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Original Research Article

Impact of physico - chemical characteristics of moat water and Sathanur dam water at Vellore and Tiruvannamalai district, India

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ABSTRACT

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The present study deals with the assessment of water quality of a periodical water samples were collected both from Vellore moat and Sathanur dam. The physical parameters included were TDs, electrical conductivity and chemical parameters included were pH, Alkalinity, total hardness, calcium, magnesium, iron, ammonia, nitrite, nitrate, chloride, fluoride sulphate, phosphate Tidy's test were studied. The result revealed that the condition of these two places showed fluctuations in physics, chemical parameters and showed pollution states of the moat water samples.

Keywords: Physico-chemical parameters, moat, Sathanur dam, water samples.

1. INTRODUCTION

The life is linked with the quality of environment, hence the biological components of fresh water depends solely on physic-chemical conditions. The changes in the physic-chemical characteristics adversely affect the living things in an environment. These properties gave limited picture of water quality at particular point of view, while the living organisms act as continuous monitors of water quality over a period of time. Water quality deals with the physical, chemical and biological characteristics in relation to all other hydrological properties. Natural waters are no longer capable of composing impurities (Bobde *et al.,* 2009; Abidin *et al*., 2009).

In India some hydrobiological work on historic water bodies have been done (Dhere and Gaikwad; 2006; Sharma *et al*., 2007; Pefaver and Gurav, 2008; Ingole *et al.*, 2009; and Shinde *et al*., 2010). This essential resource is increasingly scarce in many parts of the world due to severe impairment of water quality. The increasing anthropongenic influences in recent years in and around aquatic systems and their catchments acres have contributed to a large extent to deterioration of water quality and declining of water bodies leading to their accelerated eutrophication. Attention should be paid immediately to boating zone region which these will be contaminant of valuable moat water resources due to high eutrophication. High concentration of nitrate or phosphate is indicator of eutrophication, keeping this view in mind present study has been under taken to assess quarterly of different parameters in moat water and Sathanur dam water.

2. MATERIALS AND METHODS

2.1. THE STUDY AREA

The Vellore Fort moats selected for the present study are situated in North Eastern part of Tamil Nadu in Vellore. Latitude 120 – 15 ^{0}N; Longitutudes 790-50 ^{0}E about 140 km from Chennai and has wide water spread area suitable for inland fish culture. At present there are about 2500 forts existing in India and in Vellore districts alone there are twenty forts, hence it is called as "District of forts". One such beautiful land fort is located in the heart of the Vellore Town and it is one of the best, preserved forts in Tamilnadu and is surrounded by a moat. The Vellore Fort occupies 7.8 Hectares of perennial water body thus it has been considered as one among the important reservoir in Vellore .The moat receives water from the run off during rainy season through in and around catchment areas. The average depth of water level during summer is 10 feet while during rainy season the water level is about 20 feet. The study area selected in entrance zone of the moat is situated in the eastern part of Jalagandeeswarar Temple (Govindasamy *et al*., 2011).

Sathanur Dam is one of the major Dams constructed across. The dam can be reached by road 30 km from Thiruvannamalai Town in Chengam Taluk among Chennakeseva Hills, Pennaeyar River. It has a capacity of 7321 million cubic feet (full level 119 feet) An area of 7183 Hectares of Land is benefited by the left bank canal and 905 Hectares of land is benefited by the right bank canal in Thandrampet and Thiruvannamalai district. This is one of the picnic places in our District coordinates –landitutude and latitude 12.18478'N, 847865^{0}E Location– Thandrampet, Tamilnadu.

2.2. SAMPLE COLLECTIONS

Surface water samples were collected at both the stations. The samples were collected in sterilized polyethene bottles, after collection of samples are immediately brought to the laboratory and analyzed.

2.3. PHYSICO - CHEMICAL ANALYSIS

Water quality parameters *viz*., colour, odour, turbidity, temperature, pH, electrical conductivity, total dissolved solids (TDS), acidity, alkalinity, total hardness, chloride, calcium, magnesium, iron, sulphate phosphate were analyzed as per the standard methods of APHA (2005) and by Vogel (2008).

3. RESULTS AND DISCUSSION

Generally the weather in the study area is quite cool, however the temperature is of enormous significance saw it regulates various physic chemical activities (Table.1, 2 and 3).

Table.1.Quarterly variation of Physico - Chemical parameters of water samples in the year (2012)

Months/years		**April-2012**		**July 2012**		**October 2012**		**January 2013**	
Sl No	**Parameters**	**Station**		**Station**		**Station**		**Station**	
		1	**2**	**1**	**2**	**1**	**2**	**1**	**2**
1	TDS	2520	349	2580	303	2625	299	3250	445
2	Electrical con	3600	646	3675	562	3750	545	5360	635
3	PH	8.28	7.2	8.3	7.9	8.3	8.3	8.2	7.63
4.	Alkalinity	412	210	445	202	488	162	473	176
5.	Total hardness	880	170	960	146	1080	148	860	102
6.	Fluoride	0.2	0.7	0.2	0.4	0.2	0.5	0.2	0.4
7.	Chloride	905	50	870	60	840	58	1020	73
8.	Ammonia	0.8	0	0.9	0.01	0.93	0.02	2.3	0.18
9	Mg	103	36	65	26.4	43	21.6	82	5
10	Ca	180	200	130	90	360	26	150	32
11	Iron	0.3	1	0.2	0.1	0.5	0	0.25	0
12	Nitrate	53	45	47	18	58	24	52	26
13	Sulphate	213	400	180	58	322	46	196	41
14	Phosphate	0.23	0	0.15	0.2	0.26	0.05	0.18	0.05

In natural water the PH scale runs from 0 to 14. The pH value of the water samples ranged from station-1 maximum 9.12 (July) minimum 8.2 (January). Station-2 maximum in 8.9 (July) minimum in 6.4 (January). The pH of water samples was alkaline throughout the study period of station-1 and station-2 was acidic in nature and basic in nature.

Water with a high TDS indicated more ionic concentration which is of inferior palatability and can induce an unfavorable physic chemical reaction in the consumers. Kataria *et al* (1996) reported that increase in value of TDS indicated pollution by extraneous sources .The high amount of dissolved suspended and total solids of samples, adversely affects the quality of water. It is unsuitable for any other purpose irrigation and drinking. The higher level of TDS value of station-1 was maximum 4970 (April) and minimum in 2520 (July), so it is not suitable for fish growing. But station-2 maximum in 699 (July) and minimum in 299(October), so the fish growth is very well in station-2.

Table.2.Quarterly variation of Physico - Chemical parameters of water samples in the year (2013)

Months/Years		April-2013		July 2013		October 2013	
Sl No	Parameters	Station		Station		Station	
		1	2	1	2	1	2
1	TDS	4460	457	3400	360	3430	508
2	Electrical con	6800	653	5860	700	4900	726
3	PH	8.23	7.54	7.8	8.5	8.12	8019
4.	Alkalinity	576	188	525	252	560	172
5.	Total hardness	800	140	950	182	440	244
6.	Fluoride	0.2	0.4	0.3	0.5	0.6	0.2
7.	Chloride	1350	72	1260	63	1100	88
8.	Ammonia	5.57	0.15	4.25	0.06	0.48	0.4
9	Mg	96	4	85	18	53	11
10	Ca	170	50	700	72	88	79
11	Iron	0.8	0	0.4	0.1	0.68	0.51
12	Nitrate	62	23	58	18	49	14
13	Sulphate	410	51	600	52	510	77
14	Phosphate	0.2	0.06	0.68	0.2	0.32	0.28

Conductivity of both water is measured of the capacity of substances or solution to conduct electrical flow. The electrical conductivity is fluctuated in station-1 was maximum 7100 (July) and minimum 3600 (April) and station-2 was maximum 999 (July) and minimum in 530 (January) respectively. Electrical conductivity of water is high due to the presence of enormous amount of ions in the water. High specific conductance causes deterioration of water and unsuitable for fish production. So the station-1 is not suitable for recreational purposes. Higher electrical conductivity was due to more total dissolved solids and chloride content which is in coherence with the results of Janaki Arunan *et al* (2004). High level of conductivity reflects on the pollution status.

Total alkalinity valued range from accepted limit - 200, maximum permissible limit -600. Total alkalinity observed in the present study is well in the prescribed standards of drinking water is ≥120mg/liter, but station-1 was maximum value of alkalinity in 728 (July) and minimum in 412 (April) and the station-2 is maximum value is 300 (July) and minimum in 162 (October). So, the station-1 is not permeable limit, but the station-2 is slightly well growth of aquatic animals.

Hardness is important parameters in the detection of water pollution due to the Calcium and Magnesium ions. Hardness value of station-1 is max-2880 (July) and minimum 440 (October) and station-2 is maximum-368 (July) and minimum in 98 (January), permissible value is 200-600, but station-1 value is high level in permissible value, station-2 value is permissible value so the fish growth is well.

Chloride concentration in station-1 is max-1350(April) and minimum 840 (October) and station-2 is maximum 102 (July) and minimum 50 (April). So the permissible value of chloride was 250 to 1000, but the permissible value of chloride limit in WHO 1350. High chloride concentration is

an indicator of pollution due to high organic wastes of animal and industrials. Human bodies also releases in high quantity of chloride. Increase in chloride content is also due to eutropication.

Table.3.Quarterly variation of Physico - Chemical parameters of water samples in the year (2014)

Months/Years		January - 2014		April 2014		July 2014	
S.No	Parameters	Station		Station		Station	
		1	2	1	2	1	2
1	TDS	2956	460	4760	368	4970	699
2	Electrical con	4800	530	5800	549	7100	999
3	PH	8.3	6.4	8.5	6.5	9.12	8.9
4.	Alkalinity	450	215	576	230	728	300
5.	Total hardness	890	98	850	150	2880	368
6.	Fluoride	0.3	0.6	0.5	0.4	0.6	0.2
7.	Chloride	956	76	1023	58	1300	102
8.	Ammonia	3.45	0.3	5.6	0.5	1.1	0.9
9	Mg	98	6	106	3	254	41
10	Ca	160	28	160	200	728	78
11	Iron	0.2	0	0.85	0.3	0.51	0.19
12	Nitrate	50	24	66	45	63	21
13	Sulphate	198	46	430	400	634	56
14	Phosphate	0.16	0.03	0.23	0	0.7	0.25

Ammonia value is acceptable limit is 0.5, but the station-1 value is not permissible but station-2 is permissible value. So the fish growth is sufficient for station-2. The maximum value of station-1 is 6.4 (April) and minimum is 0.9 (July) and station-2 is maximum-0.9 and minimum is 0.06 (July). Magnesium concentration in station -1 during the study period ranged from maximum in 254 (July) and minimum 43 (October) and the station -2 is maximum – 41 (July) and minimum is 3 (April), so the permissible value is 30-100 limit.

The content of calcium in the water samples of station -1 maximum value in 728 (July) and minimum value in 130 (July) and station-2 maximum value in 360 (October) and minimum 26 (October). The excessive Ca is causes more disease in aquatic animals. High concentration of iron could cause a disease of fresh water fishes. The maximum and minimum value in station -1 0.3 and minimum value 0.2 and station -2 maximum value is 0.3 and minimum value is 0.1. The standard limits 0.3 mg /liter of dissolved iron prescribed by WHO 1984.

The main source nitrate is decomposition of organic matters. Nitrate represents the final product of biochemical oxidation of ammonia. The maximum and minimum value in station-1 is 163 and 49 and station-2 maximum and minimum value in 45 and 13 respectively. So the permissible limit was 45. Station - 1 nitrate value is high. So the fishes are not survived. High concentration of sulphate could cause a cathartic action on human beings and can also cause respiratory problems. The maximum and minimum value in station-1 is 14 and 634 and station-2 maximum and minimum value is 13 and 41. So the permissible value 200-400. But station-1 is not permissible value.

The excess amount of phosphate may lead to eutropication. The maximum and minimum value of phosphate in station-1 is 0.68 and 0.18. In station -2 is 0.25 and 0.16. So Phosphate in station -2 was below the permissible limit throughout the study period.

4. CONCLUSION

The present comparative study about station-1 was highly disturbed due to fish growth. The reasons behind the disturbance were mainly due to pollution. Station-2 was not high disturbed so the fish growth is well.

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CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests regarding the publication of this paper.