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# Physico-chemical investigation of river cauvery in bhavani region, Erode district, Tamil nadu, India

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**ABSTRACT**

River Cauvery is the major river system of south India. The nature of the quality of river water were studied for 11 physico-chemical parameters at four locations of the River Cauvery near Bhavani region of erode district, for a period of one year (January-December 2012) at monthly intervals. Over the years of time, river has been subjected to human interference regularly and water quality was getting deteriorated profoundly. Major anthropogenic activities practiced were in and around the study area. Agriculture, abstraction of water for irrigation and drinking, washing cloths, discharging of sewage waste, sand mining, boating, fishing, open defecation and religious ritual activities along the stretch were generating serious threat to the biota of the river by altering the physico-chemical concentration of the river system. The seasonal and yearly trends were discussed to comprehend anthropogenic interferences on the river. The Temperature, pH, Turbidity, Total Suspended Solids (TSS), Electrical Conductivity (EC), Phenolphthalein Alkalinity, Total Alkalinity and Total Hardness levels indicate the moderate quality of water. The values of Dissolve Oxygen (DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) levels indicate the presence of major organic pollution sources. The possibility is that since there are major industries in the study area, the major source of organic pollutants could be from these industries and domestic source. Thus present study concludes that river water was not severely polluted. Almost all the results are within the permissible limit when compared with Bureau of Indian Standards. However, it is suggested adequate treatment measures for the industrial effluents so as to reduce the organic pollutants before the situation becomes alarming.



## Introduction

Water is the elixir of life, a precious gift of nature to mankind and to millions of other species living on the earth. It is fast becoming a scare commodity in most parts of the world. Though water is available in the universe in huge quantity in the order of 1400 x $10^6$ $km^3$, only 3% of the waters in the universe are fresh water. Among the fresh waters only about 5% of them or 0.15% of the total world waters are readily available for beneficial use **(Environmental Planning Frame Work, 2001).**

Rivers are vital and vulnerable freshwater systems that are critical for the sustenance of all life. However, the declining quality of the water in these systems threatens their sustainability and is therefore a cause for concern. Rivers are waterways of strategic importance across the world, providing main water resources for domestic, industrial and agricultural purposes **(Faith, 2006).**

The river water is used for irrigation or drinking by people and livestock. Contamination of the river has increasingly become a serious problem in many of the river basins of the Tamil Nadu (a State in India). River Cauvery face serious pollution problems due to industrial effluents. River Cauvery receives city sewage, industrial effluents, anthropogenic wastes and is subject to change due to seasons, climate, geochemistry of the land over which it flows and influx of waters from various tributaries. This study reports the quality of the Cauvery river water at Bhavani region. Physical and chemical parameters of pollution were assessed. Water pollution is caused by the sudden or ongoing, accidental or deliberate discharge of a polluting material. The maintenance of healthy aquatic ecosystem is depended on the physico-chemical properties of the river. A regular monitoring of water bodies with required number of parameters with reference to the quality of water not only prevents the outbreak of diseases and occurrence of hazards but checks the water from further deterioration. The purpose of the present study is to define the physico-chemical investigation of River Cauvery in Bhavani region of Erode district, Tamil Nadu, India.

## Materials and methods

The River Cauvery is one of the great rivers of India and is considered sacred by the Hindus. The river originates at Talakaveri flows southeast some 765 km to enter the Bay of Bengal. The river is the source for an extensive irrigation system and of hydroelectric power. Upstream stretch of Moon Road and Perumalmalai of River Cauvery located in Erode district, approximately 20km away from Erode city has been taken up as the study area to monitor the quality of the river water. Four sampling stations over a distance of 3Km were selected for the study. They are Moon Road, Komarapalayam, Sangameshwarar Temple and Perumalmalai. Totally one surface water sample was collected from each sampling station. 5Lit capacity of plastic container for physico-chemical samples, 300ml Borosilicate glass bottles for DO and BOD samples. For DO and BOD, special care has been taken to avoid the entrapment of atmospheric oxygen during collection. Collected samples were

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brought to the laboratory carefully by preserving in refrigerator at $4^0$C. Various physico-chemical parameters including Temperature, pH, Turbidity, Electrical Conductivity, Total Suspended Solids, Total Hardness, Total alkalinity, Dissolved Oxygen, Biochemical Oxygen Demand and Chemical Oxygen Demand were analyzed using standard methods of American public health association **(APHA, 1998).** Bureau of Indian Standards **(BIS, 1991** and **1998)** for river water quality has been considered for comparison of surface water quality.

**Results and discussion**

Physico-chemical parameters of the four stations Moon Road, Komarapalayam, Sangameshwarar Temple and Perumalmalai are given in Tables 1,2,3 and 4 respectively. The annual Minimum, Maximum and Average values of physico-chemical parameters are given in Table 5. The annual minimum, maximum and average values are also showed in Fig.1.

From the results, it is clear that the samples from almost all the sampling stations of the River Cauvery had various parameters level is with in permissible limit. Along the river, the moderately affected one was found to be station III (Sangameshwarar Temple). The indiscriminate discharge of sewage along with Municipal solid wastes would moderately affect the aquatic ecosystem and also its biota, thus posing a threat to human health. **(Nautiyal *et al.*, 1993)** have reported that various physico-chemical parameters significantly influence plankton, benthos and other aquatic life in Indian River systems. The rivers are polluted by both point and non-point sources in which non-point source pollution plays an important role in degrading the water quality.

Temperature of water may not be as important in pure water because of the wide range of temperature tolerance in aquatic life, but in polluted water, temperature can have profound effects on DO and BOD. The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the stream **(Ahipathy** and **Puttaiah, 2006).**

Industrial discharges and sewage effluents can also cause elevated temperatures in a stream or river. During the study period the Annual minimum temperature value was $24^o$C recorded in the stations Moon Road and Komarapalayam. Annual Maximum value was $33^o$C were observed in Perumalmalai. The Average temperature ranges between $28.2^o$C to $29.3^o$C. A gradual increase in temperature is observed from station 1 to 4. At all the stations with the marginal variations were observed. This can be attributed to the increasing amount of pollution load in the down stream.

pH is an important factor that determines the suitability of water for various purposes, including toxicity to animals and plants. Several factors affect pH. Carbon dioxide ($CO_2$) enters water from a variety of sources, including the atmosphere, runoff from land, release from bacterial activity in the water and respiration by aquatic organisms. Very high (greater than 9.5) or very low (less than 4.5) pH values are unsuitable for most aquatic life. Young fish and immature stages of aquatic insects are extremely sensitive to pH levels below 5 and may die at these low pH values. High pH levels (9-14) can harm fish by denaturing cellular membranes. Changes in pH can also affect aquatic life indirectly by altering other aspects of water chemistry. Low pH levels accelerate the release of metals from rocks or sediments in the stream. These metals can affect fish metabolism and the ability to take water in through the gills. Requirement desirable limit is 6.5 to 8.5 **(BIS, 1991).**

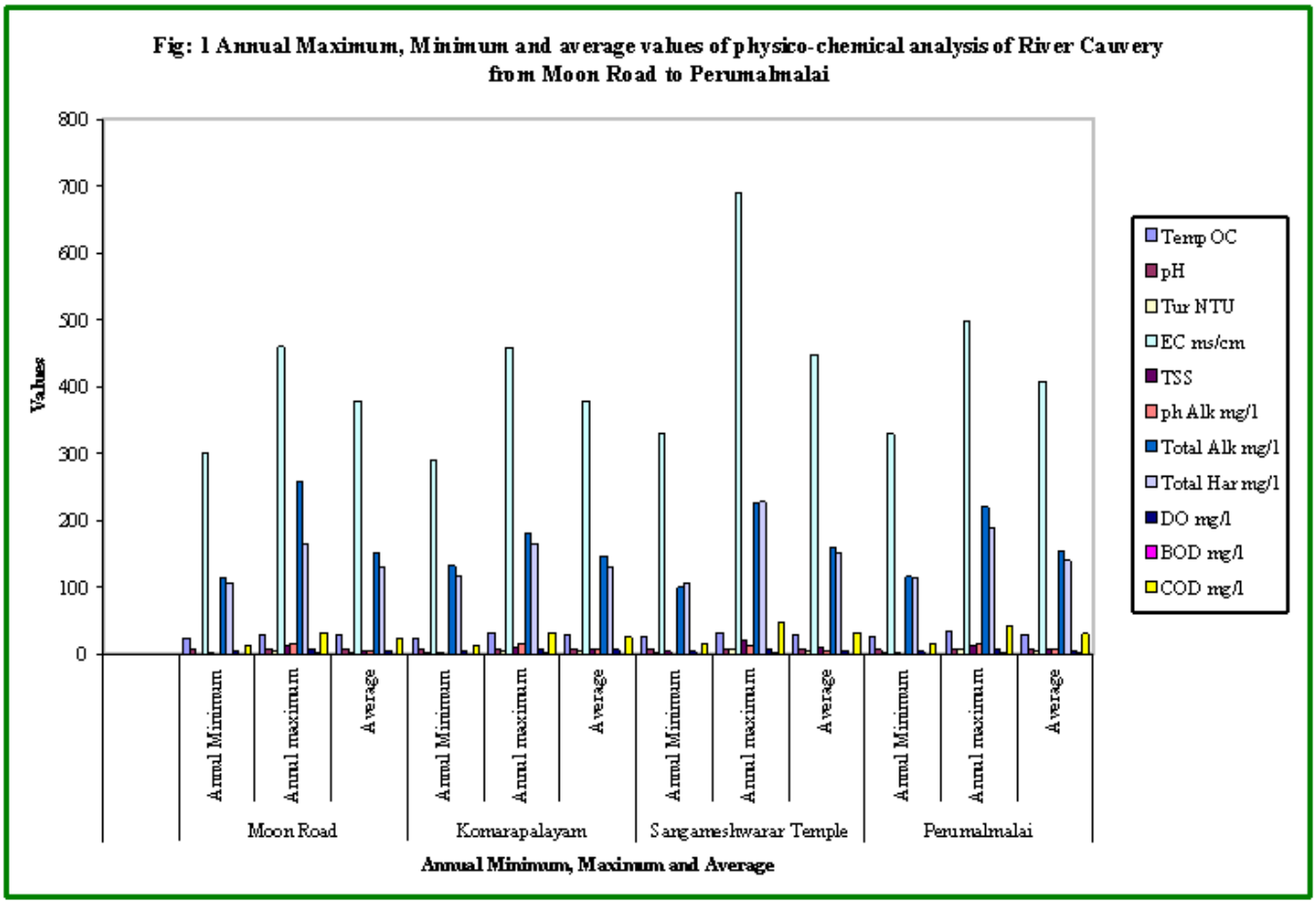
In the present study pH was found slightly alkaline in all the four stations through out the study period. It might be due to increasing draining of effluent discharge and domestic sewage to the river and microbial activities. Average pH values in all the stations showed the more or less same during the study period. Annual minimum pH value was 7.1 recorded in the stations Perumalmalai. Annual Maximum value was 8.5 were observed in all the four stations. The Average pH ranges between 8.1to 8.3. The winter maximum are due to decreased decomposition rate owing to reduced microbial activity and increased algal productivity. The summer minimum is due to increased decomposition rate, leading to acidification and lowered pH **(Chetana** and **Somashekar, 1997).** But in the present study the river water gets summer maximum and winter minimum is due to the flow of water levels. In summer the water flow is very low. So the level of pollutants entry is very high. Yearly averages indicate no significant variations in all the sampling stations.

Turbidity in water is caused by suspended and colloidal matter such as clay, silts, finely divided organic and inorganic matter, plankton and other microscopic organisms. The clarity of natural body of water is an important determinant of its condition and productivity. The acceptable limit for turbidity is 10 NTU **(BIS, 1998)**. In the present study the minimum turbidity value was 1NTU noticed at Moon Road. The maximum was 8NTU recorded in the station, Sangameshwarar Temple. At the time of sampling presence of microscopic algal population and high amount of suspended solids were observed. It indicates the considerable amount of organic load present in that location. The average turbidity range between 2 to 3.7 NTU. All the samples analysed are well within the permissible limit.

Electrical Conductivity is a measure of the ability of an aqueous solution to carry an electric current. This ability depends on the presence of ions on their total concentration, mobility and valence and on the temperature of measurement. Ions come from the breakdown of compounds and conduct electricity because they are negatively or positively charged when dissolved in water. Therefore, specific conductance is an indirect measure of the presence of dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron can be used as an indicator of water pollution. Solutions of most inorganic compounds are relatively good conductors. Molecules of organic compounds that do not dissociate in aqueous solution conduct a current very poorly **(APHA, 1992).** Although conductivity is not regulated, it is a good indicator of the amount of dissolved solids in water.

In the present study the annual minimum Electrical Conductivity value was 290Ms/cm recorded in the station Komarapalayam. The annual maximum was 690Ms/cm recorded in the station Sangameshwarar Temple. Increasing levels of conductivity and cations are the products of decomposition and mineralization of organic materials **(Begum** and **Krishna, 2008)**. In all the stations minimum values are observed in rainy season due to dilution with rain water and maximum in summer owing to evaporation and discharge of sewage water to the river. Significant variations of yearly averages were found in case of Electrical conductance. The average EC ranges between 378.9 to 447.5 Ms/cm.

The Alkalinity of natural waters is due primarily to the salts of weak acids, although weak or strong bases may also contribute. Bicarbonate represents the major form of alkalinity, with that carbonate and hydroxide alkalinity also.




The alkalinity provides an index for the nature of salts present in the samples. The mixing of large quantity of industrial effluents in low water content as well as high evaporation rate could be associated with the increased alkalinity during summer in the samples collected from different stations of the study area. The high value of alkalinity shows the presence of weak and strong bases such as carbonates, bicarbonates and hydroxides **(Janin *et al.*, 2003).**

In the present investigation total alkalinity reveals summer maximum and monsoon minimum values. The minimum value was 114mg/lit was observed at Moon Road. The maximum values are 159.9 mg/lit at Sangameshwarar Temple. Desirable limit of alkalinity is 200 mg/lit. A total alkalinity of 100-200 mg/lit will stabilize the pH level in a stream. At Present investigation all the sampling location the alkalinity value was within the permissible limit. (Maximum allowable limit 600 mg/l), **BIS (1991).** The average ranges between 147 to 159.9 mg/l.

The Total Hardness of water is an important consideration in determining the suitability of water for domestic and industrial uses. Hardness is caused by multivalent metallic cations and with certain anions present in the water to form scale. The principal hardness-causing cations are the divalent calcium, magnesium, strontium, ferrous iron and mangonous ions. The acceptable limit for total hardness is 600mg/lit **(BIS, 1991)**.

Total hardness is an expression for the total amount of the calcium and magnesium cation concentration in a solution. While a high level of total hardness can cause nuisances to water users, water hardness itself is not a safety issue for human consumption **(Wilson** and **Parrot, 1999).**

In the present study Total hardness of all the stations showed summer maximum due to reduced inflow and evaporation, monsoon minimum was due to increasing inflow and dilution. Increasing trend of yearly averages was observed at all the sites with the range of 129 to 150.8 mg/lit. In the present investigation the annual average values are with in the permissible limit in all the sampling station throughout the year of study. The annual minimum value was 106 mg/l recorded in the stations Moon Road and Sangameshwarar Temple. The maximum was 228 mg/l recorded in the station Sangameshwarar temple.

Dissolved oxygen content is one of the most important factors in stream health. Its deficiency directly affects the ecosystem of a river due to bioaccumulation and biomagnifications. The oxygen content in water samples depends on a number of physical, chemical, biological and microbiological processes. DO values also show lateral, spatial and seasonal changes depending on industrial and human activities. Oxygen is the single most important gas for most aquatic organism, free oxygen ($O_2$) or DO is needed for respiration. DO levels below 1 parts per million (ppm) will not support fish; levels of 5 to 6 ppm are usually required for most of the fish population. The average values of DO levels (6.5mg/l) indicate the average quality of river water **(APHA, 1998).** DO values were found maximum during winter and minimum during summer, which might be due to natural turbulence and higher algal productivity produces $O_2$ by photosynthesis in rainy period and active utilization in bacterial

**Table 1. Monthly Variations of physico-chemical characteristics in the Station Moon Road of River Cauvery**

| Month of Sampling | Temperature °C | pH | Turbidity NTU | EC Ms/cm | TSS mg/l | Phenolphthalein Alkalinity mg/l | Total Alkalinity mg/l | Total Hardness mg/l | DO mg/l | BOD mg/l | COD mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January-2012 | 24 | 8.4 | 2 | 378 | 4 | 16 | 144 | 124 | 6.2 | 0.8 | 12.8 |
| February | 26 | 8.3 | 2 | 366 | 12 | 4 | 132 | 124 | 6.2 | 0.8 | 32 |
| March | 28 | 8.2 | 3 | 421 | 8 | 0 | 150 | 140 | 5 | 1.1 | 32 |
| April | 30 | 8.4 | 3 | 378 | 6 | 16 | 142 | 128 | 4.2 | 0.8 | 12.8 |
| May | 30 | 8.5 | 2 | 388 | 2 | 8 | 144 | 122 | 4.8 | 0.8 | 25.6 |
| June | 30 | 8.5 | 4 | 384 | 2 | 14 | 146 | 128 | 3.7 | 0.3 | 16 |
| July | 29 | 8.3 | 2 | 387 | 7 | 10 | 150 | 128 | 6 | 0.5 | 16 |
| August | 29 | 7.6 | 1 | 390 | 4 | 0 | 150 | 128 | 5.3 | 1.7 | 32 |
| September | 27 | 7.8 | 2 | 300 | 3 | 0 | 114 | 106 | 6.7 | 0.7 | 16 |
| October | 28 | 7.5 | 1 | 335 | 3 | 0 | 148 | 133 | 5.7 | 0.4 | 32 |
| November | 28 | 7.4 | 1 | 360 | 4 | 0 | 132 | 126 | 6.4 | 0.4 | 32 |
| December | 29 | 8 | 1 | 460 | 4 | 0 | 258 | 166 | 8.2 | 0.4 | 16 |
| Min | 24 | 7.4 | 1 | 300 | 2 | 0 | 114 | 106 | 3.7 | 0.3 | 12.8 |
| Max | 30 | 8.5 | 4 | 460 | 12 | 16 | 258 | 166 | 8.2 | 1.7 | 32 |
| Average | 28.2 | 8.1 | 2 | 378.9 | 4.9 | 5.7 | 150.8 | 129.4 | 5.7 | 0.7 | 22.9 |

**Table 2. Monthly Variations of physico-chemical characteristics in the Station Komarapalayam of River Cauvery**

| Month of Sampling | Temperature °C | pH | Turbidity NTU | EC Ms/cm | TSS mg/l | Phenolphthalein Alkalinity mg/l | Total Alkalinity mg/l | Total Hardness mg/l | DO mg/l | BOD mg/l | COD mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January-2012 | 24 | 8.4 | 3 | 378 | 3 | 16 | 142 | 124 | 5.9 | 0.8 | 12.8 |
| February | 27 | 8.3 | 3 | 368 | 4 | 10 | 132 | 126 | 6.5 | 1.1 | 24 |
| March | 29 | 8.2 | 3 | 422 | 4 | 0 | 150 | 140 | 5.6 | 0.8 | 24 |
| April | 31 | 8.4 | 2 | 378 | 4 | 14 | 142 | 128 | 5.1 | 2 | 32 |
| May | 30 | 8.5 | 3 | 394 | 6 | 12 | 144 | 122 | 5.4 | 1.7 | 24 |
| june | 31 | 8.5 | 3 | 384 | 8 | 14 | 146 | 128 | 5.9 | 0.8 | 24 |
| July | 31 | 8.4 | 5 | 384 | 8 | 12 | 148 | 124 | 5.4 | 0.7 | 24 |
| August | 28 | 7.7 | 3 | 384 | 8 | 0 | 148 | 124 | 5.1 | 0.8 | 24 |
| September | 27 | 7.8 | 5 | 290 | 9 | 0 | 146 | 124 | 7.1 | 0.9 | 32 |
| October | 26 | 7.3 | 2 | 353 | 6 | 0 | 152 | 126 | 7.2 | 0.9 | 32 |
| November | 27 | 7.3 | 3 | 355 | 6 | 0 | 132 | 116 | 6.5 | 0.7 | 24 |
| December | 29 | 8.1 | 5 | 458 | 8 | 0 | 182 | 166 | 8.1 | 0.7 | 32 |
| Min | 24 | 7.3 | 2 | 290 | 3 | 0 | 132 | 116 | 5.1 | 0.7 | 12.8 |
| Max | 31 | 8.5 | 5 | 458 | 9 | 16 | 182 | 166 | 8.1 | 2 | 32 |
| Average | 28.3 | 8.1 | 3.3 | 379 | 6.2 | 6.5 | 147 | 129 | 6.15 | 0.99 | 25.7 |

**Table 3. Monthly Variations of physico-chemical characteristics in the Station Sangameshwarar Temple of River Cauvery**

| Month of Sampling | Temperature °C | pH | Turbidity NTU | EC Ms/cm | TSS mg/l | Phenolphthalein Alkalinity mg/l | Total Alkalinity mg/l | Total Hardness mg/l | DO mg/l | BOD mg/l | COD mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January-2012 | 25 | 8.4 | 2 | 369 | 6 | 14 | 140 | 120 | 6.2 | 0.8 | 24 |
| February | 27 | 8.2 | 3 | 331 | 8 | 0 | 100 | 106 | 6.2 | 0.8 | 24 |
| March | 31 | 8 | 4 | 690 | 6 | 0 | 216 | 228 | 5.1 | 0.8 | 32 |
| April | 31 | 8.3 | 5 | 381 | 8 | 10 | 132 | 124 | 4.8 | 1.5 | 42 |
| May | 31 | 8.5 | 4 | 465 | 10 | 14 | 160 | 160 | 5 | 1 | 36 |
| June | 32 | 8.4 | 5 | 408 | 6 | 10 | 150 | 134 | 4.5 | 1.1 | 36 |
| July | 30 | 8.2 | 5 | 404 | 12 | 0 | 154 | 136 | 4.8 | 1.3 | 42 |
| August | 30 | 7.6 | 3 | 404 | 12 | 0 | 154 | 136 | 4.5 | 0.9 | 32 |
| September | 26 | 7.6 | 8 | 440 | 4 | 0 | 126 | 126 | 6.8 | 0.2 | 16 |
| October | 29 | 7.7 | 5 | 548 | 20 | 0 | 223 | 196 | 6.4 | 1.3 | 48 |
| November | 28 | 7.3 | 3 | 407 | 8 | 0 | 138 | 148 | 6.7 | 0.6 | 32 |
| December | 28 | 7.9 | 3 | 523 | 10 | 0 | 226 | 196 | 7.2 | 0.3 | 24 |
| Min | 25 | 7.3 | 2 | 331 | 4 | 0 | 100 | 106 | 4.5 | 0.2 | 16 |
| Max | 32 | 8.5 | 8 | 690 | 20 | 14 | 226 | 228 | 7.2 | 1.5 | 48 |
| Average | 29 | 8.1 | 4.2 | 447.5 | 9.2 | 4 | 159.9 | 150.8 | 5.7 | 0.9 | 32.3 |

**Table 4. Monthly Variations of physico-chemical characteristics in the Station Perumalmalai of River Cauvery**

| Month of Sampling | Temperature °C | pH | Turbidity NTU | EC Ms/cm | TSS mg/l | Phenolphthalein Alkalinity mg/l | Total Alkalinity mg/l | Total Hardness mg/l | DO mg/l | BOD mg/l | COD mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January-2012 | 25 | 8.4 | 4 | 391 | 6 | 14 | 142 | 128 | 5.9 | 1.4 | 16 |
| February | 27 | 8.2 | 3 | 361 | 8 | 0 | 124 | 120 | 6.5 | 1.1 | 24 |
| March | 30 | 8.2 | 2 | 452 | 8 | 0 | 156 | 144 | 5.4 | 0.6 | 24 |
| April | 32 | 8.5 | 7 | 382 | 6 | 12 | 140 | 124 | 5.9 | 1.5 | 24 |
| May | 31 | 8.5 | 5 | 457 | 2 | 16 | 160 | 156 | 4.8 | 0.8 | 24 |
| June | 33 | 8.5 | 4 | 388 | 4 | 14 | 148 | 128 | 3.4 | 2 | 42 |
| July | 30 | 8.4 | 2 | 392 | 4 | 16 | 154 | 128 | 5.1 | 1.8 | 42 |
| August | 29 | 7.5 | 4 | 390 | 12 | 0 | 154 | 136 | 4.8 | 1.2 | 36 |
| September | 28 | 7.7 | 4 | 330 | 10 | 0 | 116 | 114 | 6.9 | 0.7 | 36 |
| October | 30 | 7.1 | 3 | 465 | 8 | 0 | 186 | 182 | 6.1 | 1 | 36 |
| November | 28 | 7.5 | 2 | 382 | 8 | 0 | 134 | 132 | 6.5 | 0.4 | 24 |
| December | 28 | 7.8 | 4 | 497 | 8 | 0 | 220 | 188 | 7.2 | 0.6 | 36 |
| Min | 25 | 7.1 | 2 | 330 | 2 | 0 | 116 | 114 | 3.4 | 0.4 | 16 |
| Max | 33 | 8.5 | 7 | 497 | 12 | 16 | 220 | 188 | 7.2 | 2 | 42 |
| Average | 29.3 | 8.3 | 3.7 | 407.3 | 7 | 6 | 152.8 | 140 | 5.7 | 1.09 | 30.3 |

**Table 5. Annual Maximum, Minimum and average values of physico-chemical characteristics of River Cauvery from Moon Road to Perumalmalai**

| SI. NO. | STATIONS | MONTHS | Temperature $^{O}C$ | $P^{H}$ | Turbidity NTU | EC Ms/cm | TSS mg/l | Phenolphthalein Alkalinity mg/l | Total Alkalinity mg/l | Total Hardness mg/l | DO mg/l | BOD mg/l | COD mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Moon Road | Annul Minimum | 24 | 7.4 | 1 | 300 | 2 | 0 | 114 | 106 | 3.7 | 0.3 | 12.8 |
| | | Annul maximum | 30 | 8.5 | 4 | 460 | 12 | 16 | 258 | 166 | 8.2 | 1.7 | 32 |
| | | Average | 28.2 | 8.1 | 2 | 378.9 | 4.9 | 5.7 | 150.8 | 129.4 | 5.7 | 0.7 | 22.9 |
| 2 | Komarapalayam | Annul Minimum | 24 | 7.3 | 2 | 290 | 3 | 0 | 132 | 116 | 5.1 | 0.7 | 12.8 |
| | | Annul maximum | 31 | 8.5 | 5 | 458 | 9 | 16 | 182 | 166 | 8.1 | 2 | 32 |
| | | Average | 28.3 | 8.1 | 3.3 | 379 | 6.2 | 6.5 | 147 | 129 | 6.15 | 0.99 | 25.7 |
| 3 | Sangameshwarar Temple | Annul Minimum | 25 | 7.3 | 2 | 331 | 4 | 0 | 100 | 106 | 4.5 | 0.2 | 16 |
| | | Annul maximum | 32 | 8.5 | 8 | 690 | 20 | 14 | 226 | 228 | 7.2 | 1.5 | 48 |
| | | Average | 29 | 8.1 | 4.2 | 447.5 | 9.2 | 4 | 159.9 | 150.8 | 5.7 | 0.9 | 32.3 |
| 4 | Perumalmalai | Annul Minimum | 25 | 7.1 | 2 | 330 | 2 | 0 | 116 | 114 | 3.4 | 0.4 | 16 |
| | | Annul maximum | 33 | 8.5 | 7 | 497 | 12 | 16 | 220 | 188 | 7.2 | 2 | 42 |
| | | Average | 29.3 | 8.3 | 3.7 | 407.3 | 7 | 6 | 152.8 | 140 | 5.7 | 1.09 | 30.3 |

decomposition of organic matter. **Rajkumar *et al.*, (2004)** and **Jitendra *et al.*, (2008)** also reported winter maximum and summer minimum DO values in their study. Yearly averages varied between 5.7 to 6.1 mg/lit, which may caution increasing accumulation of organic load and human activities with the river system. Annual minimum DO was 3.4 mg/l recorded in the station Perumalmalai; Maximum was 8.2 mg/l in Moon Road.

Biological Oxygen Demand is a measure of the oxygen in the water that is required by the aerobic microbial organisms. The biodegradation of organic materials exerts oxygen tension in the water and increases the biochemical oxygen demand **(Begum** and **Krishna, 2008).** Rivers with low BOD have low nutrient levels. Unpolluted natural waters will have a BOD of 5 mg/l or less. BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater amount of BOD more rapidly depletes oxygen level in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD values are the same as those for low dissolved oxygen; aquatic organisms become stressed, suffocate, and die. Sources of BOD include leaves, woody debris, dead plants and animals, animal manure, effluents from pulp and paper mills, wastewater treatment plants, feedlots and food-processing plants, failing septic systems and urban storm water runoff **(USEPA, 1997).** Seasonal analysis reveals that BOD values are more during summer fallowed by monsoon and winter. The annual average value was 0.2 mg/lit recorded in the station Komarapalayam. The annual maximum was 2 mg/lit was observed in the station Komarapalayam and Perumalmalai. BOD levels in every location, which indicates the absence of major organic pollution sources in the study area.

Chemical Oxygen Demand (COD) is a measure of the oxidation of reduced chemicals in water. It is commonly used to indirectly measure the amount of organic compounds in water. The measure of COD determines the quantities of organic matter found in water. This makes COD useful as an indicator of organic pollution in surface water **(King *et al.*, 2003** and **Faith, 2006).** In the conjunction with the BOD test, the COD test is helpful in indicating toxic conditions and the presence of biologically resistant organic substances **(Sawyer *et al.*, 2003).** Annual minimum values are 12.8 mg/lit was noticed in the station Moon Road and Komarapalayam. The annual maximum value is 48 mg/lit in Sangameshwarar Temple (Fig: 1). All the above analytical values are with in the permissible limit in all the sampling locations.

**Conclusion**

Thus the present study was concluded that river water of the study area was not greatly polluted in respect to physico - chemical assessment. But in the surrounding sampling location of the river has been subjected to human interference regularly. Major anthropogenic activities practiced in and around the sampling stations. They are Agriculture, abstraction, washing cloths, discharging of sewage waste, sand mining, boating, fishing, and open defecation. The studies attributed river water was not fit for direct utilization due to the above human interferences, which require continuous monitoring and treatment process if the water is to be used for drinking purposes. Some steps and awareness programs are needed to educate local villagers to safeguard the precious river and its surroundings from further deterioration.

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