



WATER QUALITY ASSESEMENT OF RIVER THAMIRABARANI AT TIRUNELVELI DISTRICT, TAMILNADU, INDIA

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ABSTRACT - Thamirabarani river is flowing continuously for 120km. It passes through many villages, town and Tirunelveli corporation. It is a perennial river and monsoon based catchment. Many pollutants are added to this river at all points. It has solid, liquid and gaseous pollutants such as BOD, COD, TSS and dissolved oxygen. Many ditch water and night soil pollutants are also added to this point. Textile pollutants and paper industrial waste are also added to this point. These are the main sources of pollutants of Thamirabarani river. Thamirabarani is a main source of water supply to many towns which include Tirunelveli corporation. In Tirunelveli municipal area the drinking water is not treated properly. Entire flow on the river has turbidity. The main aim of this paper is to analyze the various pollutants and its removal process.

KEY WORDS- river thamirabarani, water quality, BOD, COD.

I.INTRODUCTION

1.1 Rivers

A river is a natural watercourse, usually freshwater, flowing towards an ocean, a lake, a sea, or another river. In a few cases, a river simply flows into the ground or dries up completely before reaching another body of water. Rivers are part of the hydrological cycle. Water within a river is generally collected from precipitation through a drainage basin from surface runoff and other sources such as groundwater recharge, springs, and the release of stored water in natural ice and snow packs (e.g., from glaciers).potamologyis the scientific study of rivers while limnology is the study of inland waters in general. Generally not all rivers are perennial and flow on the surface all around the year. Subterranean rivers flow underground in caves or caverns but intermittent rivers(or ephemeral rivers) only flows occasionally and can be dry for several seasons of for several years at a time.

1.2 River Tamirabarani

The Thamirabarani River also spelt Tamaraparani, Tamiraparani or Thamiravaruni, is a perennial river which originates from the famous Agastyarkoodam peak in the hills of the Western Ghats above Papanasam in

the Ambasamudram taluk and flows through Tirunelveli and Tuticorin districts of the Tamil Nadu state of southern India. The Tamarabarani basin is situated between latitudes 8.21' N and 9.13' N and between longitudes 77.10' The old Tamil name of the river is Porunai. From the source to sea, the total length of the river is about 125 km. The Tamiraparani River originates from the peak of the Pothigai hills on the eastern slopes of Western Ghats at an elevation of 1,725 meters above sea-level. The river is joined by its headwater tributaries Peyar, Ullar, Pambar before it flows into the Kariyar Dam reservoir, where it meets Kariyar. The river forms the Vaanatheertham waterfalls (40m high) as it enters the Kariyar reservoir.Servalar joins Thamirabarani before it enters into the Papanasam lower reservoir, which was built for the Papanasam Hydroelectric station. The river descends down the mountains near Papanasam, where it forms the Kalyanatheertham falls and Agasthiar falls.

The river flows on the plains eastwards from Papanasam. The first tributary to join Thamiraparani in the plains is the Manimuthar River, which originating from Manjolai hills and joins Thamiraparani near Aladiyoor village. The towns Ambasamudramand Kallidaikurichi are located respectively on the left and right banks of Thamiraparani, after which the river meets the tributary Gadanathi at Tirupudaimaruthur. Before the Gadanathi's entry into the Tamiraparani, the Gadanadhi is joined by the rivers Kallar, Karunaiyar and Veeranathi or Varahanathi which joins the river Gadanathi about 1.5 km north-east of Kila Ambur. The Gadanathi is fed by the Jambunadhi and Ramanadhi Rivers. The Pachaiyar river which originates from the Kalakkadu reserve forests at about 1,300 m above sea level joins the Tamiraparani near Tharuvai village in Palayamkottai Taluk.

The river bisects the twin cities Tirunelveli and Palayamkottai before meeting its major and affluent tributary Chithar (Chitrathi) which arises in the Kuttralam hills and receives supply from the rivers Gundar, Hanumanathi and Karuppanathi. The Chithar river runs almost parallel to Thamirabarani till it joins the main river near Sivalaperi. Thamiraparani passes through the taluks of Tirunelveli and Palayamkottai of Tirunelveli district and Srivaikundam and Tiruchendur taluks of Thoothukkudi district. The river grains into Gulf of Mannar near Punnaikayal in Tiruchendur taluk of Tuticorin district.

The river drains with its tributaries an area of about 4400 km². As most of its extensive catchments areas



lay in the Western Ghats, the river enjoys the full benefit of both the monsoons which make the river perennial. Since all its tributaries are arising from the Western Ghats, the river is prone to heavy floods especially during the northeast monsoon. In the year 1992, there was an unexpected flood in Thamirabarani, which claimed hundreds of lives. Prior to the bifurcation of the Tirunelveli district, the Tamiraparani was the only major river in Tamil Nadu which had its source and drain in the same district. After bifurcation, the river traverses the two districts of Tirunelveli and Tuticorin.

Many anicuts, dams and reservoirs on the Thamirabarani river, along with those on the Manimuthar River, provide a large proportion of the water for irrigation and power generation for Tirunelveli District. It is fed by both the monsoons – the south west and the north-eastern and is seen in full spate twice a year if the monsoons do not fail. The Gadanandhi has 6 anicuts and a reservoir of 9,970,000 m³, and irrigates 38.87 km² of wetlands. The Ramanadhi has 7 anicuts, a reservoir of 4,300,000 m³, and irrigates 20.23 km² of wetlands. Pachaiyar River has 12 anicuts and irrigates 61.51 km² of wet and dry lands.

The important irrigation channels branching off from both the banks of the river Tamiraparani are, South Kodaimelalagian channel, North Kodaimelalagian channel (Kodaimelalagian anicut), Nathiyunni channel (Nathiyunni anicut), Kannadian channel (Kannadian anicut), Kodagan channel (Ariyanayagipuram anicut), Palayam (Palavur anicut) channel, Tirunelveli channel (Suthamalli anicut), Marudur Melakkal, Marudur Keelakkal (Marudur anicut), South Main Channel and North Main Channel (Srivaikundam anicut). Of these the first seven anicuts were constructed during the period of ancient and medieval rulers and the last anicut namely the Srivaikundam anicut was constructed and completed by the British in 1869.

1.3 Need for present study

The Tamirabarani is a symbol of Tamil culture and civilization and an identity of the far south of India. The river is the main source of water for the districts of Tirunelveli and Tuticorin as it is the only perennial river in the region and it runs through the heart of the cities. Thousands of people depend on the river for their routine activities and satisfying their basic needs. But Anthropogenic drivers such as the urbanization and economic dependence which being a major force in shaping the land scape of tirunelveli and Tuticorin has increased the pollution load in the river .Local complaints and news paper reports on the cleanliness less of the river have made the subject a major issue to discuss. Although Tirunelveli district authorities have taken steps to evict encroachments near the Thamirabarani river encroachments have not yet been removed from other areas and sewage being still let in to the river. Several people have a bath in the river water as they have no option.

It is high time to study the level of pollution in the water and the different point and nonpoint sources of

pollution discharges into the river. As the polluting of the rivers can affect the health of the rivers the assessment of quality would give the present health situation of the river, the effect of human activities on the cleaning capacity of the river and how much the river is able to endure the pollution. This has led to the need to assess the present condition of quality of the river, and to identify whether the river is fit for further human activities.

II. MATERIALS AND METHODS

2.1 Location of Sampling Points

The study is carried out along the stretch of the river Tamirabarani on a length of 125kms starting from its origin at karayar in the Tirunelveli district till the point where it drains into the Bay of Bengal at punnaikayal. Total of 25 locations have been identified which includes origin, major point and nonpoint pollution source locations, major towns



and cities and also where different tributaries join the river. The sites were decided after conducting literature reviews, seeking expert opinion and several site visits.

The first sampling point is at karayar dam from where the river originates. The quality at the origin has to be monitored so as to determine and assess the initial status of the river. The second sampling point is at mundanthurai bridge .Servalar is one of the majour tributaries of tamiraparani which arises from Servalar reservoir. Kalyana theertham is the next sampling point which is located just below the papanasam lower dam. Thalaiyanai dam is the next sampling point which is the next dam after papanasam lower dam and it is comparatively smaller. The water that comes to thalaiyanai dam is from the agasthiar falls, which is polluted by the tourists and the local people.

Servalar joins Tamirabarani river at about 5kms downstream of the Tamirabarani river. The sample from the point is analysed so as to study the impact of the tributary in the river. The next sampling point is at Madura Coats. Madura Coats Private Limited is a thread and zip supplier and manufactures a complete range of cotton, synthetic threads for the Indian and export markets. The industry discharges a lot of its effluents into the river and hence samples were taken to ascertain the level of discharge of pollutants into the river. The water from Manimuthar reservoir is a main source of water which



helpsto maintain the water level in river Tamirabarani. The water from Manimuthar reservoir flows through Manimuthar channel to join the river Tamirabarani.

Aladiur is the point where the tamirabarani river joins the manimuthar which arises from manjolai .sample is collected at this point to note the changes in the pollution level of tamirabarani river due to the combination of both the rivers. The next sampling point is at the Kallidaikurichi bridge in Ambasamudram at distance of 30kms downstream of Papanasam dam. The region is selected for sampling because the Ambasamudram town is a region where there is rapid urbanization taking place and the area is surrounded by agricultural fields, and hence whether agricultural runoff causes any pollution to the river has to be determined. The next point is at Thiruppudaimaruthur. Thiruppudaimaruthur is the point where the gadana river joins thamiraparani river . gadana river adds a lot of pollutants into the tamiraparani river which pose a major influence in increasing the pollution level of tamirabarani river.

The next point ai at Mukkudal.Mukkudal is the panchayat town of Tirunelveli located about 20 km west of the city. It is known as the temple village. Chemahadevi (Sun paper mills) is another fast developing town on the banks of river Tamirabarani at about 55kms downstream from Papanasam. Another reason for selection of this site is presence of Sun paper mill which is situated on the banks of the river and which caused of lot of grievance in the local community for discharge of waste into the river till recent times. Even though there is no discharge being made into the river these days, the water quality at Chermahadevi has to bemonitored for presence of any kind of pollution. Tharuvai Panchyar river is yet another tributary which arises from Vadakku Panchyar reservoir. The samples collected at Taravai help determine the characteristics of the Panchyar river.

Kokkila kulam is a developing town at the banks of river Tamirabarani at a distance of 60kms downstream of Papanasam. The analysis of the samples collected from the region gives data about the quality of water in that region. Vannarapettai is the heart of Tirunelveli city. At the heavily populated and urbanized region the river Tamirabarani is utilized for disposal of sewage and waste. Dosens of sewage canals are let into the river which could have adverse impacts on the health of the river. The river is also used for purposes like bathing, cleaning etc by hundreds of people on a daily basis and hence the need for assessment of the quality of river in this region is out of question. Naranammalpuram This point near KTC nagar is use to know about the pollution level of tamarabarani river after passing vannarpettai ,during its way to the naranammalpuram due less human encroachmentthere is chance decrease in the pollution level of water. The next sampling point is at seevalaperi. At seevalaperi the chittraru joins the tamirabarani river.

Next to seevalaperi the sample is collected at vallanadu,the analysis of the samples collected from this

region gives data about the quality of water after the joining of chittraru. Kongaraya kurichi is the next point after vallanadu, which is one major village before srivaikundam. the area is surrounded by agricultural fields and hence it may contribute pollution due to agricultural run off. The next sample point is at alwarthirunagari is a highly populated town which is next to the srivaigundam, it is an highly populated town and contribute considerable pollution to the tamirabarani river. It's about 31 km from Tirunelveli and 29 km from Tiruchendur, on the banks of the river Tamirabarani. The Next point is maveedu pannai which is asmall village along the banks of tamarabarani river.

Eral is a costal town at about 120kms downstream of the river. It is essential to assess the quality of the river at the tail end region. Attur is the region 125kms downstream of the river. The water sample collected at this region help to know the final pollution level of the river. Punnakayal is the point where the river joins the Arabian sea. The water here joins with the sea water to form backwater. The water sample collected at this region help to make a final quality assessment for the river.

2.2 SAMPLE COLLECTION

All water samples were collected from the above 25 locations along the river during the month of Februray. During the present study some of the physical and chemical parameters were determined. The measurement of pH Chloride, Total Hardness, Alkalinity, BOD, COD, TDS and Turbidity were analyzed by using procedures using APHA manual.

III. RESULTS AND DISCUSSION

The samples from all the sampling points were collected during the month of February and analyzed. The various physical and chemical parameter that were analyzed and the water quality parameters of samples are given below in table 1 and 2.

The pH values of all the sampling locations shows that the pH is within the permissible limits of 6 - 8. There is a slight increase in the pH downstream which shows that there may be a small impact of urbanization on the river but not enough to affect its quality. The chloride value in the river remains constant and very much within permissible limits. There is no effect of urbanization in the chloride concentration in the river. The high value of Chloride greater than the permissible limit of 250mg/L at Punnakayal is only due to the influence of sea water intrusion .

Permissible limits of total hardness 300 mg/L. The graph clearly shows that the hardness value steadily increases along the course of the river except at Thiruppudai Maruthur where the increased hardness value of Gadanadanadhi increases the hardness value of Tamirabarani during both the seasons. The steady increase of hardness could due to urban activities like bathing, washing clothes, vehicles etc which release detergents and



other impurities into the water which increases hardness of the water.

The permissible limits of alkalinity is 200 mg/L. On comparing the graphs of Hardness and Alkalinity it is found that they both have a similar slope and the effect of urbanization and the influence of Gadananadhi in Alkalinity value of Tamirabarani is similar to that of Hardness. From author the alkalinity is higher than the permissible value which once again is the contribution of sea water intrusion.

The permissible limits of BOD value is 5 mg/L. the value of BOD seems to above the permissible value which may be due to increase in the discharge of pollutants from the industries. The permissible limits of COD value is 10 mg/L. the value of COD seems to above the permissible value which may be due to increase in the discharge of pollutants from the industries. The permissible limits for TDS is 500mg/L. The TDS value in the river remains almost unaltered and very low till the water reaches Kalladaikurichi (Bridge). In the points beyond Kalladaikurichi it is observed that the TDS values increases. The increase in TDS shows the urban impact in the river and the high TDS value at Punnaikayal beyond the permissible limit is due to the sea water intrusion. Except for Punnaikayal at all the other locations the TDS value is within the permissible limits.

Table 1. Water Quality parameters of samples (Location 1-13)

	1	2	3	4	5	6	7	8	9	10	11	12	13
pH	6.23	6.30	6.34	6.12	6.28	6.41	6.75	6.50	7.01	7.03	7.89	7.13	6.68
Chloride(mg/L)	34.38	35.35	31.64	35.35	39.46	35.35	32.56	48.68	53.76	53.76	10.62	45.94	49.57
Total Hardness(mg/L)	34	38	48	38	36	44	48	49	55	161	143	149	154
Alkalinity(mg/L)	23	35	28	29	38	39	48	49	47	178	167	153	140
BOD(mg/L)	6.5	7.5	8.5	30.9	50.8	60.8	53	75	64	150	180	200	140
COD(mg/L)	90	200	254	240	316	568	456	320	295	306	258	528	450
TDS(mg/L)	17.6	23.4	20	23.8	32	39.6	47.5	20	206	106	337	112	186
Turbidity	0.2	0.5	1.2	0.9	1	3.6	2.5	1.7	0.5	0.8	5	2.9	1.5

Table 1. Water Quality parameters of samples (Location 14-25)

	14	15	16	17	18	19	20	21	22	23	24	25
pH	7.02	6.93	7.06	6.83	7.36	7.11	7.2	7.39	7.26	6.98	7.33	7.45
Chloride(mg/L)	51.42	51.42	52.84	59.94	56.38	79.82	73.64	51.83	65.45	86.89	96.72	201.53
Total Hardness(mg/L)	146	141	145	141	142	164	156	264	216	238	258	218

Alkalinity(mg/L)	153	149	155	186	164	189	185	165	168	189	231	246
BOD(mg/L)	180	155	140	170	165	154	121	132	110	200	140	250
COD(mg/L)	362	325	266	300	276	254	310	425	298	356	385	450
TDS(mg/L)	280	210	230	232	221	287	280	458	348	385	429	520
Turbidity	0.9	0.8	0.5	0.9	0.6	0.7	0.5	0.5	0.7	0.6	0.9	1.5

The permissible level of turbidity is 10 mg/L. Turbidity is a measure of suspended minerals, bacteria, plankton, and dissolved organic and inorganic substances. Turbidity level is well below the permissible limits at all station points. The turbidity level show a considerable increase in the down stream of Madura coats and sun paper mill (Cheranmahadevi)

Based on the industries and agricultural areas around tamirabarani river and the test results obtained by analyzing the samples at various points, it has been found that the major polluting agents are industrial waste and agricultural waste. a comparatively little amount of pollution is contributed by domestic sewage. Agricultural wastewater treatment relates to the treatment of wastewaters produced in the course of agricultural activities. Agriculture produces a range of wastewaters requiring a variety of treatment technologies and management practice. Some of the techniques that can be adopted to control the pollutants are Crop rotation and Planting perennial crops. Domestic sewage treatment domestic sewage includes carrying body wastes, washing water, food preparation wastes, laundry wastes, and other waste products of normal living. Since the areas surround Tamirabarani River don't have a proper transportation system for sewage, septic tanks were widely used, hence the level of pollution contributed by domestic waste is very low.

But in some places around Tirunelveli corporation are well developed and hence a proper sewage treatment plant would reduce the pollution level of water, discharged into river. Industries around banks of tamirabarani river generates wastewater with high concentrations of toxic pollutants. some of the major industries around tamirabarani river are sun paper mills (Cheranmahadevi, Madura Coats(Papanasam), VVminerals (punnaikayal).Some of the measures that can be adopted to control the pollutants. These industries which generates large volumes of wastewater should have well developed treatment plants within their factories to remove the toxic substances. These industries should work on redesigning their manufacturing processes to reduce or eliminate pollutants, which would greatly enhance the reduction in the pollution level of the river.

IV CONCLUSION

The main source of Water supply in tirunelveli district is from tamirabarani river. Lot of intake towers would be necessary for the future consumption and yet water treatment plant has to constructed in every area



before supply which is a tedious process. Instead of installing water treatment plants for all the sites where intake towers were located, drinking water can be supplied through pipelines from Thamirabarani dam, to selective zones of Tirunelveli district using head advantage decreasing from M.S.L +222.02 mts (Papanasam) to M.S.L +36.39 mts (Tirunelveli junction). The route for the supply of drinking water originates from Thamirabarani dam and reaches Tirunelveli via Papanasam, Vikramasingapuram, Ambasamuthiram, Veeravanallur, Cheranmahadevi, Pathamadai, Melapalayam, Tirunelveli junction, etc. covering nearly 20 zones (54.0kms) of Tirunelveli district. A single water treatment plant can be introduced in Tirunelveli district near the Thamirabarani dam and the water flows from the plant due to the potential head advantage using gravity through pipe lines. The initial cost for the project might be costly but however the project would be economical while comparing with the existing structure. Site visits reveal several untreated domestic wastewater channels, a bus service center and a paper mill discharges into the river Thamirabarani. The contaminants and the self-cleansing capacity of the river indicate the river health, extent of human impacts and present status of health of the river has to be identified and suitable remedial measures like reuse of waste water has to be implemented so as to preserve the nature's gift for the future generations to enjoy without paying the cost of our misbehaviors.

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