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Research Article

Study of Water Quality Of Malaprabha River Near Habbanatti, Belgaum, Karnataka

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Abstract: An attempt has been made to know the water quality of Malaprabha river of Belgaum near Habbanatti from June 2011 to May 2012. Water samples were collected and brought to the laboratory for analysis. Concentrations of investigated parameters were within the permissible limits of the WHO drinking water quality guidelines throughout the study period. Site is having Swayambu Hanuman temple, many people visit every day and throw floral offerings, cleaning utensils, clothing and bathing. Thus, there is a need of monitoring the river water quality.
Keywords: Physical factors, Chemical factors, Malaprabha river, Western Ghat, Habbanatti

INTRODUCTION

A river is defined as a large natural stream of water emptying into an ocean, lake or other water body usually fed along its course by converging tributaries. Rivers and streams drain water that falls in upland areas. Moving water dilutes and decomposes pollutants more rapidly than standing water but many rivers and streams are significantly polluted all around the world. A primary reason for this is that of all three major sources of pollution (industry, agriculture and domestic) are concentrated along the rivers. Industries and cities have been located along the rivers because the rivers provide transportation and convenient place to discharge waste.

Water quality monitoring has one of the highest priorities in environmental protection policy. The main objective is to control and minimize the incidence of pollutant oriented problems and to provide water of appropriate quality to serve various purposes such as drinking water supply, irrigation etc.

Anthropogenic influences as well as natural processes degrade surface waters and impair their use for drinking, industrial, recreation or other purposes. One of the most serious problem faced by mankind is the problem of water pollution. Billions of gallons of water from cities and housing settlements, industries and agriculture land are thrown to freshwater every day [1].

Today most of the rivers of world receive effluents which contain substances from simple nutrients to highly toxic matters. These substances adversely affect the water qualities and thereby affect the flora and fauna of ecosystems. So, it is necessary to evaluate reverine water for better aquatic environment. Quantity of potable water is as important as its quality. Datta and Datta [2] stated that various physical, chemical and biological factors are the variables that govern the quality of drinking water.

River quality monitoring is most essential aspect of restoring the water quality. One of the main objectives of the river water quality monitoring is to assess the suitability of river water for drinking purposes, irrigation outdoor bathing etc. The physical and chemical quality of river water is deciding its suitability for drinking purposes. On the basis of assessment the natural river water has been categorized as desirable, permissible and unfit for human consumption. So far no study was undertaken to evaluate the water quality of Malaprabha river at this area.

MATERIALS AND METHODS

River Malaprabha is one of the prominent river of Krishna basin. River originates in the Western Ghat at Kanakumbi village which lies between 15^0 42" 20' North latitude and 74^0 13" 9' East longitude. The assessment of physic-chemical factors was carried out for one year i.e,. from June 2011 to May 2012.

Sampling site was selected near Habbanatti of Malaprabha river, located between 15^0 42' 19.2" North latitude and 74^0 42' 26.7" east longitude. Samples were collected monthly during

7.30 am to 9.00 am and this was uniformly maintained throughout the study period. Collected water samples were brought to the laboratory for analysis of physico-chemical factors following the procedures of standard methods [3] and [4]. Physico-chemical parameters such as temperature, pH were measured at site only. Remaining parameters such as dissolved oxygen, biochemical oxygen demand, EC, total solids, sodium, potassium, total hardness, calcium, magnesium nitrate iron and fluoride were analyzed in the laboratory. Data for rainfall obtained from District Statistical Office. After analysis statistical application such as standard deviation, simple correlation coefficient test was used.

RESULTS AND DISCUSSION

The data on physico-chemical analysis has been presented in Table 1, Seasonal variations of Physico-chemical parameters and Simple correlation test was presented in Table 2 & 3 respectively.

The physico-chemical factors of natural water body may vary substantially at different seasons of the study period. The factors contributing to such changes include topography of the area, atmospheric precipitation by rain and other meteorological forces in and around water body.

Water bodies undergo temperature variations along with normal climatic fluctuations. These variations occur seasonally and in some water bodies over a period of 24 hours. Temperature affects physical, chemical and biological processes in water bodies. As water temperature increases, the rate of chemical reactions increases with the evaporation of water. High water temperature enhances taste, odour, colour and corrosion problems [5]. Cool water is generally more potable than warm water. In the present study temperature ranged from 22 ^{0}C to 31 ^{0}C. Higher temperatures were recorded in summer . Similar observations made by Goudar et al[6] in Tunga river of Shivamogga. Temperature inversely correlated with rainfall, DO, Fe and nitrate. It was positively correlated with TDS, EC, chloride, sodium and potassium.

Rain is a type of precipitation, a product of the condensation of atmospheric water vapour that is released on the earth's surface. Rainfall can be a significant source of variation in surface water quality. Runoff can improve, degrade or not alter the water quality of streams depending on the land use, slope, soil type. Rainfall in both the sites was ranged between 30 mm to 745.7 mm. Maximum rainfall observed in the month of August and minimum rainfall 30 mm in May. There was no rainfall from December to April.

pH is regarded as a measure of concentration of hydrogen ions in water and refers not only the scale intensity of acidity or alkalinity but also serves as an important index for the degree of pollution [7]. pH value ranged between 6.9 to 8.42. pH value indicate slightly acidic to alkaline condition and found within permissible limit of 6.8 to 8.5 as per BIS[8]. Similar observations were recorded by [9] and [6].

BOD is an important parameter that indicates the magnitude of water pollution by oxidizable organic matter. Values ranged between 0.8 mg/l to2.6 mg/l. Similar observations recorded by Agarwal and Arora [10] in Koushalya river. Maximum values recorded in summer could be a result of reduced rate of water flow, degradation of organic matter and accumulation of wastes due to anthropogenic activities, while low BOD values during monsoon could be attribute to the dilution of river water [11].

Dissolved oxygen is essential for sustaining the plant and animal life in any aquatic system. In the present study. Do values ranged between 5.9 mg/l to 8.5 mg/l. Maximum values observed in monsoon and minimum values observed in summer because solubility of oxygen decreases with increase in temperature, it is in concurrence with [12]and [13].

Total dissolved solid is a measure of the solid materials dissolved in the river water. This includes salts, some organic materials .Waters with higher solids content have laxative and sometimes the reverse effect upon people whose bodies are not adjusted to them. TDS consist of oxygen demanding wastes, disease causing agents, which can cause immense harm to public health [14] .TDS is the common indicator of polluted waters. In the present study TDS values ranged between 86 mg/l to 288 mg/l. Maximum values were recorded in summer followed by winter and monsoon. Maximum value was observed in April, this may be due to the domestic sewage mixed with river water.

Electrical conductivity is a numerical expression of the ability of an aqueous solution to carry an electric current. As most of the salts in the water are present in the ionic form, are responsible to conduct electrical current. Electrical conductance values recorded from 130 µ mhos/cm to 470 µ mhos/cm. Maximum values were recorded in the month of April and March, it may

be due to the addition of raw sewage from the surroundings and due to anthropogenic activities.

Table 1: Monthly variations in Physico-chemical factors of Malaprabha river at Habbanatti

	Temp	Rain fall	pH	BOD	DO	TDS	EC	Cl	Na	K	SO_4	TH	Ca	Mg	NO3	Fe
June 2011	22	725.6	7.33	1.0	6.2	240	380	44	6.4	1	20.4	140	29	18.2	3.8	1.0
July	22	673.8	7.8	1.6	6.2	86	130	28	2	1.6	7.8	46	9.6	5.34	4.4	.46
August	24	745.7	8.42	0.3	8.5	118	170	26	2.5	.9	9.2	80	15	10.32	4.44	1.00
September	26	469.2	7.1	0.9	7.5	110	170	24	3.4	2	10	58	15.2	4.86	3.74	.78
October	26	255.6	6.9	0.9	7.6	98	162	28	4	.8	8	46	14.2	2.55	3.86	0.3
November	28	30	7.4	1.5	7	110	180	30	6	1.2	10.2	48	16.1	1.88	2.86	0.41
December	30	00	7.6	1.4	6	160	290	56	9.5	1.4	10.1	70	26	1.21	3	.2
January 2012	30	00	7.7	1.8	6	195	300	70	12	3.1	14.5	82	26	4.13	1.86	0.3
February	30	00	7.6	2.1	5.9	240	340	86	14	5.2	14	100	43	1.82	2.46	0.3
March	31	00	7.46	2.22	7	238	346	84	12.1	4.1	15	94	18.4	11.66	2.34	0.3
April	30	00	7.8	1.1	7.2	288	470	90	9.2	2.2	18	104	26	9.47	2.76	0.25
May	30	9.4	7.3	1.3	6.2	265	430	54	11.4	2.7	31.4	88	19	9.84	1.78	0.28

All are average values, expressed in mg/l except temp(C^0), pH and Conductivity (µ mhos/cm), Rainfall in mm, BDL=Below Detectable Limit)

Table 2: Average seasonal variations in Physico-chemical factors of Malaprabha river at Habbanattiduring 2011-12.

	Monsoon	**Winter**	**Summer**
Temp	23.5 ±0.95	28.5 ± 0.95	30.25 ± 0.25
Rainfall	653.5 ± 63.28	71.4 ± 61.8	2.35 ± 2.35
pH	7.66 ± 0.23	7.4 ± 0.17	7.54 ± 0.10
BOD	.95 ± 0.26	1.47 ± 0.18	2.08 ± 0.28
DO	7.1 ±0.55	6.65 ± 0.39	6.57 ± 0.31
TDS	138.5 ± 34.5	140.75 ± 22.52	257.75 ± 11.80
EC	212.5 ± 56.6	233 ± 36.04	396.5 ± 31.97
Cl	30.5 ± 4.57	46 ± 10.23	78.5 ± 8.26
Na	3.57 ± 0.98	7.87 ± 1.78	11.6 ± 0.99
K	1.37 ± 0.25	1.62 ± 0.5	3.55 ± 0.68
SO4	11.85 ± 2.88	10.7 ± 1.36	19.6 ± 4.02
TH	81 ± 20.88	61.5 ± 8.73	96.5 ± 3.5
Ca	17.2 ± 4.14	20.57 ± 3.15	26.6 ± 5.73
Mg	9.68 ± 3.09	2.44 ± 0.62	8.19 ± 2.17
NO3	4.09 ± .18	2.89 ± 0.40	2.33 ± .20
Fe	0.81 ±.12	0.302 ± 0.11	.28 ± 0.05

Table 3 : Simple correlation coefficient test between physico-chemical factors of Malaprabha river near Habbanatti.

	Temp	RF	pH	BOD	DO	TDS	EC	Cl	Na	K	SO4	TH	Ca	Mg	NO3	Fe
Temp	1.000	-.956**	-.094	.554	-.253	.530*	.535*	.739**	.833**	.638*	.313	.081	.409	-.329	-.879**	-.763**
RF		1.000	.234	-.609*	.359	-.459	-.482	-.676**	-.794**	-.554*	-.279	.017	-.388	.435	.874**	.867**
pH			1.000	-.138	.175	.029	-.007	.140	-.054	.013	-.152	.153	.054	.140	.172	.225
BOD				1.000	-.675**	.335	.269	.627*	.707**	.778**	.103	.071	.389	-.251	-.636*	-.636*
DO					1.000	-.392	-.408	-.418	-.588*	-.426	-.369	-.269	-.533*	.119	.507*	.438
TDS						1.000	.984**	.837**	.781**	.564*	.797**	.828**	.650*	.487	-.671**	-.259
EC							1.000	.797**	.747**	.451	.815**	.794**	.611*	.464	-.666 **	-.295
Cl								1.000	.881**	.768**	.409	.572*	.695**	.097	-.721**	-.554*
Na									1.000	.805**	.538*	.488	.724**	-.036	-.909**	-.600*
K										1.000	.288	.311	.594*	-.105	-.670**	-.442
SO4											1.000	.618*	.295	.535*	-.603*	-.114
TH												1.000	.659**	.739**	-.272	.252
Ca													1.000	-.010	-.466	-.185
Mg														1.000	.113	.553*
NO3															1.000	.659**
Fe																1.000

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level

Chlorides are widely distributed in nature. Presence of chloride ions in drinking water sources can be attributed to the dissolution of salt deposits, effluents from chemical industries, sewage, irrigation, drainage. Each of these sources may result in local contamination of surface and groundwater. In potable water, the salty taste produced by chloride concentration is variable and depends on the chemical composition of the water. In the present study chloride values fluctuate between 24 to 90 mg/l. Higher chloride concentration recorded in summer season, this may be due to increased temperature and evapotranspiration of water [15]. Chlorides are troublesome in irrigation water and also harmful to aquatic life [16].

All natural waters contain some sodium, since sodium salts are highly water soluble and it is one of the most abundant elements on earth. Increased concentrations in surface waters may arise from sewage and industrial effluents. Sodium values were ranged between 2 to 12.1 mg/l. The World Health Organization guideline limit for sodium in drinking water is 200 mg/l. Potassium is found in low concentrations in natural waters since rocks which contain potassium are relatively resistant to weathering. In the present study potassium values were recorded from 0.9 to 5.2 mg/l.

Sulphate occurs in natural waters in concentration ranging from a few to several thousand milligrams per liter. Generally sulphates are present in all aquatic systems because of physical and chemical weathering of rocks containing sulphates and oxidation products of disulphides [17].The sulphates are derived from discharge of domestic sewage, surface and agriculture runoff [13]. Sulphate values were ranged between 7.8 mg/l to 31.4 mg/l. Its value is much lower than the permissible limit as prescribed by WHO and BIS standards. High concentration of sulphate was appeared in the month of May this may be due to the discharge of industrial wastes to the river. High sulphates in water along with sodium interference with the normal functioning of intestine causing gastrointestinal irritation and stomach trouble .

Present study clearly indicates that most of the parameters analysed in the Malaprabha river near Habbanatti were in acceptable range as prescribed by [8] and [5]. The river at this point is suitable for drinking, bathing, recreation, irrigation purposes. But presence of Swayambu Hanuman temple, every Saturday lot of people visit and throw wastes. People, particularly those living along the banks of river, should realize that the river is for them and they are for the river and not a waste disposal site. Anthropogenic activities must be reduced and continuous monitoring of river is essential. It can be concluded that the river water is within the safe limits and is fit for consumption.

Total hardness values were recorded from 46 mg/l to 140 mg/l. Maximum value recorded in the month of June and minimum values were recorded in July and October . Seasonally higher values were recorded in summer months. Total hardness was higher in summer but Jayakumar et al [18] noticed higher values in monsoon. However, [19] and [20] do not consider the hardness of water as a pollution parameter. According to them it only indicates water quality in terms of calcium and magnesium.

Calcium is an essential element for all organisms and is incorporated into the shells of many aquatic invertebrates and bones of vertebrates. Calcium is present in all waters as Ca and is readily dissolved from rocks rich in calcium minerals. Industrial as well as water and waste water treatment, processes also contribute calcium to surface water. Calcium and Magnesium values were fluctuated between 9.6 mg/l to 29 mg/l and 1.21 mg/l to 18.2 mg/l respectively.

The main source of nitrate is the decomposition and biodegradation of organic matter. Increased levels of nitrate may be due to the intrusion of sewage and industrial effluents into the river. Unpolluted natural water contains usually minute amount of nitrate. In the present study nitrate level ranged between 1.78 mg/l and 4.44 mg/l. Lower values indicates unpolluted and due to excessive rainfall. Seasonally nitrate level was low in summer. Similar observation was recorded by Swarnalatha and Narsingrao, [21] in Banjar lake of Hyderabad.

CONCLUSION

Iron values were fluctuated between 0.2 mg/l and 1.0 mg/l. The iron contents of some of the water samples are higher than the guidelines value of 0.3 mg/l [5] but they are within the permissible limits .The presence of higher concentration of iron may be due to leaching of iron containing rocks and mineral. Excess iron dosage through drinking water may cause general weakness, constipation, muscle weakness, vomiting, high pulse rate, hypertension etc .

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