

Water Quality Index of Kapila River Water, Nanjangudu Industrial Area, Mysore, India

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ABSTRACT: The present study was carried out to assess the water quality of Kapila river water which was collected from Nanjangudu, Mysore district, at two different points. Sample S_1 was collected from the populated area of the Nanjangudu and Sample S_2 was collected from one km upstream. Water quality index (WQI) is a simple, convenient method to depict the overall water quality status in a single term. The various water quality parameters like pH, Total Dissolved Solids, Alkalinity, Electrical Conductivity, Hardness, calcium and magnesium ions are studied to obtain the WQI for Kapila river water. The sums of these are substituted in the equation to obtain WQI. This made authors to analyse the Water Quality Index (WQI) of Kapila river water with an objective to assess the water quality for drinking and domestic purposes.

KEYWORDS: Kapila River, Water Quality Index, Alkalinity, Hardness, Electrical Conductivity

I. INTRODUCTION

Rivers water is a basic natural resource and essential for human activities, agricultural, generation of electricity and industrial activities etc. Rivers provide important nutrients for living species and also support economic activities. The chemical composition of water has great influence on the ecology of water for living beings. All human civilizations have developed near river banks to fulfil their necessity of water and for the food resources like farming, fishing and Irrigation. During their agriculture, people started using chemical fertilizers, pesticides, insecticides etc to get better yields without knowing that this may cause serious problems to the quality of water. From the beginning of human civilization, with the unplanned organization and industrialization, aquatic resources are being used for dumping Industrial and domestic wastes, thereby polluting the aquatic bodies. In India, due to increase growth of urbanization and industrialization, water bodies are getting polluted. Many authors have analysed the water quality of different rivers [1 – 17]. So the author has put a sincere effort to study the various physico – Chemical parameters like Temperature, Total dissolved solids, Total hardness, pH, Electrical conductivity, Alkalinity, Calcium and Magnesium ions of Kapila River water from Nanjangudu, Mysore district, Karnataka. The Kapila is also called Kabini is a river flowing in southern India. It originates in Wayanad district of Kerala state, flows eastward to join river Kaveri and enters into the Bay of Bengal.

II. MATERIALS AND METHODS

Samples were collected from two different places from Nanjangudu as per standard procedure. Sample-1 (S_1) from the populated locality of area and Sample-2 (S_2) from one km up the river from the area. The physico – chemical parameters like Calcium and Magnesium ions, Electrical Conductivity, Alkalinity, pH, Total dissolved solids, Total hardness was studied using standard methods [18]. The results obtained were compared with WHO and ISI standards [19]. AR grade chemicals and glass distilled water were used to prepare the reagents. Digital Systronics pH – meter and Systronics – Conductometer were used for the determination of pH and Electrical Conductivity respectively. The WHO and ISI standards are listed in table 1.

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III. CALCULATION OF WATER QUALITY INDEX

WQI gives a single numeric value to define water quality for a definite location in a simple way. This is calculated on the basis of various physico – chemical parameters of the water. The quality of water is obtained in terms of index number which is easy to understand and also to suggests, whether the water is fit for drinking and domestic purposes [20].

Calculation of Quality rating (Q_i):

Quality rating for each parameter was calculated by using the following equation

$$Q_i = \frac{(V_{\text{actual}} - V_{\text{ideal}})}{(V_{\text{standard}} - V_{\text{ideal}})} \times 100$$

Where, Q_i = Quality rating of i^{th} parameter for a total of n water quality parameters.

V_{actual} = Actual value of the water quality parameter obtained from laboratory analysis

V_{ideal} = ideal value of that quality parameter can be obtained from the standard tables.

V_{ideal} for pH = 7 and for other parameters it is equating to zero

V_{standard} = Recommended WHO standard of the water quality parameter.

Calculation of Unit weight (W_i):

Unit weight was calculated by a value inversely proportional to the recommended standard (S_i) for the corresponding parameter using the following expression

$$W_i = \frac{K}{S_i}$$

Where, W_i = Unit weight for n^{th} parameter,

S_i = Standard permissible value for n^{th} parameter

K = proportionality constant,

For the sake of simplicity, K is assumed as 1,

The overall WQI was calculated by using the following equation

$$WQI = \frac{\sum W_i Q_i}{\sum W_i}$$

Where, Q_i = quality rating,

W_i = Unit weight

IV. RESULTS AND DISCUSSION

The various physico – chemical parameters of Kapila river water were studied and analysed. The results are tabulated in table 1 and are compared with WHO and ISI standards to draw the final conclusion on the water quality of Kapila River.

1. TEMPERATURE

Temperature was recorded at time of sampling. It is an important parameter that affects the chemical and biochemical reactions in water. It was found to be 26⁰C for both the samples. Table 1.

2. pH

pH is defined as the negative logarithm of hydrogen ion concentration. The ideal pH for potable water is between 7 and 8. pH of water is affected by hydrolysis of salts of weak acids and strong bases vice versa and dissolved gases like carbon dioxide, ammonia etc. It was reported as 6.7 for both the samples S_1 and S_2 which was less according to WHO but within the limit of ISI standard. Table 1, Fig 1.

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3. ELECTRICAL CONDUCTIVITY

Electrical conductivity is defined as the capacity of water to conduct electricity and depends upon the temperature, Concentration and mobility of ions. The dissolved salts and minerals in the water affect the conductivity of water. The electrical conductivity was found to be 210 μ s/cm and 222 μ s/cm for samples S₁ and S₂ respectively which is well within the permissible limits. Table 1, Fig 1.

4. TOTAL DISSOLVED SOLIDS

Total Dissolved Solids is the sum of all the dissolved chemicals present in the water. The amount of Total Dissolved Solids was reported as 290 mg/L for S₁ and 310 mg/L for S₂ samples which is well within the permissible limit. Table 1, Fig 1.

5. TOTAL HARDNESS

Total hardness of water is due to the presence of calcium and magnesium of bicarbonate, chloride and sulphate and it is expressed in terms of CaCO₃ equivalents. Total hardness was reported as 128 mg/L and 135 mg/L for samples S₁ and S₂ respectively which is well within the said standards. Table 1, Fig 1.

6. CALCIUM AND MAGNESIUM IONS

The presence of calcium and magnesium ions in excess in water leads to various kinds of diseases like stone formation, cancer etc. due to their deposition in the soft tissues of living species. Presence of Calcium ions was found to be 95 mg/L and 99mg/L for S₁ and S₂ samples respectively, which is higher according to standard limits. Magnesium ions was found to be 33 mg/L and 36 mg/L for samples S₁ and S₂ samples respectively which is little high according to ISI standard but well within the WHO standard. Table 1, Fig 1.

7. ALKALINITY

Alkalinity of water is defined as the capacity to neutralize the acids. Alkalinity of water is due to the presence of bicarbonates, carbonates and hydroxide ions. It was found to be 160 mg/L for both S₁ and S₂ samples which is higher than the said standard limits. Table 1, Fig 1.

TABLE 1:
Results obtained, methods employed and WHO & ISI Standards

Parameters	Method	WHO Standards	ISI Standards	S ₁	S ₂
Temperature	Thermometric	-----	-----	26 ⁰ C	26 ⁰ C
pH	pH metery	7.0 – 8.0	6.5 – 8.5	6.7	6.7
Electrical Conductivity	Conductometry	1400	-----	210	222
Total Dissolved Solid	Filtration Method	1000	500	290	310
Total Hardness	EDTA titration	100	300	128	135
Calcium	EDTA titration	75	75	95	99
Magnesium	EDTA titration	150	30	33	36
Alkalinity	Titration Method	120	120	160	160

Water sample S₁ is collected from the Populated locality of area and S₂ is sample collected from 1 km up the river from the area. Hardness, Calcium ions, magnesium ions, Total Dissolved solids and Alkalinity were expressed in mg/L and Electrical conductivity as μ s/cm. Temperature was recorded in ⁰C.

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Table 2:
CALCULATION OF WQI FOR S₁ SAMPLE

Parameters	Observed values	Standard values	Unit Weight (W _i)	Quality rating (Q _i)	Weighted values (W _i Q _i)
pH	6.7	8.5	0.1176	20	2.3529
Electrical Conductivity	210	300	0.0033	70	0.2331
Total Dissolved Solid	290	500	0.002	58	0.116
Total Hardness	128	300	0.0033	42.667	0.1420
Calcium	95	75	0.0133	126.667	1.6884
Magnesium	33	30	0.0333	110	3.663
Alkalinity	160	120	0.0083	133.333	1.1110
			∑W _i = 0.1813		∑ W _i Q _i = 9.3065

$$\text{Water Quality Index (WQI)} = \frac{\sum W_i Q_i}{\sum W_i} = 51.3322$$

It is observed from Table 2 that the WQI is 51.33 for S₁ sample collected from the populated locality of area which indicates that the Quality of water is poor and this water needs treatment before any use.

Table 3
CALCULATION OF WQI FOR S₂ SAMPLE

Parameters	Observed values	Standard values	Unit Weight (W _i)	Quality rating (Q _i)	Weighted values (W _i Q _i)
pH	6.7	8.5	0.117647	20	2.3529
Electrical Conductivity	222	300	0.003333	74	0.2464
Total Dissolved Solid	310	500	0.002	62	0.124
Total Hardness	135	300	0.003333	45	0.1498
Calcium	99	75	0.01333	132	1.7595
Magnesium	36	30	0.03333	120	3.996
Alkalinity	160	120	0.008333	133.333	1.1110
			∑ W _i = 0.1813		∑ W _i Q _i = 9.7394

$$\text{Water Quality Index (WQI)} = \frac{\sum W_i Q_i}{\sum W_i} = 53.7200$$

It is observed from Table 3 that the WQI is 53.72 for S₂ sample collected from 1 km up the Kapila River from the area which reveals that the Quality of water is poor and should be subjected to treatment to remove the impurities before the consumption.

TABLE 4
WATER QUALITY INDEX (WQI) STATUS OF WATER QUALITY [21]

Water Quality Index Level	Water Quality Status
0 – 25	Excellent water quality
26 – 50	Good water quality
51 – 75	Poor water quality
76 – 100	Very poor water quality
> 100	Unsuitable for drinking

Different levels of water quality index and their respective water quality status were given in Table 4.

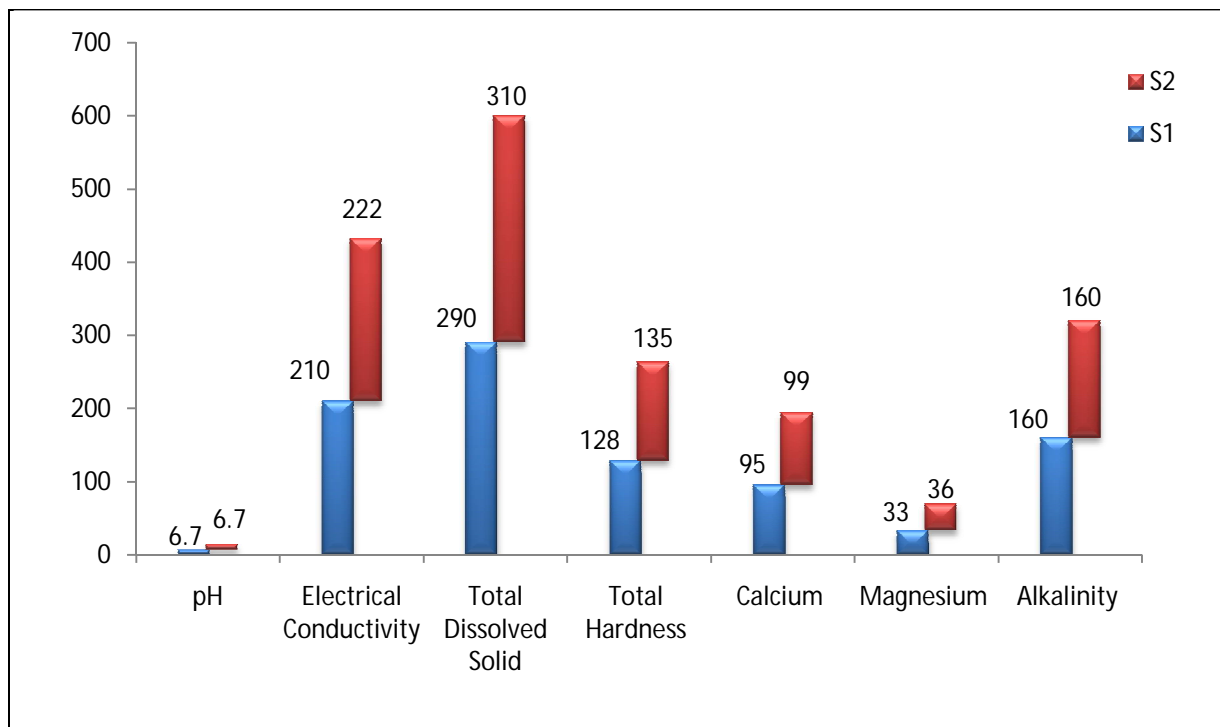


Fig 1 Graphical representation of physico – chemical parameters of Kapila river water

V. CONCLUSION

The Water Quality Index for Kapila river water has been calculated for the samples (Tables 2 and 3) and was found to be 51.33 and 53.72 for S₁ and S₂ respectively. The present study reveals that the quality of water is poor (Table 4) [21]. These results reveal that water quality of river is getting deteriorated, mainly due to run-off and sewage water from the town. As the surrounding villagers are dependent on the river water for drinking and domestic purposes so it should be made free from the impurities before some serious health issues are reported. Irrigation with highly alkaline water will spoil the soil texture and will lead to the destruction of the crops. Sewage water from the city should be subjected to the treatment plants so that it should not get mixed up with the river water.

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