IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 8, August 2016
ISSN (Online) 2348 – 7968 | Impact Factor (2015) - 4.332
www.ijiset.com

Analysis of Water Quality in Selected Stations along River, Tambaraparani Kanyakumari District, Tamilnadu, India

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Abstract

One of the critical areas of environmental assessment is water quality, because of its significance in maintaining the health of human beings and that of the ecosystem. River water is a vital freshwater ecosystem and is very critical for sustainable development. The study of water quality is necessary to determine the health status of any water body. In this study, physic – chemical parameters of Tambaraparani river in Kanyakumari District was analysed along four important stations; one in the origin, one in the river mouth and two in route. In the present study, maximum electrical conductivity (134 ± 10.5 µs/cm) was observed at station IV. Factors like total dissolved solids (90 ± 6.8 mg/l), pH (7.51 ± 0.008), alkalinity (32 ± 2.7 mg/l) and total hardness (48 ± 3.3 mg/l) were found to be high at station IV. Anthropogenic activity is maximum in station IV. Yet the different factors are well within permissible limits. Based on Bureau of Indian Standards, this river water is highly suitable for drinking and agricultural use.

Keywords: *water quality, river, water, physic-chemical*

1. Introduction

Water is the valuable resource for life and also for various activities (1). About 80% of the earth's surface is covered with water and it is used for drinking, domestic, agriculture and industrial use (2). River and lakes are important water resource and these resources are widely utilized by mankind over the years to the extent that very few, if not many are now in a natural condition (3). The maintenance of healthy aquatic ecosystem mainly depends on the physicochemical properties of water and biological diversity of aquatic organisms (4). The interactions of both the chemical and physical properties of water play a significant role in distribution, composition, abundance, diversity of aquatic organisms (5). To minimize energy expended for survival, species typically favour habitat conditions that optimize their physiology process (6). Fish populations are mainly dependent upon the physicochemical characteristics of their aquatic habitat which supports their biological functions (7). The physicochemical factors such as, temperature, pH, Dissolved Oxygen, turbidity and water transparency have been significantly identified as the potent determinants in fresh water ecology (8). The physiochemical factors such as, temperature, salinity, dissolved oxygen, salinity, and depth and the fish diversity is highly correlated (9). Blaber and Blaber (10) reported that turbidity is mainly associated with productive feeding areas and provides cover for fishes. Other studies have determined that fish move away from alkaline waters when pH levels approach 9.0 – 10.0, unless more important survival factors outweigh avoidance, including food availability or availability of predators (11). There are many factors responsible for distribution of organisms in various fresh water habitats according to their adaptations, which allow them to survive in a specific environment (12). In India, water resource is mainly depends on ground water and surface water. However, surface water is under great threat than ground water because of pollutants, urbanization, industrialization and the use of pesticides in the agricultural sector. Kodhaiyar river is one of the important rivers in Kanyakumari District, Tamilnadu, which originates from Western Ghats of Agasthia hills and end with Arabian sea, at Thengapattinam area. The water quality of this water is mainly affected by rubber processors, brick producers, and the discharge of human and animal wastes (13). The present study was conducted to analyse the present status of different physiochemical parameters of the water from Kodhaiyar river.

2. Materials and methods

2.1 Study Area

The present study was carried out along four different stations from Kodayar river. This river has two major tributaries with the Pechiparai Dam and Perunchani Dam

respectively built across them Kodayar and Paralayar. The origin of Tambaraparani river is the Western Ghats and the river confluences with Arabian sea near Thengapattanam, about 56 km west of Kanyakumari town. The study area includes the Pechipparai Dam and four sampling stations were selected from Muthukuzhivayal to Kuzhithurai in Kanyakumari District, Tamilnadu for assessing the water quality.

2.2 Stations

The station I is located near Kodayar Bridge. The substratum is sandy with few builders and the water flow is very slow and it is located in the interior forest (8º 31′27.1″N and 77′19.5.90″E). The station II is located at Pechipparari dam (8º 26′ 52.3″N and 77º 18′30.4″E). Stream bank shows luxuriant growth of rubber plantations. Anthropogenic activities like cleaning of automobiles, bathing and washing of clothes were noticed in this station. The third sampling station is Moovathumugam (8°33′387″N and 77°28′511″). Heavy water flow from the river and bottom is sandy. The two main tributaries Paraliyar and Kodayar join at Moovttumugham to form Tambraparani. Anthropogenic activities like bathing, washing clothes, tourists visits were noticed in this site. The fourth sampling station is Kuzhithurai (8.3129° N, 77.2041° E), near to Kuzhithurai bridge. Waste water from residents and municipal waste water mix with river water. Anthropogenic activities like washing clothes, dumping construction wastes into river, dumping non-degradable wastes, bathing were noticed in this site.

2.3 Collection of water samples

Sampling of water was carried out over a period of one year from February 2009 to January 2010 on a monthly basis throughout the study period in all the four stations. Water samples required for the hydro biological analyses were collected during the early hours of the morning from the selected stations. These bottles were labelled with respect to the collecting stations, date, and time in order to avoid any error between collection and analysis. All the sample collections were immediately preserved in an icebox and brought to the laboratory for determining the specific water quality parameters. Two-way analysis of variance (ANOVA) was carried out to evaluate the variation of water quality parameters (14).

3. Results and discussion

3.1 Electrical conductivity

It is numerical expression of the ability of water sample to carry an electric current. The EC of water samples of station I to IV were described in Figure 1. The electrical conductivity of water sample of station I varied between 32±3 µs/cm and 54 µs/cm. The EC value was high in July and low during the month of October. Among all stations, station IV showed more electrical conductivity (134 ± 10.5 µs/cm).

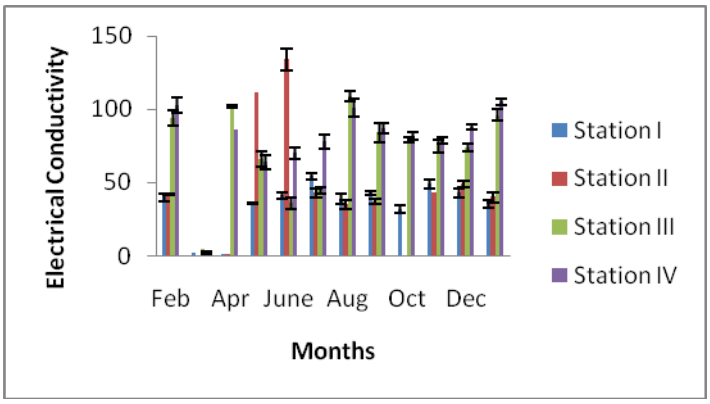

Fig. 1 Monthly variation of EC in the water sample from different stations (Feb 2009 – Jan 2010).

The higher value was observed in the month of June and decreased in the month of March. There is a sharp decrease in conductivity from February to March during the study period. The higher value of conductivity registered indicating the pollution level in the water. Statistical analysis by Two-way ANOVA on EC of water as a function of variation between seasons are statistically significant ($F= 13.17173$; $p<0.05$). The higher value of conductivity registered indicating the pollution level in the water. Discharges to streams can change the conductivity depending on their make-up. Conductivity is the measure of capacity of a substance or solution to conduct electrical current through the water. High EC values indicated the presence of high amount of dissolved inorganic substances in ionized form (15).

Table 1. Two way ANOVA for the data on EC of water as a function of variation between different season Vs variation between different stations.

Source of Variation	SS	df	MS	F	P-value	F crit
Variation between season	1214.482	2	607.2408	3.317959	0.107	5.143
Variation between station	7231.929	3	2410.643	13.17173	0.004*	4.757
Error variance	1098.098	6	183.0164			
Total variance	9544.509	11				

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3.2 Total dissolved solids (TDS)

Salts like carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrates of calcium, magnesium, sodium, potassium, iron etc. are dissolved in natural water. Total dissolved solids (TDS) refer to any minerals, salts, metals, cations or anions dissolved in water. The high content of dissolved solids increases the density of water. The TDS values varied from 21±2 mg/l to 36±0.23 mg/l in station I. Its highest value was observed in the month of June (90±6.8 mg/l) in station II (Figure 2). Fresh water contains various kinds of inorganic minerals as well as some organic materials in dissolved state. Higher concentration of these substances causes pollution. Dissolved solids do not contain gas and colloids. In drinking water it is an important parameter which gives particular test to water. Statistical analysis by Two way ANOVA on TDS of water as a function of variation between stations are statistically significant (F= 15.85; p<0.05). In natural water dissolved solids are mainly minerals (16). In drinking water it is exclusively important parameter which gives particular test to water. Water with a high total dissolved solids indicated more ionic concentration. Kataria *et al.* (17) reported that increase in value of TDS indicated pollution by extraneous sources.

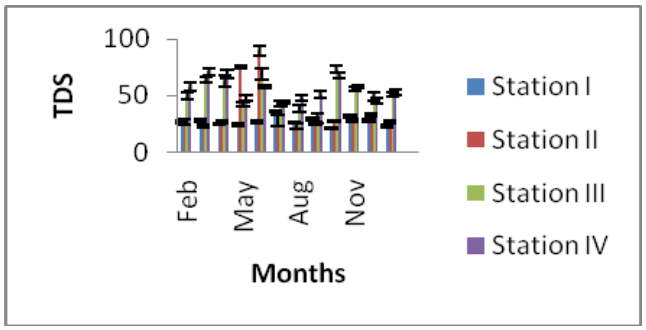

Fig. 2 Monthly variation of TDS in the water sample from different stations (Feb 2009 – Jan 2010).

Table 2. Two way ANOVA for the data on TDS of water as a function of variation between different season Vs variation between different stations.

Source of Variation	SS	df	MS	F	P-value	F crit
Variation between season	50.243	2	25.12	0.4028	0.6852	5.14325
Variation between station	2965.614	3	988.5	15.850	0.00294*	4.75706
Error variance	374.1937	6	62.36			
Total variance	3390.051	11				

3.3 pH

The BIS (Bureau of Indian Standards) limits of pH for drinking water are 6.5-8.5. The pH of water samples from station I to IV is described in Figure 3. The maximum value of pH of the water samples was recorded as 7.51±0.08 at station II in the month of May and minimum pH value was recorded as 5.2±0.07 in station I in the month of October. Because most of the chemical and biochemical reaction are influenced by the pH it is of great practical importance. In almost all seasons, the water pH was very near to neutral pH (7.0). Based on the present observation, the water was highly suited for domestic use. Statistical analysis by Two-way ANOVA on pH of water as a function of variation between stations and seasons are statistically insignificant. The pH is an important parameter in evaluating the acid-base balance of water (18). The principal component regulating ion pH in natural waters is the carbonate, which comprises CO_2, H_2CO_3 and HCO_3 (14).

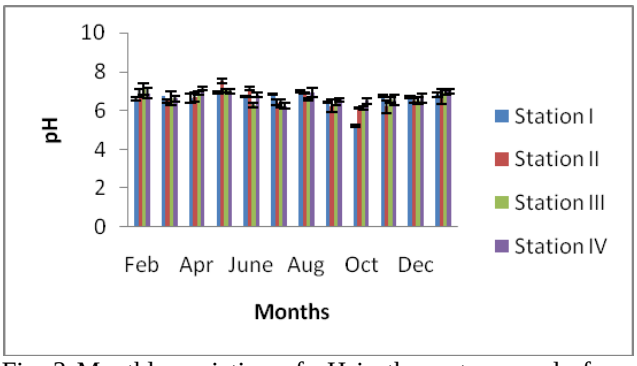

Fig. 3 Monthly variation of pH in the water sample from different stations (Feb 2009 – Jan 2010).

Table 3. Two way ANOVA for the data on pH of water as a function of variation between different season Vs variation between different stations.

Source of Variation	SS	df	MS	F	P-value	F crit
Variation between season	0.3188	2	0.1594	0.4834	0.63873	5.1432
Variation between station	1.1584	3	0.386	1.1710	0.39587	4.7570
Error variance	1.9783	6	0.3297			
Total variance	3.4556	11				

3.4 Alkalinity

The total alkalinity of water ranged between 6.0±0.09 and 44±1.09 mg/l. The alkalinity of water samples from station I to station IV is described in Figure 4. The observed maximum alkalinity value was 16±0.2 mg/l, 24±1.5 and 32±2.4 mg/l, respectively in station I, II and IV. Statistical

analysis by Two-way ANOVA on alkalinity of water as a function of variation between season ($F = 5.38$; $p<0.05$) and station ($F = 11.1$; $p<0.05$) are statistically significant. Alkalinity increases as the amount of dissolved carbonates and bicarbonates increase (19). The high concentration of sewage and industrial waste may be the cause of high alkalinity. Total alkalinity in river water ranges from 132 mg/l to 192 mg/l (20).

3. 5 Total hardness

In the present study water samples of different locations was observed in the range of 7±1.3 mg/l to 44 ±1.3 mg/l. The maximum total hardness was observed as 12±0.7 mg/l, 48±3.3 mg/l, 32±1.6 mg/l and 31±1.3 mg/l, respectively in station I, II, III and IV. The result

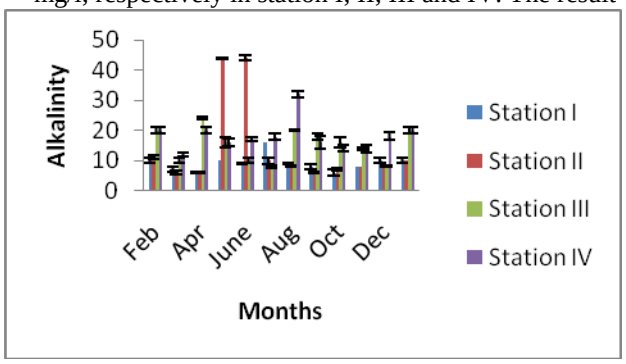

Fig. 4 Monthly variation of alkalinity in the water sample from different stations (Feb 2009 – Jan 2010).

Table 4. Two way ANOVA for the data on alkalinity of water as a function of variation between different season Vs variation between different stations.

Source of Variation	SS	df	MS	F	P-value	F crit
Variation between season	46.67	2	23.336	5.384	0.045801*	5.14
Variation between station	144.3	3	48.126	11.104	0.007316*	4.7
Error variance	26.0	6	4.333			
Total variance	217.0	11				

indicated that this water is highly suitable for drinking purpose. The total hardness of water samples from station I to station IV is described in Figure 5.

Statistical analysis by Two way ANOVA on total hardness of water as a function of variation between stations are statistically significant ($F= 8.277$; $p<0.05$). The hardness of water is not a pollution parameter but indicates water quality. Although hard water has no effect on health but it is unsuitable for domestic use.

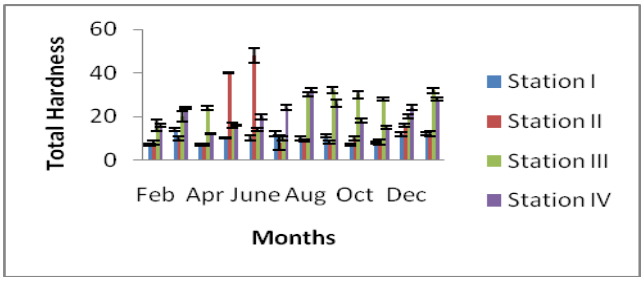

Fig. 5 Monthly variation of total hardness in the water sample from different stations (Feb 2009 – Jan 2010).

Table 5. Two way ANOVA for the data on total hardness of water as a function of variation between different season Vs variation between different stations.

Source of Variation	SS	df	MS	F	P-value	F crit
Variation between season	25.59	2	12.79	1.043	0.40	5.143253
Variation between station	304.68	3	101.56	8.27	0.0148	4.757063
Error variance	73.61	6	12.26			
Total variance	403.89	11				

Hardness is mainly due to presence of divalent cations like Ca^{++}, Mg^{++}, Sr^{++}, Fe^{++} and Mn^{++} which may be present in the combination with various anions like HCO_3^-, SO_4^{--}, Cl^-, NO_3^-, SiO_3^- etc (21). Hardness of water is a measure of its capacity to produce lather with soap (22). According to some classification, water having hardness upto 75 mg/l is classified as soft, 76-150 mg/l is moderately soft, 151-300 mg/l as hard and more than 300 mg/l as very hard (23). Based on the present finding, the water sample collected from the all four seasons was considered as soft water because of low hardness.

References

[1] G. N. P. Kumar, P. Srinivas, G. K. Chandra, and P. Sujatha. Delineation of groundwater potential zones using remote sensing and GIS techniques: A case study

of Kurmapalli Vagu Basin in Andhra Pradesh, India. Int J Water Res Environ Eng. 2(3), 2010, 70-78.
[2] S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control. 7th ed. S. Chand and Company Ltd., Ram Nagar, New Delhi, India, 2007, 44-75
[3] J. A. Adakole, D. S. Abulode, and M. L. Balarabe. Assessment of water quality of a man- made Lake in Zaria, Nigeria. In Sengupta M. and Dalwap R. (Editors), Proceeding of Taal 2007, the 12th World Lake Conference, 2008, 1273 – 1282.
[4] K. Venkatesharaju, P. Ravikumar, R. K. Somashekar, and K. L. Prakash. Physico-chemical and bacteriological investigation on the river Cauvery of Kollegal stretch in Karnataka. Kathman Uni J Sci Eng Technol. 6(1), 2010, 50-59.
[5] S. Deepak, and N. U. Singh. The Relationship between Physico-chemical Characteristics and Fish Production of Mod sagar Reservoir of Jhabua District, MP, India. Res J Recent Sci. 3, 2014, 82-86.
[6] K. R. Matthews. An experimental study of the habitat preferences and movement patterns of Copper, quillback, and brown rockfish (*Sebastes* spp.). Environ Biol. Fish. 29, 1990, 161-178.
[7] R. O. Ojutiku, and R. J. Koloanda. Temporal and spatial variations in some physico-chemical parameters of River Chanchaga, Niger State, Nigeria. J. Appl. Biosci. 47, 2011, 3242– 3245.
[8] S. Thirumala, B. R. Kiran, and G. S. Kantaraj. Fish diversity in relation to physico-chemical characteristics of Bhadra reservoir of Karnataka, India. Adv Appl Sci Res 2(5), 2011, 34 – 47.
[9] S. Marshall, and M. Elliott. Environmental influences on the fish assemblage of the Humber estuary, U.K. Estuarine. Coast Shelf Sci. 46, 1998, 175–184.
[10] S. J. M. Blaber, and T. G. Blaber. Factors affecting the distribution of juvenile estuarine and inshore fish. Journal of Fish Biol. 17, 1980, 143–162.
[11] D. M. Scott, M. C. Lucas, and R. W. Wilson. The effect of high pH on ion balance, nitrogen excretion and behavior in freshwater fish from a eutrophic lake: A laboratory and field study. Aquatic Toxicol. 73, 2005, 31-43.
[12] M. Jeffries, and D. Mills. Freshwater Ecology. Principles and Applications. 1990, 335–337. Belhaven Press, London and New York
[13] S. P. Kumar, J. A. Angelin, E. E. Jebamalar, and S. S. Manohar. Effect of salinity on the distribution of aquatic insects of Manakudy estuary, Kanyakumari District. J. Basic Appl. Biol. 4(3), 2010, 91-97.
[14] Z. H. Zar, Biostatistical Analysis. Printice Hall Inc. Englewood Clifs, N.J., 1974, 592 pp.
[15] N. Gupta, K. K. Yadav, V. Kumar and D. Singh. Assessment of Physicochemical Properties of Yamuna River in Agra City. Int.J.ChemTech Res.. 5(1), 2013, 528-531.
[16] T. Senthilnathan, K. V. Parvathavarthini, and Santhi M. George. Assessment of ground water quality of Maraimalai nagar town near Chennai, India. Journal of Env. Research and Develop. 5(4), 2011, 943.
[17] H. C. Kataria, H. A. Quereshi, S.A. Iqbal and A.K. Shandilya. Assessment of
water quality of Kolar Reservoir in Bhopal (MP). Pollution Res. 15, 1996, pp 191-193.
[18] N. M. Usha, K. C. Jayaram and H. L. Kantha, Assessment of Surface and Ground water Quality of Hebbal Lake, Banglore-Case Study. Proceedings of Tall 2007: The 12thWorld Lake Conference: 2008, 1737-1741.
[19] P. G. Smitha, K. Byrappa and S.N. Ramaswamy. Physico-chemical characteristics of water samples of Bantwal Taluk, South-Western Karnataka, India. J. Environ. Biol. 28, 2007, 591-595.
[20] B. J. Ugale, C. J. Hiware. Limnological study of an ancient reservoir Jagtunga Samudra located at Kandhar, Dist. Nanded, Maharashtra, India. Eco. Envi and Cons. 11(3-4), 1999, 473-475.
[21] R. K. Trivedy, and P.K. Goel. Chemical Biological Methods for Water
Pollution Studies. Environmental Publication, Karad, India,1984, pp 104.
[22] K. Jothivenkatachalam, A. Nithya and S. C. Mohan. Correlation analysis
of drinking water quality in and around Perur block of Coimbatore District, Tamil Nadu,
India", Rasayan J. Chem. 3(4), 2010, 649654.
[23] K. Saravanakumar, and R. R. Kumar. Analysis of water quality parameters of groundwater near Ambattur industrial area, Tamil Nadu, India. Ind J. Sci. Technol. 4(5), 2011, 1732-1736.