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WATER QUALITY ASSESSMENT OF VRISHABHAVATHI RIVER, BIDADI A CASE STUDY

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ABSTRACT

Vrishabhavathi River is a constituent of the Arkavathi River Basin, Bangalore Urban and Ramanagara. District and covers an area of 381.465Km^2, representing seasonally dry tropical climate. This River is the main surface water source which is tributary of river Arkavathi, which joins the Cauvery River. It drains a major parts of Bangalore metropolis and is an outlet for domestic and industrial effluent of that area. Earlier this surface water is mainly used for agricultural and drinking purposes. Since this watershed lies in Bangalore urban and rural area, today this water is only used for agricultural purpose which is also not safe. In order to assess the surface water quality, the present study has been undertaken to map the spatial variability of the surface water quality in the watershed using Geographical Information System. The water qualities of 5 stations were randomly selected in Vrishabhavathi watershed for the present study.

In Vrishabhavathi River, colour and odour is present. Activated carbon and copper sulphate is used for the removal of colour and odour.

Filtration is necessary for the sample of water as we have obtained TSS value above 100 mg/l. TDS is above 500 mg/l in order to remove it flocculation treatment is also necessary. DO is below 4mg/l and COD is above 250 mg/l so aeration process need to be provided. The BOD value is above 30 mg/l so we have to treat it by algae growth method.

***Keywords**: Alkalinity, BOD, COD, DO, Electrical conductivity, Hardness, pH, Turbidity, Temperature, TDS, TSS,*

I. INTRODUCTION

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70% of water.

But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases.

Vrishabhavathi River is the main surface water source which is tributary of river Arkavathy, which joins the Cauvery River. It drains a major parts of Bangalore metropolis and is an outlet for domestic and industrial effluent of that area. Today this water is only used for agricultural purposes which are also not safe.

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Degradation of tanks in the urban area is the main factor for the change in the water quality. Due to Urbanization, instead of tanks settlements are built in the watershed. From the settlements watershed is receiving the domestic sewage water.

This sewage water finally reached in to the main river Vrishabhavathi. To overcome from this problem we have to analyze the surface water quality in the Vrishabhavathi River. Some physical test should be performed for testing of its physical appearance such as turbidity, temperature etc, while chemical tests should be perform for its pH, TDS, BOD, COD, dissolved oxygen, alkalinity, hardness and other characters.

II. OBJECTIVES OF STUDY

The work has been taken up with the following objectives

2.1 To determine the physical parameters (Temperature, turbidity) of river water sample at selected points in Vrishabhavathi river.

2.2 To determine the chemical parameters (pH, Hardness, Alkalinity, TDS, DO, BOD, COD) of water sample at selected points in Vrishabhavathi River.

III. MATERIALS AND METHODS

In this chapter, the study area is described in detail. The detailed list of equipment along with photographs and chemicals used for the study has been indicated. The criteria for selection of sampling points, methodology adopted for analysis have been explained.

3.1 Details of Study Areas

3.1.1 The study area

The study area consists of Vrishabhavathi river situated near the Bidadi industrial area.The river is located at $12^0$45'48"N latitude, $77^0$25'36"E longitude. Total area of Vrishabhavathi Lake is1018 acre with a population of 9,917 and population density of 290 /km^2. It has traditionally been a centre of industrial and education and has been categorized as the industrial area in the state of Karnataka.

3.1.2 Geology and Hydrogeology

Bidadi is a town situated on the Bangalore express way and is the part of Ramanagara district in the state of Karnataka. The town is located 32 km from Bangalore towards Mysore and is connected by both rail and bus to Bangalore city. For studying the rainfall pattern 10 years actual rainfall from 1996-2005 is considered as per the data, normal annual rainfall Bangalore urban district received is 831mm. typical monsoonal climate prevails in the distract with major contribution of rainfall during south waste monsoon.In general prevails pre-humid to semi arid climatic condition prevail in the districts. Average temperature is 23.1°c.

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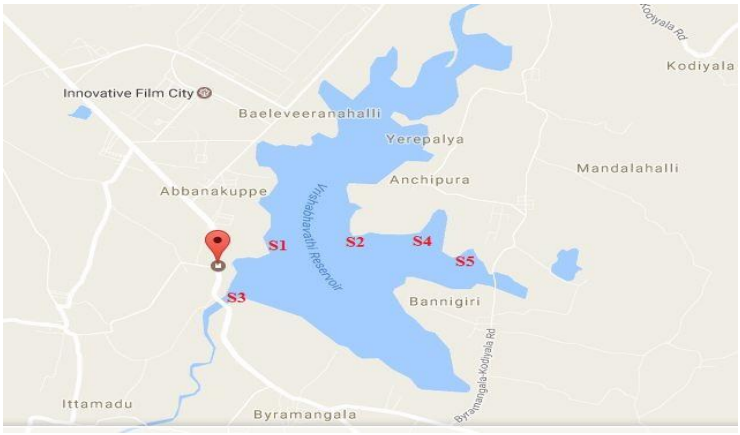

Fig 2.Location map showing sampling station of study area.

VI. METHODOLOGY

4.1 Sampling Points

The sampling points in the lake are selected with utmost care and so chosen that the samples collected from those stations represent the actual pollution scenario of the lake. A total of five sampling stations were established along the lake.

Station S1: Inlet (Point of Sewage entry)

Station S2: Inlet Phase-1(Industrial wastewater from industries)

Station S3: Inlet Phase-2(Industrial wastewater from industries)

Station S4: Corner point (where water from lake goes out to agricultural land)

Station S5: Outlet

4.1.1Determination of river water pH meter

Method: electrometric

4.1.2 Determination of river water turbidity

Method: electrometric

4.1.3 Determination of river water electrical conductivity

Method: electrometric

4.1.4 Determination of river waterAlkalinity, Hardness

Method: titration

4.1.5 Determination of river water DO, BOD, COD

Method: titration

V. TEST AND RESULT

This chapter briefly presents the results of the sampling and analysis of the samples. Discussions on 10 water quality parameters have been given. Analysis and discussion on chemical and physical parameters are also included. Sampling was done in the river in a month from Sep 2016 to Mar 2017. For better understanding and analysis of the results, tables and necessary graphs have been included.Water quality samples were collected and analysed for different chemical and physical parameters from 5 sampling stations located in Vrishabhavathiriver.

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5.1 Physical analysis

5.1.1. Turbidity

Month	S-1	S-2	S-3	S-4	S-5
September	245	233	235	236	240
October	100	150	155	188	142
November	238	220	233	296	209
December	196	201	222	196	232
February	254	241	186	199	220
March	234	267	219	204	255

Table 4.1.1: Turbidity recorded at five stations of Vrishabhavathi river (Sept'16-Mar'17)

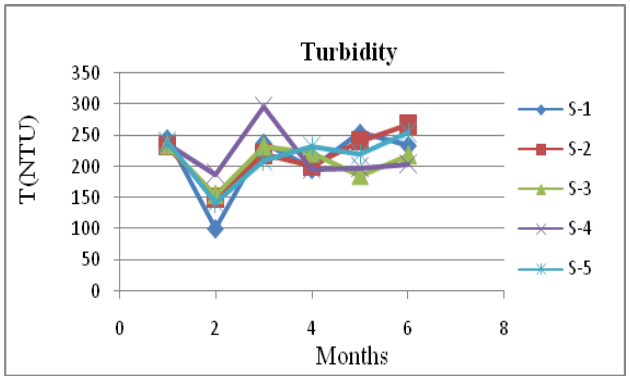

Fig 4.1.1 Variation of Turbidity at 5 stations

5.2 Physical analysis

5.2.1 pH

Month	S-1	S-2	S-3	S-4	S-5
September	7.12	6.9	7.1	7.2	7.0
October	7.3	7.16	7.2	7.1	7.8
November	7.3	8.1	6.9	7.0	7.6
December	7.9	7.8	7.5	8.2	7.3
February	7.7	7.5	8.1	7.3	7.7
March	7.8	7.2	7.8	7.7	7.3

Table 4.2.1 pH recorded at five stations of Vrishabhavathi river (Sept'16-May'17)

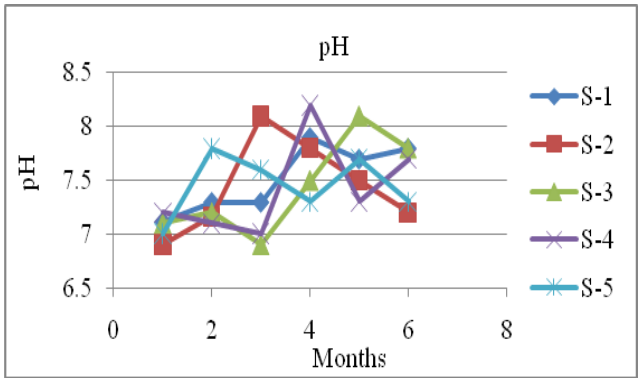

Fig 4.2.1 Variation of pH at 5 stations

5.2.2 Electrical Conductivity

Month	S-1	S-2	S-3	S-4	S-5
September	1.429	1.302	1.231	0.542	1.407
October	1.429	0.985	1.345	0.499	1.126
November	1.098	1.123	1.34	0.55	1.321
December	1.039	1.251	1.108	0.958	1.251
February	1.149	1.236	1.03	0.969	1.33
March	1.245	1.305	1.09	0.609	1.422

Table 4.2.2: EC (Electrical Conductivity) recorded at five stations of Vrishabhavathi river (Sept'16-May'17)

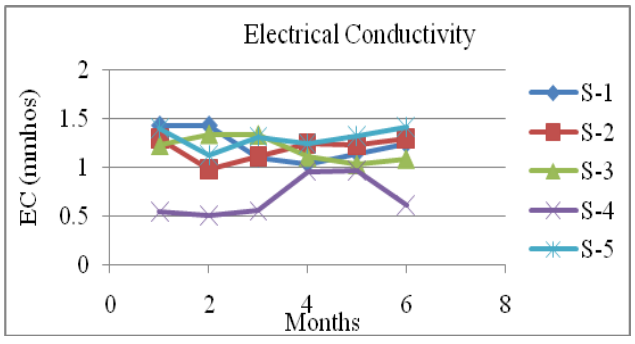

Fig 4. Variation of Electrical Conductivity at 5 stations 2.2

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5.2.3 Alkalinity

Month	S-1	S-2	S-3	S-4	S-5
September	106	96	121	142	116
October	125	195	110	108	120
November	95	100	134	182	104
December	182	129	99	106	162
February	132	170	101	91	160
March	120	133	160	142	121

Table 4.2.3: Alkalinity recorded at five stations of Vrishabhavathiriver (Sept'16-May'17)

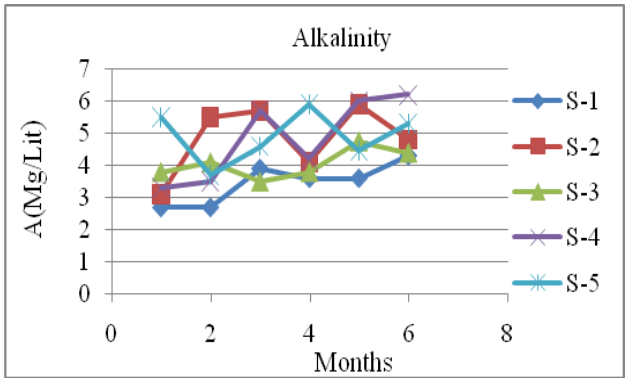

Fig 4.2.3 Variation of Alkalinity at 5 stations

5.2.4 Total hardness

Month	S-1	S-2	S-3	S-4	S-5
September	492	504	454	438	113
October	115	505	309	416	368
November	309	319	187	416	251
December	486	442	366	389	192
February	480	289	389	454	123
March	318	337	326	231	317

Table 4.2.4: Total hardness recorded at five stations of Vrishabhavathi river (Sept'16-May'17)

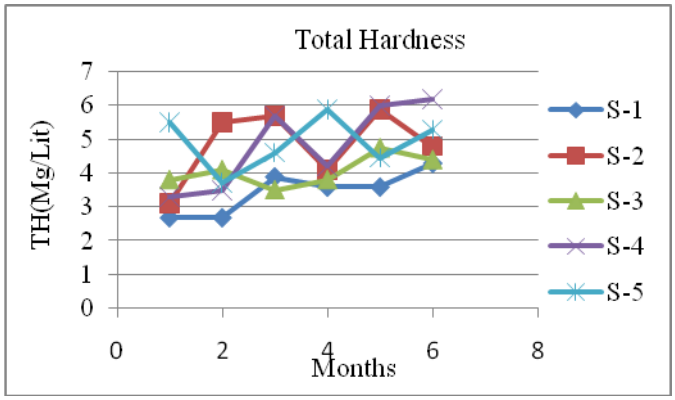

Fig 4.2.4 Variation of Total hardness at 5 stations

5.2.5 TSS

Month	S-1	S-2	S-3	S-4	S-5
September	268	294	237	251	72
October	78	294	183	379	388
November	337	296	231	231	388
December	309.5	348	326	259	263
February	198	348	223	217	314
March	261	238	283	187	329

Table 4.2.5: TSS recorded at five stations of Vrishabhavathi river (Sept'16-May'17)

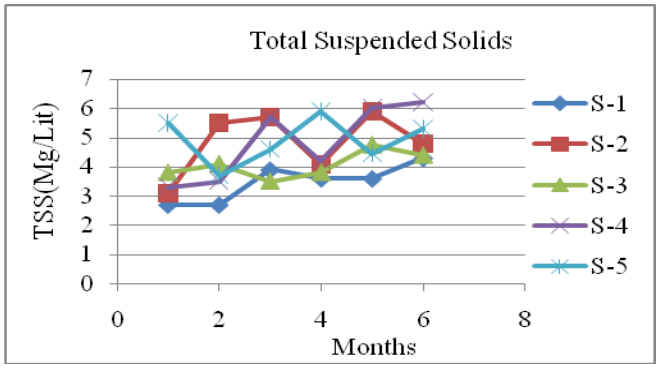

Fig 4.2.5: Variation of Total Suspended Solids at 5 stations

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5.2.6 TDS

Month	S-1	S-2	S-3	S-4	S-5
September	987	936	918	873	467
October	987	727	843	788	814
November	727	375	375	843	609
December	791	828	746	711	342
February	828	585	936	920	830
March	660	536	430	930	823

Table 4.2.6: TDS recorded at five stations of Vrishabhavathi river (Sept'16-May'17)

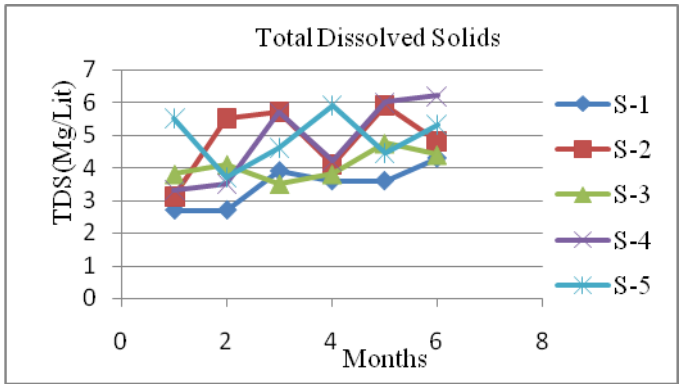

Fig 4.2.6 Variation of Total Dissolved Solids at 5 stations

5.2.7 DO

Month	**S-1**	**S-2**	**S-3**	**S-4**	**S-5**
September	**2.7**	**3.1**	**3.8**	**3.3**	**5.5**
October	**2.7**	**5.5**	**4.1**	**3.5**	**3.7**
November	**3.9**	**5.7**	**3.5**	**5.7**	**4.6**
December	**3.6**	**4.1**	**3.8**	**4.2**	**5.9**
February	**3.6**	**5.9**	**4.75**	**6.0**	**4.45**
March	**4.3**	**4.8**	**4.4**	**6.2**	**5.3**

Table 4.2.7: Dissolved oxygen recorded at five stationsVrishabhavathiriver (Sept'16-May'17)

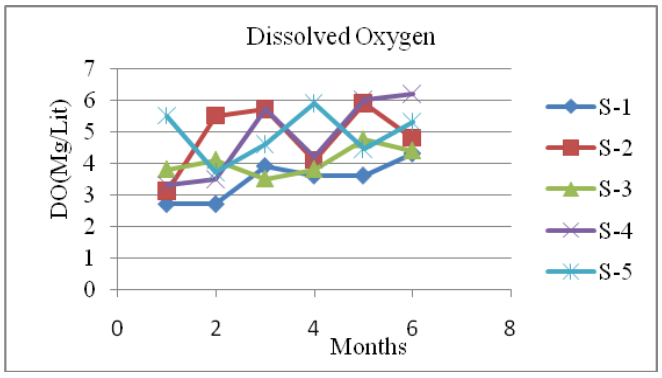

Fig 4.2.7 Variation of Dissolved Oxygen at 5 stations

5.2.7 COD

Month	S-1	S-2	S-3	S-4	S-5
September	625	536	424	528	432
October	637	257	324	566	508
November	416	246	442	248	292
December	438	328	438	438	236
February	432	242	312	226	292
March	304	306	296	208	278

Table 4.2.8: COD recorded at five stations of Vrishabhavathi river (Sept'16-May'17)

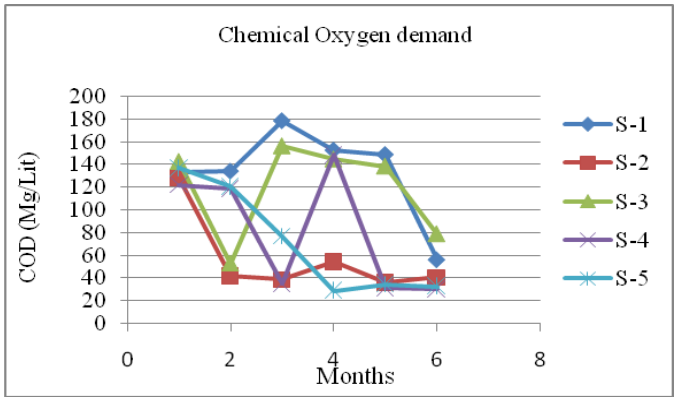

Fig 4.2.8 Variation of Chemical Oxygen demand at 5 stations

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5.2.8 BOD

Month	S-1	S-2	S-3	S-4	S-5
September	132.8	128.4	142.6	122	136.8
October	134.2	42.2	52.8	118.8	120.2
November	178.4	38.8	156.4	35.2	76.4
December	152.6	54.4	144.8	148.8	28.8
February	148.8	36.2	138.6	31.6	34.4
March	56.4	40.8	78.8	30.2	32.8

Table 4.2.9: Bio-Chemical Oxygen Demand recorded at five stations ofVrishabhavathi river (Sept'16-May'17)

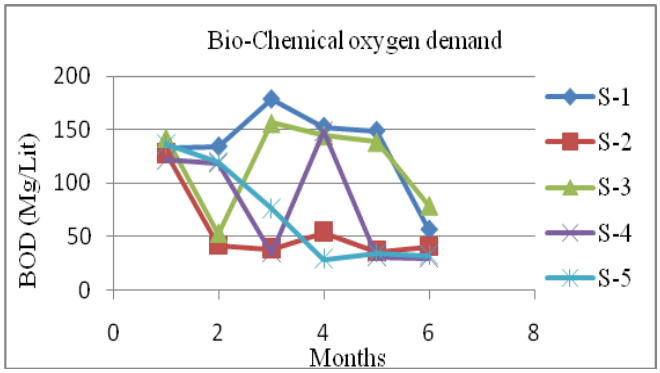

Fig 4.2.9 Variation of Bio-Chemical Oxygen demand at 5 stations

VI. CONCLUSION

Various chemical parameters in studied river showed distinct, temporal and spatial variations thought study period. The present study has shown that Vrishabhavathi river is much more polluted in terms of various chemical parameters such as pH, Hardness, Alkalinity, TDS, BOD, COD, DO etc,

Vrishabhavathi river was above described limit. This result shows that the Vrishabhavathi river receives very high pollutions from the surroundings. And the wastage of river highly contaminated and if the similar condition continue for the longer period, Vrishabhavathi river may soon become ecological inactive.

The main objective of study was to know physical and chemical characteristics of Vrishabhavathi river. Samples were collected and analysed for different physical and chemical parameters reveals that Vrishabhavathiriver is pollutant due to wastage coming from Bangalore city sewage wastewater and industries wastewater.

The present study shows that some of the parameters were above or below the permissible limit of wastewater standards. Some parameters like pH, turbidity, conductivity, COD, BOD etc...

The pH of the Vrishabhavathi river near industrial area is quite moderate. COD concentration recorded was comparatively high during pre-monsoon seasons due to high temperature and low dilution. TSS and TDS comparatively low level within the permissible limit. The alkalinity of water body was much higher than the world and Indian standard. Hardness is quite less than the level specified in the standard. From the above conclusion it has been made evident that the industrialization in Bidadi industrial area was responsible for the present deteriorating condition. The mitigation majors along with long term monitoring network will improve in that region. It is seen that improvement can be achieved in water quality, health, aquatic life, flora and fauna etc. with implementation of mitigation measures. At Vrishabhavathi river, colour and odour is present. Activated carbon and copper sulphate is used for the removal of colour and odour.

Filtration is necessary for the sample of river water as we have obtained TSS value above 100 mg/l. TDS is above 500 mg/l in order to remove it flocculation treatment is also necessary. DO is below 4mg/l and COD is above 250 so aeration process need to be provided. The BOD value is below 4mg/l so we have to treat it by algae growth method.

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