

Study of Physico-Chemical Parameters and Correlation among Different Parameters in Water of Kathani River, Gadchiroli, Maharashtra

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Abstract: *The present investigation was conducted for the time period of twelve months (June 2014-May 2015) to evaluate the physico-chemical parameters of water at different sites of Kathani river, Gadchiroli, Maharashtra and also to study the influence of seasonal changes on physico-chemical parameters and to study correlation among different parameters. Four sites were selected for the investigation and the water samples were collected on monthly basis. The water samples were processed for analysis by adopting standard methods to investigate concentration of various physico-chemical parameters and to study correlation among different parameters. The study area experiences a seasonal climate change and thereby a seasonal fluctuation in physico-chemical parameters. Majority parameters were found within the permissible limit of WHO. EC, TDS and Hardness were at their maximum during summer season. pH throughout the period of investigation had maintained the alkaline range. Anion concentrations were higher during monsoon season. Iron concentration was maximum throughout the rainy season and had crossed the permissible limit of WHO. Higher iron concentration in monsoon was attributed to high input of iron via iron ores in a flooded situation. The highest positive correlation was observed between TDS and EC, TH with Ca and Mg and also between anions. TA and DO showed negative correlation with majority of parameters. Thus from the above study, it is suggested to prevent human infringement and restrict excess of iron from water before consumption to procure good quality water for consumption.*

Keywords: Physico-chemical parameters, seasonal variation, correlation, Kathani river, Gadchiroli

1. Introduction

Fresh water is the finite resource essential for agriculture, industry and even human existence, without which of adequate quality and quantity, sustainable development will not be possible [1]. A reliable supply of clean wholesome water is high essential in a bid to promoting healthy living among the inhabitants of a defined geographical region [2]. Water quality, which is influenced by various natural processes and anthropogenic activities, therefore is worldwide current environmental issue in research [3] [4]. The water quality is deteriorating due to improper water management, unscientific water disposal and lack of environment awareness. This has led to scarcity of potable water affecting human health [5]. In the last few decades there has been increasingly greater emphasis on the deterioration of water quality of Indian rivers [6]. The assessment of the changes in river communities as a result of impact of pollution is particularly interesting issue within the framework of aquatic ecology, since running waters are becoming adversely affected by anthropogenic discharge [7].

Earlier investigations revealed that Wainganga river and its tributaries are relatively pollution free. However in the last decade because of pollution growth, waste disposal, agricultural practices and indiscriminate use of water by fishing, farming and funerals on the bank of river, quality of water is deteriorating due to various pollutants. Therefore the present investigation has been undertaken to analyze monthly, seasonal and yearly variation in physico-chemical

parameters and to assess the water quality of Kathani river near Gadchiroli town, of Maharashtra. As Kathani river is near Gadchiroli, the district with growing pace is facing threats through increased agricultural practices, overgrazing cattle, human interference and poaching by continuous sand excavation, interrupted water flow and burning dead bodies. If remained unnoticed for further few years, it may cause disaster to the chemistry and biology of river ecosystem.

2. Study Area

Gadchiroli town, a district headquarter belonging to eastern Vidarbha of Maharashtra state is located at 20.1884 N and 80.003 E longitude. The district stretches over an area of Maharashtra state. The Kathani river originates in the Dhanora Pendhari hills, flows about four Km away from Gadchiroli westwards and merges Wainganga river near Bormala village about 6 Km away from Gadchiroli town. It is main tributary of Wainganga and often gets flooded during monsoon and overflow of Gosikhurd dam project on Wainganga. The South-West monsoon arrives over the district by the second week of June. The rainfall during the period from June to September constitutes about 90% of annual rainfall. The variation in the annual rainfall from year to year is small.

Site K₁ (Near Bormala Ghat) : It is situated downstream where river confluence with Wainganga near Bormala village. It is almost free from human disturbances and domestic pollution. However agricultural practices are going on on the bank during monsoon.

Site K₂ (Near bridge on Gadchiroli) : It is situated on Nagpur highway, about 4 Km away from Gadchiroli town. It receives domestic sewage, cattle bathing, funeral and dead bodies and idol immersions apart from watermelon cultivation.

Site K₃ (Near Adpalli-Gogaon Ghat) : it is situated near Adpalli-Gogaon village, 6 Km from Gadchiroli and experience no much pollution except domestic and agricultural run off.

Site K₄ (Near Kharpundi Bridge) : It is situated about 7 Km away from Gadchiroli upstreams near Kharpundi village at Kharpundi bridge. It receives a steady flow of river water with cattle bathing, domestic wastes and cloth washing etc.

3. Materials and Methods

The samples of the Kathani river were collected at monthly intervals from the four selected sites on the second Sunday of each month, from June 2014 to May 2015. The samples were collected between 9.00 AM to 11.00 AM from each sampling site in pre-cleaned, sterilized polythene containers of two litre capacity and brought to the laboratory for the analysis of various physico-chemical parameters. Water temperature, pH, EC and TDS were recorded immediately on the spot using a Celsius thermometer, pH meter, conductometer and TDS meter respectively. The following physico-chemical parameters were analyzed as temperature, pH, TDS, electrical conductivity, Total Hardness, Ca²⁺ Hardness, Mg²⁺ Hardness, Total Alkalinity, Dissolved Oxygen, Biochemical oxygen demand, Chloride, Fluoride, Sulphate, Nitrate, Free CO₂, Phosphate and Iron. The parameters were analyzed by using standard procedures described in APHA (2012) [8] and Trivedi and Goel (1990) [9]. The data were collected from the period of twelve months from June 2014 to May 2015, from four different sites of Kathani river and their average values of each months have been cited in the present text.

4. Results and Discussion

The results of physico-chemical analysis of Kathani river water are presented as monthwise variation and correlation matrix in the table 1 and 2 respectively. Physico-chemical parameters were analyzed in the light of WHO standards [10].

Water Temperature: The water temperature depends on geographical location and meteorological condition. Hutchinson (1957) [11] suggested that meteorological conditions are responsible for seasonal changes in temperature. In the present study mean water temperature ranged from minimum of 21.48^oC in December 2014 to the maximum of 34.32^oC in May 2015. Seasonally the values were highest during summer as 28.19 ± 4.28^oC followed by rainy and then winter season. Winter season witnessed the lowest water temperature as 22.84 ± 1.22^oC. Highest water temperature during summer might be due to low water level and higher atmospheric temperature. Similar reports were observed by Salve and Hiware(2008) [12].

pH: Present study revealed that mean pH of water ranged from 7.29 in April 2015 to 8.18 in August 2015. Seasonally the values of pH were highest during monsoon as 8.10 ± 0.07 and minimum during summer as 7.37 ± 0.13. Bobdey (2002) [13] had recorded pH values between 7.0 to 8.50 in the river Wainganga at Pauni, Maharashtra. Gangwar and Joshi (2007) [14] in the Ganga river at Haridwar and Saksena et al (2008) [15] in the Chambal river also recorded parallel findings. Minimal values of pH during summer might be due to reduced water level, increased concentration of organic matter with subsequent rise of CO₂ but intense sunlight accelerate photosynthetic activities of algae and macrophytes which in turn enhance carbohydrates intake and thereby decrease pH in summer. (Bobdey et al, 2007) [16].

Electrical Conductivity (EC) : Electrical conductivity signifies the amount of total dissolved salts. Therefore increased conductivity of river water indicates contamination of ionic pollutants. Mean EC during study period was ranged between 114 µs/cm in November 2014 to 284 µs/cm in May 2015. Seasonal variation in EC showed maximum EC during summer as 236.7 ± 37.4 µs/cm and minimum during winter as 124.6 ± 14.74 µs/cm. Summer maxima of EC might be due to low current of water, higher rate of evaporation and higher TDS. Whereas winter minima of EC might be due to lower atmospheric temperature and reduced rate of decomposition. Parallel funding were reported by Thomas et al (2001) [17] in the Kurland Wetland ecosystem and Chavan A.W. (2009) [18] in the river Wainganga.

Total Dissolved Solids (TDS) : Total Dissolved Solids indicates the salinity behaviour of river water. The mean TDS value during the period of investigation was ranged between 82.1 mg/L in November 2014 and 195.8 mg/L in May 2015. Seasonal variation of TDS revealed maximum value as 158.7 ± 26.6 mg/L during summer and minimum value as 89.9 ± 6.24 mg/L during winter. Values of TDS were found within the permissible limit of WHO. Srinivasrao et al., (2007) [19] observed similar findings in Godavari river at Nanded, Maharashtra, due to factors such as rainfall, biota causing changes in ionic concentration and the nature of bottom deposit.

Total Alkalinity (TA) : Total Alkalinity of water is its capacity to neutralize acids and its normally due to presence of bicarbonates, carbonates and hydroxide of calcium, sodium and potassium. In the present investigation mean TA was ranged between 43.5 mg/L in August 2014 and 96.8 mg/L in December 2014. TA values were found within the permissible ranged by WHO 2011. Seasonal variation in TA showed that maximum TA of 82.38 ± 14.30 mg/L was observed during winter season and minimum of 57.68 ± 10.98 mg/L during monsoon season. Monsoon minima of TA might be due to dilution effect as large quantity of rain water dilutes the organic matter in river water. The results were concurrences with the observation of Tiwari (1983) [20], Sikandar (1987) [21] and Chavan A. (2009) [18].

Total Hardness (TH) : The average total hardness of river water samples was found to be in the range of 47.1-135.1 mg/L which was within the permissible limit of WHO. The

minimum TH as 47.1 mg/L was observed in the month of October 2014 while the maximum TH as 135.1 mg/L was reported in the month of May 2015. Seasonal variation in TH revealed that, maximum TH was reported during summer as 115.8 ± 16.33 mg/L and minimum TH during winter as 60.18 ± 12.15 mg/L. Higher values of hardness during summer can be attributed to decrease in water volume and increase of rate of evaporation of water. Pande and Sharma (1998) [22] reported higher values of TH during summer and lower during winter and rainy season in the river Ramganga at Moradabad. Hujare (2008) [23] also reported similar seasonal fluctuation.

Calcium and Magnesium Hardness: Calcium and Magnesium are the two most prevalent divalent metal ions which are responsible for hardness of water. The presence of calcium in the water is more likely in the form of carbonate, which is also indicated by high values of hardness in water samples. Mg hardness exhibit strong relation with chloride which reveals that Mg mainly remains present as $MgCl_2$ (Bhandari and Nayal, 2008) [24]. In the present investigation Ca hardness was found in the range of 29.5-78.8 mg/L which was within the permissible range of WHO. As far as temporal variation, minimum Ca hardness was encountered in the month of October while maximum Ca hardness, in the month of May.

Mg hardness was found to be in the range of 16.8-57.6 mg/L which was again with the permissible limit of WHO. Minimum Mg hardness in the month of September while maximum Mg hardness, in the month of July. Seasonally maximum and minimum Ca^{2+} hardness was reported in summer as 70.2 ± 6.67 mg/L and winter as 36.6 ± 6.90 mg/L respectively. Similarly maximum and minimum Mg^{2+} hardness was reported in summer as 45.62 ± 9.72 mg/L and 23.58 ± 5.28 mg/L in winter respectively. Similar results were reported by Mohanta and Patra (2000) [25].

Free CO₂: In the present investigation free CO₂ was ranged between 3.16 mg/L in September and 8.08 mg/L in May 2015. Seasonal fluctuation of free CO₂ revealed that, maximum free CO₂ was encountered during summer as 7.77 ± 0.26 mg/L and minimum free CO₂ during monsoon as 3.44 ± 0.22 mg/L. Summer maxima of free CO₂ might be due to their higher rate of decomposition of organic matter by microorganisms and their higher respiratory activity while monsoon minima might be due to dilution effect of rainwater on decomposed organic matter.

Carbon dioxide in natural water is derived from various sources, viz from the atmosphere, respiration of animals and plants, bacterial decomposition of organic matter, inflowing ground water seeping into the ponds and other metallic compound of Ca, Mg, K and Na. (Ultsch, 1973) [26]. The results of current investigation were found to be in concurrence with those of Venkateshwarlu et al (1982) [27] in river Moosi, Hyderabad.

Dissolved Oxygen (DO): In the present investigation DO varied between 4.9 mg/L in September 2015 and 7.5 mg/L in January 2015 which was within the permissible range by WHO. Seasonal variation in DO revealed that maximum DO was noticed during winter as 7.22 ± 3.11 mg/L and

minimum DO, during monsoon as 5.68 ± 0.60 mg/L. winter maxima in DO might be due to clear zone, fall in temperature, increase in solubility of oxygen, more photosynthetic activities and high aeration rate whereas monsoon minima of DO might be due to increased organic matter of surface run-off. Winter maxima of DO was also observed by Mahadevan and Krishnaswami (1983) [28] in river Vaigai, South India. However summer minima of DO was noticed by Shivanikar et al., (1999) [29] in Godavari river, and Sawane et al., (2004) [30] in Irai river.

Biochemical Oxygen Demand (BOD) : In the present research BOD was ranged between 1.92 mg/L in November 2014 and 3.0 mg/L in May 2015. BOD was found to be in the permissible limit of WHO. Seasonal variation of BOD revealed that maximum BOD in water recorded as 2.77 ± 0.16 mg/L during summer while minimum BOD was recorded as 2.01 ± 0.09 mg/L during winter season. The BOD has been a fair measure of cleanliness of water on the basis that value less than 1-2 mg/L are considered clean, 3 mg/L fairly clean, 5 mg/L doubtful and 10 mg/L definitely polluted. Similar results were observed by Malviya et al., (1990) [31] in Narmada river.

Chemical Oxygen Demand (COD): In the present study average COD had varied between a minimum of 4.49 mg/L in October 2014 and a minimum of 12.5 mg/L in the month of May 2015. Amongst three seasons it was found higher during summer as 10.87 ± 1.47 mg/L and lower during winter as 4.88 ± 0.28 mg/L. It was in accordance with the observation made by Shankar et al (1986) [32] on river Reh in Doon valley.

Chloride (Cl⁻): In the present study, Cl⁻ concentration varied from 9.2 – 22.7 mg/L, minimum being in the month of October and maximum in the month of July 2014. It was ranged within the permissible limit of WHO. Seasonal variation in chloride revealed the maximum values as 18.8 ± 3.26 mg/L during monsoon season while maximum as 10.35 ± 1.05 mg/L during winter season. Higher values during monsoon is due to receiving high amount of domestic and other organic wastes along with surface run-off whereas lower values during winter is due to dilution effect of post monsoon period. The results were in concurrence with those of Dahegaonkar (2008) in Zarpat river, Chandrapur [33].

Sulphate (SO₄²⁻) : In the present investigation sulphate content varied from a minimum of 2.7 mg/L in November 2014 to 7.1 mg/L in July 2014, which lie within the permissible limit of WHO. Seasonal fluctuation in sulphate concentration showed maximum values as 5.85 ± 1.07 mg/L during winter season. Monsoon maxima might be due to bringing high input of sulphate from catchment area and discharge of domestic wastes. Minimum sulphate concentration during winter might be due to not having any appreciable organic input. Parallel findings were also observed by Kulshrestha et al., (1992) [34] in Manasarovar reservoir, Bhopal.

Nitrate (NO₃⁻): In the present investigation nitrate concentration varied between the minimum of 0.39 mg/L in the month of May 2015 and maximum of 3.1 mg/L in the month of July 2014 which lie within the permissible range of

WHO. Seasonal variation in nitrate reflects maximum values as 2.34 ± 0.62 mg/L during monsoon while minimum values as 0.78 ± 0.36 mg/L during summer season. Monsoon maxima might be due to influx of nitrogen rich flood water bringing contaminated sewage water, run-off from agriculture fields. Summer minima of nitrate might be attributed to activity of denitrifying bacteria, utilization of nitrate by phytoplankton and macrophytes as an evidence of high photosynthetic activity. Similar findings were reported by Arvind Kumar and Singh (2002) [35] in Mayurakshi river.

Phosphate (PO_4^{3-}) : In the present research phosphate concentration was ranged between 0.032-0.105 mg/L, the minimum being in the month of January 2015 and the maximum in the month of July 2014. Slight excess concentration was reported in the month of July which exceeded the permissible limit of WHO. Seasonal variation of phosphate revealed its maximum concentration as 0.079 ± 0.018 mg/L during monsoon while minimum concentration as 0.043 ± 0.009 mg/L during winter season. Higher phosphate values during monsoon might be due to high input of phosphate from ashes of funerals, nutrient soil deposition from catchment area and agricultural runoff. Similar results were observed by Chavan (2009) [18] in Wainganga river near Bramhapuri.

Fluoride (F^-): In the present study, fluoride concentration varied between 0.26-0.70 mg/L, the minimum being in the month of December 2014 and maximum in the month of July 2014. The values were ranged within the permissible limit of WHO. Seasonal fluctuation point of view, the maximum fluoride concentration was reported during monsoon as 0.628 ± 0.006 mg/L and the minimum value was recorded during winter as 0.295 ± 0.04 mg/L. Nazneen Sadat (2012) reported minimum value in monsoon and maximum in summer, in Godavari river, Nanded [36].

Iron (Fe^{2+}): In the present study iron concentration in water ranged in the month of November while maximum concentration was recorded in the month of August. Seasonal variation of iron concentration showed maximum values as 0.61 ± 0.25 mg/L during monsoon and minimum values as 0.078 ± 0.029 mg/L during winter. Values of iron concentration were beyond the permissible limit of WHO during monsoon. Higher values of iron during monsoon might be due to presence of iron ores along the mainstream of river that would probably have brought to the water especially in the flooded situation. Parallel findings were obtained by Pathak H. in the water bodies of Sagar city (2012) [37].

5. Correlation Analysis

Interrelationship studies between different variables are very helpful tools in promoting research and opening new frontiers of knowledge. The study of correlation reduces the range of uncertainly associated with decision making. The numerical values of correlation coefficient (r) for 18 parameters are tabulated in the form of correlation matrix in table 3. The highest positive correlation is observed between total dissolved solids and electrical conductivity (0.962), total hardness and calcium (0.989), total hardness and magnesium (0.986), chloride and phosphate (0.958), chloride and fluoride (0.926) and fluoride and phosphate (0.919). There is also higher positive correlation between temperature and EC (0.836), temperature and TDS (0.890), temperature and BOD (0.852), total hardness and EC (0.883), EC and BOD (0.878), TDS and TH (0.892), TDS and BOD (0.891), BOD and COD (0.897), chloride and phosphate (0.886), iron and chloride (0.827), sulphate and phosphate (0.856) and phosphate and nitrate (0.844). Thus positive correlation was observed between maximum inorganic ions. Total alkalinity and dissolved oxygen showed negative correlation with majority of parameters.

Table 1: Monthly Mean Values of Physico-chemical Parameters of Kathani river water, Gadchiroli during 2014-2015

Month	Temp	pH	EC	TDS	TA	TH	Ca ²⁺	Mg ²⁺	CO ₂	DO	BOD	COD	Cl ⁻	SO ₄ ⁻²	PO ₄ ⁻³	NO ₃ ⁻	Fe ²⁺	F ⁻
Jun-14	27.35	8.08	184.2	156.3	68.8	120.7	64.80	54.90	3.70	6.2	2.43	9.19	17.7	6.0	0.06	1.62	0.35	0.56
Jul-14	25.22	8.14	181.8	126.3	55.2	134.2	76.60	57.60	3.44	5.5	2.32	9.10	22.7	7.1	0.11	3.10	0.62	0.70
Aug-14	24.65	8.18	115.2	98.7	43.5	54.20	33.60	20.50	3.44	6.1	2.39	11.43	19.8	5.8	0.07	2.17	0.94	0.63
Sep-14	25.22	8.02	126.2	96.5	63.2	53.50	36.80	16.80	3.16	4.9	2.38	9.10	15.0	4.5	0.08	2.46	0.54	0.62
Oct-14	24.35	7.93	115.2	88.1	67.5	47.10	29.50	17.60	5.19	6.8	2.14	4.49	11.7	2.7	0.05	2.16	0.08	0.35
Nov-14	22.35	7.80	114.0	82.1	73.0	53.90	32.90	21.00	5.87	7.2	1.92	4.87	10.5	2.7	0.04	1.29	0.04	0.30
Dec-14	21.48	7.89	123.5	92.7	96.8	65.10	38.80	26.30	5.27	7.4	2.01	5.04	10.0	2.9	0.04	1.02	0.11	0.26
Jan-15	23.18	7.76	145.8	96.6	92.2	74.60	45.20	29.40	5.31	7.5	1.97	5.14	9.2	2.8	0.03	1.08	0.08	0.27
Feb-15	24.38	7.57	202.0	134.1	67.2	97.80	63.70	34.20	7.89	6.6	2.61	9.64	14.2	4.4	0.05	1.24	0.11	0.55
Mar-15	26.70	7.29	215.8	146.8	58.0	108.0	66.40	41.60	7.62	6.6	2.71	9.62	13.0	3.8	0.05	0.84	0.10	0.42
Apr-15	27.35	7.29	242.0	158.2	61.0	122.3	71.90	50.50	7.50	6.7	2.77	11.72	13.4	3.3	0.05	0.64	0.11	0.38
May-15	34.32	7.34	287.0	195.8	48.2	135.1	78.80	56.30	8.08	6.7	3.00	12.50	9.8	3.4	0.05	0.39	0.14	0.34
Mean	25.55	7.77	171.0	122.7	66.22	88.87	53.25	35.55	5.54	6.52	2.39	8.49	13.9	4.12	0.06	1.50	0.27	0.45

Table 2.1: Correlation Matrix of physico-chemical parameters for annual variation during 2014-15

	Temp	pH	EC	TDS	TA	TH	Ca ²⁺	Mg ²⁺	Free CO ₂
Temp	1.000								
pH	-0.365	1.000							
EC	0.860	-0.595	1.000						
TDS	0.889	-0.488	0.970	1.000					
TA	-0.621	-0.065	-0.466	-0.472	1.000				
TH	0.682	-0.346	0.888	0.891	-0.348	1.000			
Ca ²⁺	0.683	-0.407	0.918	0.896	-0.371	0.990	1.000		
Mg ²⁺	0.662	-0.273	0.832	0.861	-0.312	0.986	0.950	1.000	
Free CO ₂	0.390	-0.955	0.630	0.527	-0.031	0.368	0.443	0.278	1.000
DO	-0.210	0.549	-0.076	-0.096	0.590	-0.134	-0.153	-0.108	0.534
BOD	0.878	-0.473	0.905	0.898	-0.684	0.692	0.742	0.616	0.539
COD	0.737	-0.133	0.745	0.760	-0.787	0.621	0.656	0.565	0.224
Fe ²⁺	-0.004	0.793	-0.205	-0.130	-0.543	-0.073	-0.096	-0.047	-0.720
Cl ⁻	0.001	0.666	0.000	0.064	-0.552	0.265	0.237	0.287	-0.586
F ⁻	0.078	0.639	0.047	0.093	-0.596	0.205	0.216	0.182	-0.526
NO ₃ ⁻	-0.342	0.848	-0.491	-0.470	-0.226	-0.256	-0.280	-0.222	-0.826
SO ₄ ⁻²	0.121	0.657	0.108	0.198	-0.508	0.387	0.354	0.409	-0.558
PO ₄ ³⁻	0.082	0.670	-0.022	0.006	-0.540	0.206	0.185	0.225	-0.641

Contd..

Table 2.2: Correlation matrix of physico-chemical parameters for annual variation during 2014-15

	DO	BOD	COD	Fe ²⁺	Cl ⁻	F ⁻	NO ₃ ⁻	SO ₄ ⁻²	PO ₄ ³⁻
Temp									
pH									
EC									
TDS									
TA									
TH									
Ca ²⁺									
Mg ²⁺									
Free CO ₂									
DO	1.000								
BOD	-0.275	1.000							
COD	-0.479	0.886	1.000						
Fe ²⁺	-0.722	0.023	0.417	1.000					
Cl ⁻	-0.742	0.105	0.427	0.827	1.000				
F ⁻	-0.884	0.221	0.504	0.811	0.926	1.000			
NO ₃ ⁻	-0.697	-0.374	-0.135	0.700	0.737	0.723	1.000		
SO ₄ ⁻²	-0.730	0.174	0.474	0.796	0.958	0.919	0.651	1.000	
PO ₄ ³⁻	-0.852	0.080	0.324	0.789	0.886	0.862	0.844	0.856	1.000

6. Conclusion

During study, water samples from four sampling sites of Kathani river, Gadchiroli (M.S) were collected for the period of 12 months (June 2014 to May 2015) and analysis of various physico-chemical parameters had been carried out. Correlation matrix was also prepared to show relationship among various hydrological parameters. In general winter quality of Kathani river has not been threatened except iron and nitrate concentration. Iron concentration and at certain extent nitrate concentration had crossed prescribed limits of drinking water quality by WHO. The reason behind hike in concentration might be due to iron ores in the vicinity, urbanization, increased anthropogenic activities, agricultural practices and increased human intervention especially at site K₂, on Gadchiroli-Nagpur highways.

Some parameters showed abrupt seasonal fluctuations, especially during monsoon where flooded situation of

Wainganga makes reverse flow of Kathani thereby increasing inorganic ions concentration. From the present study it is estimated that Kathani river water is qualitatively fit yet concentration of few constituents are either on borderline or crossed the permissible limit at some sampling sites. Therefore some steps must be taken towards human awareness to prevent human infringement to protect water from contamination and the divinely gifted river of Gadchiroli, Maharashtra.

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