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Research Article

HYDROBIOGICAL PARAMETERS STUDIES OF THE ALAGANKULAM RIVER, RAMANATHAPURAM DISTRICT, TAMIL NADU, INDIA

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ABSTRACT: The present study was carried out to determine the pysico-chemical characteristics and nutrients in two stations of Alagankulam River, Ramanathapuram, and South East Coast of India during January to December 2012. All the pysico-chemical parameters were analyzed using standard methods (Apha, 1998). The minimum and maximum values of water temperature (°c), Dissolved oxygen (mg/lit), Salinity (ppt), P^H, Calcium (mg/lit) was 26-35 (Station 1), 26-35 (Station 2), 5.0-7.1 (S1), 5.0-7.1 (S2), 0.01-0.06 (S1), 0.02-0.07 (S2), 7.0-8.2 (S1), 7.2-8.3 (S2), 22.1-29.4 (S1), 19.9-26,2 (S2) respectively. The range of Alkalinity (mg/lit), Silicate (mg/lit), Sulphate (mg/lit), Chloride (mg/lit), Ammonia (mg/lit), Phosphate (mg/lit) and nitrite (mg/lit) was 16.1-28.6 (S1), 18.5-26.8 (S2), 0.13-2.28 (S1), 0.81-1.74 (S2), 26.13-41.29 (S1), 28.9-49.70(S2), 6.1-8.7(S1), 5.5-7.9 (S2), 0.2-1.9 (S1), 0.2-1.9 (S2), 3.3-9.2 (S1), 1.3-8.5 (S2), 13-28 (S1) and 12-27 (S2) respectively.

Key words: Alagankulam River, Alkalinity, Nitrite, Phosphate, Physico-chemical parameters, Ramanathapuram, Silicate.

INTRODUCTION

Water is the prime resource of man's food supply and most important household and industrial tool. One of the most important crises of 21st century is the availability of drinking water, a resource material to our survival and growth. The quality of water is subjected to major physical, chemical and biological changes due to the influx of sediments and dissolved substances. Water quality assessment generally involves analysis of physico- chemical, biological and microbiological parameters and it also reflects on abiotic and biotic status of the ecosystem. Assessment of water quality in a region is an important aspect for any developmental activity of the region (Jain *et al*., 1996).

In early days, water was primarily used for domestic needs like drinking, washing, bathing and cooking etc. But due to industrial and urban development, requirement of water for these activities has increased along with domestic purpose. Water of good quality is required for living organisms. The quality of water is described by its physical, chemical and microbial characteristics. But if, some correlations were possible among these parameters, then significant ones would be fairly useful to indicate the quality of water (Dhembare *et al*., 1997). The deterioration of quality, loss of biodiversity and fast depletion of water resources are the main challenges, which need urgent attention. The immunological study gives the proper direction in decision-making processes for problems like pollution control, fish andother aquatic lives. This represents the organic material available in particulate form on which the animal population of aquatic ecosystem depends directly or indirectly. The studies of physico-chemical parameters are used to detect the effects of pollution on the water quality.

Water supply systems are important, but at the same time wastewater treatment systems are also equally important. Approximately 80% of water turns to waste water after its utilization. This wastewater should be properly treated before discharging into any water body. In case of river as a receiving body, when waste water is discharged on upstream side of river, downstream community uses the same water from the river for its day to day needs. Hence it is very much important that wastewater should be properly treated before discharging into river and maintaining sanctity of river. The sewage either seeps into the soils or pollutes ground water or it flows through streams and rivers and pollutes surface water.

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Rivers are the most important fresh water resource for man, social, economic and political development has been largely related to the availability and distribution of fresh waters contained in rivering systems. Water quality problems have intensified through the ages in response to the increased growth and concentration of populations and industrial centers. Polluted water is an important vehicle for spread of diseases. In developing countries 1.8 million people, mostly children die every year as a result of water related diseases (WHO, 1993). The water quality parameters in river systems have been studied earlier reports (Bhowmic and Sigh, 1985; Chessman and Robinson, 1987; Jain, 1999: and Sharma, 2004. Hence, the present study was conducted to study the physico-chemical parameters of this river water in different seasons of the year.

MATERIALS AND METHODS

The area under present study is Alagankulam river lies between latitude which is 9° 22' 34" N and longitude 78° 57' 11"E in Ramanathapuram, South East Coast of India. The location map of the two selected sites namely Nathi Palam and Attrankarai is presented in figure 1. The distance between two different sampling sites about 3 km. The average depth of the two stations is about 2-4 m and this river occupies nearly about 18 km. It has a year round connection with the open sea. The study was carried out over a period of 12 months i.e. in the year of 2012. Throughout the study period, sampling of water was carried out on the basis during the last week of every month. Sampling was done usually during the morning hours between 8.30am -10.30 am. . The samples were collected monthly on 3rd of every month between 9.00am to 10.00 am. Water samples were taken from both stations by using acid washed polypropylene containers of 1 liter capacity from depth of 15-30 cm. below the surface water, by gently wading the polythene cans into the water. Samples were analyzed by adopting the procedures outlined by standard methods. Water temperature was measured by mercury thermometer. P^{H} was measured by digital pH meter (Elico pH-13 model). Salinity was estimated by Argentometric titration method. The dissolved oxygen was estimated by Winkers method.The calcium, phosphate, silicate, alkalinity, nitrite, sulphate and chloride were analyzed by using standard methods (APHA, 1998).

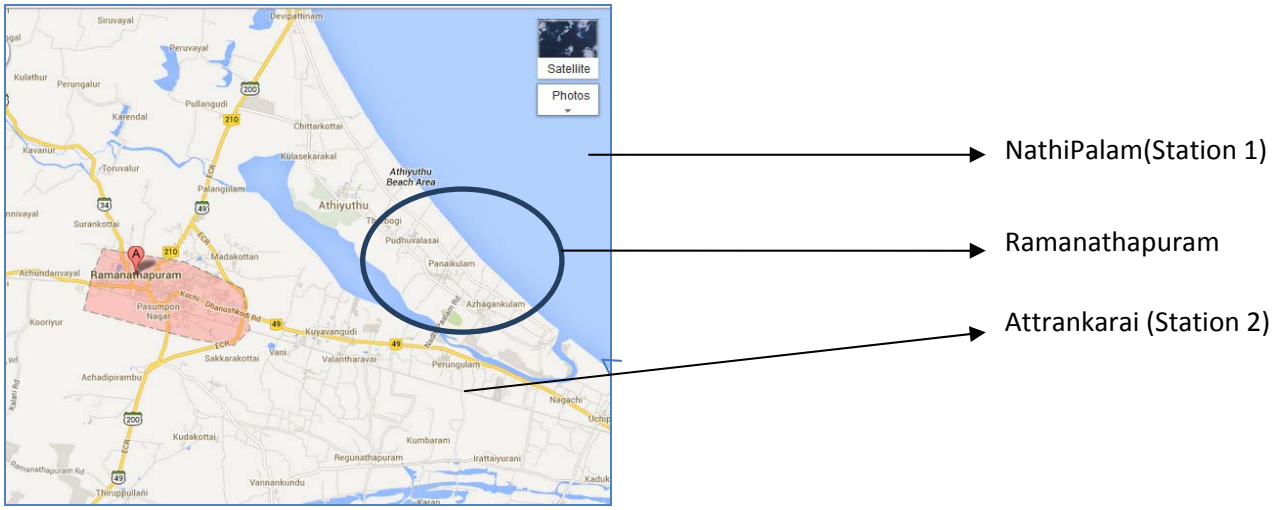

Figure 1. Alagankulam River

RESULTS AND DISCUSSION

During study period the maximum water temperature 35^{0} C has been recorded in the month of May and minimum 26^{0} C in the month of December at both the stations. Temperature is basically important for its effect on certain chemical and biological reactions taking place in water and in organisms and inhabiting aquatic media. The variation in water temperature is similar to other reservoir of Tamil Nadu as reported by Khaiwal *et al.*, 2003). Dissolved Oxygen concentration have varied from 5.0 to 7.1 mg/lit respectively. The minimum value has been recorded during May and the maximum values during November in the both stations. The trend noticed in the present study is in accordance with the findings of (Abida and Harikrishna, 2008; Singh *et al.*, 2010). The low dissolved oxygen concentration observed during summer could be ascribed to the higher salinity of the water and higher temperature. The trend noticed in the present study is in conformity with the findings of (Ketchum, 1951; Jayaraman, 1954). Dissolved oxygen concentration varies according to many factors; the main factors are due to photosynthesis and respiration by organisms. BOD and COD values were similar to the dissolved oxygen concentration in the present study.

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The salinity in the station 1 was minimum 0.01 ppt during the month of January and maximum 0.06 ppt during the month of June. The salinity in the station 2 has varied from 0.02 - 0.07 ppt. Minimum was recorded during the month of January and the maximum during the month of April. The present study agrees earlier observations (Ray *et al.*, 1996 and Shastri, 2000). Similar trend in the salinity values were also observed from various part of south East coast of India (Satpathy, 1996; Seenivasan, 1998; Palanichamy and Rajendran, 2000; Sundaramanickam *et al.*, 2008; Soundrapandian *et al.*, 2009).

The pH at the water varied from 7.0 to 8.2 in station 1 and 7.2 to 8.3 in station 2. Minimum value has been recorded in the month of November and maximum in the month June at both the stations. This study agreement with previous studies (Singh And Singh, 1995; Sujithaet *et al.*, 2011). The maximum pH may be due to the buffering capacity of water and geology of catchments area (Rashid, 1982). The pH does not have any adverse health effect but it altars taste of water higher pH reduces the germicidal potentially of chloride and induces the formation of toxic Trihalomethanes. Most of the natural waters are generally alkaline due to the presence of sufficient quantities of carbonate (Trivedy and Goel, 1984). The influence of neritic waters was also there in the study area. The pH of waters gets drastic change with time due to exposure to biological activity and temperature. The Calcium content fluctuated between 22.1 to 29.4 mg/lit in station 1. The maximum value has been recorded in the month of July and minimum in the month of February. In stations 2 maximum (26.2 mg/lit) has recorded in June and the minimum (19.9 mg/lit) has been recovered in the month at February. During summer the decrease of calcium level in water is due to photosynthetic activity of macrophytes (Karul *et al*., 1980). The calcium amount was inversely proportional to water level (Osborne, 1987).The rise of calcium is due to leaching from calcium rich mineral rocks. The total alkalinity in the stations was minimum in the September 16.1 mg/lit) and maximum in the month of April (28.6 mg/lit) at station 1. The alkalinity at the water has varied from 18.5 to 26.8 mg/lit at station 2. Minimum has be recorded during the month of September and maximum in the month of May. Total alkalinity of water is due the presence of mineral salt present in it. It was primarily cause by the carbonate and bicarbonate ions observed by (Unnai, 1984). Alkalinity value reserve as an index of productive potential of water (Manahan, 1994). Anthropogenic activity leads to entry of more domestic wastes, washing, bathing etc., High value of alkalinity were also observed by Singh, (1995). The silicate content ranges between 0.13 to 2.28 mg/lit at station 1. The maximum value has been recorded in the month of October and the minimum in the month of March. In station 2 maximum (1.74 mg/lit) in the month of November and the minimum (0.81 mg/lit) in the month of March. Silicate content was higher than that of the other nutrients recorded in this study.The high monsoon values could be due to large influx of freshwater derived from land drainage carrying silicate leached out from rocks and also from the bottom sediment (Govindasamy *et al*., 2000; Rajasegar 2003). The low values recorded in the summer could be attributed to uptake of silicates by phytoplankton for their biological activity (Saravanakumar *et al*., 2008).

High concentration of sulphate could cause a cathartic action on human beings and can also cause respiratory Problems. The Sulphate content ranges between 26.13 mg/lit (January) to 41.29 mg/lit (July) in station 1, 28.9 mg/lit (January) to 49.70 mg/lit (July). The maximum Sulphate content was recorded during July and minimum was recorded during January in both stations.The increase in concentration and run off waters from agricultural lands might have also contributed to overall sulphate content in the river water. The chloride content fluctuated between 6.1 to 8.7 mg/lit in station 1. The maximum value has been recorded in the month of November and the minimum in the month of May. In station 2 maximum (7.9 mg/lit) has recorded in the month December and the minimum (5.5 mg/lit) has been recorded in the month of April. The desirable and permissible value of chloride is 200-1000 mg/l. An excess of chloride beyond desirable limit in inland waters is considered as index of water pollution.The existence of considerable amount of chloride in river water may be due to discharge of industrial effluents into it. Sewage water and industrial effluents are rich in Chloride content and discharge of these waste water result in greater chloride level in fresh waters (Hasalam, 1991). The total amount of Ammonia was minimum 0.2 µm in the month of April and maximum 1.9µm in the month January at station 1. The amount Ammonia in the station 2 was minimum (0.2µm) in the month of December and maximum (1.9µm) in the month of June.This may be partly due to the death and subsequent decomposition of phytoplankton and also might be the excretion of ammonia by planktonic organisms (Ananthan, 1994; Rajasekar 1998). The Phosphate value was minimum (3.3µm) in the month of March and maximum 9.2µ in the month of December at station 1. The Phosphate in the station 2 was maximum (8.5µm) in the month December and minimum (1.3µm) in the month of May. Earlier studies revealed such low levels of phosphate content in many of the Indian rivers (Jakhar *et al;* 1981, Devaraj *et. al.*, 1998).

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The weathering's of rocks, the fertilizers and the detergents are the sources of inorganic phosphate (Bragadeeswaran, 2001). The high amount of phosphate observed during monsoon season could be due to turbulence and mixing in water column, while the low amount observed during the post monsoon season could be due to high salinity and the utilization of nitrite by phytoplankton (Rajasekar, 2003). The highest Nitrite value (28µm) has been recorded in the month of November and December and minimum (13µm) in the month of May at station 1. The Nitrite in the station 2 was maximum (27µm) in the month of October and minimum (12µm) in the month of June at station 2.Nitrite might be formed by reduction of nitrate, oxidation of ammonia and recycling of nitrogen and by bacterial decomposition of planktonic detritus (Govindasamy, 2000). Nitrite was high during monsoon and was low in summer seasons.Conclusively, in this study the water quality properties in terms of its physico- chemical parameters and heavy metals concentrations in water from the Alagankulam river of Ramanathapuram were assessed. It would form a useful tool for further assessment and monitoring of this water body (Table 1 and Table 2).

Table 1. Physical-chemical status of Alagankulam River at Nathi Palam (Station 1) of during the year 2011 from January to December.

Components	January	February	March	April	May	June	July	August	September	October	November	December
Surface water temperature (^{0} C)	28	28	29	33	35	32	31	31	30	29	27	26
Dissolved Oxygen (mg/lit)	5.3	6.0	6.1	5.8	5.0	5.1	6.8	6.9	6.7	6.4	7.1	6.8
Salinity (ppt)	0.01	0.03	0.05	0.05	0.04	0.06	0.04	0.03	0.04	0.03	0.04	0.03
pH	7.5	7.3	7.4	7.2	7.7	8.2	8.0	8.0	8.1	7.6	7.0	7.4
Calcium (mg/lit)	25.5	22.1	26.8	25.8	27.6	22.9	29.4	23.9	27.1	25.4	23.9	26.7
Alkalinity (mg/lit)	19.4	19.5	26.8	28.6	26.6	20.1	19.9	16.4	16.1	17.2	18.9	17.3
Silicate (mg/lit)	1.29	0.61	0.13	0.29	1.20	1.15	0.90	2.11	0.69	2.28	1.94	1.80
Sulphate (mg/lit)	26.13	29.4	32.1	31.9	40.33	31.07	41.29	33.2	40.1	37.2	33.3	36.14
Chloride (mg/lit)	6.9	6.3	6.5	6.4	6.1	6.7	7.3	6.9	7.1	7.2	8.7	8.6
Ammonia(mg/lit)	1.9	1.4	1.1	0.2	0.3	0.3	1.8	1.8	1.8	0.8	1.8	0.7
Phosphate(mg/lit)	7.0	6.8	3.3	6.4	7.5	4.8	5.5	4.1	3.8	6.5	9.1	9.2
Nitrite (mg/lit)	26	24	22	20	13	15	14	17	17	26	28	28

Table 2. Physico-chemical status of Alagankulam River at Attrankarai (Station 2) of during the year 2012 January to December.

Components	January	February	March	April	May	June	July	August	September	October	November	December
Surface water temperature (^{0} C)	28	28	29	31	35	32	31	31	30	29	27	26
Dissolved Oxygen (mg/lit)	5.4	6.0	6.1	7.1	5.0	5.3	6.4	6.6	5.9	6.1	7.1	6.7
Salinity (ppt)	0.02	0.03	0.05	0.07	0.06	0.05	0.06	0.05	0.04	0.04	0.03	0.03
pH	7.3	7.4	7.9	8.1	8.2	8.3	7.8	7.5	7.5	7.5	7.2	7.3
Calcium (mg/lit)	21.2	19.9	26.1	25.0	24.2	26.2	24.1	25.4	23.3	22.9	25.6	20.5
Alkalinity (mg/lit)	21.1	20.6	23.5	21.9	26.8	25.8	25.1	21.5	18.5	19.3	23.1	24.5
Silicate (mg/lit)	1.40	1.36	0.81	1.07	1.11	0.98	1.15	1.13	1.39	1.60	1.74	1.65
Sulphate (mg/lit)	28.9	45.4	33.2	30.4	44.3	45.1	49.70	30.4	30.1	38.11	39.2	37.41
Chloride (mg/lit)	5.8	5.6	5.7	5.5	6.1	7.7	6.4	6.1	6.1	7.8	7.7	7.9
Ammonia(mg/lit)	1.2	1.4	1.6	1.3	1.7	1.9	1.7	1.6	1.1	0.8	0.7	0.2
Phosphate(mg/lit)	4.6	5.1	2.4	3.1	1.3	3.5	4.4	4.9	3.4	2.9	4.6	8.5
Nitrite (mg/lit)	24	25	23	25	16	12	15	13	15	27	25	24

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CONCLUSION

The physico-chemical studies of the selected sampling sites of Alagankulam River Water, using this methodology is good for to identifying the water status. Eventhough this river crossed over many villages there is no pollutant found in the water. Due to free pollution fishes are recommended to consume public people. The Physico-chemical condition of the river water of selected two stations, using this methodology is good and recommended. However, in the two stations, the water quality parameters are not very much varied. The Water temperaure, Dissolved oxygen, Salinity, P^H, Alkalinity, Calcium, Silicate, Sulphate, Chloride, Ammonia, Phosphate and nitrite was found to be slightly monthly variation. The variation in Physico-chemical parameters mainly depends on monsoon rains. The fluctuations in physico-chemical parameters influence the natural activity and effciency of riverine organism.

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