

Current Water Quality Status of River Thamirabarani

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I. Abstract

The present study was conducted for the time period of three months (January – March 2017) with an aim to find out the physico-chemical nature of water at different sites of River Thamirabarani upto punnaikayal in order to access the physical properties and chemical nature of its water and the impact of sites on their concentration. Fifteen sites were selected for the study purpose and the samples were collected on monthly bases. The samples thus collected were processed for the detection of pollutants with their relative concentrations following the standard methods. It was observed that the concentration of these pollutants was varying with respect to the collection sites, so was the case with respect to its physical nature. Also it was observed that there was a difference in concentration of these elements at different sites when compared among themselves. The data of physico-chemical nature of water of river Thamirabarani obtained during the study have been mentioned in Table 1,2,3. Furthermore it was also observed that concentration of some of these elements was more than the permissible limits as recommended by WHO which could have a definite impact on life. Keeping the same in view the present study was taken into consideration in which an attempt was made to access the water quality of River Thamirabarani and it is believed that this study would be helpful in formulating control strategy in near future.

II. Introduction.

Water is one of the most important components of life and life without it is impossible. ^[4]“However due to increasing anti-environmental human activities and some natural processes the quality of water is decreasing continuously and is posing a great threat to all forms of life including humans.” ^[5]“Polluted water is the major cause for the spread of many epidemics and some serious diseases like cholera, tuberculosis, typhoid, diarrhea etc. Although several attempts have been made by a number of researchers (Harrison, 1958; Lenat and Crawford, 1994; Biggs, 1995; Gergel et al., 1999; Caraco et al., 2003; Donohue et al., 2006) to study various aspects of water quality and the factors responsible for its degradation in order to formulate a significant control strategy all over the globe yet the problem is on rise.” The need of the hour is to take immediate steps to treat the water and minimize its negative impacts. ^[10]“The fast changing and increasing rate of construction, development of small scale industrial units, increasing rate of transportation, human population, immense use of fertilizers and pesticides and use of some other harmful substance have brought a drastic change in river. Thamirabarani which has posed a great life”, therefore it was felt to take must initiative into the same in order to gain some knowledge about the same said problem.

Table 1: Physico-chemical characteristics of Thamirabarani river in January 2017

Sam. No.	Latitude (N)	Longitude (E)	Temp (°C)	EC (µs)	pH	TDS	DO	BOD	COD	Alkalinity	Acidity	Hardness	Sulphate	Cl	Na	Ca	K
1	8°42'42"	77°22'30"	31.1	84.2	8.43	22	7.81	0.024	16.67	60	0	10	17.12	7.94	0.3	30.7	0.1
2	8°42'42"	77°22'30"	31	44.8	6.89	15	7.80	0.037	18.67	72	4	20	10.89	19.85	0.6	43.0	0.2
3	8°42'35"	77°22'41"	31	149.1	7.81	44	7.09	0.160	16.67	88	3	15	16.49	25.81	2.4	107.8	0.3
4	8°40'56"	77°25'40"	31.6	125.7	7.80	47	8.30	0.025	16.67	66	6	20	14.78	11.91	2	63.3	0.3
5	8°41'35"	77°27'46"	34.6	161.8	8.05	49	7.53	0.123	16	78	4	25	24.43	9.93	1.7	62.1	0.3
6	8°43'45"	77°29'48"	34.6	157.6	7.81	63	7.12	0.087	19.33	110	6	20	14.32	8.93	2.0	88.4	0.4
7	8°43'45"	77°31'05"	32.2	191.3	7.93	73	7.71	0.037	20	94	4	25	11.20	12.90	2.1	99.1	0.4
8	8°42'47"	77°32'40"	30.3	174.9	8.20	73	7.60	0.259	18	208	4	40	18.36	29.78	2.3	102.9	0.5
9	8°42'05"	77°33'56"	31.3	231	8.01	76	7.03	0.013	17.33	110	4	35	19.29	23.82	2.3	116	0.5
10	8°41'25"	77°36'25"	32.3	235	8.26	80	7.51	0.098	13.33	106	4	50	25.36	10.92	2.3	118.7	0.5
11	8°41'20"	77°37'58"	31.1	216	8.14	81	8.12	0.062	14	144	4	35	8.56	18.86	2.3	122.8	0.5
12	8°40'58"	77°39'11"	31.6	214	8.04	80	7.90	0.037	15.33	100	6	35	3.11	12.90	2.2	128.4	0.5
13	8°43'41"	77°42'52"	30.4	174.3	8.18	54	8.19	0.058	16.67	87	5	25	9.80	29.78	1.9	93.1	0.3
14	8°43'48"	77°42'57"	32	143.1	7.40	51	5.87	0.049	12	72	6	20	14.32	32.26	1.8	107.4	0.3

*All values are in mg/l except for pH and EC

The sampling points along the course of the river are

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| <ol style="list-style-type: none"> 1. Papanasam Lower dam. 2. Madhura coats upstream. 3. Madhura coats downstream. 4. Aladiyur. 5. Kallidaikurichi. 6. Thirupudaimarudhur. 7. Mukkudal- Thenthirupvanam. 8. Sun paper mill upstream. | <ol style="list-style-type: none"> 9. Sun paper mill downstream. 10. Pazhavor treatment plant. 11. Keelaseval- Manik nagar. 12. Gopalamudram- VOC nagar. 13. KTC Depot upstream. 14. KTC Depot downstream. 15. Punnaikayal. |
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Map showing the sampling points:



Table 2:Physico-chemical characteristics of Thamirabharani river in February 2017

Sam. No.	Latitude	Longitude	Temp (°C)	EC (µs)	pH	TDS	DO	BOD	COD	Alkalinity	Acidity	Hardness	Sulphate	Chloride	Na	Ca	K
1	8°42'42"	77°22'30"	33.6	40.9	7.95	20	7.02	0.012	14	140	4	20	30.65	7.94	1.3	14.4	0.2
2	8°42'42"	77°22'30"	34.6	99.8	7.08	26	7.30	0.049	14.67	148	8	15	14.63	17.87	1.2	19.6	0.2
3	8°42'35"	77°22'41"	32.3	146.7	6.70	47	7.01	0.074	13.33	108	6	20	29.56	9.93	3.4	18.2	0.2
4	8°40'56"	77°25'40"	34.2	118.4	7.58	39	8.32	0.012	10.67	106	6	15	34.85	9.93	3.3	15.9	0.3
5	8°41'35"	77°27'46"	34.3	109	7.89	36	7.86	0.123	13.33	86	6	25	40.92	7.94	2.4	17.5	0.2
6	8°43'45"	77°29'48"	36.2	85.9	7.04	32	7.51	0.148	16	76	2	25	34.39	8.93	2.2	16.0	0.2
7	8°43'45"	77°31'05"	32.2	137.5	8.43	39	7.71	0.073	20	76	2	35	32.99	8.93	1.4	15.0	0.2
8	8°42'47"	77°32'40"	34.2	136.3	7.16	42	8.41	0.160	12	82	4	40	35.63	8.93	1.5	19.9	0.2
9	8°42'05"	77°33'56"	38.2	145.6	7.88	40	7.90	0.074	14.67	100	4	40	40.77	8.93	1.6	15.1	0.2
10	8°41'25"	77°36'25"	34.1	148.9	8.40	46	7.87	0.123	12.67	106	2	30	43.10	6.95	1.7	17.0	0.2
11	8°41'20"	77°37'58"	32.2	114.3	8.95	39	8.14	0.123	11.33	88	4	25	8.56	7.94	1.5	19.9	0.2
12	8°40'58"	77°39'11"	33	130.8	8.03	40	8.27	0.123	12	102	6	35	6.69	7.94	1.6	15.9	0.2
13	8°43'41"	77°42'52"	31.2	212	7.12	40	8.80	0.123	10	142	6	35	12.14	18.93	2.1	18.7	0.3
14	8°43'48"	77°42'57"	32.2	143.5	6.75	50	8.64	0.098	11.33	110	6	35	11.05	17.94	1.9	18.6	0.3
15	8°38'11"	78°46'32"	32.3	29400	8.48	14900	5.75	0.148	10	400	10	1700	115.5	1381	171	1563	12.1

*All values are in mg/l except for pH and EC

III. Materials and methods.

The water samples from fifteen sites of the River Thamirabharani were collected on monthly basis and were analyzed for detection of concentration of inorganic substances followed by standard methods. Temperature and dissolved oxygen was recorded by using a electronic DO meter on site. pH of the water was determined by electrometric method using a laboratory pH meter, before taking the readings the Ph meter was calibrated by using buffer solution of pH 4 and Ph 9.2. All the readings were taken at 25°C. Conductivity was determined by electrometric method using a laboratory conductivity meter. The alkanity was examined by using phenolphthalein indicator. Chloride was estimated by argentometric titration method in the form of silver chloride. Calcium, sodium and potassium was identified using flame photometer.

IV.Results.

The results obtained during the present study show that the physico-chemical nature of water of the river Thamirabharani has been affected and the concentration of some of the constituents has crossed the permissible limits recommended by BIS. The DO level in the river Thamirabarani never decreases below the prescribed values except at Punnaikayal site where the DO levels are 5.87, 5.75, 5.82 mg/l respectively for Jan, Feb, March 2017. pH should be in the range of 6.5 to 8.5 for drinking and domestic purposes. The pH values analyzed using pH meter was found to be more or less similar for each sample, where values were ranging from 6.5-9. The amount of TDS in all the cycles ranges from 20-80 mg/l. But TDS at Punnaikayal sampling site was found to be very high as 14900 mg/l. The sampling points usually has a BOD less than 1mg/l. The hardness of the water ranges from 10-45 mg/l and at the Punnaikayal sampling site the hardness was found to be 1700 mg/l due to the vicinity of the site near the sea. The maximum permissible limit for acidity according to BIS is 8.2 mg/l. The value of acidity ranges from 2-8 mg/l

Table 3: Physico-chemical characteristics of thampirabharani river in March 2017

Sam. No.	Latitude	Longitude	Temp (°C)	EC (µs)	pH	TDS	DO	BOD	COD	Alkalinity	Acidity	Hardness	Sulphate	Cl	Na	Ca	K
1	8°42'42"	77°22'30"	32.3	64.5	7.25	19	6.63	0.050	13.33	60	4	20	19.34	6.96	0.5	3.3	0.2
2	8°42'42"	77°22'30"	31.5	38.7	8.50	13	7.78	0.135	18.67	44	6	15	10.89	17.94	0.6	8.4	0.2
3	8°42'35"	77°22'41"	31.0	133.6	7.48	50	6.67	0.074	12	54	4	15	18.67	11.91	3	7.0	0.2
4	8°40'56"	77°25'40"	32.9	69.6	7.82	26	7.49	0.099	11.33	48	6	25	17.12	8.93	3.2	9.9	0.2
5	8°41'35"	77°27'46"	32.7	90.5	8.17	31	7.03	0.061	13.33	54	6	20	25.45	9.93	1.7	5.4	0.4
6	8°43'45"	77°29'48"	34.2	77.1	7.98	29	7.24	0.062	12.67	52	4	30	17.12	10.92	1.1	6.6	0.2
7	8°43'45"	77°31'05"	33.2	79.6	8.00	29	7.93	0.037	12	48	6	25	10.89	8.93	1.1	5.8	0.2
8	8°42'47"	77°32'40"	34.6	93.9	8.35	34	7.50	0.074	14.67	58	8	20	23.34	9.93	1.2	5.1	0.2
9	8°42'05"	77°33'56"	33.5	111.2	7.62	39	6.55	0.099	10.67	66	6	20	18.67	9.93	1.2	6.2	0.2
10	8°41'25"	77°36'25"	34.2	114.9	7.71	41	7.03	0.025	18.67	68	8	40	26.45	8.93	1.2	8.5	0.2
11	8°41'20"	77°37'58"	32.6	97.3	6.70	34	7.35	0.025	12.67	52	8	35	7.78	9.93	2.5	6.8	0.2
12	8°40'58"	77°39'11"	33.8	96.9	7.21	35	7.30	0.098	14.67	54	6	30	6.22	8.93	1.2	5.9	0.2
13	8°43'41"	77°42'52"	31.5	199	7.00	51	8.28	0.037	18.67	60	8	40	10.89	12.90	1.6	9.9	0.3
14	8°43'48"	77°42'57"	31.5	123.4	6.89	48	5.57	0.012	16	70	6	45	17.12	14.89	1.5	9.9	0.3
15	8°38'11"	78°46'32"	31.5	27700	8.55	14600	5.82	0.024	22.67	260	10	1600	121.7	1225	158	2285	11.7

*All values are in mg/l except for pH and EC

but at Punnaikayal site, it was found to be 10 mg/l. Chlorides are generally limited to 250mg/l in supplies intended for public use. The chloride value of all the samples are in the range 6.95 to 18.93 mg/l but the chloride content is as high as 3381 mg/l. Permissible limit of sulphate for drinking water is 400mg/l. The sulphate value of all the samples are in the range 3.11 to 121.78 mg/l. The EC value of all the samples are in the range from 38.7 µs/cm to 174.9 µs/cm and Punnaikayal site exceeds the permissible limit. Permissible limit of potassium in drinking water is 2.5 ppm. The value of Potassium in all the samples are in the range 0.1 to 0.5 ppm and Punnaikayal site exceeds the permissible limits. The value of sodium in all the samples are in the range 0.3 to 171.8 ppm. The value of calcium in all the samples are in the range= 3.3 to 128 ppm except Punnaikayal site where the value is 2285 ppm.

V. Discussion.

The results observed from the tests conducted conclude the following inference and they are discussed below. D.O. test is used to evaluate the

pollution strength of domestic and industrial wastes. The DO levels of the various sampling points along the river is well above the prescribed BIS standards except Punnaikayal site. The pH is used to express the intensity of acidic or alkaline condition of samples. The pH controls the biochemical reactions in the environment. pH should be in the range of 6.5 to 8.5 for drinking and domestic purposes. The pH values analyzed using pH meter was found to be more or less similar for each sample, where values were ranging from 6.5-9 with only a few sites having pH greater than 8.5. The desirable limit for TDS recommended by BIS is 500 mg/l. The TDS ranges from 15 to 81 mg/l with maximum concentration of 14900 mg/l at punnaikayal sampling site. The B.O.D values ranges from 0.01 to 0.25 mg/l which represent the amount of oxygen the microbes need to stabilize biologically oxidisable matter. The hardness of the water ranges from 10-45 mg/l and at the Punnaikayal sampling site the hardness was found to be 1700 mg/l due to the vicinity of the site to the sea. Acid waters are of concern because of their corrosive characteristics and the expense involved

in removing or controlling the corrosion-producing substances. The corrosive factor in most waters is carbon dioxide, but in many industrial wastes it is mineral acidity. The Acidity value of all the samples are in the range 0 to 10 mg/l. More than 50 mg/l cannot be used in R.C.C works. According to BIS, permissible limit of alkalinity for drinking water 200 to 600mg/l. The alkalinity value of all the samples are in the range 44 to 400 mg/l. Hence alkalinity is within safe limits throughout the course of the river. The Hardness value of all the samples are in the range= 10 to 1700 mg/l. Hard waters cause excessive consumption of soap used for cleaning purposes. Lathering does not take place until hardness ions precipitate the dirt. The water collected at Punnaikayal sampling site is hard and exceeds the BIS permissible limits. The chloride value of all the samples are in the range 6.95 to 29.78 mg/l but chloride value is 3384 mg/l at Punnaikayal site. Chlorides associated with sodium exert salty taste, when its concentration is more than 250mg/l. There is no known evidence that chlorides constitute any human health hazard. For this reason, chlorides are generally limited to 250mg/l in supplies intended for public use. According to BIS, Permissible limit of sulphate for drinking water= 400mg/l. The sulphate value of all the samples are in the range= 3.11 to 121.78 mg/l. Hence sulphates are within the safe limits as prescribed by BIS. The samples were tested for Sodium, Calcium, Potassium using the flame photometer and all the sites except Punnaikayal are within the safe limits.

Conclusion. The analysis of the water samples collected from various points along the course of the Thamirabharani clearly indicates that only few sites such as Sun paper mill downstream, KTC depot downstream are polluted due to industrial wastes. But Punnaikayal site has the worst water quality due to severe salt water intrusion due to its vicinity to the ocean. It is suggested that the Sun Paper mill and Madhura coats industries have to upgrade their effluent treatment processes and plants and KTC depot needs to release the wash water only after treatment. And also it is suggested that the river points near Punnaikayal and Aathur is unfit for water supply.

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