge of sewage in the dam. Due to this reason, decrease in concentration of parameter in monsoon period may be due to dilution of water with rainwater. Thitame and Pondhe (2010) have reported similar observation which supports our findings. Karne and Kulkarni (2009) have also observed the most of parameter higher amount concentration in summer season as compared to reaming season. Similar results were obtained by Rao (1971, 1972), Venkatshwarlu (1969), More and Nandan (2000), Aher *et al*. (2000), Gore and Pingle (2003) and Acharya (2003).

CONCLUSION

In the present study of various physico-chemical parameters of Kotmara reservoir has good water quality in this studied period. Therefore, Kotmara reservoir water quality is good for drinking directly in the all season, but K2 location quality of water is poor in all periods. I also recommended that water used for agriculture and other purposes. Overall observation in the present study period there is not proper management about water quality and protection. If this situation will be not control in the future, then the next few years water quality is lower as per WHO and ICMR norms. Finally, it is concluded that the all physico-chemical parameters values of Kotmara reservoir good water quality at all the locations for all different period.

Table 1: Average values of Physico-Chemical Parameters of Kotmara Reservoir water for different seasons during the Period of 2018.

Season	Site	Physico- chemical parameters																
		T	pH	NTU	TH	FCO_2	DO	TDS	BOD	TA	Cl	TC	TBC	NO_3	Ca	Mg	K	SO_4
Winter (P1)	K1	20.72	7.24	12.39	86.55	3.07	8.19	140.50	15.86	144.63	11.36	0.07	26.28	0.04	13.24	3.64	0.55	1.58
	K2	21.36	7.31	13.47	96.06	2.93	7.94	151.00	16.98	143.50	9.62	0.05	23.52	0.05	13.37	5.04	0.57	1.51
	K3	20.68	7.36	13.09	83.34	2.88	8.59	133.50	14.70	127.38	9.96	0.08	26.27	0.03	12.93	4.00	0.52	1.95
Summer (P2)	K1	25.67	7.55	15.52	108.86	7.96	5.28	150.88	15.86	45.00	7.43	0.12	43.81	0.10	13.26	7.46	1.43	2.36
	K2	25.95	7.15	16.40	94.35	9.98	5.54	171.29	15.44	47.50	7.81	0.13	41.44	0.10	16.12	8.23	0.80	2.45
	K3	25.74	7.75	14.79	74.86	7.20	6.60	128.25	11.47	43.25	8.26	0.14	39.35	0.11	14.95	5.96	1.48	2.30
Monsoon (P3)	K1	22.13	7.47	14.10	55.13	5.07	6.76	90.00	16.68	62.50	11.54	0.42	27.21	0.55	4.59	5.34	0.14	0.74
	K2	22.63	7.51	14.32	69.75	8.27	6.79	112.00	13.70	62.75	13.14	0.50	28.32	0.61	4.89	5.27	0.14	0.84
	K3	21.60	7.43	15.03	68.60	5.25	6.17	99.00	14.22	65.00	12.98	0.54	27.40	0.61	4.51	5.35	0.18	0.75
Post-Monsoon (P4)	K1	18.02	7.49	13.76	65.38	3.51	6.45	98.00	17.79	88.00	14.99	0.76	25.75	0.04	10.17	5.16	0.53	3.26
	K2	18.50	7.34	13.60	66.50	3.92	7.94	82.55	15.38	94.75	17.09	1.25	24.12	0.07	8.42	6.70	0.65	3.16
	K3	17.90	7.37	13.43	60.25	3.44	8.59	77.63	18.47	81.80	14.86	0.92	20.83	0.03	8.38	5.53	0.48	4.86

* All parameters values are expressed in mg/L except pH, Temperature (T) and Turbidity (NTU).

Table 2: Average values of Physico-Chemical Parameters of Kotmara Reservoir water for different seasons during the Period of 2019.

Season	Site	Physico- chemical parameters																
		T	pH	NTU	TH	FCO_2	DO	TDS	BOD	TA	Cl	TC	TBC	NO_3	Ca	Mg	K	SO_4
Winter (P1)	K1	19.63	7.45	15.72	83.20	2.68	5.77	99.50	19.44	130.00	11.31	0.32	23.08	0.04	13.38	6.23	0.12	1.71
	K2	19.94	7.48	15.97	103.96	3.37	4.29	111.75	21.39	138.75	13.35	0.37	20.75	0.08	15.08	5.48	0.11	2.59
	K3	19.51	7.38	15.88	100.03	3.20	6.01	99.13	19.7	137.13	10.70	0.37	23.74	0.04	12.94	6.05	0.19	1.69
Summer (P2)	K1	23.55	7.63	18.51	104.93	21.66	5.56	229.25	20.45	89.88	7.38	0.04	28.84	0.48	16.39	5.84	0.09	2.53
	K2	25.60	7.52	20.04	118.25	21.59	4.76	227.00	22.75	111.25	5.59	0.05	34.16	0.43	19.85	6.87	0.35	3.60
	K3	23.24	7.51	16.28	100.05	18.20	5.26	210.20	18.42	92.88	6.52	0.05	27.86	0.54	16.33	6.11	0.26	2.09
Monsoon (P3)	K1	22.13	7.27	16.97	38.38	10.57	7.79	79.50	9.18	89.00	16.28	0.30	9.05	0.96	9.00	5.49	0.03	1.82
	K2	22.63	7.29	18.80	50.63	11.59	7.64	86.50	10.62	79.86	19.10	0.31	9.97	1.15	9.57	6.12	0.06	1.86
	K3	21.60	7.14	16.69	44.50	8.76	7.93	73.86	9.04	84.50	16.60	0.32	11.32	1.23	8.67	5.50	0.03	1.24
Post-Monsoon (P4)	K1	18.02	7.32	14.76	58.63	2.96	9.29	74.88	17.11	94.75	22.82	0.97	15.80	0.07	5.13	4.78	0.08	1.64
	K2	18.50	7.32	16.16	64.00	2.98	9.16	90.75	16.86	89.75	24.99	1.09	17.24	0.09	6.50	5.99	0.12	1.84
	K3	17.30	7.23	14.88	58.65	3.29	10.29	77.50	17.23	91.50	24.92	1.05	22.66	0.03	4.90	4.56	0.09	1.70

* All parameters values are expressed in mg/L except pH, Temperature (T) and Turbidity (NTU).

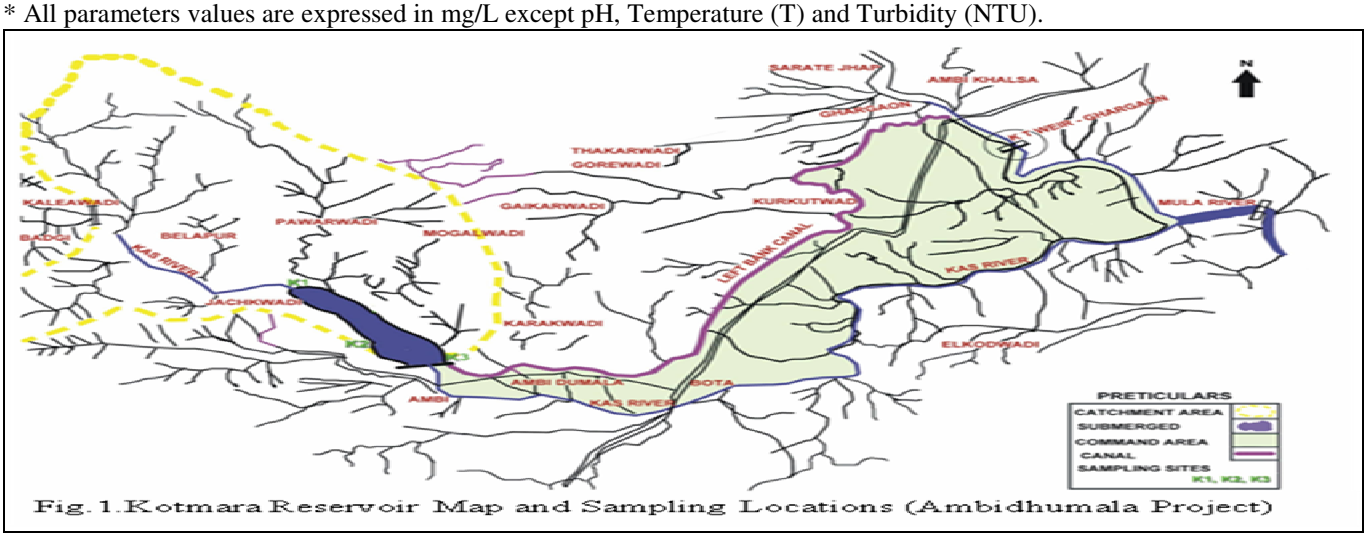

Fig. 1. Kotmara Reservoir Map and Sampling Locations (Ambidhumala Project)

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