PHYSICO-CHEMICAL AND BACTERIOLOGICAL PARAMETERS OF KAVERI RIVER AT TALAKAVERI REGION - A COMPARATIVE STUDY

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ABSTRACT

Water - the basic and primary need of all living processes. The study of physico-chemical and bacteriological aspects of water bodies is important in evaluating the tropic status of water bodies. Talakaveri is the main origin place of Kaveri River at Madikeri taluk, Kodagu district, Karnataka. About 20 physicochemical and five bacteriological parameters were studied for three seasons namely summer (February – May), Monsoon (June – September) and winter (October – January) during 2009 - 2011. All the parameters were found statistically significant. From the correlation study the carbon dioxide, nitrate and phosphorous were negatively correlated with other parameters such as temperature, pH, conductivity, salinity, TDS, TSS, TS, hardness, calcium, magnesium, DO, BOD, COD and TOM respectively. The dendrogram study revealed the clusters above 90% were those of conductivity - total organic matter, pH - sulfate, hardness – magnesium and TDS-TS are high. The only correlated occurrence of bacteria to the physicochemical parameters at 90% above was that of conductivity, total organic matter, water temperature, atmospheric temperature and total plate count. In seasonal bacteriological study, the MPN counts were recorded maximum of 21 MPN/100ml in summer seasons. Less count of Salmonella sp and Shigella sp were recorded in Talakaveri river water samples.

***Keywords*:** Physicochemical, bacteriological, statistical analysis, Talakaveri

INTRODUCTION

Good quality water is very necessary for good and healthy life. It is an essential part of protoplasam and creates a state for metabolic activities to occur smoothly; therefore, no life can exist without water (Dubey and Maheshwari 2006). Water plays an essential role in the ecosystem. Due to increased human activity, water pollution is widely spreading throughout

the world. Study on the quality of water in some streams of Cauvery River at Mandya district, Karnataka state, India, was done by Begum and Harikrishna, 2008. Significant spatial variation was observed in physico-chemical parameters of the study stations. If high total coliform and fecal coliform counts are found in water is considered not fit for drinking. (Sharma *et al.* 1986)

Talakaveri is the origin of Kaveri River. It is one of the famous pilgrims and tourist spots, where many pilgrims and tourist from different countries visit to this place. It is situated about 1, 276 meters above sea level. Bathing in holy water is one of the traditional beliefs in India and River Kaveri is considered as the holiest river in Kodagu.

The quality of natural water is generally governed by various physico-chemical and microbiological parameters. It is very necessary to understand the physico-chemical and bacteriological qualities of water. Presence of coliforms, total dissolved solids, conductivity, pH, Hardness, DO, BOD and COD are some of the significant parameters to study the water quality. The present study was aimed to know the seasonal variations in physicochemical and bacteriological parameters in holy water as it attracts many tourist and pilgrims across different countries.

MATERIALS AND METHODS

1. Sampling Site and Collection of Samples:

Kodagu district located in the southwestern part of Karnataka state falls in the high precipitation zone with picturesque topography occupying the eastern and western slopes of the Western Ghats. The river Kaveri takes its birth at Talakaveri in the Brahmagiri hills in Madikeri taluk coordinates 12^0 23' N 75^0 31' E and 12.38^0 N 75.52^0 E. The district is in humid tropical belt of Western Ghats and situated to the South – West in Karnataka state between 11^0 56' and 12^0 15' N latitude and 75^0 22' and 76^0 11' E longitude (Keshavamurthy and Yoganarasimha 1990).

2. Physicochemical Analysis of Kaveri River:

About 20 physico-chemical parameters such as atmospheric temperature and water temperature measured using mercury thermometer, pH, conductivity, salinity and total dissolved solids were analyzes using Standard SYSTRONIC WATER ANALYZER KIT Model No: 371, total suspended solids with filtration and weighing, total solids and magnesium by calculation method, hardness and calcium in EDTA titrimetric method, chloride by argentometric method, carbon dioxide and total organic matter by titrimetric method, nitrate using spectrophotometer SYSTRONICS SPECTROPHOTOMETER Model No. 105 method, sulfate by turbidometric method, phosphorous in stannous chloride method, dissolved oxygen by azide modification method, biochemical oxygen demand by 5 day BOD test and chemical oxygen demand by open reflux method were analyzed with the application of Standard methods for the examination of water and wastewater of APHA (1998). Physicochemical parameters such as pH, Temperature, Dissolved oxygen and Carbon dioxide were analyzed on the spot using analysis kit such as pH strips, mercuric thermometer, conical flask, pipettes, reagents, indicators, amber bottles and BOD bottle to

avoid bias and remaining parameters were performed in the laboratory within 6 hours upon storage at -4^0 C (APHA 1998).

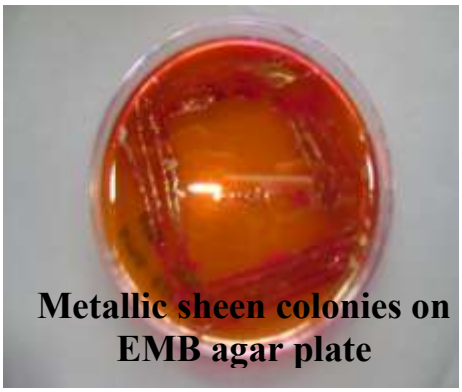
3. Bacteriological Analysis of Kaveri River:

Bacteriological studies were conducted to know the microbial quality of Kaveri river water using laboratory manual Aneja (2003).

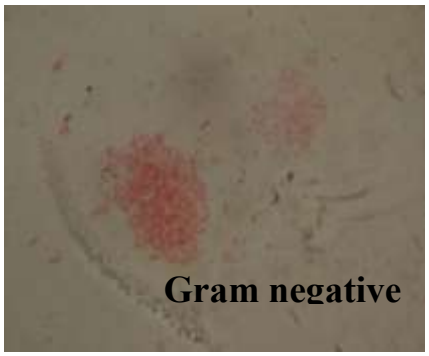
Total plate count method was used for isolation of bacteria. The water sample of 0.1 ml and 1.0 ml were inoculated by pour plate method using standard Nutrient Agar Media. Then plates were incubated in ACCULAB bacteriological incubator for 24 to 48 hours. After incubation, the total number of colonies were counted and recorded with the help of colony counter – HIMEDIA HANDHELD DIGITAL COLONY COUNTER, Model No. LL 663.

Most probable number tests were performed by using multiple tube fermentation technique. Which includes-*(a) Presumptive coliforms test*, performed for water samples, which was collected and then double strength (2) and single strength lactose broth was prepared. Broth was sterilized along with glass wares. 5 test tubes were labeled as 10, other 5 as 1 and another 5 as 0.1 to10 (2X) 10ml of sample was added, to 1(1X) test tubes 1ml of sample and to 0.1(1X) tubes 0.1 ml sample was added. Then the tubes were incubated at 37ºC for 48hrs. Colour change and gas formation was observed.*(b) Confirmed test:* The positive results of presumptive coliform test were taken and then sterile brilliant green lactose broth was inoculated with all positive presumptive tubes. Then Incubated at 37ºC for 48hrs and observed for gas production. *(c) Completed coliform test:* The positive results of confirmed test were taken for completed test and EMB (Eosin Methylene blue) agar media was prepared and sterilized along with glass wares at 121^0C for 20min. Media was poured to Petri plates and allowed to solidify. Plates were inoculated with positive tubes of confirmed test by streak plate method. Then Incubated at 37ºC for 24hrs in inverted position and observed for coliform colonies. Brilliant green lactose broth and nutrient agar slants were inoculated with colonies on EMB agar plate and incubated at 37ºC for 24hrs. Brilliant green lactose broth tube was observed for gas production. Colonies on nutrient agar slant was gram stained and observed for its gram reaction and cell morphology (Plate – 1).

1. Presumptive test



2. Completed test



3. Confirmed test: Gram staining

Plate 1: MPN test of Kaveri River at Talakaveri region

Salmonella sp and *Shigella* sp colonies were isolated on *Salmonella – Shigella* (SS) Agar media and it was prepared, sterilized along with glass wares at 121ºC for 20mins using autoclave and water sample was mixed thoroughly by shaking and then 1ml of sample was transferred to each Petri plates. Cooled media was poured to different Petri plates and sample was mixed by gentle swirling. Then plates were allowed to solidify and incubated at 37ºC for 24 - 48hr and observed for growth of colonies (Aneja 2003).

RESULTS AND DISCUSSION

Seasonal physicochemical and bacteriological variations of Kaveri River water at Talakaveri region from February, 2009 to January, 2010 and February, 2010 to January, 2011 was tabulated in table 1 and 2 respectively. About 20 physicochemical parameters such as atmospheric temperature, water temperature, pH, conductivity, salinity, total dissolved solids, total suspended solids, total solids, hardness, calcium, magnesium, chloride, carbon dioxide, nitrate, sulfate, phosphorous, DO, DO, COD and total organic matters and bacteriological parameters such as total plate count (0.1 and 1.0 ml of water samples), most

probable number test and *Salmonella* - *Shigella* agar test were recorded with greater seasonal variation.

Temperature plays an important role in water system. Change in temperature was observed in water due to biotic and abiotic reactions and water temperature changes were according to change in atmospheric change as observed by Kundangar *et al*. (1996). The water temperature increased in accordance with increased in atmospheric temperature. In the present study water temperature was ranged between 9.25 to 21.05^{0}C and 8.01 to 22.13^{0}C from February, 2009 to January, 2010 and from February, 2010 to January, 2011 respectively.

The fluctuations in optimum pH ranges may lead to an increase or decrease in the toxicity of poisons in water bodies (Ali 1991). In the present study, the pH ranged from 6.1 to 6.97 and 6.23 to 6.96 from February, 2009 to January, 2010 and from February, 2010 to January, 2011 respectively. According to Medera *et al.* (1982), the pH of most natural water ranges from 6.5 - 8.5 while deviation from the neutral pH 7.0 as a result of the CO_2/bicarbonate/carbonate equilibrium.

Table 1: Seasonal physicochemical and bacteriological parameters of Kaveri River water at Talakaveri region from February, 2009 to January, 2010

	Seasonal Analysis from February, 2009 to January, 2010											
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
AT	20.45	26.7	27.0	27.4	16.5	16.4	16.45	16.45	17.85	17.6	17.6	18.5
WT	16.65	19.0	19.15	21.05	11.25	9.25	9.5	10.2	12.15	12.75	13.7	14.0
pH	6.95	6.90	6.81	6.97	6.35	6.10	6.2	6.25	6.55	6.89	6.86	6.94
Cond	39.94	43.25	44.38	48.2	26.3	19.19	16.4	16.19	20.48	26.06	28.13	29.96
Sal	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
TDS	18.16	20.03	21.36	21.48	16.18	13.01	12.28	12.9	17.06	19.99	19.92	22.63
TSS	0.24	0.3	0.32	0.34	0.2	0.16	0.13	0.15	0.18	0.22	0.2	0.24
TS	18.4	20.33	21.68	21.82	16.38	13.17	12.41	13.05	17.24	20.21	20.12	22.87
Hard	21.83	22.88	22.98	22.94	17.35	12.11	12.38	13.21	16.68	20.58	21.46	21.73
Ca	3.1	3.26	3.31	3.29	1.83	1.5	1.51	1.6	2.79	3.42	3.12	3.07
Mg	4.57	4.79	4.8	4.8	3.8	3.6	2.65	2.83	3.39	4.18	4.47	4.55
Cl	11.51	11.6	11.83	11.47	9.78	8.64	8.06	8.0	8.83	10.56	11.46	11.59
CO2	60.17	58.62	57.13	58.08	65.31	74.17	72.48	72.59	70.38	67.23	67.27	68.03
Ntrt	10.51	10.32	10.3	10.32	10.64	11.18	11.11	10.98	10.84	10.58	10.59	10.52
Sult	1.98	2.11	2.01	2.1	1.42	1.16	1.14	1.18	1.77	2.06	2.1	1.98

Table 1: Seasonal physicochemical and bacteriological parameters of Kaveri River water at Talakaveri region from February, 2009 to January, 2010 (Contd…)

	Seasonal Analysis from February, 2009 to January, 2010											
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
P	0.5	0.46	0.48	0.48	0.52	0.54	0.61	0.6	0.56	0.53	0.53	0.5
DO	9.62	10.99	11.66	11.47	8.5	6.15	5.24	5.31	5.46	5.48	5.8	6.07
BOD	2.33	2.41	2.5	2.62	2.21	2.16	2.03	2.08	2.0	2.04	2.12	2.7
COD	20.0	26.0	31.0	35.0	24.0	19.0	16.0	13.0	16.0	21.0	26.0	21.0
TOM	0.043	0.051	0.056	0.057	0.039	0.026	0.017	0.014	0.022	0.037	0.034	0.031
TPC 1	23.0	32.0	36.0	39.0	23.0	18.0	15.0	9.0	14.0	16.0	23.0	27.0
TPC 2	48.0	57.0	59.0	60.0	47.0	32.0	30.0	35.0	41.0	52.0	52.0	43.0
MPN	8.0	11.0	14.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note 1: AT-atmospheric temperature (^{0}C) , WT- water temperature (^{0}C), pH, Cond- conductivety (µs), Sal- Salinity (µs), TDS- total dissolved solids (mg/l), TSS- total suspended solids (mg/l), TS- total solids (mg/l), Hard- hardness (mg/l), Ca- calcium (mg/l), Mg- magnesium (mg/l), Cl- chloride (mg/l), CO2- carbon dioxide (mg/l), Ntrt- nitrate (mg/l), Sult- sulfate (mg/l), P- phosphorous (mg/l), DO- dissolved oxygen (mg/l), BOD- biological oxygen demand (mg/l), COD- chemical oxygen demand (mg/l), TOM- total organic matter (mg/l), TPC1- total plate count CFU/100ml (0.1ml of water sample), TPC2- total plate count CFU/100ml (1.0ml of water sample), MPN- most probable number (MPN/100ml), SL- *Salmonella* sp (per 100ml of water samples), SG- *Shigella* sp (per 100ml of water samples)

Note 2: Darkened Regions: In table 1 and 2 indicates the highest and lowest values.

The slight seasonal fluctuation of pH can be attributed to the combined effect of temperature, dissolved CO_2, liberation of ions and buffering capacity of water (Agarwal 1999). Variation in pH is due to photosynthetic rate, microbial activity and environmental interference. Maximum values during summer of April and May is may be due to increased photosynthesis of the algae resulting into the precipitation of carbonates of calcium and magnesium from bicarbonates causing higher alkalinity (Agarwal and Rozgar 2010).

Hardness in the present study ranged from 12.11 – 22.98 mg/l and 13.17 – 23.10 mg/l from February, 2009 to January, 2010 and from February, 2010 to January, 2011 respectively. Hardness was below the permissible limit in all samples and might have caused increased concentration of salts by excessive evaporation as also observed by Bhatt *et al*. (1999). Magnesium was below the permissible limit in all the sampling sites of this study.

In the present study TDS found to be increased during summer and winter seasons (Chart 1 and Chart 3). During summer and winter relative amount of solutes were high due to decrease in the water level in the river (Bhattaraj *et al*. 2008). The Talakaveri water contains less TDS (12.28 – 22.63 mg/l during February, 2009 to January, 2010 and 11.36 – 23.96 mg/l during February, 2010 to January, 2011). These values are far below the permissible level of drinking water standards of WHO (1000 mg/l). This result is also supporting the studies of Agarwal and Rozgar (2010).

The calcium content was found to be between 1.5 – 3.31 mg/l and 1.61 to 4.02 mg/l from February, 2009 to January, 2010 and from February, 2010 to January, 2011 respectively and it was lesser than the ISI, WHO and ICMR permissible limit for fresh water (Zune 1990). The concentration of calcium was highest in summer season as it was also observed by Agarwal and Rozgar (2010).

Chloride is one of the important indicators of pollution. Chlorides are present in sewage, effluents and farm drainage. It is responsible for the brackish taste in water and is an indicator of sewage pollution because of the chloride content in urine. The value of chloride concentration in water was highest during summer season. These values are usually in the lower range of values in different rivers of India (Sabata and Nayar 1995). In the present study chlorine value was below the permissible limit, may be attributed to the absence of major pollutants.

DO is very important parameter of water quality and an index of physical and biological process occuring in water. In the present study the value for DO ranged from 5.24 – 11.47 and 5.41 – 10.96 mg/l from February, 2009 to January, 2010 and from February, 2010 to January, 2011 respectively. The similar trends were also found by Bhattaraj *et al. (*2008). When temperature increases gas solubility of water decreases and microbial activity increases; both these changes can reduce DO in water. But in the present study the DO values in all the months are almost closely related and not much difference in temperature was recorded. This is because Kodagu district is the hilly region with high dense of vegetation which creates cold environment for both terrestrial and aquatic ecosystem. The same trend was also reported in Beeshazaari Lake by Burlakoti (2003) and in Gaindahawa Lake by Simkhada (2003).

BOD is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or stabilization of organic water (Hawkes 1993). It is very important indicator of the pollution status of a water body. Many workers like John (1952), Robert (1969) and Richard (1966) showed higher BOD during summer due to low level at river discharge. The values of BOD clearly showed higher concentration during summer and comparatively low during winter and monsoon respectively Bhattaraj *et al. (*2008).

COD is a measure of pollution in aquatic ecosystems. It estimates carbonaceous factor of organic matter (Agarwal and Rozgar 2010). The range of values of COD in the present study was 13.0 to 35.0 mg/l and 12.0 to 41.0 mg/l from February, 2009 to January, 2010 and from February, 2010 to January, 2011 respectively. The higher degree of pollution was recorded during summer season. The highest COD during summer may be due to use high amount of worship materials and throwing coins to water. TOM in the present study recorded very less amount because it is far away from agricultural and industrial fields.

Table 2: Seasonal physicochemical and bacteriological variations of Kaveri River water at Talakaveri region from February, 2010 to January, 2011

	Seasonal Analysis from February, 2010 to January, 2011											
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
AT	19.1	22.47	23.11	25.16	14.23	11.43	13.23	13.73	14.95	16.13	18.95	19.24
WT	17.47	20.33	20.71	22.13	10.14	8.01	9.40	9.44	11.61	12.04	16.92	17.87
pH	6.96	6.84	6.88	6.9	6.71	6.23	6.30	6.28	6.63	6.83	6.71	6.9
Cond	40.14	42.95	43.44	49.15	28.14	20.72	18.94	17.06	19.71	26.14	28.71	29.41
Sal	0.02	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02
TDS	19.23	22.71	23.96	23.8	18.18	18.23	11.36	11.74	15.41	16.96	18.14	18.56
TSS	0.2	0.22	0.38	0.33	0.18	0.19	0.15	0.16	0.23	0.19	0.21	0.2
TS	19.43	22.93	24.34	24.13	18.36	18.42	11.51	11.9	15.64	17.15	18.35	18.76
Hard	22.81	22.86	22.9	23.1	16.14	15.14	13.17	14.47	15.96	18.11	18.94	21.32
Ca	4.02	3.41	3.38	3.34	2.16	2.05	1.93	1.61	2.14	2.99	3.22	3.61
Mg	4.58	4.74	4.76	4.82	3.41	3.19	2.74	3.13	3.37	3.68	3.84	4.32
Cl	12.16	12.83	12.43	12.41	10.31	9.46	9.11	8.67	8.55	9.48	11.46	11.71
CO2	68.13	64.71	59.13	58.48	66.31	78.04	76.84	74.59	71.38	70.43	70.41	68.96
Ntrt	10.5	10.48	10.53	10.5	11.63	11.42	10.83	10.76	11.43	10.96	10.85	10.63
Sult	2.11	2.13	2.04	2.08	1.91	1.37	1.33	1.41	1.87	2.08	2.13	2.16
P	0.51	0.52	0.48	0.5	0.55	0.53	0.58	0.68	0.61	0.58	0.5	0.55
DO	7.96	8.43	8.21	8.99	10.46	10.96	6.46	5.96	5.41	5.96	6.13	6.28
BOD	2.28	2.48	2.53	2.68	2.43	2.13	2.08	2.11	2.10	2.04	2.14	2.18
COD	24.0	31.0	36.0	41.0	31.0	24.0	12.0	18.0	26.0	28.0	32.0	21.0
TOM	0.046	0.055	0.058	0.058	0.036	0.022	0.02	0.018	0.023	0.036	0.038	0.041
TPC 1	23.0	28.0	35.0	39.0	20.0	16.0	12.0	11.0	16.0	15.0	20.0	26.0
TPC 2	48.0	52.0	57.0	67.0	51.0	47.0	40.0	42.0	38.0	33.0	46.0	49.0
MPN	0.0	0.0	12.0	21.0	0.0	6.0	4.0	0.0	0.0	0.0	14.0	4.0
SL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
SG	0.0	0.0	2.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	2.0	0.0

The Standard plate counts for all the water samples were generally high, exceeding the standard limit. Recommended standard is Nil (FAO 1997a). The most probable number (MPN) for the presumptive total coliform count of the water samples ranges from 8 to 21 MPN/100 ml only during summer season from February, 2009 to May, 2009 and 4 to 21 MPN/100ml during February, 2010 – January, 2011 respectively. It indicates that water was contaminated by coliforms, because of high inflow of pilgrims and tourist from various states and countries. Because of this in holy water may lead to the spread of dangerous diseases. The total plate count of 9 – 39 CFU/ 100ml recorded for 0.1ml of water sample and 30 – 60 CFU/100ml for 1.0ml water samples for Talakaveri water samples during February, 2009 to January, 2010 recorded the bacterial density. The chart 1 and 2 illustrate the variation of seasonal physicochemical and bacteriological parameters of Kaveri River at Talakveri water from February, 2009 to January, 2010.

According to the study by Agarwal and Rozgar, (2010), the maximum number of total coliforms was in the month of April and June. The minimum number was recorded in the month of January. Bhattaraj *et.al*., (2008) showed that average total coliform (TC) and fecal coliform (FC) counts were highest in mid-monsoon followed by pre-monsoon and lowest in winter.

Omezuruike *et al*. (2008) revealed that the original source of any drinking water is rich in aquatic microbes, some of which could be dangerous if they enter the human body. Most common bacteria present in water bodies are *Salmonella sp, E coli, Enterobacter sp, Klebsiella,* etc. These enter the water bodies due fecal contamination. This leads to the outbreak of intestinal disorders. The *Salmonella* and *Shigella* were found only during February, 2010 to January, 2011 which ranged between 1 to 2 colonies/100ml. The chart 3 and 4 illustrate the variation of seasonal physicochemical and bacteriological parameters of Kaveri River at Talakaveri from February, 2010 to January, 2011. In many developing countries, availability of water has become a critical and urgent problem and it is a matter of great concern to families and communities depending on non-public water supply system.

The table 3 gives the detailed comparative analysis of physicochemical and bacteriological variation at Talakaveri region of Kaveri River. Pearson's correlation matrix of Talakveri water samples recorded with high significance of correlation between physic-chemical and bacteriological parameters such as atmospheric temperature, water temperature, conductivity, TSS, carbon dioxide, phosphorous, DO, BOD, COD, TOM and total plate counts with 100% correlation. Whereas that of pH, salinity, TDS, TS, hardness, calcium, magnesium, chloride, nitrate, sulfate and MPN counts were recorded with about 90% correlation. The carbon dioxide, nitrate and phosphorus are negatively correlated with other parameters (Table 3). From the correlation study it was clear that the any changes in water the phsico-chemical parameters are very much essential and these are also important factors for living beings. All the correlation was significant of 0.01 levels.

The comparative study was also done by using dendrogram (average linkage between groups which is illustrated in Figure -1). From the Figure -1 it was observed that clusters above 90% were those of conductivity - total organic matter, pH - sulfate, hardness – magnesium and TDS - TS are high. However clusters of microbial counts were lesser than those described above. The only correlated occurrence of bacteria to the physicochemical parameters at 90%

above was that of conductivity, total organic matter, water temperature, atmospheric temperature and total plate count, while other bacterial counts and physico-chemical parameters were not highly correlated.

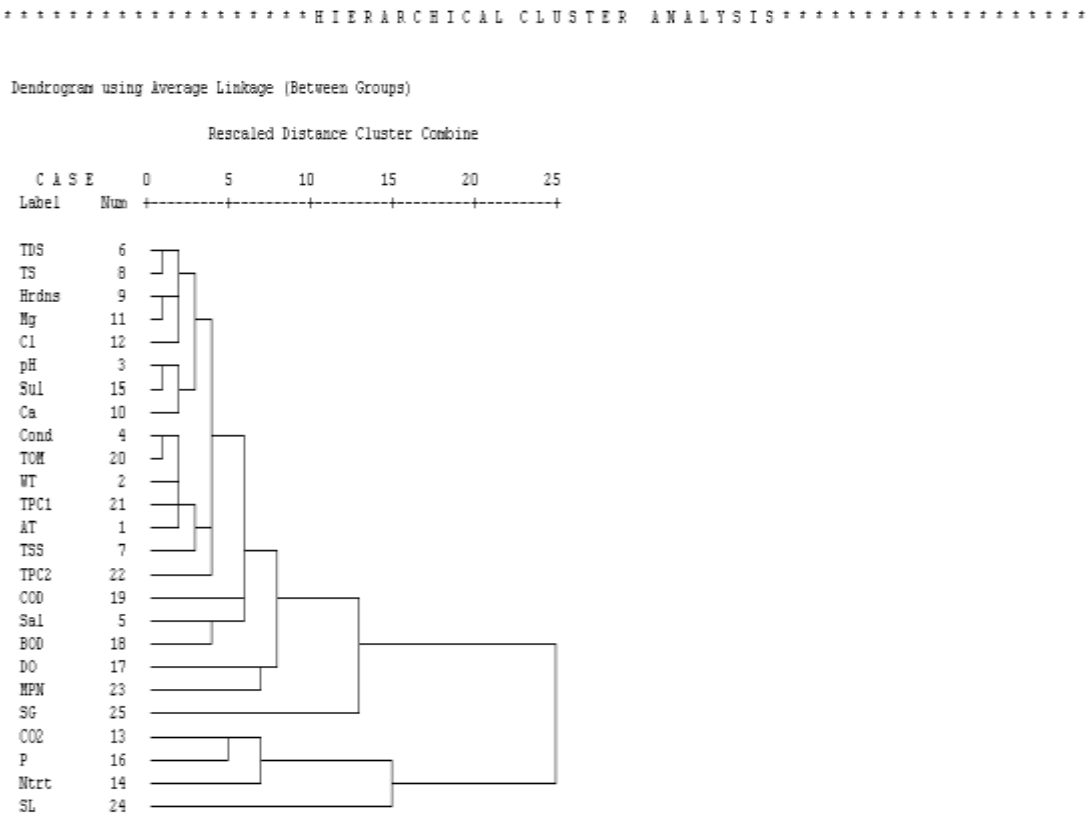


Figure 1: Dendrogram of physicochemical and bacteriological parameters of Kaveri River water at Talakaveri region

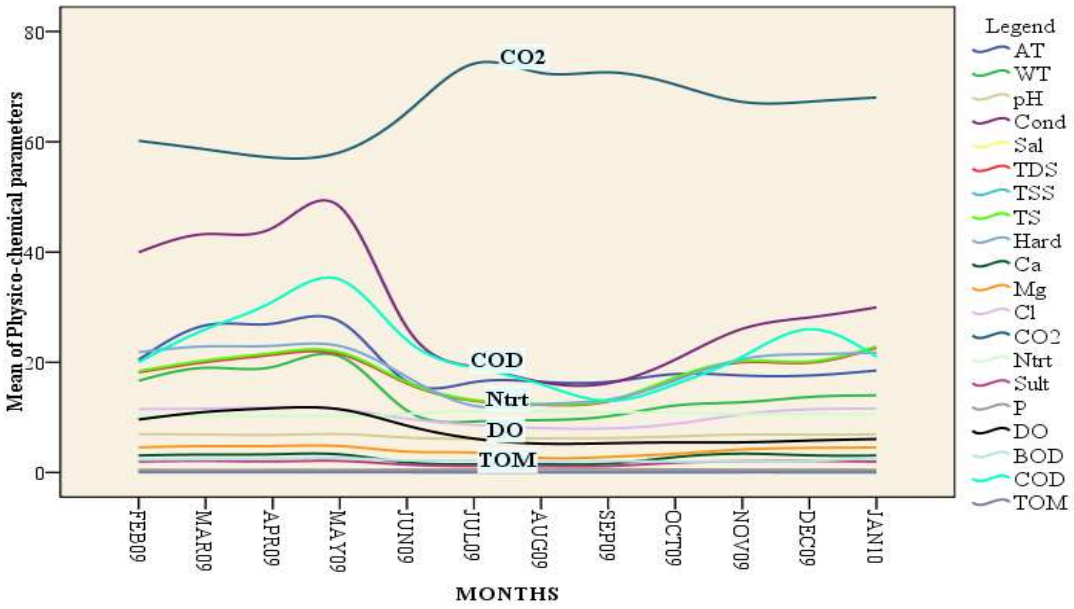


Chart 1: Sequence chart (Time Series) of physicochemical variations of Kaveri River water at Talakaveri region from February, 2009 to January, 2010

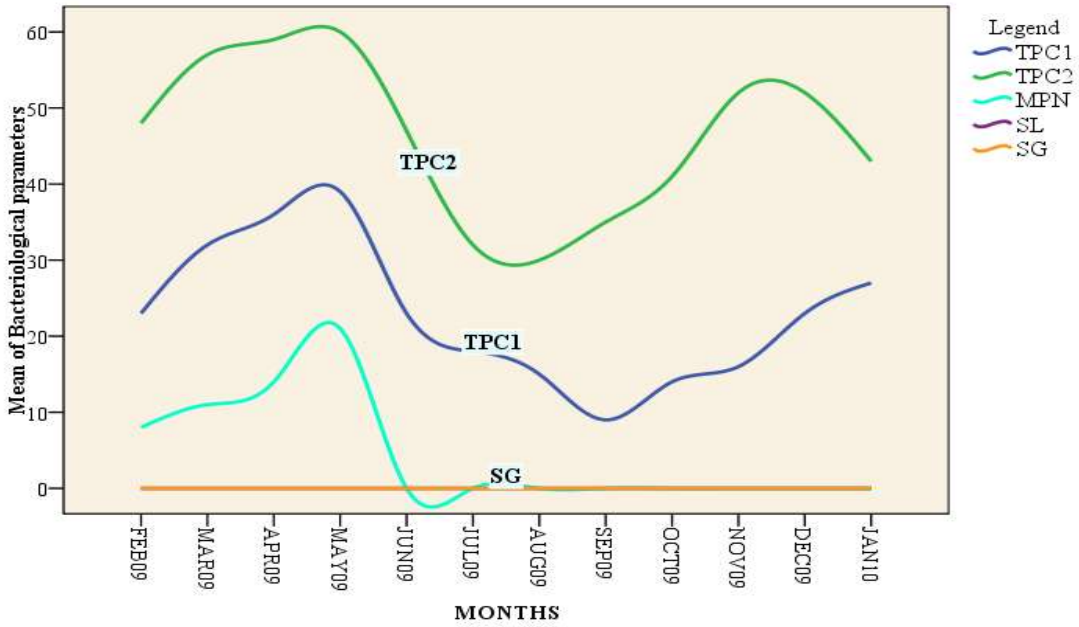


Chart 2: Sequence chart (Time Series) of bacteriological variations of Kaveri River water at Talakaveri region from February, 2009 to January, 2010

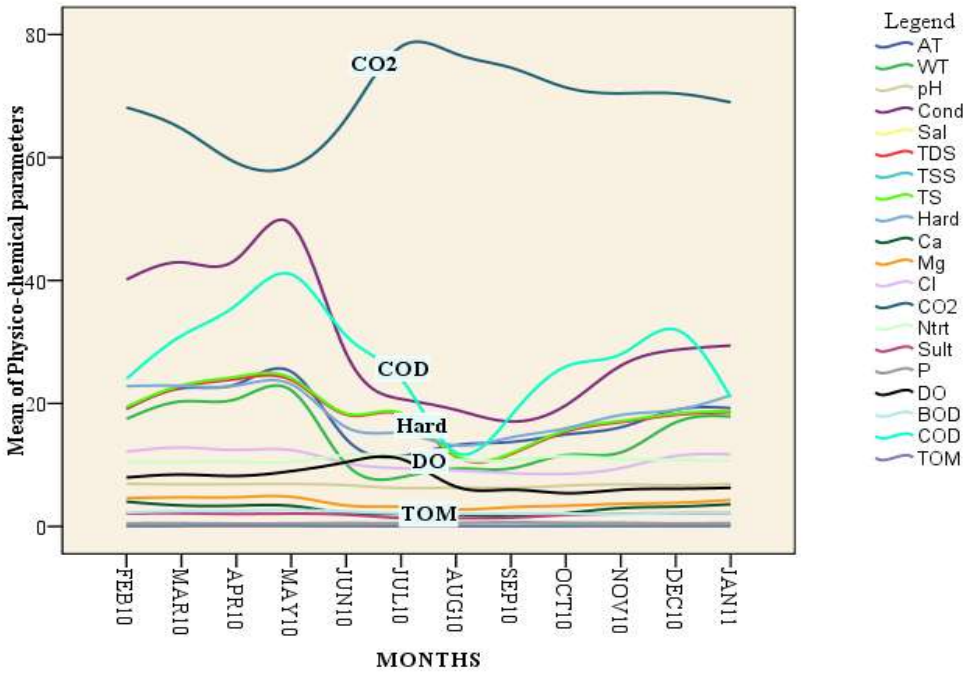


Chart 3: Sequence chart of (Time Series) physicochemical variations of Kaveri River water at Talakaveri region from February, 2010 to January, 2011

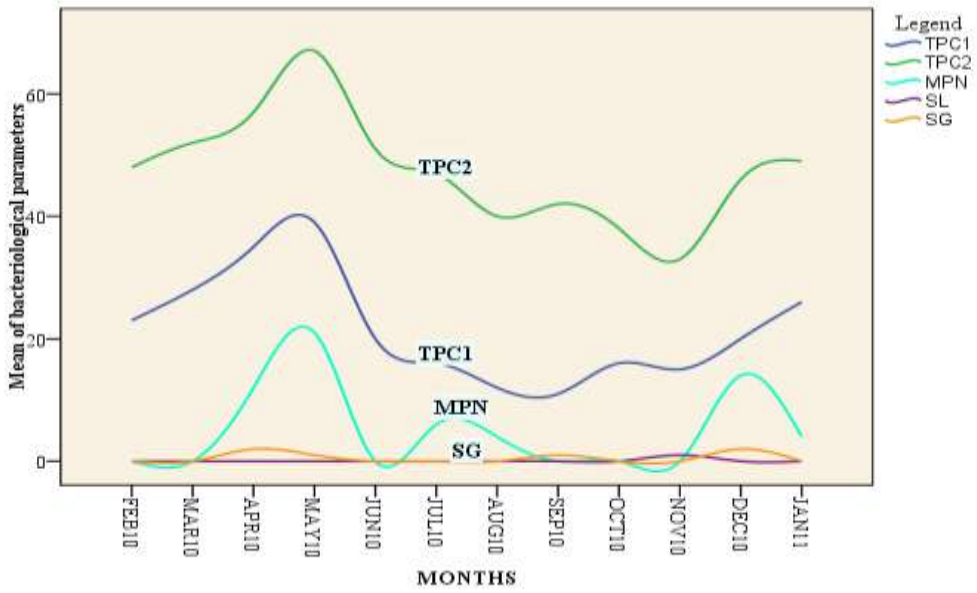


Chart 4: Sequence chart (Time series) of bacteriological variations of Kaveri River water at Talakaveri region from February, 2010 to January, 2011

Table 3: Pearson's correlation matrix of physicochemical and bacteriological parameters of Kaveri River water at Talakaveri region from February, 2009 to January, 2011

	AT	WT	pH	Cond	Sal	TDS	TSS	TS	Hrdns	Ca	Mg	Cl	CO2	Ntrt	Sul	P	DO	BOD	COD	TOM	TPC2	MPN
AT	1																					
WT	.910**	1																				
pH	.650*	.788**	1																			
Cond	.885**	.933**	.779**	1																		
Sal	.652*	.778**	.627*	.787**	1																	
TDS	.694**	.803**	.819**	.834**	.678**	1																
TSS	.830**	.824**	.658*	.852**	.646*	.798**	1															
TS	.699**	.806**	.819**	.838**	.680**	1.000**	.804**	1														
Hrdns	.786**	.895**	.924**	.897**	.659*	.902**	.774**	.903**	1													
Ca	.660*	.826**	.923**	.771**	.592*	.817**	.613*	.816**	.925**	1												
Mg	.821**	.883**	.849**	.908**	.655*	.882**	.794**	.883**	.960**	.849**	1											
Cl	.712**	.879**	.837**	.889**	.731**	.884**	.701*	.884**	.936**	.874**	.920**	1										
CO2	-.897**	-.837**	-.725*	-.900**	-.649*	-.748**	-.856**	-.752**	-.817**	-.626*	-.836**	-.734**	1									
Ntrt	-.772**	-.750**	-.600*	-.703**	-.427	-.548*	-.589*	-.551*	-.772**	-.673*	-.764**	-.685*	.676*	1								
Sul	.597*	.768**	.962**	.726**	.576*	.802**	.615*	.802**	.887**	.922**	.807**	.822**	-.647*	-.513	1							
P	-.716**	-.709**	-.620*	-.794**	-.556*	-.790**	-.716**	-.792**	-.754**	-.675*	-.805**	-.785**	.724**	.560*	-.582*	1						
DO	.525*	.452	.303	.681**	.495*	.486*	.587**	.490*	.455*	.271	.484*	.485*	-.614**	-.249	.273	-.626**	1					
BOD	.700**	.709**	.570*	.813**	.808**	.755**	.762**	.758**	.675**	.464*	.730**	.723**	-.742**	-.495*	.477*	-.658**	.626**	1				
COD	.601*	.707**	.585*	.755**	.694**	.762**	.763**	.765**	.646*	.537*	.656*	.680**	-.674**	-.249	.652*	-.575*	.543*	.664**	1			
TOM	.851**	.915**	.765**	.964**	.733**	.836**	.837**	.839**	.884**	.774**	.906**	.890**	-.887**	-.669**	.750**	-.792**	.633*	.742**	.806**	1		
TPC2	.715**	.777**	.658*	.844**	.676*	.804**	.803**	.807**	.802**	.657*	.780**	.807**	-.792**	-.589*	.651*	-.697**	.683*	.703**	.732**	.834**	1	
MPN	.727**	.704**	.388	.705**	.698**	.511*	.782**	.517*	.510*	.414	.517*	.520*	-.641**	-.449*	.383	-.598**	.604*	.590*	.664**	.655**	.705**	1

**. Correlation is significant at the 0.01 level (2-tailed).

CONCLUSION

Drinking water or potable water is the term used for safe water, which is fit for human consumption. Water is one of the main sources for microorganisms, which cause health problems. As observed, the quality of water changes according to the seasons. From the present study, the comparative analysis of Kaveri river water at Talakaveri region was found be acceptable for physico-chemical parameters. According to water quality standards (WHO, ISI, ICMR, FAO), the microbial counts in water should be nil. But in Kaveri River water samples at Talakaveri region recorded bacterial counts, which is not acceptable and not fit for use. The correlation study by dendrogram showed about 90% correlation occurrence between physico-chemical and bacteriological parameters. The correlation study also concluded that the any changes in water, the physico-chemical parameters are very much essential and it is also necessary for all living beings for metabolic reaction. So Kaveri river water at Talakaveri region must be protected before it reaches the extent pollution and proper sanitation steps to be taken because as it is attracts many tourists and pilgrims from various states and counties.

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