Research Article

Seasonal Changes in Physico-Chemical Parameters of Mullai Periyar River, Tamil Nadu, India

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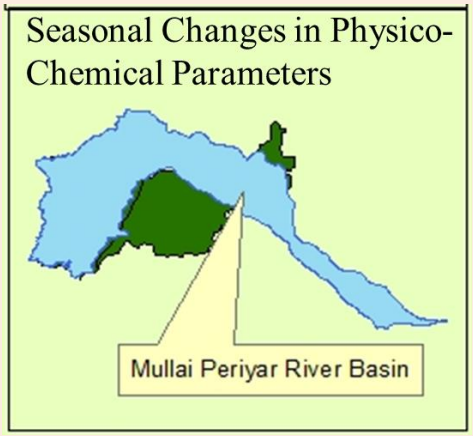
Abstract

Seasonal variations in ecological parameters exert a profound effect on the distribution and population density of both animal and plant species. The productivity in terms of planktonic biomass in freshwater bodies is regulated by various physico - chemical factors viz., temperature, pH, EC, total dissolved solids, total hardness, chloride, sulphate, dissolved oxygen, total nitrogen, sodium, potassium, phosphates etc. A field study was conducted (February 2012 and January 2013) to develop a data-base on seasonal changes of physico - chemical parameters of Periyar river, Tamil Nadu, India. Water samples were collected during dry and wet seasons from six stations and analyzed for various physico - chemical parameters. Physico - chemical parameters assessed in this study were well within the recommended standards (IS 10500.-2004). Only a few parameter values were higher than the recommended standard values (IS: 2296).The data generated from this study will guide potential remediation and other management decisions.



Keywords: Water pollution; Mullaiperiyar River; Physico-chemical parameters.

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Introduction

Water quality is a term that is most frequently used, but rarely defined, probably because it has no fixed definition, but apparently fairly well understood by users. Thus, the quality of water is a reflection of the source environment and the activities of man, including the use and management measures. However, the desirable properties of water quality should include: Adequate amount of dissolved oxygen at all time, a relatively low organic content, pH value near neutrality, moderate temperature, and freedom from excessive amount of infectious agents, toxic substances and mineral matter [1]. Various factors are responsible for water pollution, which makes it quite undesirable for portability. Such factors include: Sewage discharge, which contributes to oxygen demand and nutrient loading to a destabilized aquatic ecosystem [9], unplanned urbanization and rapid growth of industrialization increase river pollution crisis india river ecosystem.The entire array is affected by pollution. The problem of water quality deterioration is mainly due to human activities such as discharge of industrial and sewage wastes and agricultural runoff which cause severe ecological damage and pose serious health hazards [23].

There are only a few reports on the assessment of water quality of Southern Indian rivers. These include the assessment of water quality of the Adayar River [7]. River Vaigai [3]. River Mullaiperiyar in Kerala [18]. Rivers Godavari, Krishna and Tungabatra [29]. River Mullaiperiyar (approximately in north latitude 9°10[1] and at altitude of 5000 ft.) is the largest among the rivers flowing west through Kerala State and hence the name Mullaiperiyar river. The rainfall in this region ranges from 3000mm to 4000mm which augments the flow of water into the river Mullaiperiyar. The water drawn from Periyar Lake through the approach channel and tunnel is let into the tributary, Vairavanar. The flow then runs through Suruliyar in the Cumbum valley in Tamil Nadu. This has become the route

for the Periyar water in Tamil Nadu. The river Mullaiperiyar in Tamil Nadu is the major water source of the Cumbum valley. The river water is widely used for irrigation, bathing washing and religious purposes. It receives effluents, and runoff from the villages and towns along its banks. In the present study, various physico-chemical parameters and physical features were chosen to assess the quality of water.

Study Area

Figure 1 shows the Mullaiperiyar river sampling location map. The study area has been divided into six sampling sites with the stretch of 53.5 km **(Figure 1).** Study area has been selected for the collection of samples on the basis of certain characteristic features. First Site Lower camp (lat $9^0$38'48.93"N, long$77^0$12'51.61"E) which is located 2 Km away from mini hydroelectric power station. This site is free from contamination because there is no intensive agriculture activities and discharge of sewage or waste water. Second site K.K.patti (lat $9^0$44'16.91"N, long$77^0$18'28.93"E). The site is exactly located near the heavy traffic bridge. Intensive agricultural activity is going. Heavy cloth washing, cattle washing and vehicle washing activities are enormous. There is no sewage or domestic waste water discharge in the site or near the site. Third site Uthamapalayam (lat $9^0$48'22.55"N, long $77^0$20'17.71"E) the site is located exactly near the heavy traffic bridges and waterfalls. Cloth washing is prime activity in this site. This site is surrounded by paddy field. Fourth site Markayankottai (lat$9^0$50'58.07"N, long$77^0$22'07.16"E) This site located away from human inhabitation. However intensive agricultural activities are going on. Worship activities and cattle washing are also noticed. Fifth site is located at the temple site near the heavily populated village Veerapandi (lat $9^0$58'01.03"N. long$77^0$26'10.46"E).Two huge temples are located on the banks of the river. Cattle washing, vehicles washing and cloth washing are dominant activities. This site is also surrounded by paddy fields. The river banks are contaminated by animal wastes and human excreta which are washed into the water. Large number of draining channels from the paddy fields is found. Water is always turbid and muddy. Sixth site is Kunnur (lat $10^0$00'18.43"N, long$77^0$30'59.50"E), which is exactly located under heavy traffic national highways bridge and at the outskirt of Theni town. That site is characterized by shallow water, more sandy substrates and with more width. From all the above sampling sites, samples were collected fortnightly commencing from 6.30 am at Kunnur and ending at 11.30 am at lower camp site, at the stretch of 53 km.

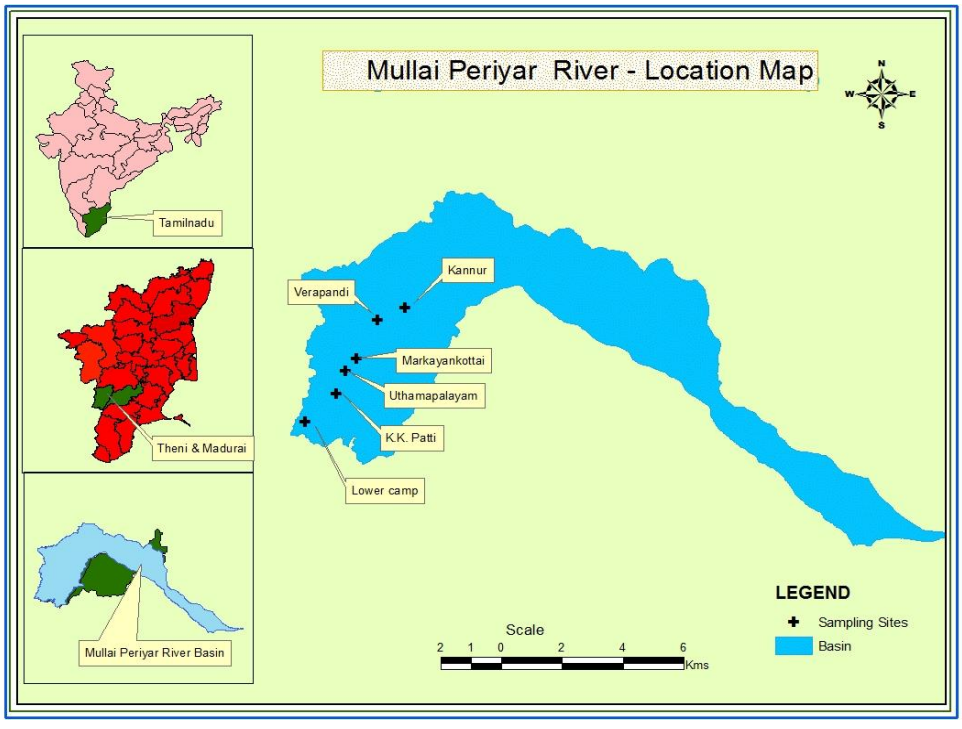

Figure1 Sampling Location of Mullai Periyar River

Materials and Methods

Water samples were collected from six selected sampling sites namely Lower Camp, K.K Patti, Uthamapalayam, Markayankottai, Veerapandi and Kunnur. Water samples were collected in sterilized clean high density polythene bottles. The samples were collected for one year (February 2012 to January 2013). The parameters like temperature, pH, colour, appearance were recorded in sampling sites itself. Laboratory evaluations were carried out as per IS: 3025 sampling and test (physical and chemical) methods for water; APHA **(**1999) was followed to analyze some chemical water quality parameters. The following parameters were analyzed for collected water samples such as pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Alkalinity (TA), Total Hardness (TH), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) Chemical Oxygen Demand (COD), Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Chloride (Cl), Sulphates (So_4^{2-}), Silica, Total nitrogen and phosphates (Po_4^{3-}).

Statistical analysis

Statistical tools were used to evaluate the relationship between the different variables. The correlation co-efficient 'r' was calculated using the following equation.

$$r = \frac{N\sum(X_iY_i) - (\sum X_i).(\sum Y_i)}{\sqrt{[N\sum X_i^2 - (\sum X_i)^2][N\sum Y_i^2 - (\sum Y_i)^2]}} \quad (1)$$

Where

Xi and Yi represents two different parameters.

N = Number of total observations.

The numerical values of correlation coefficient (r) for 17 parameters are represented in **Table 2**.

Result and Discussion

Continuous monitoring of physico-chemical characteristics of water bodies will help to preserve natural resources and improve the quality of water. The physico-chemical characteristics of Mullai Periyar river water are summarized and tabulated **(Table 1)** and compared with IS 10500:2004 guidelines for drinking water quality to assess their suitability for human consumption and IS: IS: 2296 Surface Water Quality Standards to assess their suitability for irrigation purpose.

Results of the assessment of physico-chemical parameters during dry and wet seasons are presented in the **(Table 1).** The majority of the water quality variables studied can be assigned to one of two seasonal influences: dry season "concentration" and rainy season run-off. Temperature is an important water quality parameter and easy to measure in water bodies which show less variation. The variation in temperature of MullaiPeriyar river water in the studied stretch did not show wide difference and fluctuating between 25.5ºC and 26.5ºC (wet season) and 27.7ºC – 27.8ºC (dry season). The temperature differential is likely to play an important role in governing species diversity because fish, insects, zooplankton, phytoplankton, and other aquatic species all have a preferred living and breeding temperature range [25]. A negative correlation was found between temperature and Po_4 (-0.61339) and DO (-0.50863) positive correlation with other chemical parameters.

The colour of the water appears clear, light brownish to light greenish. The flow of water is low it appears light brownish colour in Veerapandi and light greenish colour in Markayankottai. During the heavy flow of water, it appears clear. Water appears turbid especially during rainy days and at the time of sewage discharge. The greenish colour indicates the high productivity of the fresh water ecosystem. Greenish and brownish colour are observed in the different sites of the river water. The greenish colour indicates the presences of the abnormal amount of nutrients present in the water and the increase the amount of phytoplankton productivity in the water and the brownish colour indicate the presence of the colloidal particles in the water [31].

The water samples were found slightly alkaline in nature (except a few sites) during both seasons with the averages being in the range of 7.0- 7.4 in wet seasons and from 7.1-7.8 in dry season. The water is thus suitable for irrigation purposes with respect to pH, i.e. there is no alkalinity hazard. With respect to the classification of the

surface water sources, it was observed that the river waters have pH from 6.7 – 8.0 both the seasons. In the wet seasons, the surface water of a few sites showed acidic characteristics (pH < 7.0) in comparison to those of the dry seasons. It is known that due to the presence of carbonate ($CO3^{2-}$) and bicarbonate ($HCO3^{-}$) ions in solution, the pH of most natural water lies between 6.5 – 8.5, but values lower than the minimum limit may be due to the presence of dissolved carbon dioxide and organic acids (fulvic and humic acids), derived from the decay and subsequent leaching of plant materials [10] Table 1 shows the variations in pH levels at each site location, for dry and wet seasons respectively. In all sampling sites the pH values fall within optimal level. A negative correlation was found between pH and Po_4^{3-} and DO (-0.20638 & -0.42228) and positive correlation with other chemical parameters and it falls within the standard permissible limit (6.5- 8.5).

Table 1 Physico-chemical characteristics of Mullai Periyar river during Feb 2012- Jan 2013 at different sampling sites & comparison with IS 10500:2004 standard

Seasons	Sampling Sites	Temperat	pH	EC	TDS	TA	TH	Ca	Mg	Cl	$So4^{2-}$	Na	K	$po4^{3-}$	TN	Si	Do	BOD	COD
Wet Season	Lower Camp	25.5	7.0	70.67	47.17	22.00	20.2	0.0	4.9	11.08	7.85	8.65	0.72	0.08	0.06	3.28	8.57	7.20	19.70
	K.K patti	25.5	7.2	192.00	125.00	55.00	47.0	5.4	10.1	17.83	20.68	15.17	1.28	0.13	0.14	3.88	8.08	10.43	27.30
	Uthamapalayam	25.5	7.4	218.00	143.00	51.67	64.0	5.5	14.3	16.77	20.83	11.00	1.33	0.10	0.14	5.27	7.98	11.45	36.50
	Markayankottai	26.5	7.4	279.83	185.00	83.33	87.8	11.3	18.6	21.67	27.67	15.50	1.27	0.14	0.22	6.18	7.25	15.33	38.00
	Veerapandi	25.7	7.4	322.00	211.67	84.33	108.8	18.0	22.1	23.17	30.67	15.17	1.97	0.15	0.23	5.30	7.05	19.67	44.83
	Kunnur	25.7	7.4	394.00	258.83	95.33	140.0	12.4	31.0	44.17	53.17	18.83	2.08	0.14	0.11	7.65	7.78	10.50	26.17
Dry Season	Lower Camp	27.8	7.1	114.00	74.00	41.00	34.3	2.0	7.9	13.00	13.25	15.90	1.93	0.04	0.08	4.25	6.70	11.05	24.50
	K.K patti	27.8	7.5	211.00	137.17	68.50	66.0	6.3	14.8	17.17	20.83	22.00	2.67	0.05	0.27	4.17	6.57	13.00	32.33
	Uthamapalayam	27.8	7.6	250.83	163.17	81.50	98.2	7.5	21.8	19.50	26.50	17.50	2.77	0.04	0.23	5.10	6.33	13.17	47.33
	Markayankottai	27.7	7.8	308.83	200.83	81.67	106.2	17.7	21.7	22.67	29.50	23.83	3.07	0.08	0.34	5.90	6.48	18.67	44.83
	Veerapandi	27.8	7.8	331.33	215.50	108.67	123.7	23.0	24.5	25.33	36.67	26.67	4.02	0.06	0.32	5.98	6.53	21.33	54.17
	Kunnur	27.7	7.8	496.50	322.83	135.00	162.2	26.2	33.0	50.83	60.00	39.50	5.18	0.07	0.19	7.88	7.00	14.17	34.83
	Min	**25.5**	**7.0**	**70.67**	**47.17**	**22.00**	**20.17**	**0.00**	**4.92**	**11.08**	**7.85**	**8.65**	**0.72**	**0.04**	**0.06**	**3.28**	**6.33**	**7.20**	**19.70**
	Max	**27.8**	**7.8**	**496.50**	**322.83**	**135.00**	**162.17**	**26.17**	**33.00**	**50.83**	**60.00**	**39.50**	**5.18**	**0.15**	**0.34**	**7.88**	**8.57**	**21.33**	**54.17**
	Avg	**26.8**	**7.4**	**265.75**	**173.68**	**75.67**	**88.19**	**11.28**	**18.72**	**23.60**	**28.97**	**19.14**	**2.36**	**0.09**	**0.19**	**5.40**	**7.19**	**13.83**	**35.87**
	SD	**1.107**	**0.261**	**117.256**	**76.427**	**30.654**	**43.240**	**8.349**	**8.711**	**11.983**	**15.114**	**8.179**	**1.279**	**0.042**	**0.090**	**1.420**	**0.740**	**4.234**	**10.461**
	IS 10500:2004	**NA**	**6.5-8.5**	**NA**	**500-2000**	**200-600**	**300-600**	**75-200**	**30-100**	**250-1000**	**200-400**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
	IS: 2296	**NA**	**6.5-8.5**	**2250 µS/cm**	**2100**	**NA**	**NA**	**NA**	**NA**	**600**	**1000**	**NA**	**NA**	**NA**	**NA**	**NA**	**>6(CPCB)**	**<2(CPCB)**	**NA**
	IS 10500:2004 Drinking water quality																		
	IS: 2296 Surface water quality (for irrigation purpose)																		
	NA : Not Applicable																		

The Electrical conductivity varied from a mean value of 70.7 - 394 µS/cm (wet season) and 114 - 496.5 µS/cm (dry season) .The values are generally higher in the dry season because of low flow of water and volume is reduced. In both seasons minimum value observed in Lower Camp and maximum value observed in Kunnur . A negative correlation was found between EC and DO (-0.24723) and positive correlation with other chemical parameters. The Total Dissolved Solids varied from a mean value of 47.2 - 258.8 mg/l (wet season) and 74 - 322.8 mg/l (dry season) .The values are generally higher in the dry season due to stagnation of water. When TDS level exceeds > 2000mg/L (IS 10500:2004) the water is likely to have objectionable tastes. However, no water sample in the present work, had TDS ≥2000 mg/L. Total Dissolved Solids represent the amount of soluble inorganic substances in the water [12]. and originates from natural sources, sewage, urban runoff, industrial wastewater and chemicals used in the water treatment process. A negative correlation was found between TDS and DO (-0.24423) and positive correlation with other chemical parameters and it falls within the standard permissible limit (500-2000 mg/l). Alkalinity of water decreases the solubility of metals .Bicarbonate content (as CaCO3) of the water samples varied from 22 - 95.3 mg/l in the wet season and and 41 - 135 mg/l in the dry season. No carbonate (CO3-) alkalinity could be found as dissolved carbonates raise the pH to more than 8.3 and in the present study, the surface water pH was

lower than this value [24] The total alkalinity is therefore almost entirely due to the presence of bicarbonate ions, which was found slightly higher levels in the post monsoon period indicating that some contribution might have come from the carbonate weathering process due to heavy downpour in the catchment. The alkalinity varies in accordance with the fluctuations in pollution load. In both seasons minimum value observed in Lower Camp and maximum value observed in Kunnur .Total alkalinity values of different sampling sites falls within the permissible limit (600mg/l) as per IS 10500:2004.

The total hardness of the surface water is dependent on the presence of Ca and Mg contents that enter the water bodies through residues of soaps, detergents and parent bed rock materials made up of Ca, Mg and other metal ions [17].The average total hardness values of the water samples varied from 20.2-140.0 mg/l (wet season) and 34.3 - 162.2 mg/l (dry season). In both season minimum value observed in Lower Camp and maximum value observed in Kunnur. [26] reported, similar range of total hardness in the Krishna river. Total hardness values of different sampling sites falls within the permissible limit (600mg/l) as per IS 10500:2004. A negative correlation was found between total hardness and DO (-0.21568) and positive correlation with other chemical parameters. It is seen that 5.7 % of the surface water sources are in 'very hard' class during the dry season and majority of the surface water bodies are in soft category in the wet season (obviously due to dilution). As much as 65.7 % of the sources are under moderately hard category in the dry seasons [8].

Calcium and magnesium have wide variations in values. The average values are Ca: 0 – 12.4 mg/l and 2.0 – 26.2 mg/l; Mg: 4.9 – 31.0 mg/l and 7.9 – 33.0 mg/l in the wet and the dry seasons respectively. All the sampling sites have higher values of calcium in the dry season than those in the wet season. Ca and Mg in both seasons minimum values were observed in Lower Camp and maximum value observed in Kunnur. Because in Lower Camp no human interference (like cloth washing, cattle washing & vehicle washing), but in other site cloth washing is the prime activity. In both the wet and dry seasons, all the water samples have Mg below the permissible limit of 100 mg/l. A negative correlation was found between Ca, Mg and DO and positive correlation with other chemical parameters (**Table. 2**).

Table 2 Correlation between Physico-chemical Parameter of the Mullai periyar river at different sampling sites during Feb 2012-Jan 2013

	Temp	pH	EC	TDS	TA	TH	Ca	Mg	Cl	$So4^{2-}$	Na	K	$po4^{3-}$	TN	Si	Do	BOD	COD
Temp	1																	
pH	0.410288	1																
EC	0.23007	0.52151	1															
TDS	0.224111	0.525851	0.998556	1														
TA	0.362443	0.567687	0.904171	0.903693	1													
TH	0.106628	0.453049	0.876867	0.876925	0.820853	1												
Ca	0.247334	0.617376	0.773325	0.771789	0.753447	0.739751	1											
Mg	0.07391	0.385802	0.838731	0.838412	0.781389	0.988169	0.630481	1										
Cl	0.108526	0.307638	0.774863	0.775795	0.618777	0.619587	0.583269	0.585835	1									
So42-	0.196836	0.409622	0.856699	0.853955	0.746548	0.740763	0.631783	0.71541	0.927422	1								
Na	0.552101	0.517872	0.691003	0.681932	0.73354	0.544472	0.638157	0.489965	0.58999	0.655966	1							
K	0.664752	0.628133	0.641008	0.632035	0.667182	0.472312	0.624533	0.411144	0.565802	0.609247	0.863109	1						
po43-	-0.61339	-0.20638	0.065164	0.062949	-0.05534	0.19856	0.155386	0.189906	0.077076	0.0793	-0.30399	-0.42709	1					
TN	0.54173	0.684847	0.355129	0.352815	0.444867	0.344338	0.522345	0.28375	0.118583	0.240378	0.477611	0.562691	-0.27671	1				
Si	0.152392	0.404586	0.694139	0.688748	0.670436	0.607476	0.585182	0.57273	0.467397	0.560844	0.576263	0.439538	0.139897	0.176767	1			
Do	-0.50863	-0.42228	-0.24723	-0.24423	-0.28985	-0.21568	-0.21424	-0.20186	-0.12234	-0.19935	-0.2863	-0.38835	0.401104	-0.41487	-0.18322	1		
BOD	0.401432	0.589954	0.417061	0.413787	0.455948	0.456167	0.614524	0.391529	0.155401	0.309488	0.335794	0.449704	0.903693	0.684797	0.28961	-0.52406	1	
COD	0.351784	0.412898	0.27988	0.272168	0.18858	0.246085	0.370721	0.203003	0.082278	0.194212	0.209172	0.335882	0.489965	0.528575	0.273687	-0.38562	0.695811	1

The mean value observed for sodium were in the range of 8.7 - 18.8 mg/l (wet season) and 15.9 - 39.5 mg/l (dry season) while potassium contents were from 0.7-2.1 mg/l in wet season and 1.9- 5.2 mg/l in dry seasons. In both seasons minimum value observed in Lower Camp and maximum value observed in Kunnur. Similarly it is found that 85.8 % of the surface water samples showed higher values of sodium in the dry season than in the wet season. As in the case of Na, 77.3 % of the surface water samples showed more potassium content in the dry season than in the wet season. Only 2.8 % of sample in the wet season and 5.7 %of sample in the dry season was found to have potassium content above 5 mg/L. Sodium is found in association with high concentration of chloride resulting in salinity while potassium is a component of potash fertilizers and animal waste. The natural sources of potassium in water are the minerals of local igneous rocks such as feldspars (orthoclase and microcline), mica and sedimentary rocks as well as silicate and clay minerals [13].

The mean value of Chloride in this study showed a range of 11.1 - 44.2 mg/l in wet season and 13 - 50.8 mg/l in dry season. 91.5 % of the surface water samples have higher chloride content in the dry season than those of the wet season. High concentration of chloride makes water unpalatable and unfit for drinking and livestock watering. However, all the surface water sources showed chloride values below the desirable limit of 250 mg/L (IS 10500:2004) which can be attributed to (i) the rate of percolation of agricultural and domestic wastes to the surface water bodies (the area is not industrial) is low and (ii) the contributions from the geological formations of the area is not much significant preventing the sources from excessive chloride accumulation[22]. Sulphate enters surface waters from groundwater, the oxidation of sulfide minerals during chemical weathering, atmospheric deposition from acid rain, human and animal waste, farming, and industrial processing and manufacturing [30]. The sulphate contents of the basin in the present study are much below the permissible limit for drinking water 400 mg/L, (IS 10500:2004) with the mean values ranging from 7.9 - 53.2 mg/l in the wet seasons and 13.3 - 60 mg/l in the dry season. The variations of sulphate concentration in different sampling sites were observed both the seasons are thus very wide.

The phosphate contents in this study, the mean value ranged from 0.08 to 0.15 mg/l in the wet season and from 0.04 to 0.08 mg/l in the dry season. In 88.5 % of the surface water samples, phosphate concentration is higher in the wet season than the dry season [25]. In both seasons minimum value observed in Lower Camp and maximum value observed in Veerapandi at wet season.The presence of vast paddy cultivation in the study area suggest that agricultural runoff is the probable source for higher concentration. Easy solubility is also responsible for phosphates finding their way into water from animal waste, runoff from agricultural land due to fertilizer use, and detergent-filled domestic wastewater [4]. A negative correlation was found between total phosphate and total nitrogen (-0.27671), BOD (-0.09684), COD(-0.03797) and positive correlation with other chemical parameters. The silica contents in this study mean values ranged between 3.3 - 7.7 mg/l in the wet season and from and 4.3 - 7.9 mg/l in the dry season. In both season minimum value observed in Lower Camp and maximum value observed in Kunnur (7.9 mg/l during dry season). Because Kunnur is characterized by sandy substrate, shallow & wide. No negative correlation was found between silica with other chemical parameters.

The total nitrogen contents in this study ranged from 0.06 - 0.23 mg/l in the wet season and 0.08 - 0.34 mg/l in the dry season. The total nitrogen contents is higher in the dry season than the wet season .In both seasons minimum value observed in Lower Camp and maximum value observed in Markayankottai (0.34 mg/l) and Veerapandi (0.32 mg/l) at dry season. Minimum value of total nitrogen observed is due to the reduction of agricultural activities and livestock grazing. The reductions in nitrogen rich fertilizers may cause the decreasing trend on total nitrogen [20]. Another high trend value was observed at the Saba River. High loading due to urban sewage and the volcanic eruption are likely the main reasons for the high average values at the rivers [21]. A negative correlation was found between total nitrogen and DO (-0.41487) and positive correlation with other chemical parameters.

The mean value of dissolved oxygen ranges between 7.1 - 8.6 mg/l during wet season and 6.3 - 7.0 mg/l during dry season. Seasonal variations observed in DO content with higher values in rainy season could be due to increased aeration because of rainfall. [6] reported that DO concentration at Asejire Lake attained its peak at the time of rainy season. The high DO value observed in lower Camp (during wet season).The lower DO value observed in few sampling site like Palayam, Veerapandi and Markayankottai (during dry season) also implies that the rivers are polluted due to addition of high organic contents leading to oxygen depletion. A negative correlation was found between DO and BOD (-0.52406) and COD (-0.38562) and positive correlation with other chemical parameters.

Biochemical Oxygen Demand (BOD) depends on temperature, extent of biochemical activities, concentration of organic matter and such other related factors. During the study period, the mean value of BOD was 7.2 - 19.7 mg/l

during wet season and 11.1 - 21.3 mg/l during dry season. In both seasons minimum value observed in Lower Camp (7.2 - 11.1 mg/l) and maximum value observed in Veerapandi (21.3 mg/l) in dry season. Due to low temperature prevailing in winter and low bacterial activity, higher levels of DO were encountered. This indicates a fall in BOD levels. Maximum value of BOD was observed in dry season due to the maximum biological affinity at elevated temperature and low in winter [11], and reduced flow of riverine water A negative correlation was found between BOD and DO (-0.52406) and positive correlation with other chemical parameters. The chemical oxygen content in this study ranges of between 19.7 - 44.8 mg/l during wet season and 24.5 - 54.2 mg/l during dry season. Seasonal variations observed in COD content with higher values in dry season could be due to increased BOD. The low COD value observed in Lower Camp(during wet season) and the high COD value observed in few sampling site like Palayam,Veerapandi and Markayankottai(during dry season) also implies that the rivers are polluted due to addition of high organic contents. These non-biodegradable compounds might accumulate and biomagnify in living organisms, which might have a high potential of adverse health effects on human [2]. A negative correlation was found between COD and DO (-0.38562) and positive correlation with other chemical parameters.

Conclusion

In order to evaluate the physicochemical parameters of Mullaiperiyar river, water samples were collected and analyzed the physic-chemical analysis of water sample in the river water at various sites like Lower Camp, K.K.patti, Palayam, Markayankottai, Veerapandi and Kunnur indicates that all the physico- chemical parameters fall well within the IS: 10500:2004 prescribed limit for drinking water except COD and BOD values. Of the six sampling sites studied, the minimum values were observed in Lower Camp (both seasons) and maximum values were observed in Kunnur. As such the water sources may be used safely for both domestic and irrigation. In the present study, the observation showed that the river water is relatively safe during wet season. But during dry season, a few parameters like DO, BOD and COD exceed the recommended level and therefore the Periyar river water is not suitable for domestic and irrigation.

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