

Water Quality Assessment Of Kagina River

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ABSTRACT

The present study focuses on the assessment of the water quality of the Kagina River to evaluate its suitability for domestic, agricultural, and industrial purposes. Water samples were collected from multiple locations along the river course during different periods to account for spatial and seasonal variations. Standard physicochemical parameters such as pH, turbidity, total dissolved solids (TDS), dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total hardness, and chlorides were analyzed following the guidelines prescribed by the Bureau of Indian Standards (BIS) and the World Health Organization (WHO). The Water Quality Index (WQI) method was used to interpret the overall water quality status. The results revealed that some parameters exceeded permissible limits at certain stretches, primarily due to domestic sewage discharge, agricultural runoff, and industrial effluents. The study highlights the need for effective wastewater management practices, regular monitoring, and community awareness to restore and maintain the ecological health of the Kagina River.

Keywords: WQA, Kagina River, pH

INTRODUCTION

Water is essential for life on the Earth, it is the source of energy, govern the evaluation and function of the universe on the earth. Water is a unique natural resource essential for life and it constantly cycles between the land and the atmosphere. Water is one of the abundantly available substances in nature. It is an essential constituent of all animal and vegetation and forms about 75 % of the matter of earth's crust. It is also an essential ingredient of animal and plant life. The same water is used for crop and animal production can also be shared with the public and the aquatic and terrestrial ecosystems. (20)

River system comprises both main course and tributaries, carrying the unidirectional flow along with sediment load of dissolved matter and anthropogenic sources. River also serves for domestic, industrial and agricultural disposal, transportation, getting food resources and for recreational activities. Increase in use of chemical fertilizer and pesticides in agriculture are due to industrialization which causes various aquatic environmental pollution and lead to depletion of water quality. Water quality has direct relation with aquatic productivity. Maximum productivity depends on optimum level of physicochemical parameters.

Rivers contains highly crucial component of natural heritage and their water quality. From the evolution of the life of humans, rivers are their basic requirements and only some of them are recently in natural condition. Around the world, aquatic systems mainly river is reported polluted due to disposal of untreated sewage and industrial waste. There are many types of materials like organic and inorganic which contain; oils, Plastic, solvents, grease, heavy metals, chemicals, pesticides etc. All these waste including storm water runoff enters surface of ground water. All these are dependent on seasons and henceforth the surface water quality must be reckoned before started water quality management programme.

Now a days, anthropogenic activities are mainly contributing to pollution. Hence this is mandatory to deploy new tools and methodologies to ascertain the stage of pollution of any system at a given time. One substitute is the estimation of water quality index (WQI), an arithmetical tool to evaluate the quality of water. Integration of physical - biological- chemical to produce a unique value as an indicator of water quality is the basic of calculation of WQI.

WQI tool was introduced by Mr. Horton in mid 1960s and afterwards water quality index was used as tool to determine quality of water in locations like; groundwater, rivers, lakes, and dams. Recreational water, fisheries and drinkable waters are some areas where some variations have been done in WQI. In other cases, the calculation of WQI has involved modulation or forecast due to reason of better interpretation of result. WQI tools are also very useful for identifying the different types of pollutions and recommending different preventive action measures. Water quality is an important aspect for evaluating temporal variations due to

seasonal changes in surface water. River Pollution, Reservoir Pollution, Lakes Pollution and groundwater pollution are the reason of anthropogenic inputs of point / non-point origins like industrial, agriculture, urban, wastewater from domestic, wastewater from industries, sewage of urban centre, workshop and science laboratories. The WQI (Water quality index) calculation plays a significant role in Classifying the water quality.(13)

In India all major 14 rivers such as Ganga, Yamuna, Godavari, Gomti, Kasi, Kaveri, Ravi, Sone, Chenab, Jhelum, Narmada, Mahi, Tapi, & Krishna are facing acute water pollution problems. In fact, all 14 rivers in India have been receiving Sewage from urban population of the country. Only 7% of the towns and cities in the country treat their domestic sewage. The rest dump them either into the river or directly in the sea. Out of 132 industrial plants that pump water into the Ganga only 12 have waste treatment plants. In India more attention should be paid to the quality of river water as the river water fulfills most of the need of the population. Biomonitoring of water is an important reliable method for assessing water quality.

1.1 CHEMICAL CONSTITUENTS OF RIVER WATER

- pH
- Chloride
- Alkalinity
- Total Hardness (TH)
- Calcium (Ca)
- Magnesium (Mg)
- Dissolved Oxygen (DO)
- Biochemical oxygen demand (BOD)
- Jar Test

1.2 AIMS AND OBJECTIVE OF THE STUDY

The main aim of this project work is to know the water quality index of the Kagina river water and to know its status whether it can be used for potable purpose or not.

The main objectives of the current study are as following:-

1. To find the physico-chemical characteristics of water samples collected from different stretches of Kagina River, Malkhed.
2. To compare the physico-chemical characteristics of water samples with BIS Standards.
3. To find the water quality index (WQI) .

LITERATURE REVIEW

Joyanta pal et.al (January 2016) have studied Quality of water in Rudrasagar Lake, Tripura, India has been investigated in this paper. Water Quality Index (WQI) was applied in Rudrasagar Lake India using water quality parameters like pH, Turbidity, Conductivity, Hardness, Alkalinity, Dissolved Oxygen, Biochemical Oxygen Demand and Nitrate. Based on the importance of the parameter for aquatic life the relative weight is assigned to each water quality parameter ranged from 1 to 4. Tests were performed on site using electronic measuring device as well as on Laboratory with samples of water collected from different locations of Rudrasagar Lake. It shows that water quality of Rudrasagar Lake falls within the good water category but marginally. Continuous monitoring of Rudrasagar lake is suggested for proper management.(9)

Deepraj Kevat et.al (august 2016) have aimed to find out the water quality of the Saank River flowing through Morena district near Banmor Industrial area. Tigr dam is Build on upstream of the Saank River near Gwalior district. River water after passing through Kaitha, Agrabhatpura, Dugnawali, Jakhauda, Banmore, Sapchauli, Nurabad, Barendra Village, it finally joins the Pilua dam constructed downstream about 30 Km away from the site in Morena district. These villages are using river water for their day to day work. Sampling and field work was conducted during the period from Dec 2015 to June 2016. Twelve water samples were collected from four sites during each season i.e. winter, summer and monsoon and 13 physico-chemical and MPN was analyzed. There are several ways to assess the quality of water as deemed fit for drinking, irrigation, and industrial use. Water quality index expressing the water quality in term of index number and provide a baseline data, is

determined and accordingly water quality is assessed.(4)

S.K.Pathak et.al (September 2015) have intended to calculate water quality index (WQI) of river Bhagirathi. It is one of the tributary of holy river Ganga of India. In order to determine the quality of its water for public use, recreation and other purposes, the eleven parameters like pH, electric conductivity, Total dissolve solids, Total suspended solids, Dissolve oxygen, Biological oxygen demand, Total alkalinity, Total hardness, Chloride, Nitrate and Sulphate were determined. The water quality index calculated from the observed parameters indicate the river Bhagirathi at Uttarakhand during winter was under good water quality condition, while at summer and rainy season of showed poor water quality index. In terms of index number, offers a useful representation of overall quality of water for public or for any intended use as well as in the pollution mitigate plan and in water quality management.(20)

MATERIALS AND METHODS

3.1 STUDY AREA

Kagina River has its source in Anantagiri hills near Vikarabad in the Ranga Reddy District of Andhra Pradesh. Mullamari River and Bennethora River are the main streams joining the Kagina River. After flowing through the Ranga Reddy district in Andhra Pradesh it enters Gulbarga district, (77°-09'-25'' longitude 17°-12'-35'' latitude) in Chincholi taluk and flows in Sedam and Chitapur talukas and joins Bheema river (main tributary of the Krishna river) near Wadi of Chitapur taluk, Gulbarga district.

The study area is Malkhed village. Malkhed is a village panchayat located in the Gulbarga district of Karnataka state, India. The latitude 17.19313 and longitude 77.157379 are the geo coordinate of the Malkhed. Bangalore is the state capital for Malkhed village. It is located around 470.8 kilometer away from Malkhed. The other nearest state capital from Malkhed is Hyderabad and its distance is 142.3 km. The other surrounding state capitals are Hyderabad 142.3 km, Mumbai 498.8 km, Chennai 566.5 km.

According to Census 2011 information the location code or village code of Malkhed village is 620493. Malkhed village is located in Sedam Tehsil of Gulbarga district in Karnataka, India. It is situated 13km away from sub-district headquarter Sedam and 45km away from district headquarter Gulbarga. As per 2009 stats, Malkhed village is itself a gram panchayat.

3.2 SAMPLING TECHNIQUES AND PRESERVATION

Sampling is the series of steps leading to the generation of water quality data and is an exceedingly important one. Care must be taken to ensure obtaining a sample that is truly representative. Further the integrity of the sample is not representative of the system sampled or if the sample has changed in chemical composition between sampling and analysis, will provide an inaccurate results.

Precautions

1. The water has been collected in bottles, especially of green colour, having well fitted stoppers or screw caps.
2. Bottles having capacity of about five liter of water is necessary for the chemical analysis.
3. Bottle has been thoroughly cleaned, by rinsing thrice with river water and emptied before collecting the sample of water
4. After collecting the sample, the stopper of the bottle have been well secured and the bottles containing samples of water have been labelled stating the date and time of collection.

3.3 SAMPLING

For sampling purpose, we have selected 2 points and collected 2 samples, one from every point selected from the river and totally 8 samples were done during the study. For this river we have stated „S“ as sample code. We have analyzed 8 samples from each sampling points. This description of sampling is given in table below in table 3.1.

Table 3.1: Sampling Points

Sl. No	Location	No of samples taken	Sample Code
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1	Jayteerth temple	08	S1
2	Near bridge	08	S2

The samples were collected from September 30, 2025 to December 1, 2025 covering monsoon season. The grab samples are collected from every sampling point at an interval of 7 days. Five litre of water samples were collected from each sampling point and immediately brought to the Environmental Engineering laboratory, Department of Civil Engineering, P.D.A college of Engineering, Kalaburagi for analysis. All the samples were tested in the laboratory to determine physico-chemical characteristics such as pH, DO, BOD, Total Hardness, Calcium hardness, Magnesium hardness, Chloride, Alkalinity, Turbidity, Jar test. The methods adopted for the determination of the parameters given below in table 3.2.

3.4 WATER QUALITY INDEX

Table 3.2: WQI and status of water quality (Chatterji and Raziuddin 2002)

Water quality Index	Grade	Water Quality Status
<25	A	Excellent water quality
26-50	B	Good water quality
51-75	C	Poor water quality
76-100	D	Very poor water quality
>100	E	Unsuitable for drinking purpose

RESULTS AND DISCUSSIONS

Table 3.3 Characteristics of Kagina River Water at Sampling Point 1

No. of samples	pH	Cl	Alkalinity	TH	Ca	Mg	DO	BOD	Jar test	Turbidity
1	8.7	71.97	104	184	176	08	11.6	2.51	1.5	110
2	8.6	51.11	54.6	198.4	173.2	25.2	9.76	2.51	1.5	220
3	8.5	40.53	61.2	206.4	156	50.4	10.3	2.75	1.5	275
4	8.9	57.90	58.6	197.2	164	33.2	9.76	2.65	1.25	245
5	8.3	295.90	90	476	180	288	5.3	2.79	1.5	125
6	8.5	129.95	96	470	192.1	272	5.3	2.44	1.5	165
7	8.4	280.70	92	456	190.4	265.6	9.7	2.37	1.25	215
8	8.6	213.63	152	567.4	212	352.4	8.76	2.51	1.25	190
SUM	68.5	1141.69	708.4	2755.4	1443.7	1294.8	70.48	20.53	-	1545
MAX	8.9	295.90	152	567.4	212	352.4	11.6	2.79	1.5	275
MIN	8.3	40.53	54.6	184	156	08	5.3	2.37	1.25	110
MEAN	8.5	142.71	88.55	344.42	180.46	161.85	8.81	2.56	-	193.12

All parameters are in mg/L except pH , Turbidity.

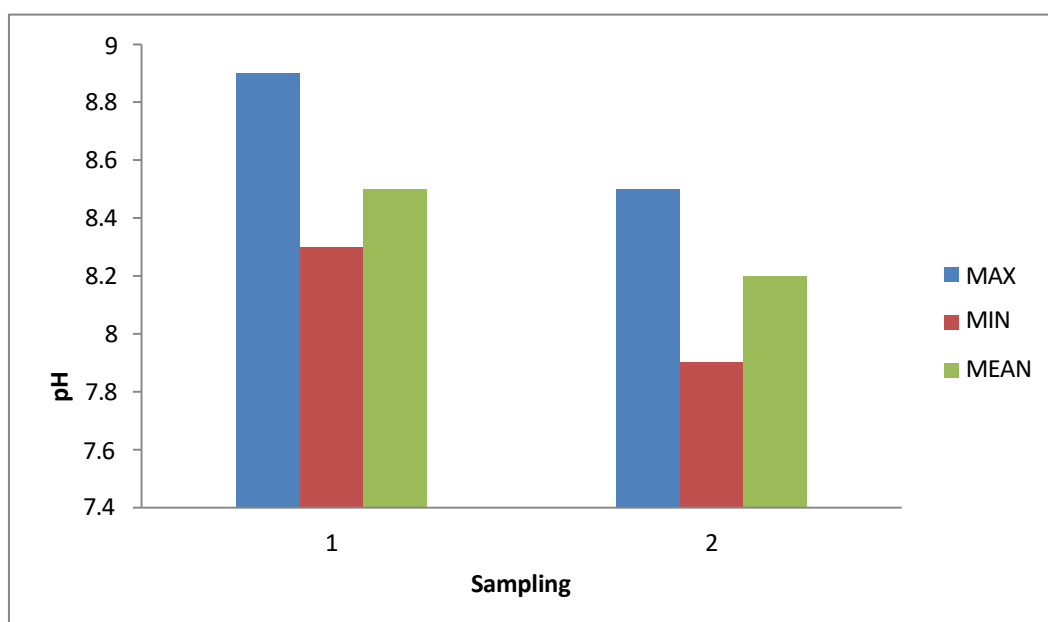
Table 3.4: Characteristics of River Water at sampling point 2

No. of samples	pH	CL	Alkalinity	TH	Ca	Mg	DO	BOD	Jar	Turbidity
1	8.3	70.9	102.8	107	78.8	28.2	5.77	2.68	1.5	95
2	7.9	48.21	85.3	102.2	80.2	22	5.47	2.19	1.25	55
3	8.5	48.21	72.6	102	92.5	19.5	5.97	2.58	1.5	75
4	8.4	53.88	101.3	104	84.6	20.6	5.27	2.48	1.5	105
5	8.1	51.04	98.6	98	96.2	18.4	5.47	1.79	1.5	60
6	7.9	73.73	72.4	107.8	75.1	32.7	5.27	1.89	1.5	45
7	8.3	53.88	76.8	105.4	95.2	10.2	5.37	1.74	1.5	110
8	8.2	56.72	78.4	107.7	85.3	22.4	6.23	2.68	1.25	50
SUM	65.6	456.57	688.2	834.1	687.9	174	44.82	18.03	--	595
MAX	8.5	73.73	102.8	107.8	96.2	32.7	6.23	2.68	1.5	110
MIN	7.9	48.21	72.4	98	75.1	10.2	5.27	1.74	1.25	45
MEAN	8.2	57.07	86.025	104.26	85.98	21.75	5.60	2.25		74.37

All parameters are in mg/L except pH.,Turbidity

4.1 KAGINA RIVER WATER CHARACTERISTICS AT DIFFERENT SAMPLING POINTS

The variation of Kagina River water characteristics at different sampling points are shown in the Fig 4.8-Fig 4.19 for pH, DO, BOD, Total Hardness, Calcium hardness, Magnesium hardness, Chloride, Turbidity, Alkalinity respectively.


Fig 1: Variation of pH

Maximum pH is observed at point 1 due to washing of clothes, utensils, animals etc.

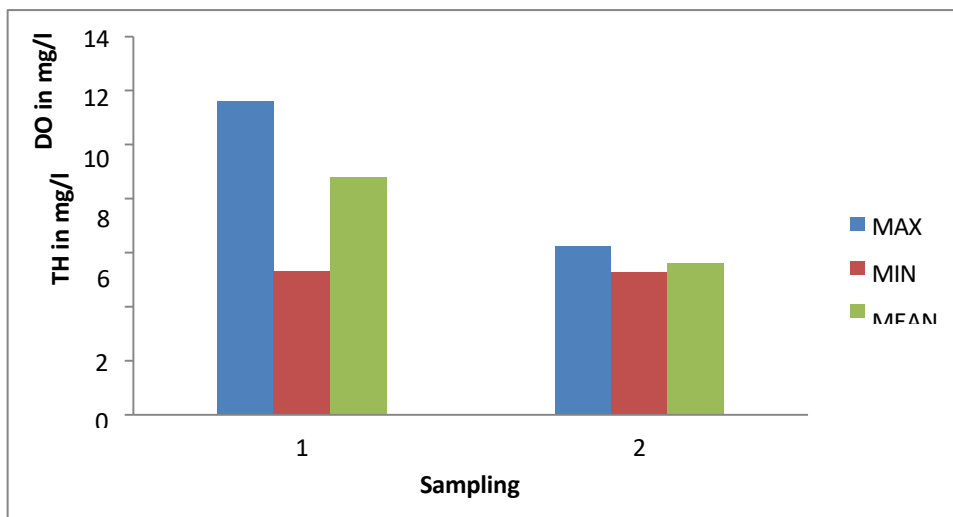


Fig 2: Variation of DO

Maximum DO is observed at point 1 as water low or extremely high DO levels can impair aquatic communities.

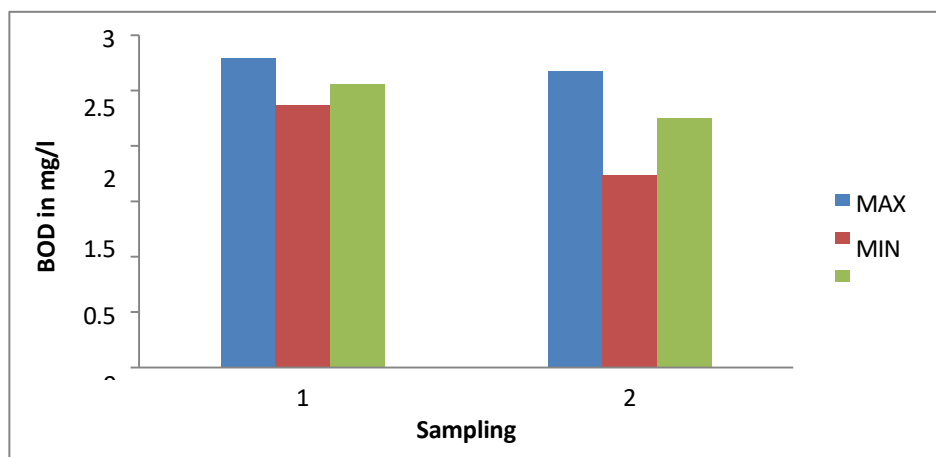


Fig 3: Variation of BOD

Maximum BOD is observed at point 1 due to discharge of temple waste, washing of clothes, utensils and animals.

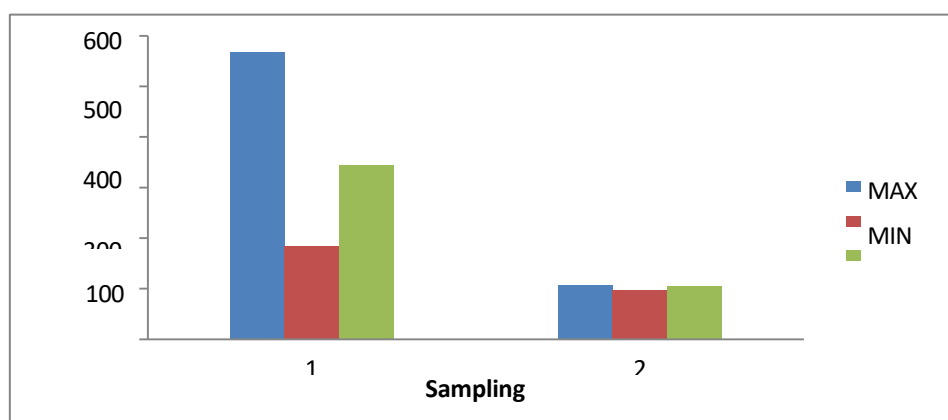


Fig 4: Variation of TH

Maximum TH is observed at point 1 due to presence of minerals, carbonates, bicarbonates.

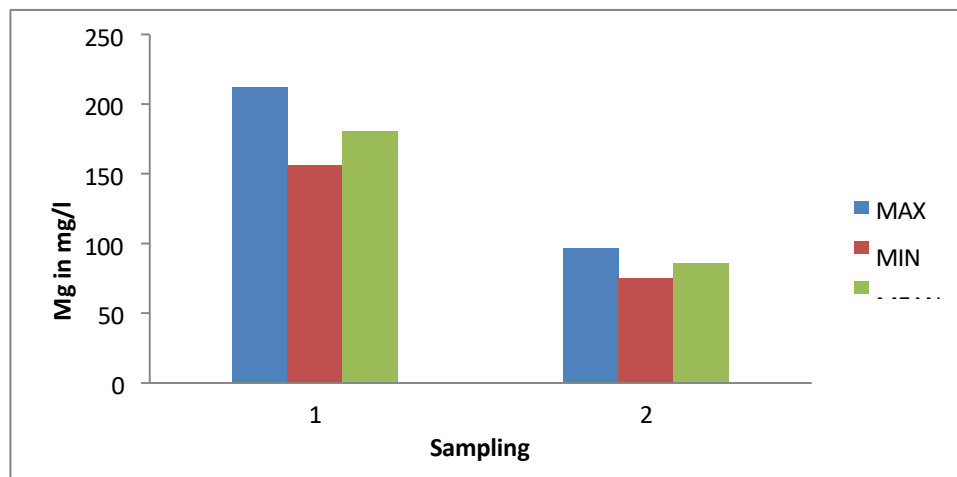


Fig 5: Variation of calcium

Maximum Ca is observed at point 1 due to presence of minerals, carbonates and Bicarbonates.

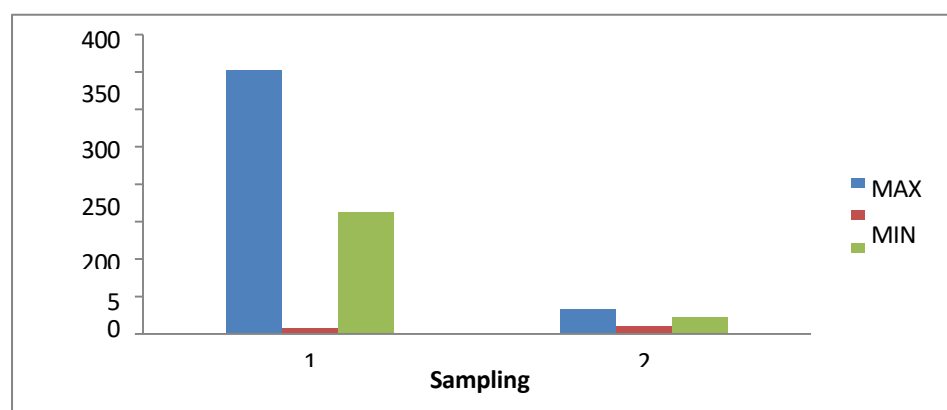


Fig 6: Variation of Magnesium

Maximum Mg is observed at point 1 due to presence of minerals, carbonates, Bicarbonates

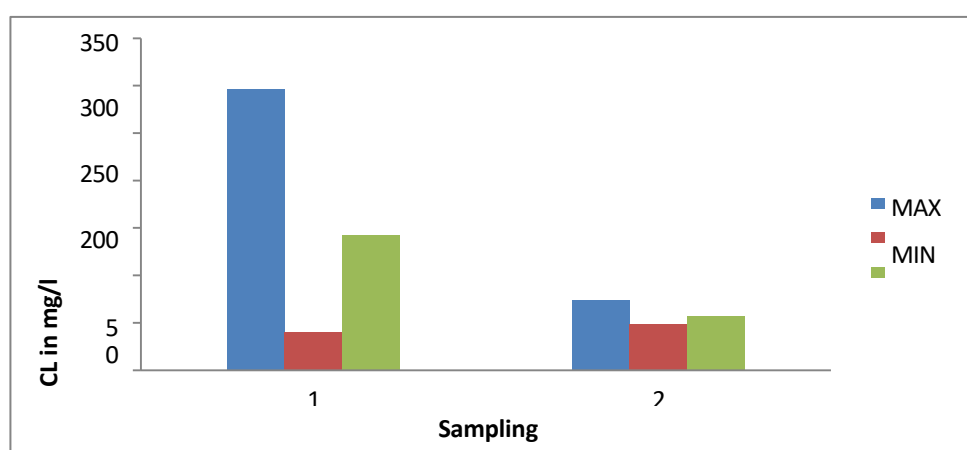


Figure 7: Variation of Chloride

Maximum Cl is observed at point 1 due irrigation drainage and use of inorganic fertilizers.

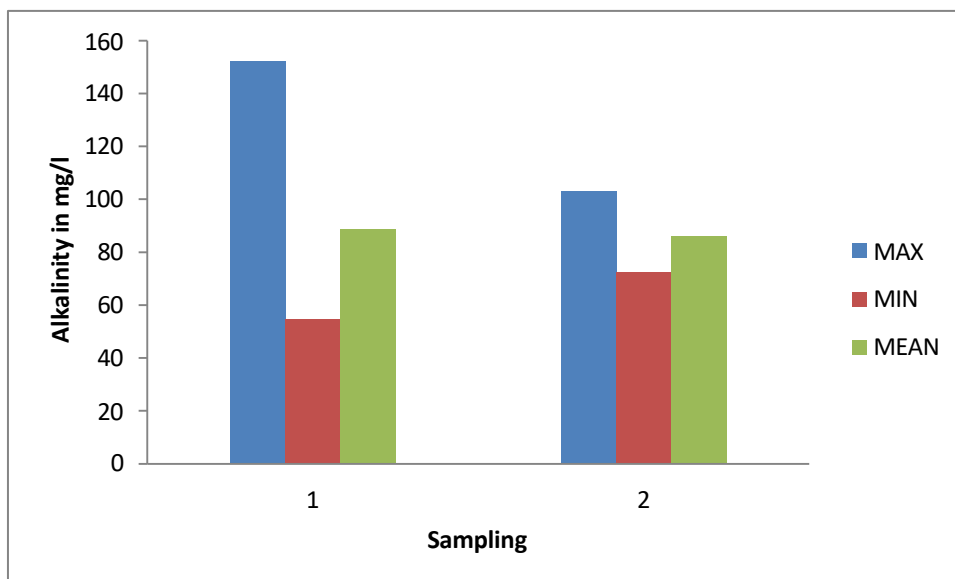


Fig 8: Variation of Alkalinity

Maximum alkalinity is observed at point 1 due to presence of carbonates and bicarbonates.

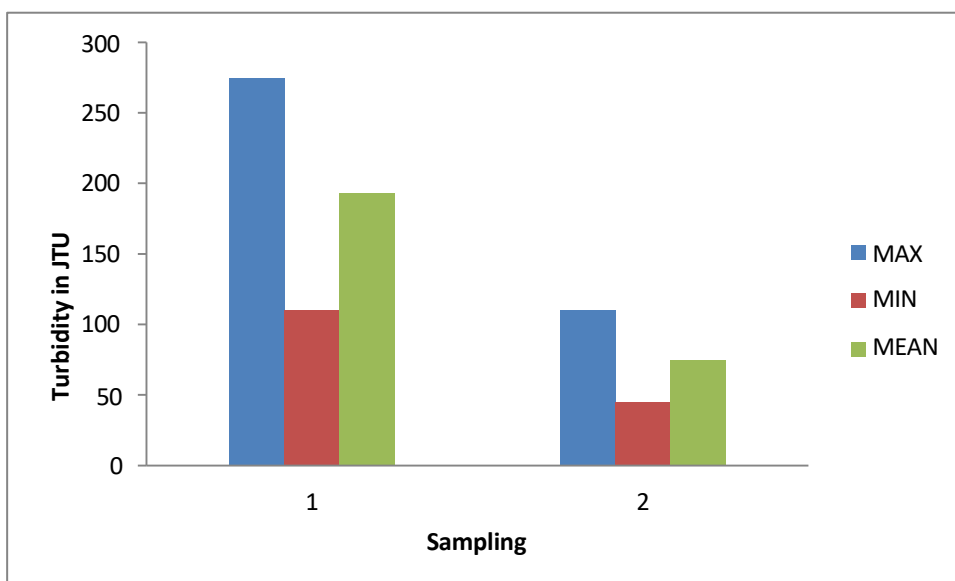


Fig 9: Variation of Turbidity

Maximum Turbidity is observed at point 1 due to presence of organic materials.

Table 4.17: Water Quality Index of Kagina River at Sampling Point 1

PARAMETERS	IS	Ci	Si	wi	Wi=(Wi/wi)	Qi=(Ci/Si)*100	Sub Index(SIi)=Wi*Qi
pH	6.5-8.5	8.5	8.5	4	0.16	100	16
Cl	250-1000	142.71	1000	3	0.12	14.27	1.71

Alkalinity	200-600	88.55	600	2	0.08	14.78	1.18
TH	200-600	344.42	600	3	0.12	57.40	6.8
Ca	75-200	180.46	200	2	0.08	90.23	7.21
Mg	30-100	161.85	100	2	0.08	161.82	12.94
DO	5	8.81	5	3	0.12	176.2	21.14
BOD	3-5	2.56	5	3	0.12	51.2	6.14
Turbidity	25 -1000	193.12	1000	3	0.12	19.31	2.31
				25			75.43

Water Quality Index(WQI)= S_{li} = 75.43

The water quality index of the samples is found out to be 75.43 which lies in “D” grade. Hence Very poor water quality

Table 4.19: Water Quality Index of Kagina River at Sampling Point 2.

PARAMETERS	IS	C _i	S _i	w _i	W _i =(W _i / w _i)	Q _i =(C _i / S _i)*100	Sub Index(S _{li})=W _i *Q _i
pH	6.5-8.5	8.2	8.5	4	0.16	96.47	15.43
Cl	250-1000	57.07	1000	3	0.12	5.70	0.68
Alkalinity	200-600	86.025	600	2	0.08	14.33	1.14
TH	200-600	104.26	600	3	0.12	17.37	2.08
Ca	75-200	85.98	200	2	0.08	42.99	3.43
Mg	30-100	21.75	8.5	2	0.08	255.88	20.47
DO	5	5.6	1000	3	0.12	0.56	0.067
BOD	3-5	2.25	5	3	0.12	45	5.4
Turbidity	25 -1000	74.37	1000	3	0.12	7.43	0.89
				25			49.59

Water Quality Index (WQI)= S_{li} = 49.59

The water quality index of the samples is found out to be 49.59, which lies in “B” grade. Hence water is of good quality.

CONCLUSIONS

Based on the study analysis and interpretation of the numerical data, the following conclusion have been drawn.

1. The Physico-chemical characteristics of Kagina River water at different sampling points were analysed and found that all the values are within the permissible limit of BIS standards.
2. The pH of Kagina River water is in between 8.2 to 8.5.
3. The DO of Kagina River water is in between 5.60 to 8.81.
4. The BOD of Kagina River water is in between 2.25 to 2.56.
5. The water quality index (WQI) of sampling point 1 and 2 are 75.43 and 49.49 respectively and

they fall under “D” WQI (Very Poor water Quality) and it is used for domestic purpose and “B” grade WQI (Good Quality Water) and it is fit for drinking purposes.

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